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ACADEMIC PRESENTATIONS
A Sustainable City Paradigm to Amman City, Jordan: Criteria and Indicators of Efficiency

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Amman City, one of the fastest grown cities in the World, is moving towards sustainable city planning. It has gone through unprecedented growth from 5000 inhabitants to current estimate of 4 million people. The debate on Amman’s sustainable city form has reached new horizons, and moved from theoretical perspectives and visions towards implication. This paper aims to characterize a sustainable city paradigm to Amman city as a framework through which the sustainable city can be visualized. It traces and reorganizes the different debates, scenarios, and visions concerning the sustainable city form. The paradigm consists of three proposed components; parameters, criteria and indicators. This paper is mainly focused on the characterization of the criteria and indicators of efficiency parameter as a major strand of sustainable city form. The paradigm is a flexible framework or a vision, out of many others, and, thus, disputable. It provides a flexible framework for officials and planners to work through and vision Amman city version of sustainability. When the paradigm applied, the indicators resemble an instrument of criteria, and hence, efficiency’s fulfillment. Once being characterized as a whole, the proposed paradigm is by no means a static model. Rather, it is a dynamic conceptual device to sensitize us to vision of what the sustainable city might become. This paper provides an approach to investigate the applicability of the sustainable city paradigm on Arabic-Islamic cities.

Keywords: sustainable city, sustainable city paradigm, efficiency, Amman City, Jordan.
Human society and nature have experienced “a great transformation” for the last two centuries. In response to various threats, from global changes to local environmental and social issues, a discourse of ecological transition has prevailed in the urban sector internationally. As a possible prescription, modern eco-city initiatives have emerged and evolved in the last three decades. However, arguably, the underlying philosophy of eco-city has existed in human history for a much longer time. From the literature, the essence of eco-city is to nurture a harmonious human-nature relationship to pave ways towards “a paradigm shift” in urban development. China is acting actively to find alternative urban development patterns and solutions to the challenges it is facing. In recent five-year plans, President Xi’s promotion of “ecological civilization” has occupied high positions in government agenda at multiple geographical levels. There are plenty of relevant policies or schemes about eco-city development, from national to municipal levels. Yet, there seems to be great gaps between policy discourses and actual practices, often derailed by socio-political processes that shape and reshape the urban environment. We have witnessed many “eco-cities” falling into swamps of technocracy, new enclosure movements, entrepreneurialism, or monopoly controlled by political will. Eco-city is indeed a political concept repleted with power-laden governance questions.

Inspired by literature of Urban Political Ecology (UPE), we will use UPE as a critical theoretical lens to decompose and interrogate the governance of eco-city in China. A representative case at the urban district level is closely studied, that is, Guangming District in Shenzhen, which is constantly regarded as the testbed and pioneer in this field. We would draw specifically on the history of socio-political struggles around realizing eco-city in Guangming. Through the last 15 years, there are several significant episodes of the utopian-efforts to envision, plan and construct an eco-city there. Within this paper, we suggest that the urban political ecology of eco-city, like all other socionatural processes, is produced through an amalgamation of discursive-constructions and ideological-practices, physical-designing, institutional-restructuring and culture-practices. Meanwhile, new forms of knowledge, understanding, and political-will must be realized in order to collectively tackle problems, reshaping contemporary urban landscape. Through this critical lens, we also seek to articulate the contradictions produced through the synthesis of nature and society, as well as who benefits and who suffers from local urban environmental metabolism. It is necessary to go beyond discussing “eco-city” as just another, in a long list of “urban-gimmicks”.

AC.01A.02

Governing Eco-cities in China: The Political Ecology of Guangming Eco-city Initiative, Shenzhen

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Sustainable Hyper-Density City Design, Connect, Conserve, and Cultivate, ---
-a Case Study in Singapore, Asia

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Issues and Needs:

Land-scarcity is one of the biggest challenges in Singapore, as one of the world’s high-density mega cities. To address this issue, Singapore’s government has reclaimed the new land from the seas. Over the past two centuries, Singapore’s land area has expanded by 25\%, and in the future, land reclamation will continue to meet the demands of urbanization. However, each reclamation from the sea destroys an underwater habitat by building over or enclosing a body of water.

The key challenge in front of us is clear. On one hand, there is the unstoppable human desire for development; on the other hand, there is limited carrying capacity of our nature and cities. As architects, we need to consider how to increase the urban density to use natural resources more efficiently and decrease the demand and impact on natural resources/ecosystem.

This study introduced a case study at Singapore, in which a system of systems was applied to redevelop an existing industrial area, which is a reclaimed land along Singapore’s western coast line, to a sustainable and livable high density urban areas. 4 task-oriented systems (self-sufficiency, social inclusivity, nature & ecosystem, and reciprocity) interweave with each other to engender an integrated and holistic network.

Goals and Approach:

In this case study, we set the design goal as connection, conservation, and cultivation to address above mentioned issues.

Regarding connection, it is to connect people by offering inclusive and accessible community space to all age groups. More importantly, the design aims to connect human society, ecosystem, and microclimates. passive design strategies are proposed to take advantage of wind, sun, water, and wildlife. Thirdly, it is to connect the new high density development with the existing mainland and engage the surrounding urban context in a sustainable way.

In terms of conservation, this design aims to decrease the impact and demand on natural ecosystem. A pillar-podium-tower-sky bridge structure is proposed to avoid reclaiming the waterbody using large footprint of concrete. This allows the off-shore ecosystem to recover, rather than to be totally destroyed after land reclamation.

At last but not least, after human society re-connects with nature, high density development and the off-shore ecosystem can cultivate a healthy symbiotic relationship with each other. With the integrative new building interface, there is a great potential for the local flora and fauna to regenerate for biodiversity whilst satisfying the high-density need of human sociey.
Environment Services Payment in the Context of Technourbansphere: Case Study in Megametropolis Paulista, Sp, Brazil

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The Payment for Environmental Services is a policy in Brazil was implemented from the revision of the Forest Code of 2012, which has been applied to rural producers, whose main objective is to encourage the maintenance of vegetation and/or recovery of permanent protection in rural areas. The “Produtor de Água” and «Projeto Nascentes» Programs in São Paulo state, are examples of projects aligned with this policy, and their objective is the hidric resources protection. The programs adopt initiatives to reduce erosion and sedimentation of water sources in rural areas together with producers and owners of these areas, who voluntarily join the programs and are committed to adopting sustainable practices and management in their lands for the conservation of soil and water. These programs are designed in a partnership format between different actors of society: federal, state and municipal public management; nongovernmental entities; rural producers (owners of the areas to be reclaimed); and private initiative. Based on this scenario, which involves a social, political and environmental complexity a methodological proposal is necessary to define a set of social and environmental indicators that must be monitored throughout the implementation and establishment of such programs, to ensure an effective and sustainable management. The methodology should involve qualitative research, based in interviews with local political agents and rural producers; and workshops socio-environmental mapping as methodological contribution to social learning. The communities of the municipalities of Salesópolis and Jundiaí, in the state of São Paulo, will be focused on as a study case. The municipalities in question present distinct situations both in relation to the programs’ progress and the political and social scenarios. The construction of indicators that can demonstrate socio-environmental improvements with the involvement of the various actors participating in these programs is considered the key factor for program sustainability. Coupled with these objectives, the involvement and application in two realities will bring a rich discussion and learning to create these indicators and their analysis in future projects and other experiences.
The project proposes to analyze the main aspects related to the participation of civil society in the Piracicaba, Capivari and Jundiaí rivers Basin Committee (CBH-PCJ), from the perspective of environmental education projects. The methodological approach adopted based on qualitative research, through participation in CBH-PCJ meetings, and application of semi-structured questionnaires for policy makers and actors from CBH-PCJ. The aim was to identify the challenges and perspectives that have involved the establishment of the protagonism of civil society, from different segments of representation in the CBH-PCJ, and formal education institutions (public and/or private schools). The projects analyzed presented as proposals the development of new values related to water resources, such as use of soil and water in the agriculture. In this sense, we have noted the importance of participatory spaces in river basin committees, through Environmental Education projects, which present as characteristics a factor of replicability and sustainability of the actions, in order to reach the sustainable development goals (ODS) of Agenda 2030. The projects have allowed an empowerment of different actors of civil society, be in formal or non-formal education approach. We could verified that all projects are focused on Water Resources Management, with great diversification and concern to reach different target audiences, with different languages and methodologies, always seeking to facilitate communication for the consolidation of the Water Resources Management System in São Paulo state. Thus, the projects developed by the CBH-PCJ have shown us an educative strategy to build democratic space for management of water resources. Likewise, the Agency of Basin PCJ, as a financial and executive arm of the CBH-PCJ, reflects a greater investment of resources and prioritization of environmental education projects. The importance of participatory spaces in river basin committees, with Environmental Education continuous projects, allows a critical and conscious thinking of those involved (all sectors from society actors), protagonists in the management of water resources. Therefore, it is essential that the committees corroborate with those projects in a participatory and democratic way.
How Machine Learning Can Help Solve America’s Lead Crisis

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In Flint, MI and Pittsburgh, PA, recent increases in water lead levels have forced governments and communities to confront their aging infrastructure. These cities are required to replace all their lead service lines but are unable to produce records of where they are. This lack of information leads to unnecessary excavations that waste time, money, and erode public confidence. These problems are not isolated to Flint and Pittsburgh: in the United States there are thousands of public water systems facing similar problems, affecting millions of people. We have used machine learning to help these cities minimize uncertainty and maximize efficiency when searching for unknown lead line locations. We demonstrate that these techniques would save tens of millions of dollars in Flint alone, and potentially billions of dollars on a national scale.

Access to safe, clean drinking water is something that most people take for granted. The recent crisis in Flint has created feelings of betrayal and distrust in institutions. Efficient and transparent recovery efforts, beside saving taxpayer money, can help rebuild lost confidence. To address this multi-faceted issue, we propose an initiative which combines data-driven decision making with human-centered design to deliver an innovative, community-based solution to the country’s lead in water problems. In this paper, we describe how new approaches can improve efforts to remove lead service lines and limit exposure to vulnerable consumers like infants and pregnant women. We also discuss how we make personalized, location-specific risk assessments, water filters, community resources and healthcare services more accessible, leading to greater transparency and better stewardship of public trust and resources.
Extensive green roofs are shallow, vegetated systems with many benefits to the environment and society. Many prescriptions for a healthy built environment include green roofs, but these often lack any specifications on the range of types of systems available. Without reference to these and other details, the extent to which green roofs serve a city’s ecological and social health is vague. The International EcoCity Standards (IES) provide a vision for an ecologically-restorative human civilization as well as a practical methodology for assessing and guiding progress. Under its four pillars of sustainability, the IES grade city health along a scale from “unhealthy” to “greener” and through various “EcoCity” benchmarks, up to the highest possible ranking of “Gaia Level”. This paper examines the roles of green roofs to the IES by locating different green roof types onto the IES framework in an eco-value matrix. In addition to literature and case studies, we refer to current projects on BCIT’s Elevated Lab, a green roof complex that includes research and implementation of various forms of technology.

With respect to ecological imperatives, EcoCity green roofs will include (but are not limited to) living soils at varying depths, beneficial soil microbes, a diversity of native plants, and life cycle provisions for animals. By contrast, “unhealthy” green roofs include (but are not limited to) sterile growing media, monocultures, and produce leachate. With respect to the bio-geo-physical pillar, EcoCity green roofs may grant access to fresh herbs for local kitchens, and use non-potable water when irrigation is required. The EcoCity Benchmark for the socio-cultural pillar can be integrated into green roofs by acknowledging indigenous cultures and by creating a sense of place using symbolic expressions.

Just as multi-functional and diverse ecosystems provide a greater range of benefits than simple systems, the eco-value matrix demonstrates how diverse and multi-functional green roofs can enhance the health and resilience of cities, urban dwellers, and ecosystems alike. By describing and visualizing the place of different green roof systems within the eco-value matrix and as relating to the different EcoCity Benchmarks, this paper facilitates the possibility of defining “Gaia-level” green roofs, with extensions to other forms of living architecture and green infrastructure.

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Green engineering plays a critical role in promoting sustainable designs that mitigate the impact on our planet in terms of lower energy use, increasing biodiversity, and addressing climate change. In developed urban areas, climate change effects can be seen drastically. Precipitation events are increasing in frequency and intensity not only in the Metro Vancouver region, but also many other climates across the globe. Drier, hotter summer months are driving cooling loads for buildings to be higher while facing capacity concerns for draining impervious areas including buildings and surrounding areas during more frequent storms. Cities with aging infrastructure and high densities face difficulty to convey stormwater runoff into drainage systems whilst simpler solutions such as increasing the number of pipes or sizes are challenging to implement in built-out areas. "Blue-green connected" roofs are a new concept that aim to provide the benefits of green roofs, with improved water retention capability, and added water detention.

Healthy green roofs reduce cooling loads and retain water. However, green roofs underperform if the vegetation is not healthy or dries up. Dry vegetation during drought pose a fire risk while holding more heat on the roof, and ultimately increase building cooling loads.

Blue roofs are emerging in urban areas that see large amounts of precipitation, enabling the use of captured water in place of potable water where applicable. However, blue roofs have been challenging to implement in the past from a structural roof load perspective and a waterproofing guarantee for occupants. Lately, waterproofing materials technology is improving significantly for blue roofs implementation.

Blue-green connected roofs are a hybrid solution that aim to combine the benefits from green-roof vegetation and an improved blue-roof water retention and detention. Using the blue roof principles to capture runoff into a cavity that can feed into a green roof when the vegetation is in need of moisture could provide a lasting solution that can be implemented widely. This research aims to provide a quantitative measure for each roof (conventional, blue, green, and blue-green connected roof) to measure the heating/cooling load, stormwater management, and observe the health of the vegetation. An experiment is being designed to test the energy and water management performance of these roofs by collecting energy and water data over 1 year. At the time of the EcoCity World Summit 2019, the experimental design and implementation will be presented, and possibly early results from preliminary data collection.
On Participatory Nature - an Open-Source Guide for the Activation of Ecology in Drosscape

Ms Maria Kaik¹, DR. Nico Tillie¹

¹Delft University Of Technology, Netherlands

The paper seeks to bridge the disciplines of the Ecological Restoration and Architecture. Due to the gap between the science and practice, not only the process of restoration is being slowed down, but also the innovation within the disciplines is limited.

Due to the ever-changing landscape, which bears traces of human modifications, it is necessary to accept the temporalities of ecology. The impact of the architectural instruments on the environment can accelerate the activation of biodiversity in drosscape. This paper demonstrates that architecture should be considered as an extension to the environment, which is also operated by natural forces. It summarizes the research on instruments which stimulates nature. It provides an anthology of possible solutions for the reconstruction and enhancement of the habitat in the post-industrial conditions.

Solutions such as a watch tower, ecoduct, green house, fish farm, bird tower, wind break, thermal mass, stiles and legislation trigger certain ecological processes and open opportunities of natural reconstruction.

A series of architectural interventions is evaluated as an interdependent network favouring rare species. Developed over time, they can react to the dynamic changes in the ecosystem. The flows present in nature are always disturbed, broken or diverted. Almost every intervention triggers a chain reaction - it starts a layered processes. Rather than via a singular element, restoration should happen via a collage of instruments, which work in a timed synchrony.

The research demonstrates a strategy for a decentralised approach, which empowers individuals to spontaneously engage with the environment, via small scale low-tech constructions. The project is accompanied by an open-source platform: www.shiftingsandsproject.com where users can not only map out the local architectural devices and embrace the mutual benefits among them, but also seek low tech solutions facilitating nature.
BC Housing’s Journey Towards Social, Environmental and Economic Sustainability

Sheryl Peters, Magdalena (Magda) Szpala, James Forsyth, Emme Lee, Susan MacDougall

BC Housing, Burnaby, Canada

BC Housing bridges the divide between social, environmental and economic sustainability through the design and construction of energy efficient social housing buildings. In the last fiscal year, BC Housing assisted 107,205 households in 298 communities across the province through a range of programs, initiatives, and partnerships. Assistance ranges from emergency shelters and homeless outreach to independent and supportive social housing to help for first time homebuyers. Construction activities include renovating existing facilities as well as building new housing units using modular, wood frame, and concrete forms. BC Housing has been carbon neutral since 2010 and reduced its GHG emissions by 28% across 600 social housing sites totaling over a million square meters of floor area. To date, BC Housing and our non-profit housing partners have 60 buildings registered with the Canada Green Building Council, 36 that received Leadership in Energy and Environmental Design (LEED) certification, and four Passive House buildings. In addition to focusing on our own buildings, BC Housing plays a key role in supporting others in addressing the climate change challenge, by conducting technical research and providing education to builders, designers and other construction professionals to help improve the quality of residential construction across the province.

Our panel will provide an overview of BC Housing’s organizational journey towards sustainability and will include case studies which highlight BC Housing’s innovative and responsive housing solutions.

Panel Speakers:

Moderator: Sheryl Peters (Provincial Director – Redevelopment, BC Housing)

- Magdalena Szpala (Senior Strategic Advisor – Sustainability, Corporate Affairs, BC Housing)

“Social Housing in the New Climate” – An overview of BC Housing’s organizational journey towards sustainability: key drivers for change, successes and challenges.

- James Forsyth (Director of Regional Development, BC Housing):

“Rapid Response to Homelessness Program” – In response to homelessness, the Province is investing $291 million to rapidly build over 2,000 modular supportive housing units across the province.

- Emme Lee (Development Manager – BC Housing)

“Partnerships to address the housing and addictions crises” – A case study of an innovative partnership between Vancouver Coastal Health and BC Housing to build a 51-bed addiction treatment centre and 90 below market rental housing units at Clark and 1st Ave.

- Susan MacDougall (Building Performance Advisor, Principal – Focal Engineering)

“Climate Adaptation at Clark and 1st Ave” – A case study of the site’s climate adaptation strategy and template for future climate comfort and energy analysis approaches.
Air pollution is a common term for airborne chemicals and agents with net detrimental effects on ecosystems. A number of sources such as industrial operations, residential/commercial heating and cooling as well as transportation emit tonnes of harmful particles and gases into the air on a daily basis. Some of those pollutants penetrate into indoor environments where people spend more than 70% of their time and add to potentially existing indoor-related pollution levels. Proper outdoor (ambient) and indoor air quality evaluation is vital for developing strategies for improving air quality, minimizing population exposure and subsequently protecting human health and other valued ecosystem components. Here we present the results of an interdisciplinary project completed by students and faculty from two BCIT programs: Environmental Engineering and Building Science. Carpentry building (NE 04) located on the BCIT Burnaby campus was selected due to airborne particles generated by handling and processing wood. Airborne wood particles were measured using DustTrak™ II Aerosol Monitor 8530, a light-scattering laser photometer, over the 5-day period at multiple locations: inside and outside the building and near the exhaust of the dust extraction system. Results demonstrated that indoor total particulate matter levels depended on the Carpentry Workshop activity and equipment used so average values ranged from 101 and 135 µg/m³ with an exception of one day with 7 µg/m³ when measurements were taken after the Workshop cleanup. These values were well below the 8-hour Time-Weighted Average (TWA) Threshold Limit Value (TLV) specified by Work Safe BC of 1,000 µg/m³. Outdoor (ambient) levels were much lower with a steady daily averages of 7 µg/m³. Measured levels were further used along with the local meteorological conditions as input parameters in CALPUFF View™, a multi-layer, non steady-state, Lagrangian dispersion model to evaluate impacts of emitted particles on campus air quality. A dense network of receptors (points of interest) was set around the Carpentry Workshop in order to calculate concentrations of particles at the breathing level (1.5 m) in surrounding atmosphere under different weather and atmospheric stability conditions. A map of dispersed particles was developed which depicted frequency of occurrence and magnitude of concentrations of potentially inhaled particles.

This presentation is dedicated to our late colleague Dixie Hudson whose creativity and passion for sustainability inspired many BCIT projects.
Air Quality – from Local to Global and Back

Dr. Goran Krstic¹, Dr. Olga Petrov¹

¹British Columbia Institute of Technology, Canada

Abstract

The exponential growth of human population, environmental degradation and global climate change are expected to have a significant impact on our planet’s ecosystems. Clean air is one of the bio-geophysical conditions integral to the functioning of ecologically sustainable communities. We provide an overview of interconnected atmospheric conditions on different temporal and spatial scales conducive to air quality. We focus on the issues and possible solutions associated with airborne pollutants related to local and global ambient (outdoor) air quality, such as ground-level ozone, particulate matter and greenhouse gases (GHG). Metro Vancouver area is presented as a case study where solutions for ambient air quality improvement outline possible trade-offs. A balance between the three pillars of sustainability: environmental (ambient air quality), social (human health) and economic (costs and benefits) aspects should be taken into consideration.

We further discuss indoor air quality as it may relate to local ambient air quality and in the context of building design, envelope air tightness, ventilation and energy conservation. In response to the carbon footprint reduction requirements and the need for a sustainable development, modern buildings are being designed, built and maintained with an objective to reduce energy use. It should be recognised, however, that striving to make buildings more energy efficient may have an adverse impact on the indoor air quality and consequently the human health, comfort and productivity in indoor environments. In energy efficient buildings with overly airtight envelopes air pollutants may accumulate indoors if ventilation and air conditioning are inadequate. Therefore, maintaining a sustainable, energy efficient and healthy indoor environment should include a balance between air tightness with building weatherization for energy savings and supplemental ventilation with adequate air conditioning requirements for a good indoor air quality.
Computational Parametric Study to Improve Air Quality in High-Density Cities

Assistant Professor Chao Yuan¹, Professor Edward Ng², Professor Leslie Norford³

¹National University of Singapore, Singapore, ²The Chinese University of Hong Kong, Hong Kong, China, ³Massachusetts Institute of Technology, Cambridge, US

In high density mega cities, air pollution has a higher impact on public health than cities of lower population density. Apart from higher pollution emissions due to human activities of densely populated street canyons, stagnated air flow due to closely packed tall buildings result in lower dispersion potentials. The coupled result leads to high air pollution concentrations being reported frequently at street side stations in Hong Kong. High density urban morphologies need to be carefully designed to lessen the ill effects of high density urban living. This study addresses the knowledge-gap between planning and design principles and air pollution dispersion potentials in high density cities. The air ventilation assessment understandings for high density planning and design are advanced to relate the air pollutant dispersion issues. The methods in this study are CFD simulation and parametric study. The SST κ-ω model is adopted after balancing the accuracy and computational cost in the comparative study. Urban-scale parametric studies are conducted to clarify the effects of urban permeability and building geometries on air pollution dispersion, for the outdoor pedestrian environment. Given the finite land resources in high-density cities and the numerous planning and design restrictions for development projects, the performance of mitigation strategies is evaluated to optimize the benefits. A real urban case study is conducted to demonstrate that suggested design strategies are feasible in the urban design.
AC.02C.01

Climate Action: Comparing Three Ways to Mobilize Community for One-planet Living

Dr. Uschi Bay¹

¹Monash University, Caulfield East, Australia

In this paper I aim to compare three ways of mobilising community for one-planet living. The three case studies will be the transnational Transition movement, the Women’s climate justice movement and the Food sovereignty movement as these are emerging and developing in the city of Melbourne Australia. I will be comparing the strategies for developing communities and building community capacity, specifically by reflecting on the governance processes, gender relations and how the focus of each group is connecting to transformation and changes in life-style and policies and programs at local, national and international levels. I will be contrasting the measures undertaken by these groups with the current political rationalities of economic or neoliberalism and the types of subjectivities these governmental logics promote. The disruption through practical measures of the current economic growth model, the processes that promote inclusiveness and non-competitive stances, including the way information and knowledge is made available to citizens and shared transnationally are elements of these three movements’ activities that promise a way forward to achieving sustainability goals. Climate action requires strategic and informal solutions for sustainable futures and these three movements represent necessary aspects for aspiring ecocities through the development of many alliances and networks across various complex systems. The similarities and contrasting methods may provide further opportunities to collaborate and connect ideas for action across several key elements like food, inclusiveness and as well as local, national and international governance and promotion of policy transformation.
AC.02C.02

Spaces, Places and Possibilities: A Participatory Approach for Developing and Using Systems Models and Visualizations for Integrated Community Planning

Dr. Robert Newell¹, Dr. Ian Picketts²

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Systems modelling exercises can support integrated community planning efforts because they have the ability to elucidate relationships and outcomes of social and physical infrastructure decisions. However, there are challenges associated with both the modelling process and applying the modelling outcomes. For the former, deciding what to include in models presents a significant challenge: including all aspects of a community and local environment is unfeasible, whereas including too few aspects leads to a non-representative model. For the latter, outcomes of systems modelling can be somewhat abstract to users in the sense that the output may not provide stakeholders and community members with a strong impression of how certain modelled scenarios would look and ‘feel’ if implemented locally. The Spaces, Places and Possibilities research project aimed to address these challenges by incorporating community participation and visualization in a community systems modelling effort. Conducted in Squamish (BC, Canada), the project consisted of three phases: (1) model and scenario development, (2) scenario modelling, and (3) scenario visualization. Phase 1 involved assembling a local government and community stakeholder focus group to discuss local issues and possible futures for Squamish. Analysis of focus group data informed the design of a community systems model and local development scenarios (i.e., different community development patterns). Phase 2 applied the systems model to examine potential outcomes the community development scenarios. Modelling primarily used ArcGIS, and it explored a variety of factors, including access to amenities and education, walkability, parks/trails, food and farm systems, public transit, housing affordability, threats to critical habitat, etc. Another focus group was held to gain feedback on the model and ideas for developing visualizations of the scenarios. The model and scenarios were refined based on this feedback, and in Phase 3, realistic, interactive visualizations were developed. Visualization development employed a combination of ArcGIS, Trimble SketchUp, Adobe Photoshop, and the Unity 3D gaming engine to (respectively) maintain spatial accuracy, develop realistic objects and textures, and create a dynamic and navigable virtual environment. Users could experience and navigate the visualizations from the first-person perspective, and these tools added salience and place-based meanings to the (otherwise abstract) output produced through the modelling work. The research found the participatory approach to be beneficial for developing community planning tools, and the main recommendation from this work is to develop these tools through iterative processes, where they are refined through multiple stages of feedback to better capture the local ‘reality’ of a place.
Advancing Women Leadership for Climate Action

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Women make up more than half the world’s population, and although they are often disproportionately impacted by climate change, their voices are not always heard due to lack of inclusion and representation at the decision-making level.

Women leaders played a pivotal role in negotiating the Paris Agreement on climate change in 2015, and they will be crucial to its success in the future. Now more than ever, enhancing women’s participation and leadership will be critical to securing a healthy, prosperous and sustainable future for us all.

C40 supports cities around the world to take bold climate action, leading the way towards a healthier and more sustainable future. Through their Women4Climate initiative, C40 aims to: empower and inspire the next generation of climate leaders through a global mentorship program dedicated to women in C40 cities; influence the conversation through leadership events and create new momentum and interest among future leaders; and raise awareness through research on gender, cities and climate to highlight the key role women play in championing climate action in cities.

In 2019, the City of Vancouver was the eighth city to launch C40’s Women4Climate Mentorship Program, joining Paris, Mexico City, Tel Aviv, Montreal, London, Quito, and Auckland.

Over the course of this ten-month mentorship program, a cohort of ten mentors are sharing their knowledge, experiences, and support with ten emerging women leaders committed to advancing climate-focused projects in the built environment. This is particularly important in Vancouver as buildings are the largest contributor of greenhouse gas emissions, and therefore are the focus of significant municipal programs and policies.

This poster presents the experiences of the women participating in the Women4Climate Mentorship Program in Vancouver, their climate action projects, and the women leaders who are mentoring them.
Building codes around the world are transitioning towards requiring net-zero energy and/or net-zero carbon buildings as the minimum performance requirement in the coming decades. In many jurisdictions, building designers need to use energy modelling to demonstrate that their building meets the minimum level of performance. As it is generally implemented now, energy modelling is used to demonstrate equal or better performance to a building modelled to the minimum code level (e.g. 9.36. prescriptive requirements), or a previously established baseline (e.g. ASHRAE 90.1 – 2007). However, this introduces some limitations, including:

• Targeted percent reductions targets may need to be revisited when the baseline code is updated.
• The reference building typically has the same architecture as the modelled building (with the exception of window distribution and potentially window-to-wall ratio), which fails to incent more energy efficient architecture (building form).
• In some cases, the mechanical systems of the reference building changes with the proposed design, leading to an energy target that can shift as the designer tries different types of mechanical system.

This paper examines the concept of flipping the concept of a reference house from a system that is based on past energy requirements, to a forward looking approach where the reference building would be modelled to a net-zero standard. Instead of designing to beat an old standard by a certain amount, results would be presented in a percentage more consumption than the reference building. There could be a number of potential benefits of this new approach:

• Shifting the focus to a common future targeted performance level.
• Percent difference from reference would not change over time leading to clearer communication to homeowners.
• Potentially harder to sell a home that meets current requirements if it is rated as a home that consumes 50% more energy than that of a reference house.
• Opportunity to address some of the limitations of the current reference house approach such as introducing efficient architectural form to the reference case.

This paper will examine the feasibility of implementing this approach for a number of building archetypes across different climate zones, comparing the results to the BC Energy Step Code’s stepped approach.
Quantifying Passive Energy Exchange Between a Rooftop Greenhouse and Host Building

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Urban agriculture is considered a means to reduce food waste, produce cheaper, healthier food and provide economic opportunities. To achieve the potential benefits, the amount of food produced through urban agriculture must be scaled beyond community gardens to include large commercial operations. Due to many reasons, one of which being scalability, rooftop greenhouses have emerged as examples of large scale commercial urban agriculture operations in Canadian and American cities. Using greenhouses to produce food is an effective way to increase resource efficiency, reduce soil degradation and produce nutritious and abundant food. In addition to the sociocultural benefits, placing the greenhouse on the roof can lower the energy demand of the greenhouse, as the building below moderates the temperature through passive heat exchange. The benefits for the greenhouse have been quantified by others, however the impact that the greenhouse has on the energy demand of the building has not. This is an important step as quantifying building energy savings for building owners and developers will further strengthen the business case for rooftop greenhouses, resulting in more widespread implementation.

The objective of this research is to quantify the difference in heat flow through a roof on a building that contains a greenhouse and one that does not by conducting both field experimental and numerical studies. A validated computer model is used to predict temperature within a rooftop greenhouse and energy exchange between the greenhouse and the host building in three Canadian cities. In addition to quantifying the passive heat exchange the model will also identify times of the year when heat can actively be exchanged between the rooftop greenhouse and the host building.
Passive Strategies for the Sustainable Design of Healthcare Facilities Located in Warm Climates

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Traditional building design protocols are undergoing a profound transformation, challenged by the addition of sustainable strategies from the early stage of the design process, and by the implementation of customized responses unique to each project, instead of providing generic solutions. In addition, current technologies are offering specific and updated information of climatic conditions in real time in many locations, offering a variety of analytical tools that can provide accurate information about existing environmental conditions, as well as an abundance of simulation tools to verify building performance. As a result, novel design workflows are emerging based on the concept of “integrated building design process”, with the objective to provide sustainable solutions for each project within a collaborative multidisciplinary teamwork, working in an integrated approach, and by implementing current digital technologies. Within this framework, this paper will feature the process of formulating sustainable passive design strategies at the early stages during the schematic design and design development phases for healthcare facilities, which are described in three sections. Phase one identifies pre-existing conditions, including physical and environmental aspects defined by specific climatic factors as inputs (solar orientation, winds, temperature, humidity, solar radiation, etc.), using a suitable software to generate an accurate diagnostic based on current Energy Code Comfort Model with passive and active strategies listed in order of relevance. Phase two analyzes critical aspects to match best design practices by evaluating strategies to optimize building performance, formulating critical design recommendations to be considered and integrated in the architectural proposal delivered in clear parameters, such as cross ventilation, natural lighting, chimney effect, passive solar walls, among other aspects. Phase three provides modeling simulations to verify building behavior (e.g. daylight, thermal comfort, air flow, acoustics) to evaluate building performance of the proposed design with respect to the most critical aspects, compared to base models and traditional building design. Two case studies are featured of buildings located in the city of El Salvador (a hospital in a rural setting, and a clinic in urban context), with the aim to formulate appropriate design strategies with the objective to use primarily passive strategies in architectural design to minimize or even to eliminate the need of active systems for heating, cooling and ventilation, in a context of warm and humid climatic conditions. Finally, the paper draws conclusions on the results obtained and on the potential development and implementation of this workflow for future projects.
Acknowledging Trade-offs and Reframing Human Excreta Management as Part of Food and Farming Systems

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Adequate handling of human excreta is an overwhelming global challenge. In 2015, more than 60% of the world population lived without access to safely managed sanitation services. Safe management and disposal of human excreta has traditionally had the dual goals of protecting human and environmental health. The ongoing shift from perceiving human excreta and sewage as waste to recognizing their value as resource has led to the emergence of a range of new and innovative sanitation solutions. These put resource recovery center stage and hold the potential to amplify progress towards multiple development goals beyond environmental and health concerns. Implementation is, however, slow. This is in part because human excreta (and sewage) management first and foremost framed as a sub-component of waste(water) management, and in part because inevitable trade-offs are overlooked. For instance, considerable research has been dedicated to energy recovery, resulting in the (partial) loss of organic matter, nitrogen, and other nutrients. Yet, analyses suggest that re-circulation of nutrients contained in human excreta has the potential to make a more meaningful contribution to the global fertilizer demand than energy recovery can make to meet the energy demand. These findings illustrate framing human excreta as a resource might lead to sub-optimal solutions if trade-offs are not taken into account. In this presentation we explore how the perception of challenges and opportunities tied to human excreta management might change if first and foremost framed as a part of food and farming systems, rather than a resource recovery challenge within waste(water) management systems. We find that such re-framing brings to the fore a range of aspects of critical importance that are currently underappreciated. Better consideration of these aspects would help guiding human excreta management towards better supporting global soil, food and nutrient security while also supporting other top priorities such as adequate sanitation for all, and protection of human and environmental health.
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Reuse of Urban and Peri-urban Organic Residues for Mitigation of Environmental Impacts from Industry

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The number of small to medium sized enterprises producing agri-food products within cities is increasing. Additionally, the spread of urbanization is creating peri-urban areas that intermingle urban residents within farming areas, creating the opportunity for ecocities. City produced agri-food products include vegetables, craft beer and high value medicinal/nutritional products derived from mushrooms and cannabis. However, these activities produce large amounts of residues. For every 10L of beer produced, 2kg of wet brewer’s spent grain (BSG) is discarded. While for each kilogram of fresh grown mushroom, 5 kg of spent mushroom substrate (SMS) is produced. As for the recent cannabis industry, it is still unknown the amount of waste, cannabis biomass (CNB), that will be produced, the estimative is that around 90% of the plant is rejected. Food and beverage manufacturing is one of the largest sectors within Vancouver’s Industrial Districts. These urban agri-food industries comprise nearly 60% of British Columbia’s food processing companies. British Columbia also holds 23% of the licensed farms for cannabis cultivation. To sustain the growth of the urban and peri-urban agri-food industry more options are needed for the management of their wastes. Currently residues such as BSG and SMS have the potential for only low-value reuse, as compost or livestock feed, for example, but most ends up being landfilled. Landfilling is not a sustainable solution for waste management within ecocities. There are opportunities for reusing these residues based on the principles of a circular economy, which is to avoid landfilling and foster industrial symbiosis, which leads to more efficient use of resources. One option is to transform these residues in biochar. Biochar is a carbon-rich solid material produced by thermal decomposition of organic materials in the presence of limited oxygen and at high temperatures, a process called pyrolysis. Biochar has large specific surface area, highly porous structure, and stable carbon matrix, which makes it a high capacity adsorbent. Biochar properties are related to the type of biomass used, heating rate, maximum pyrolysis temperature and time. Moreover, biochar can be modified using steam or iron impregnation. These modifications can be done to produce biochar for specific purposes, such as metal removal or to capture nutrients from waste water streams. Nutrient enriched biochar can be used for bioremediation of forestry sites, returning the nutrients to the soil. Hence closing the cycle, from natural resource extraction, production, residues repurpose, and finally, returning nutrients into the soil.
Identifying Urban Nutrient Hotspots

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Our food system depends on the input of nutrients in the form of synthetic fertilizers, produced from finite reserves (phosphorus and potassium) or via fossil-fuel-intensive processes (nitrogen). The reason for this large input on the front end is to account for the losses of nutrients further down the line in the food system. One of these losses is through our urban sewage system, in which the nutrients contained in excreta (urine and feces) are either lost to the atmosphere, lost in the sludge, or lost in the effluent and discharged to surface waters. Proposals for new sanitation systems, that promote nutrient recycling to agriculture have been emerging in the last decades. To effectively recover nutrients via new sanitation systems requires source-separation of wastewater streams. Separation increases concentration (reduces dilution) and reduces cross contamination of streams (ie. separating toilet (black) wastewater from voluminous shower and sink (grey) wastewater.

The implementation of new sanitation systems is most opportune in locations with high excreta production. People, however, are transient in space, moving between home, work, commercial and public domains. Their toilet use patterns are equally as dispersed, releasing nutrients into the sewer system at various geographical locations. How then do you identify locations with high excreta production? Our study shows spatial dynamics of nutrient production in the city of Amsterdam, the Netherlands through a GIS-based model. Results identify buildings or areas where large loads of nutrients are produced, labeled ‘nutrient hotspots’. These buildings or areas can then be targeted for the implementation of NS systems.

The nutrient hotspots are considered nutrient supply points, which can supply nutrients to agriculture. Our research has further linked these supply points with agricultural demand points (demand for fertilizer on cropland) in the municipality of Amsterdam, identifying transport distances between supply and demand points. Spatial and temporal variations are simulated by the model to account for seasonal demand and storage capacity.

The new model concretizes the field of circular nutrient management, which is otherwise often described in abstract terms, i.e. the results can inform decision makers where promising points of intervention for appropriate nutrient management strategies are located. The model is suitable to use for other urban areas as well, as we expect that the GIS data needed will be readily accessible and available for governmental/municipal institutions. Therefore, the model has a potential impact that extends far beyond Amsterdam alone.
Impact of Informal Services on the Development of Urban Areas in Imo State, Nigeria.

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Impact of Informal Services on the Development of Urban Areas in Imo State, Nigeria.

BY

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ABSTRACT

In Nigeria there is persistent rise in unemployment especially in the urban areas. The unending influx of people into the urban areas continued to aggravate the unemployment situation. The dimension of unemployment in the country transcends the normal inadequate job opportunities and resources underutilization but includes the gross mismatch between job expectation and actual job availability. These trends have led to the inability of the formal sector to absorb the job seekers and to the rapid expansion of the informal sector. The situation has made an increasing number of people dependent on informal activities as means of survival in the urban and rural areas of Nigeria. The topic “The Impact of Informal Services on the Development of Urban Areas in Imo State, Nigeria” is an investigative analysis of the contribution of informal services in the development of urban areas in Imo State, Nigeria. The aim is to assess the impact of informal services on the development of Owerri, Orlu and Okigwe, the three key towns of Imo State of Nigeria. To actualize this aim, objectives were formulated and five informal services selected from five key official sectors of Nigerian economy. The data for the study was generated from survey of 300 randomly selected informal service providers in the three towns of Imo State of Nigeria with the questionnaire, interview guide or schedule and group discussions as data collection instruments. The probability sampling method and multi-stage sampling technique were adopted in the selection of areas, districts and sampling of the questionnaire to respondents selected. The Special Package for Social Sciences (SPSS) version 20 aided in the data analysis. Findings revealed that the informal services in the towns positively affects the development of the towns through the creation of employment opportunities, income generation and improved living standards of participants and their families. Recommendations made includes the formulation of strategic policies for the integration of these informal services into the urban development policies of the Local Government Areas, the State and the Central Government as well as tactical policies to realize the findings and conclusions from the study.

KEYWORDS: INFORMAL SERVICES, DEVELOPMENT
The National Policy on Solid Waste, in its 20 years of operation, since its first version, clearly shows a change in all treatment of Waste Management in the country, as the insertion of reverse logistics, co-responsibility, in addition to other instruments, shows how important this proposal is. On the other hand, since the implementation in 2010, until today, the figures show a timid advance, especially regarding the final destination in Landfills, which shows that the Policy still has a hard way to go. The legality of the involvement of Brazilian society, in a cultural transformation, aimed at the reduction and reuse of waste, the promotion of citizenship with social reintegration, together with the obligation of the final consumers, to follow the rules established in this new model of waste management and adequate return of them, for their reuse, destination or final disposition.
Synergic Effects of Circular and Network Economies to Enhance Urban Sustainability

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The necessity and urgency to increase the sustainability of the present socio-economic system provide a fertile ground for developing the concept of circular economy. Circular economy is defined as a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling.

Among these activities, recycling was already implemented in many countries to reduce resource depletion and manage waste. However, recycling alone cannot entirely solve the present sustainability challenges, since increased recycling does not reduce the flow of material and energy through the economy, maintaining and reinforcing the production-based paradigm.

Urban agglomerations represent places of both intensive and extensive consumption that provide many possibilities for implementing circular economy activities. However, these initiatives, which are often introduced by municipalities using a top-down approach, are seldom successful and sustainable because of the challenges raised by their coordination and management. These challenges can be addressed using the principles of the network economy, in which value and information are created and shared by all members of a network rather than by specific institutions, economies of scale stemming from the network size. A widespread application of the network economy are the peer-to-peer sharing systems that connect individuals and/or organizations and facilitate the identification and usage of idle resources.

Circular economy activities can be better introduced, coordinated and managed using a decentralized approach - based on local information networks, which connect citizens, activist organizations, local agencies, municipalities and enterprises to identify and apply the best solutions for improving the sustainability of life in urban areas. Our paper provides and analyses several examples of urban network initiatives that enhance the effectiveness of circular economy activities, using case studies from the Shareable organization database. Based on these examples, we develop propositions regarding the managerial and operational principles of using network economy applications to organize, manage and enhance circular economy initiatives. These principles are integrated into a comprehensive model, which leads to managerial and practical implications.
The growth and development of cities in Nigeria, and parts of the developing world, has continued to engage the attention of various researchers, professionals and governmental agencies. Each of the groups appears to focus on the aspect or sectoral component of interest to them. Governmental agencies armed with statues, regulations and extant laws cannot distinctively define or profile their duties or enforce the laws and regulations to control unplanned development. The result is chaotic transformation against the tide and plan envisaged for the city, at inception. The disfigurement of city structure and pattern, transport infrastructure and arrangements, as well as shapes and scenic beauty by the construction and alteration of structures without recourse to building plans, approvals, renewal procedures, is increasingly common. This has, ultimately, changed the cityscape, the functionality of buildings, as well as the outlook of neighbourhoods and zones, mainly to earn economic and social advantages. The scenario has created diverse social, economic, environmental and general urban planning problems. The cities are undergoing unplanned transformations, which negates livability and the essence of city planning and development in the short and long runs, and which calls to question the need for regulatory and governmental agencies. The study cursorily considered and examined the following relevant factors in the survey, city original functions, level of provision of infrastructural facilities and social amenities, enforcement of plethora of regulations by governmental and allied agencies, and the role of private sector in the transformation and outlook of the contemporary cities in Nigeria.

The study considered 5 cities, which are administrative capitals, in southern Nigeria. The cities are Enugu, Owerri, Port Harcourt, Uyo and Calabar. Data generated were analyzed using appropriate tools. The outcome revealed non-conformity and disobedience to regulations with no visible administration of sanctions, and it profiles the styles, condition of cities now and in the future, amidst rising poverty and worsening social and economic conditions. It maintains the sanctity and enforcement of regulations as key to efficient and effective performance, and functionality, of cities in Nigeria for sustainable development, functionality and livability of the dwellers.
Towards Ecocities: The Impact of the Slum Dwellers of Western Suburb in Guayaquil-Ecuador on the Puerto Lisa Estuary

Ms Carmen Freire

This research evaluates the explosion of the slum dwellers in developing countries, within the framework of the ecocities. Referring to Habitat programs from 1976 on Vancouver-Canada through Habitat III on Quito-Ecuador in 2016, as well as the Sustainable Development Goals (SDG’s) to be reached by 2030.

Ecocities represent the hope for change and play a leading role in the global development agenda. It is only through this proposal, that we can include essential assets such ecosystems, the engagement of governmental agencies and non-governmental organizations (NGO’s), the communities benefitting from these projects and more equitable financial models.

Almost 1 billion people, or 32 per cent of the world’s urban population, live in slums, moreover, the focus of global poverty is moving to the cities, a process now recognized as the ‘urbanization of poverty’. This number is projected to rise to over two billion in the next 30 years.

The case on search is located in the Western Suburb of Guayaquil-Ecuador, assessing the impact of the spontaneous communities settled on the banks of the Salado Estuary, on the branch called Puerto Lisa. These slums had caused the destruction of flora and fauna and the water quality. Puerto Lisa’s longitude of almost 3 kilometers, holds 4,900 people and 967 home units. They started to build palaphites on the water without any infrastructure services since 1950.

The assessment of the World Bank on Ecocities suggest the use of natural resources as positive features to solve the diagnosed conflicts. One of the challenges is incorporate the potential of the seven Protected Forest and five Protected Areas of 64,677 Has of Guayaquil that are not connected with the urban structure. The reserves composed of Green Forests, Parks, Mangroves, Marshes, and mountains with an exceptional ecological potential need to be preserved. Proposing “Green Networks” (Tree Streets, public parks, and regional Parks) linked to the “Blue Network” (water branches), reinforcing the capacity of resilience for the whole city.

The Restoring of the Puerto Lisa branch would require the relocation of the families around. Planning an emergency plan of Recuperation of the Hydrological Water Cycle of this branch. Including Wetlands, water storage ponds, Mangrove revegetation and the implementation of Oysters project to accelerate the process of decontamination. The Design of Residential Units with Domestic Harvesting Rain water projects and Green Infrastructure, placed in streets with high level of transportation.
Regulatory and Policy Urban Planning Objectives Revisited According to Environmental Indicators: The Case of the Greater Montreal

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This conference is on the role and impact of environmental policies, urban planning and management of urban infrastructure on the reduction of the ecological footprint for the Greater Montreal. Considering that the ecological footprint is an indicator measuring the quantity of natural resources consumed relative to the resources available for a defined region, the problematic of the ecological footprint in Canada and in the Greater Montreal region is introduced. The objective is to review the governance having an impact on the ecological footprint, to evaluate current policies and planning in order to propose for changes for a sustainable future. The legislative power distributions between the federal and provincial entities are reviewed. The provincial power is also distributed at the metropolitan, regional and local levels. Montreal metropolitan region is composed of agglomerations (Montreal and Longueuil), cities (Laval and Mirabel) and regional county municipalities, for a total of 82 municipalities. The current policies and regulations in the cities part of the Greater Montreal region have an impact on the ecological footprint. A decision-making tool is established to evaluate the current policies in terms of their impact on the ecological footprint and current planning documents. Modifications are suggested to the current policies and regulations connected to the environment, urban planning and infrastructure management to make our demand on natural resources more sustainable.
Willingness to Use Non-motorized Transport Is Under-estimated

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Rampant motorization in the developing world has more recently been addressed through the development of mass rapid transport. Non-motorized modes of transport—principally walking and cycling—have been assumed to be supportive of collective forms of transport but rarely as standalone systems. Assumptions about the willingness to walk or the willingness to ride a bicycle are usually based on existing highly motorized environments. As a consequence, planning is missing out on an opportunity to re-introduce non-motorized systems with a much greater reach than were thought imaginable with competing motorized systems. In the following paper, we present several empirical studies from Shanghai, Beijing, Tianjin and Shenzhen, China, showing the real potential for such non-motorized systems, even as the motorized and public transport alternatives have continued to develop. As has been found in northern Europe, bicyclists in Shanghai consistently found their travel to be more comfortable than riding in public transport. Bicycle share declined when it was no longer possible to execute the bicycle trip or where such travel became uncomfortable. Commuting distance in Beijing by bicycle remains close to the mean distance of the commute for all commuters living in central Beijing, but varies considerably by district. Clearly, the local environment, rather than income or the availability of a car, is the key factor in such variable use of the bicycle. Dedicated walking environments can be much larger than previously imagined, as in the case of the central pedestrian streets of Tianjin. The Huaqiangbei area of Shenzhen is a large urban area where the numbers of pedestrians have continued to rise dramatically while the number of car users has remained stable. In each case, planning policies, or the absence of specific disincentives, have promoted non-motorized travel. These empirical studies of non-motorized travel, where alternative motorized modes are available, strongly suggest that such systems could be generalized across urban areas, even those of megacities. Expansion of these non-motorized systems makes sense from a public health perspective, but also offers great opportunities to reduce the increasingly burdensome investment in heavy transport infrastructure.
Building a Cycling-friendly Transportation System for Luhe District in Nanjing, China

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As the number of cars in China has gone up to 200,000,000 from 20,000,000 within only 17 years (2000-2017), environmental problems (like traffic jams or air pollution) and chronic diseases (like obesity) are common to see. Thus it is urgent to call for environmentally-friendly transportation. Fit, convenient and pollution-free, riding a bicycle has become a necessary way for low-carbon transportation. This paper aims to build a cycling-friendly transportation system by exploring how to select hierarchical cycling routes and how to design the cross sections of the cycling lanes at each level. Taking Luhe District of Nanjing as an example, this study first identifies slow space cores according to the planned land use map. Secondly the slow space cores are superposed onto the current road network to extract cycling nodes. Then the minimum path analysis to connect each node is made, and the cycling routes at different levels are selected——cycling highways, cycling corridors, cycling passways and leisure trails. Finally the sections of the cycling routes are designed by each type of the lanes corresponding to bicycle travel characteristics.
Challenges and Solutions for the Mass Deployment of Electric Vehicles

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Global environmental pollution is one of the catastrophic problems that resulted from industrialization and economic development of countries around the world. A leading cause to this problem is transportation, specifically gasoline vehicles. Utilization of renewable energy and electrification of transportation is a solution to this problem. Although electric transportation reduces emission gasses, there are challenges and barriers to mass deployment of electric vehicles (EVs). This paper provides analysis of the main challenges in substantial deployment of EVs, and presents some solutions to these challenges.

While it is highly recommended that owners of EVs charge at home, not everyone has the ability to charge at home. Some detached homes do not have garages, and these “Garage Orphans” must park on the street. Charging EVs at the curbside is problematic as extension cords introduce tripping hazards. Those who live in Multi Unit Residential Buildings (MURBs) have the challenge of trying to find adequate electrical capacity in their parkades where electrical infrastructure was never designed for the additional EV loads. This paper explores innovative solutions such as EV Energy Management Systems (EVEMS), and Fast Charge units for these challenges.

Charging networks exist today, but are often proprietary, and are not necessarily interoperable. EV drivers that use one vendor’s network may not be able to use another vendor’s network. They need to carry many RFID cards for various charging networks, this is inconvenient and complicated to remember how much credit is stored on the various cards in order to use charging stations that have. Roaming technology is promising to address this issue, as is Payment Card Industry (PCI) compliant payment systems for EV chargers.

For the electrical grid, utilities are looking for innovative ways to manage negative grid impacts. If large numbers of EVs are charging simultaneously, this peak load can create issues for the grid. Solutions that look promising to manage these peaks include Energy Management Systems that use the Open Automated Demand Response (OpenADR) protocol to communicate to EVEMS to manage charging during peak load events. Vehicle to Grid (V2G) is also discussed as an opportunity to manage peak loads.

Lastly, this paper discusses the importance of battery recycling for EVs. Lithium is an element that has significant environmental impact when mined, and up to 85% of the lithium in a lithium-ion battery can be recovered. Currently, however, there is no coordinated effort to see that the end-of-life batteries are recycled.
Human society is steadily becoming more urbanized. In 2018, the UN’s Department of Economic and Social Affairs found that 55% of the human population lived in an urban environment. They predicted that if the current population trends continue, 68% of humans will be living in cities by 2050. This means that the urban population will increase by 2.5 billion in three decades. As a result of cities as the major hubs of consumption, waste production will increase. Thus, there is an immediate need to make urban centers as renewable as possible. This research project analyzes cities waste production problems and proposes solutions to those challenges. The first problem is the unsustainable heating of buildings. Approximately 100 000 tonnes of greenhouse gas emissions are generated from heating buildings in the city of Vancouver. In 2010, Vancouver was able to apply sustainable district heating to the Southeast False Creek community using heat generated by the district’s sewer system. This reduced greenhouse gas emissions by 50% and provided 70% of the energy demanded by that community. If this small-scale project can be replicated throughout the city of Vancouver, the environmental benefits would be astounding. The next problem involves food waste generated by excessive consumerism. In 2017 the National Zero Waste Council of Metro Vancouver researched food waste produced by average households in Canada. Findings showed that in one year Canada wasted over $17 billion worth of edible food, while in Vancouver, 34% of all waste is edible food. Following positive European examples, our solution is to prohibit supermarkets from discarding unsold edible food by obliging them to donate it to a charity organization instead. The final problem we are tackling is non-recyclable solid waste. According to a Metro Vancouver Recycling and Solid Waste Management report, 37% of municipal solid waste ended up in landfills. Approximately 20% of the disposed waste is sent to the Waste-to-Energy (WOE) facility. WOE generates electricity and produces bottom ash as a by-product. Currently, bottom ash is sent to landfills. We are proposing a plan to use this by-product in various building materials such as a binder and cement substitute to effectively reduce waste production.
Making Cement from Demolished Concrete: A Potential Circular Economy Through Geopolymer Chemistry

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Concrete is the most used construction material on Earth, and unfortunately it cannot be truly recycled at the end of its service life. Demolished concrete is dumped, or more commonly, downcycled as crushed aggregate and fill because the hydration of the cement component is considered irreversible. If useful cement could be regenerated from waste concrete, a significant circular economy might develop and waste concrete could be reused to its highest potential.

Concrete is mostly made of aggregate (~70-85 wt.%) and any attempts to recycle concrete into cement must consider the chemistry of the aggregate (often aluminosilicate minerals). The remainder of material in concrete consists of hydrated Portland cement and other binding phases resulting from blending of gypsum and supplementary cementitious materials (such as fly ash) and other minor additives. Since the concrete bulk chemistry is dictated mostly by the aggregate, and aggregate is often composed of aluminosilicate minerals, we propose that a Si, Al, O covalently-bonded system (i.e. geopolymer) may provide the most direct pathway for recycling waste concrete to its highest potential, as cement.

To evaluate the feasibility of recycling demolished concrete, we converted a sample of local concrete waste into a K-Ca poly(sialate-multisiloxo) geopolymer cement and evaluated several key performance properties of this cement.

The bulk of the geopolymer cement reagent was produced from waste concrete, and 15 wt.% hardening reagent added to the cement paste. The cement paste mix design was not optimized under the scope of this study, and even so, the preliminary mix fulfilled several important criteria specified in ASTM C1157 for general use cement. One promising mix design had acceptable setting time (initial setting time of 51 minutes, final setting time of 195 minutes), and developed useable strength (compressive strength of ~25 MPa, and tensile strength of ~2 MPa after 3 days). The energy used to process waste concrete was quite high (estimated to be ~25 GJ/tonne) due to inefficiencies introduced by micro-scale production. At industrial scale, energy use is predicted to be of the same order of magnitude as Portland cement production (perhaps 5-13 GJ/tonne).

To summarize, we converted Portland cement concrete to an ambient-cured geopolymer cement for the first time – a process that requires compatible aggregate composition. Extensive work is needed to develop, evaluate and standardize this potentially promising technique before commercial application. Nonetheless, this is an important first step toward a circular economy for concrete.
A Hybrid Model for Sustainable Urban Metabolism in Metropolitan Communities

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The trending issue of climate change, along with its disturbing implications, has led to a rise in interest for a more sustainable way of life. Consequentially, this movement has also popularized the global development of ecocities. Intending to rebuild society using alternative ecological solutions, various governments and organizations have challenged themselves to produce a versatile yet applicable ecocity model. Others have tasked themselves in creating a metric system to evaluate and measure the effectiveness of said models correctly. Urban metabolism, or the flow of resources within a city, has become a common point of evaluation. This research project uses urban metabolism to assess how the world’s leading ecocities are reducing their waste output, thus, reinforcing the resilience of their circular metabolism. Due to their similarities in nature and design, case studies for the Sino-Singapore Tianjin Ecocity flagship cooperation project between the governments of Singapore and China, along with Dockside Green from Canada were used for this research project. Key performance indicators, planning principles and adherence to guidelines set by international green building certification programs were used to calculate the quantitative effectiveness of these ecocity models. Qualitative data, such as reviews from prominent sustainability researchers, were also included in the measurement process. By cross-referencing similar aspects of the design between the two cases, several plausible conclusions were drawn from the data set. The most crucial finding suggested that the effectiveness of both ecocity models were inhibited by the practicality and feasibility of their master plans; in particular, several of the quantitative goals for bending the urban metabolism were discovered to be ineffective, inefficient or unsuccessful. To mitigate the issues found in the aforementioned ecocity designs, this research project aims to introduce a hybrid model based on the success and pitfalls of the projects mentioned above, with the overarching objective of optimizing previous prototypes and proposing feasible solutions to precedent problems. It utilizes the quantitative indicators that were shown to be highly effective across both case studies but also takes account its viability by applying the feedback gathered using qualitative data. Furthermore, a general set of principles and guidelines have been introduced to maintain a broad scope of the project, thus keeping its overall feasibility. This hybrid model ultimately strives to serve as a flexible template for achieving circular urban metabolism.
Human-centered design thinking, which emphasizes user needs, abduction and rapid prototyping, is a promising avenue in the field of sustainability in a built environment. Employed by international organizations (IDEO.org, Dschool, MindLab, Hasso Plattner Institute, INDEX ...), design thinking has yielded promising results in terms of sustainability solutions. However, little is known about the impacts of the collaborative use of this approach with citizens and the intervention strategies that ensure its success. An analysis of the work of 25 international organizations who are experts in design thinking (websites exploration, interviews and questionnaires) and four experiments on design thinking (with university students and citizens) has identified the impacts of design thinking and effective intervention tools to use during the process. Helped by the facilitators, the solvers worked on adapting the University of Ottawa campus to the needs of international students, on solving a drinking water problem in Quebec, on adaptations to flooding in Morocco and on the decontamination of a sewage treatment pond in New Brunswick.

The researchers analyzed the advice given by international NGOs to succeed in design thinking. They analyzed the solutions proposed by the participants in the four experiences of design thinking, the skills they mobilized, and their impressions of the process and the use of some facilitating digital tools (ICT). Design thinking requires a large investment of time during the definition of the problem. Despite the time required, it promotes collaboration and the gradual appropriation of the problem by the resolvers. Understanding the user experience is associated with effective solutions. The synthesis of the problem ideally passes by the statement: How could one ...? Brainstorming and reorganizing ideas by theme is effective in stimulating the creativity of solutions. The rapid construction of prototypes with simple hardware provides a tangible but incomplete picture of new solutions. Employed at strategic moments in the process, the digital tools Facebook, RealTime Board, Tinkercad and Knowledge Forum can facilitate an extended co-construction of the problem; the proposal, choice and prototyping of solutions; and action planning. ICTs can, however, weigh down design thinking because resolvers must learn to master these tools. Design thinking has an added educational value since it mobilizes high level skills in resolvers: communication, creative problem solving, critical thinking and empathy.
AC.04C.02

Human-centered Design Strategies to Reinforce Achuar Communities Through Sustainable Solutions and Digital Education in the Heart of the Amazon, the Case Study of Kutsutkau

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Thousands of isolated indigenous people in the Amazon region of Ecuador live miles away from populated centers and restricted from the social, political participation, educational and health benefits provided. Due to low literacy rates and health issues, indigenous people face challenges such as high pressure on the ecosystem, lack of understanding of resources management, introduction of inequitable foreign economic dynamics that affects the value they have on their own culture and normally launch new categories such as “poverty” and upraised threats to their traditional way of living. Undoubtedly, the future survival and well-being of modern indigenous Amazonian communities and the rainforest resides in being connected to the resources available in their expanded communities while maintaining their traditional ways of living.

This study is centered in the significance of providing the Achuar communities with educational and communication resources tailored for their needs through an energy-autonomous, community-centered, education hub in order to strengthen their beliefs of respectful practices with the environment by developing education and sustainability. Through a social-innovation approach, literature reviews and ethnographic and quantitative research, the team measured an education and socioeconomic baseline to developed the pilot house analysis and implementation in Kusutkau -only accessible by lightweight airplanes or a 10-day walk through the jungle-, one of the communities of the Achuar tribe which comprised over 6,000 people. Pukuni Community House (PCH) project impacts directly to 84 people living in the village, and 700-800 in the surrounding area benefited by the improved communication and the culture-oriented application software. Once this model is replicated in the region, it will benefit around 6,000 members of the Achuar group, filling the communication gap and reinforcing communities to preserve their environment through their traditional and sustainable methods.

Although there is no predesigned formula to ensure the success of an initiative, it is extremely important that it is sustainable and human-centered, increasing the opportunities of the central actors. For PCH the task was clear: to provide tools that allow them to acquire knowledge and strengthen it by eliminating the lack of freedom, especially those that preclude the information access. In this sense, the Internet is presented as a very valuable mechanism. Regarding sustainable development, the search focuses on preventing environmental damage. Thus is crucial that, all the components of the project contribute to the conservation of ecological processes, the preservation of the diversity of genetics and promotion of the sustainable use of resources.
Collaborative Research to Build Ecocities: Water and Health Infrastructure Resilience and Learning (WHIRL)

Dr. Richard Smith¹, Dr. Shawn McElmurry¹, Dr. Matt Seeger¹, Dr. Kristin Taylor¹, Dr. Joanne Sobeck¹, Dr. Paul Kilgore¹, Dr. Nancy Love², Dr. Branko Kerkez², Dr. Jackie MacDonald Gibson³

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Two interdependent systems essential to socially just and ecologically sustainable cities are water and health systems. In many places, it is difficult to avoid and fix problems related to water quality when they happen. The United States National Science Foundation has funded the WHIRL project to assess threats to safe water quality and what happens when people’s access to clean water is disrupted. These disruptions may arise from climate change related events, aging infrastructure, or system failure. We believe that understanding these connections can improve water quality and health. Our presentation will provide an overview of the project.

The WHIRL project has been building relationships with water and health authorities as well as community stakeholders to identify problems that impact water quality, and show ways where drinking water and public health can work together. WHIRL has three goals:

1. Describe how drinking water utilities, public health departments and communities depend on each other and the kinds of challenges these groups experience.

2. Describe what we have learned from past water-related disruptions and how we can use this information to improve drinking water utility and public health department outcomes toward achieving safe water quality.

3. Develop a way to warn people about water quality issues and to quickly respond to these issues.

The WHIRL team is made up of scientists, researchers, and students who study engineering, communication, community behavior and public health from three research universities. We are working with the Water Research Foundation (WRF), National Association of County and City Health Officials (NACCHO), Great Lakes Water Authority (GLWA), City of Flint, Genesee County Health Department, City of Toledo, Wayne County Health Department, In-Situ Inc., and American Indian Mothers, Inc. (AIMI). The first year of the four year project will be spent building relationships and doing case studies of water and health systems in five communities. The second year will involve a national survey of water and health authorities. The third year will include follow up interviews with water and health authorities. By the fourth year, we strive to achieve the following outcomes:

• improve how information about drinking water quality and public health is used,

• improve communication around safe water quality between drinking water utilities and public health departments,

• inform people from all groups and backgrounds about drinking water and public health, and

• support community education around and involvement in decisions about safe water quality.
Rethinking the Territory, Concepción Chile. A Resilient and Strategic Planning for a Vulnerable Urban Coastal System

Ms Catalina Rey Hernandes\textsuperscript{1}, Dr Nico Tillie\textsuperscript{1}

\textsuperscript{1}Delft University Of Technology, , Netherlands

This research aims to re-envision the city, understanding it as a living system where change creates growth and renewal, and where uncertainty is our new normal.

The continuous struggle between cities and nature, forces human settlements to look for stability and safety, trying to control the dynamics and flows of underlying landscapes. In Chile, this tension is present in many urban settlements trying to deal with the natural dynamics.

Chile, as a territory, is exposed to multiple dynamic natural forces such as the Pacific. With a coast line of 6.435 km, that is defined by the collision of two tectonic plates in constant movement, this regularly triggers a series of natural disasters that affect cities in different ways and degrees in the country. Concepción has been affected severely during the last two decades. Concepción is a coastal urban area that has grown into the flood plain of two river mouths and an ecological important tidal coastal wetland landscape.

Although Concepción is built in a wet soil, city and water never meet; there is a dissociation where one is superimposed on the other. Furthermore, the whole system is increasingly at risk due to the urban pressure of the expanding city, resulting in degradation of ecosystems and natural infrastructure and with that exposing the coastal city to even more frequent and severe natural hazards.

The key opportunity to face the existing challenges does not lie in the primacy of one system upon the other. Both, city and landscape need to interact in a more redefined way, looking for multifunctional structures and a new awareness of the importance of the presently disrupted landscape. What is a new resilient urban landscape backbone?

The following research resulted in a void adaptive network based on design principles: 1. Value the natural system as the base infrastructure for the future city. 2. Use of voids (unplanned spaces) as an emergent, autonomous and self-organized network to create redundancy and multifunctional spaces for risk management. 3. Reformulate the city as a provider of nature: larger green spaces, landscape connectivity and protection of the ecological values of the existing nature.

Applying these steps lead to a resilient spatial framework for the city of Concepción that can provide more stability and safety against natural disasters. The designed backbone was consequently tested in a few natural disaster scenarios and adapted where necessary. This approach can be applied in other cities with similar challenges.
Nature-based Solutions for Sustainable Cities: An Urban Green Equity Perspective

Dr. Lorien Nesbitt¹, Dr Michael Meitner², Dr Cecil Konijnendijk³, Ms Cynthia Girling⁴, Dr Stephen Sheppard¹

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Urban forests are a key tool to provide nature-based solutions (NBS) to create more livable, sustainable cities. Given the importance of NBS to urban residents, it is important to evaluate 1) the distributional equity of urban forests that form part of NBS, and 2) the recognitional equity of processes to co-create and manage NBS at the local level.

This research examined the distributional equity of urban forests in 10 US cities. Urban forests were characterized three ways (mixed vegetation, woody vegetation, and public parks), to reflect the variable NBS associated with different types of urban vegetation. Data were analyzed using Spearman’s correlations and spatial autoregressive models. The research also examined the key dimensions of recognitional equity in co-creating NBS via an analysis and synthesis of relevant literature.

Strong positive associations were observed between urban forests, higher education and income across most cities, highlighting key areas of concern in the equitable distribution of NBS. Negative associations between racialized status and urban forests were observed but were weaker and less common. Park area was more equitably distributed than mixed and woody vegetation, although inequities existed across all cities and vegetation types. Four dimensions of recognitional equity emerged from the analysis that can inform how NBS are designed, planned and operationalized at the local level.

Cities are spaces in which the world’s populations meet and co-create urban forests and NBS. This reality provides opportunities for mutual learning and improved resilience but can also lead to inequity in our access to and governance of NBS. Our findings can stimulate strategies to foster equitable planning and implementation of truly equitable, community-created NBS.
Designing and Testing a Plant Palette for Biodiverse Streetscapes

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The City of Melbourne’s Nature in the City Strategy aims to increase biodiversity and habitats within the municipality and make them more ecologically connected. Key to this is a target of increasing understorey plants on land managed by the City by 20% by 2027. There is strong evidence that increasing the volume of understorey vegetation in urban landscapes and the percentage of it that is native has positive effects on a range of fauna. However, moving away from ubiquitous trees and mown grass to more complex understorey vegetation is challenging, particularly along streets which are the most common public landscapes. Complex streetscape vegetation is currently almost completely absent and is difficult to establish due to harsh conditions, multiple infrastructure constraints and the horticultural limitations of many native plant species.

We have developed a web-based streetscape understorey planting guide designed explicitly to support local biodiversity and acknowledge the constraints of the urban environment. Further, we are testing its effectiveness using a Before-After-Control-Impact (BACI) experimental approach and regular plant health assessments at four streetscapes planted in 2018. More than 80 plant species, predominantly native, were selected based on horticultural attributes, tolerances and availability, and the biodiversity resources they provide. Priority fauna species included native bees, butterflies and birds so plants were selected to provide resources such as flowers yielding high amounts of nectar and pollen, larval food sources for local butterflies, seed and fruit for birds and nesting locations for uncommon birds (i.e. spiky shrubs) and solitary native bees (i.e. hollow plant stems). “Before” biodiversity surveys conducted at all sites twice in 2017 revealed relatively low levels of existing biodiversity including 8 native bees, 5 butterfly and 27 bird species, probably due to very few flowers being present. This presentation will report on the results of the project two years after planting, lessons learnt and ways forward for other cities wishing to increase biodiversity in the urban matrix.
Using Transferable Development Rights for Climate Action

Mr. Rick Pruetz

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Over 320 cities around the world use a market-based regulation called transferable development rights, or TDR, primarily to preserve environmental resources, farmland and historic landmarks. However, TDR can also mitigate greenhouse gas emissions by curbing sprawl, reducing vehicular travel, and promoting the development of diverse, mixed use centers where residents can easily reach employment, schools, shopping and other daily destinations on foot, by bicycle or using public transportation. TDR can also help cities adapt to climate change by reducing or eliminating development potential in areas vulnerable to wildfire, sea level rise, flooding and other growing hazards.

Most TDR programs already implement climate action even though the adopting legislation may not explicitly state climate action as a goal. Farmland preservation programs help create permanent greenbelts capable of sequestering carbon, securing local food supplies and promoting compact communities that reduce auto dependency. Similarly, TDR programs originally adopted to preserve woodland habitat, river corridors and other greenspace are also keeping development out of dangerous wildland urban interfaces, storm surge zones and ever-expanding floodplains.

This paper will report on the results of a new survey of all 320 cities using TDR. It will explore the extent to which these cities recognize the role of TDR for climate action and update my ongoing research on which TDR programs are succeeding (or not succeeding) and how best practices can be achieved. Examples will include Montgomery County, Maryland, where a 72,000-acre agricultural reserve permanently protects farms and habitat while concentrating development within a compact growth corridor. Similarly, this paper will highlight the TDR program in King County, which has preserved over 140,000 acres of greenspace to date partly though interjurisdictional transfers into Seattle.

TDR is one of many climate action tools. Some cities rely entirely on land use regulations for implementation; however, the tendency to haphazardly rezone land explains why most US cities are surrounded by sprawl and why a million acres of US farmland are converted to development every year. Many cities realize the superiority of permanent preservation but prefer more traditional techniques that primarily rely on taxation. But competition for limited tax dollars is already fierce and certain to grow in the future as communities recover from increasingly disastrous fires, floods and coastal storms. Instead of relying on tax dollars, TDR uses private sector profit to fund climate action. The survey will help public officials decide whether TDR should be part of their implementation strategy.
Repurposing the City: Small Town Regeneration in Kinston, North Carolina

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Just as manufacturing and traditional industries have abandoned large cities due to globalization, they have also vacated rural areas. Because of their size and remoteness, small towns rely on few industries, leaving them more vulnerable to industry exodus that can result in social and economic collapse. Further, traditional industries in rural areas are commonly dependent on resource extraction that are subject to depletion. For these reasons, regeneration of rural small towns is an area of growing research. Numerous small towns are retooling to attract new industries, particularly tourism and entertainment, with the goal of creating more livable and healthy cities. This study asks, can an entire city be repurposed to capitalize on new economies?

In this case study, regenerative efforts in Kinston, NC are analyzed in the context of the remaking of a small town through new socio-economic pathways. Starting in the late twentieth century, Kinston’s economy began a downward spiral when the two main industries, textiles and tobacco, abandoned the region. Mired in poverty for decades, the town struggled to find a new direction until the efforts of a group of young, energetic entrepreneurs began a regenerative effort. Important to this effort, is a place-based remaking of the city that highlights arts, entertainment, and embedded cultural assets found in Kinston as a mechanism for regeneration. This study aims to position this research within the ongoing research into small town regeneration. This case details the results of interviews with key constituents in this effort as well as a review of news and other media publications. While this process is still unfolding, some conclusions about this effort can be drawn. They include; grassroots efforts by several local champions show success as a catalyst in small town regeneration; exploitation of local cultural assets are a strong way to create places that promote tourism and entertainment related industries that increase livability; and the arts and entertainment can provide avenues for renewal of these forgotten places.
Interactions Between Livability, Spatial Equity and Climate Mitigation in Future Neighbourhoods

Ms Cynthia Girling, Mr. Yuhao Lu

University Of British Columbia, Vancouver, Canada

Where and how are community planning goals of livability, spatial equity and climate mitigation complimentary? Where and how are they in tension? How can planners, stakeholders and elected officials assess whether potential policy alternatives are synergistic, neutralizing or at odds? To answer these and related questions, community planners need knowledge and tools to simulate, rehearse and test policy alternatives incrementally and iteratively.

In this presentation we will share an innovative methodology and new outcomes-oriented knowledge developed to inform both long range and day-to-day planning related to urban livability, spatial equity and climate mitigation. Looking at two demographically and physically distinct cities in British Columbia, Canada (Prince George and Vancouver), we developed a series of iterative ‘what-if’ experiments in decadal increments from 2020 to 2050 for future changes to urban form using archetypal urban patterns found in communities across BC. We modeled all of the experiments against key indicators of energy and emissions reductions and livability, including equity of access to diverse housing types, active mobility, shops, services and green spaces. Evocatively visualized measured results clearly show how and to what extent various urban form changes will produce co-benefits of livability and climate mitigation and where conflicts occur. It will also demonstrate how policy actions and urban form strategies must differ in communities of different sizes and geographies to achieve relevant beneficial outcomes.

Outcomes of this presentation:
1. Understand better how and to what extent various urban form changes, such as mixed use areas, compact form, diverse forms of housing, and active transportation infrastructure, may produce co-benefits of livability, spatial equity and climate mitigation and where conflicts occur.
2. Understand better how policy actions and urban form strategies will differ in communities of different sizes and geographies to achieve goals and co-benefits.
3. Discuss with other conference participants how the findings may apply to different communities and what strategies will return co-benefits for livability and climate mitigation.

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AC.05C.01

Analysis of Creative Industry Policy in Hong Kong for Sustainable Development

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In the post-industrial era, the cultural and creative industries have become the key development agenda in many cities. Many governments have regarded the creative industries as a powerful tool to boost revenue. Recently, scholars have an increasing interest in the policies concerning the operation and execution of the creative industries. The setup of creative clusters is a common strategy to support the development of creative industries. These creative clusters are highly related to economic development as well as urban policies and planning. The author attempts to argue that a healthy cluster is not simply an agglomeration of creative practitioners. It should balance the essential elements (i.e., cluster, creativity and community) to support the wellbeing of practitioners so that the creative clusters can grow in a sustainable way. In Hong Kong, the government has identified the creative industries as one of the region’s six key industries because of its revenue-generating potential. With an aim to transform Hong Kong into a creative city, the government has established the Design Incubation Programme (DIP) to assist creative practitioners. A creative cluster has been formed under this programme with the full support of the government. This paper examines the significance of creative policies on the sustainability of creative clusters by examining the DIP programme using the 3Cs model of sustainable cultural and creative clusters (Tsang & Siu, 2016). The research data was drawn from direct observation and semi-structured interviews with creative practitioners. The study endeavours to illustrate the impact on urban policies and planning by the creative clusters in the densely-populated cities. It also argues that the business-oriented approach that programme managers have applied hampers the programme’s potential to assist creative practitioners and develop a sustainable creative cluster.
Ecofiction and Prose: The Presentation Will Engage the Community with Examples Showing How the Written Word, Particularly in Ecologically Oriented Fiction and Prose, Can Have a Positive Impact on Culture, Building Healthy Micro- and Macro-Communities Dealing with Change and Loss in the Planet’s Rapidly Shifting Natural Landscapes and Climates.

Mrs Mary Woodbury¹

¹BCIT, Burnaby, Canada

The presentation explores how ecologically oriented fiction and prose can have a positive impact on culture, building healthy micro- and macro-communities dealing with change and loss in the planet’s rapidly shifting natural landscapes and climates.

The presentation is offered by Mary Woodbury, curator at Dragonfly.eco, who has explored the growing field of ecofiction for over six years. Ecologically oriented fiction covers such topics as climate change and sustainability. The importance of this fiction is that it provides social documentation of the harsh ecological changes of our times, helps readers cope with the devastating realities of planetary change, provides cautionary tales with ordinary heroes who inspire change, and gives hope to those who feel powerless in the face of incredible species and landscape loss.

The presenter will use visual aids and handouts to discuss the following: historical and modern trends in environmental fiction: preaching vs. storytelling, major contemporary authors, the concept of local and world literature, and the diversity of styles used in ecological storytelling.

A further exploration into the diversity of novels and prose will break down genres, styles, topics, and place-writing. The presenter will look at how each of these categories can impact culture and society. For example, a heartwarming story might evoke empathy, whereas a cautionary tale might result in fear. Writing about one’s place might engage the local community but also might draw interest from readers far away. Writing in various genre fictions might interest those who already like to read works from those particular fields of literature, but literary fiction is starting to blur with genre fiction and opens a new type of reality within fiction.

The presenter will read short excerpts from a handful of major eco-novels and prose and, after each, will briefly discuss that work and what type of reader reaction it got. The audience may then participate by considering how they have reacted to similar works--how a story has changed them in small or large ways--and how stories of all kinds have had an even larger societal impact, such as with Upton Sinclair’s “The Jungle” or Harper Lee’s “To Kill a Mockingbird”.

Toward the end of the presentation, the presenter will provide further reference to the following: studies of environmental fiction’s impact on society, a list of major works and authors in the field, and further online references. The presentation will close with a brief Q&A.
The Roles of Affect, Education, and Nature in Motivating Actions on Sustainability

Ms Andrea Byfuglien¹, Dr Tara Moreau², Mr Oliver Lane³, Dr Jiaying Zhao¹

¹University Of British Columbia, Canada, ²University of British Columbia Botanical Garden, Canada, ³Society Promoting Environmental Conservation, Canada

Generating behavior change for transformation toward sustainability is a significant challenge of our time. The United Nations launched Agenda 2030 in 2015, comprising 17 global Sustainable Development Goals (SDGs) as a network of targets for achieving sustainable development. In order to reach these goals, behavior change at a large scale is not only necessary but crucial. A key question is how to promote pro-environmental behavior. Multiple factors have been found to influence pro-environmental behavior, including affect, environmental concerns, and environmental knowledge. To date, the relationship between these factors is still unclear. In this project, we have conducted an experiment in the Botanical Garden at the University of British Columbia, along with Society Promoting Environmental Conservation, to determine how a sustainability education program and nature influence pro-environmental behavior. Moreover, we aim to determine the role of affect in mediating this relationship. A particular aspect of affect which we are examining is arousal, the state of being physiologically alert and attentive. In the experiment, participants were randomly assigned to spend time in the garden (nature condition), go on a tree-top canopy walk (nature+arousal condition), go on a tree-top canopy walk and receive sustainability education (nature+arousal+education condition), or a control condition where they did neither. In the education condition, participants received verbal and interactive education from instructors on the SDGs. We measured participant’s arousal level as well as positive and negative affect at the end of the experiment. In addition, we also measured pro-environmental behavior, which included the likelihood of signing petitions for environmental causes, signing up to receive newsletters from the botanical garden, signing up to receive volunteering opportunities for the botanical garden, or donating to the botanical garden. Our preliminary results suggest that participants in the education condition were the more likely to engage in pro-environmental behavior than those in the other conditions. This raises a potential that the education program can be an effective tool to mobilize public engagement on sustainability. We are currently examining how arousal mediates the relationship between education and behavior. As such, the current study can bridge the gap between environmental knowledge and pro-environmental behavior by examining whether the affective response of arousal impacts educational interventions. The results of this research can help inform the value of education and nature in a botanical garden in encouraging pro-environmental behavior, in order to understand how behavior change tools can be designed to foster action to achieve the SDGs.
Are All Greens the Same? Investigating the Effect of Urban Park Quality on Visitors’ Mental Well-being Outcomes

Ms Jessica Felappi\textsuperscript{1}, Mr Jan Sommer\textsuperscript{1}, Ms Wiltrud Terlau\textsuperscript{3}, Mr Theo Koetter\textsuperscript{2}

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Cities worldwide have been seeking new alternatives for building and transforming urban areas in order to provide healthier and more resilient environments for their inhabitants. The integration of green infrastructure into urban planning has gained momentum as a threefold strategy as it provides benefits to human health and well-being, preserves biodiversity, and improves environmental health. Urban parks, when well designed and managed, may act as restorative environments, which allow people to recover cognitive capacities and relax, while providing habitat for local flora and fauna. However, it is important to investigate what attributes present in these spaces may maximize or prevent mental restoration of visitors in order to develop objective recommendations to green space design and management.

This study will identify how mental restoration reported by park visitors may be influenced by objective indicators of urban park quality. The Global South is especially underrepresented in such studies. Therefore the megacity of São Paulo, Brazil, was selected as study area due to the variety in parks’ design and quality, high prevalence of mental disorders, and geographic location that overlaps a biodiversity hotspot (Atlantic Forest). In total, 18 parks and 500 parks visitors will be sampled. First, the perceived restorativeness and restoration outcomes reported by users will be correlated with subjective perceptions of the settings. Subsequently, the relevant perceptions will be correlated with objective indicators of park’s qualities. In this presentation, preliminary results of the field work conducted in the first semester of 2019 will be presented.
AC.05D.02

Residential-scale Ecological Design Initiatives Can Improve on City-scale Sustainability, Resilience, and Infrastructure Demands - Accessing Grassroots and Professional Landscaping Standards

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Cities are suffering from environmental degradation and social inequity due to drought, earthquakes, climate change, fire, flood, and acts of terrorism. Government, business, and the general public seek relief by creating programs to move towards sustainability and resiliency. These frameworks, and the theories that underpin them, are inherently complex – sometimes creating an overwhelming amount of information and mixed messages. Further, citizens may feel powerless to ‘make a difference in the world’, with the resulting confusion and apathy creating a negative feedback loop; bad becomes worse.

There are several formal and informal approaches in urban design that can aid the public that inhabit residential buildings to create more sustainable communities - and by extension, cities. Professional programs, quasi-government policies, and grassroots organizations exist that specialize in backyard conservation, naturalization, biodiversity habitat restoration, and sustainable landscape management.

Recently, a professionally vetted international standard in certifying sustainable landscapes, SITES v2, has been introduced to the green building industry. The SITES website states that it “...is a sustainability-focused framework that ushers landscape architects, engineers and others toward practices that protect ecosystems and enhance the mosaic of benefits they continuously provide our communities, such as climate regulation, carbon storage and flood mitigation”. SITES v2, at its simplest, can be used as a checklist to enhance residential ecological stewardship.

Grassroots programs are administered and endorsed by non-profits to encourage homeowners to create naturalized yards: to attract beneficial insects, pollinators, birds, butterflies, and wildlife in general. The main theme is to increase ecological diversity in the urban environment. Food, water, shelter, and space become the cornerstones for an eco-landscaping list that strives to balance environmental function and aesthetic form.

LEED, and other well-known environmental certifications, also complement professional and grassroots approaches to ecological landscaping. All of these programs allow a common pragmatic language of sustainability to be shared with environmental professionals (designers, planners, policy makers), academic researchers, and urban citizens. If urban leaders strategically incorporate eco-centric design programs, then the city will move towards greater resiliency, sustainability, and regeneration.

The learning outcome for this conference presentation is to show that private land holdings, specifically residential lots, are key bio-physical spaces that are opportunities to become part of an ecologically enhanced community. Residential property users and city administrators can work together to use pragmatic urban design education, tools, and techniques that will improve the overall livability of cities.
Building Cities as Gardens: Green Teams For Green Growth

**Dr. Tara Moreau**¹, Mr Oliver Lane², Ms Andrea Byfuglien³, Dr Jiaying Zhao⁴

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The way we build our homes – our cities, towns and villages can and should serve both local and global goals. Like a garden, cities are designed, sown, nourished, harvested and turned under. Cities also undergo a constant state of change where people and wildlife can flourish or fizzle under human and natural influences. Growing socially just and ecologically sustainable cities is the work of our lifetime and essential for future lifelines.

Globally, there are over 3500 botanical gardens rooted in communities around the world. As stewards of plant conservation, botanical gardens unite as allies to connect people and plants through conservation, education, public outreach, display and research. Increasingly, gardens are engaging the public in critical conversations of climate change, biodiversity loss, plant extinctions, and the role of cities as sites for green growth and green economies.

At UBC Botanical Garden in Vancouver, Canada a new program is taking root. The Sustainable Communities Field School is a community-based research and education initiative designed to engage businesses and organizations in social justice and ecological sustainability through team building tours. With curriculum grounded in local and global policies (i.e. Greenest City Action Plan and the UN Sustainable Development Goals) groups are guided through different garden landscapes and treetop adventures. Time outside the office and away from busy workplaces supports participants to engage in critical conversations of sustainable food choices, biodiversity loss, waste reduction, water conservation, and more. With tour content co-created with Canada’s oldest environmental non-profit SPEC (Society Promoting Environmental Conservation) and research collaborations focused on sustainable behaviour change, the Field School team is planting seeds of sustainability to inspire individuals and groups to consider that businesses can be grown to serve local and global goals just as cities and gardens do.
Elements of Community Capacity Building in Post-earthquake Reconstruction of Nepal

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The devastating earthquake of April 25 of 2015 and its aftershocks caused widespread destruction of physical infrastructures including houses, school buildings, health clinics, temples and heritage structures in hilly regions of central Nepal. It was soon realized that massive scale capacity building of affected communities is a prerequisite for any meaningful recovery from the impacts. The disaster impacts were unprecedented and scale of need for the recovery was not experienced in the recent past. On the other side, the opportunities the disaster created to build better for future would only be materialized when essential components of sustainable development are well integrated in the reconstruction process. The institutional arrangements, development of technical and human resource, capacity building and awareness raising of communities around safe and affordable housing are major preconditions for building back better.

The reconstruction of more than seven hundred thousand houses, more than seven thousand school building and other thousands of rural clinics, government buildings and heritage required a massive scale training of engineers, technologists, masons and social mobilizers. The process of establishing institutional entities, development of reconstruction standards and guidelines and checklist requires a thorough process of consultations and a meaningful community engagement. At the same time, there was also huge scale and the urgency of the reconstruction process where several hundred thousand of houses belonging to individuals in villages need to be constructed within a short time with direct involvement of state. This often demands a trade-off. The entire reconstruction process also created an unprecedented interface between technology and society in the field. While engineers who work in villages become the vehicle of the techno-legal regime established by the state through building codes and construction compliance guidelines, communities never subjected to such regulation and technological prescriptions in the past have a hard time integrating them into their life styles.

This paper looks into the aspects of capacity building in the reconstruction process and examines the factors that had significant influences. Factors accounted are socio-cultural context of the country, availability and distribution of resources, pre-disaster status of techno-legal regime and subsequent transition for reconstruction. The interface between technology and culture in the framework of safe housing is analysed in relationship dynamics between the communities and technical experts as well as between state’s legal regime and realities in the field.
Over 1 billion people currently live in slums in the world and the number of slum dwellers are expected to grow in the coming decades. Majority of these slums are located in less developed countries, which experience greater rates of urbanization. The number of slum dwellers in developing countries increased from 689 million in 1990 to 880 million in 2016, according to the United Nations World Cities Report 2016.

India is one of the fastest developing countries with many metropolitan cities. In 2001, the slum population was 52 million which increased to 65 million in 2011 as per census of India. The existence of slums contributes to the degradation of urban environmental quality and sustainable development in the metropolitan cities.

Slums are characterized by unhealthy and unhygienic conditions leading to sub-human conditions. At the same time, slum dwellers can be economically valuable citizens, as they contribute to the city’s overall growth by accepting low wages and rendering essential services to the urban community. We need to have a better understanding of slums and look forward for the growth and development of the slum dwellers. This leads to a need to upgrade the living conditions of the slum dwellers which subsequently leads to improvement in their quality of life.

There are lot of initiatives taken by the government of India to make cities smart. Smart city projects are an outcome of such initiatives. As slums are an integral part of a city, there is need to envision how to make the slums also smart. The research paper focus on the study and understanding of slums and contribute in developing them for a better tomorrow.

Chennai, Capital of Tamil Nadu which is the fourth largest metropolitan city in India is identified as the study area to conduct the research. A systematic study about the slums in different categories (i.e. In situ, Rehabilitated & Redeveloped) in the study area is carried out to understand the pressing issues in physical, social and economic conditions in the study area. Novel ideas to bring about development in in these slums for the betterment of its inhabitants are also included in the study.

The outcome of the research will be to give policies and proposals in upgrading the living conditions of slum dwellers to bring positive changes in their quality of life and make the slums smarter.
The environment encompassing climate has been undergoing changes in the last few decades and ecosystems are either adapting to or mitigating adverse effects of the change or doing both for sustainability. Also happening, is a rapidly growing population in Africa, which is putting pressure on inadequate infrastructure and facilities of cities and towns, especially in the housing, transport and energy sectors. Nigeria’s increasing population needs to be matched with sustainable development. Many communities in recent times have experienced flooding and ocean surge, resulting in loss of lives, food, roads, livelihoods and properties. Strengthening resilience to climate-related hazards is an urgent target of Goal 13 of the United Nations sustainable development goals. That a link between urbanization and carbon emissions has been well established suggests that economic development grows alongside with urbanization. Whereby economic development is lacking, then urban growth becomes unsustainable. This study becomes apt as it is necessary to identify factors driving ongoing urban growth while exploring the climate change and sustainable development linkage to argue the implications of increasing urbanization and the need to build resilience. The study specifically investigates the adaptive capacity of urban residents in response to identified disasters, determines the factors influencing flood risk perception among the residents; ascertain the disaster response decision making process and identify the critical actors along the pathway as well as identifying opportunities for risk managing firms. The study adopts a framework that encompasses conceptual views of vulnerability, disaster risk, disaster risk reduction, and capacity building for disaster management and adaptive strategies. The study uses publicly available secondary data in addition to primary data collected from urban dwellers. Econometric tools such as the principal component analysis (PCA) and path analysis are used in data analysis. PCA is used to identify the major variables relevant to run further analysis on the determinants of flood risk perception and adoption of risk reduction strategies while path analysis is used to decompose the impact of climate-related disasters into direct and indirect effects. This study reveals indigenous knowledge of the causes, effects, vulnerability, and mitigation responses to disasters among urban residents that informs appropriate behavioural adjustment, risk communication, and adequate intervention strategies. The paper also identifies pathways to the sustainability of this urban growth and concludes that rural development and strong political will to implement existing urban development policies amongst others are needed to sustain growing urbanization.
AC.06C.01

Rapid Assessment of City Policies for Sustainability and Health

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Background

There is an urgent need to significantly reduce greenhouse gas (GHG) emissions in cities in order to meet climate change mitigation goals. Emission reduction can provide co-benefits for urban environmental quality, sustainability, population health and health equity. However, there is little empirical data on the potential impact of different policies to support evidence-based decision-making. The Cities Rapid Assessment Framework for Transformation (CRAFT) is a scoping tool intended to provide quick estimates of the health and environmental implications of policies in cities.

Methods

The CRAFT framework has been developed for both London, UK, and Rennes, France; here, we describe its application to London. Spreadsheet-based, it uses relatively simple but transparent methods to quantify the reductions in GHG emissions, exposures to environmental hazards and improvements to public health. Changes in emissions, exposures, and health are estimated using a proportional reduction method. For example, changes in emissions are estimated by multiplying total sectoral emissions by the fraction of the sector that the policy addresses, followed by the relative reduction in emissions per intervention. Changes to environmental exposures include ambient air pollution, housing-related risks, and transport-related exposures. Finally, standard epidemiological methods are used to estimate mortality due to current exposures and policy-related proportional exposure reductions.

Results

Here we describe results for London’s Transport Strategy, including:

1. London’s entire transport system to be zero emission by 2050
2. 80% trips made on foot, by cycle or by public transport (from 60% today) by 2041
We estimate that a zero emission transport system would reduce GHG emissions by 25.4%, and reduce ambient PM2.5 7.5%. This would lead to a total of 225 annual premature deaths averted due to ambient PM2.5 exposure. Increasing the trips made by foot, bicycle, or public transit by 20% reduced GHG emissions by a comparably modest 0.2%, while ambient PM2.5 was reduced by 4.4%. A total of 454 annual premature deaths would be avoided due to both reduced PM2.5 exposure as well as increased physical activity.

Conclusions

The model is rapidly able to provide indicative estimates of the impact of various policies on city emissions, exposures to a selection of environmental hazards, and population health. While not detailed here, the model also evaluates the impacts of the London Environment Strategy and Housing Strategy. Further work will extend the model to cities in China (Beijing and Ningbo) and Kenya (Nairobi and Kisumu).
Lessons Learned from BC’s Climate Innovators

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Since the aspirational goal of COP21 to limit global temperature increase to well below 2 degrees Celsius, it is clear that cumulative Nationally Determined Contributions (NDCs) fall short of achieving this goal. Local governments have a key role to play in implementing climate innovations as they have jurisdiction over a significant portion of GHG emissions. Meeting the Climate Change Challenge (MC3) is the first longitudinal study exploring climate innovation in Canadian municipalities. A tri-university research collaborative, it focuses on British Columbia, whose voluntary efforts to set and meet climate change goals were far more ambitious than those offered by the federal government (and almost any other province in North America at the time), that included introducing a carbon tax and the Climate Action Charter voluntary agreement in 2007. Since then, 187 of the 190 local governments in BC have signed the Charter to take action on climate change. Research in the first phase explored the dynamics of innovative local responses to the coordinated suite of government legislation, complimentary policy instruments, financial incentives and partnerships with quasi-institutional partners. In the second phase, the 11 original case studies were revisited to explore the nature of transformative change in development paths and indicators of change. Methods include sentiment analysis, decomposition analysis of regional/local emissions, and modeling relationships between climate action co-benefits and trade-offs. This paper provides a synthesis of research outcomes and their implications for environmental governance at multiple scales and the potential of policy innovations to accelerate transformation to a carbon neutral economy.
Do Local Governments Really Embrace Change? A Sentiment Analysis

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Drawing from interviews conducted with local government officials in British Columbia, this research performed a non-computational sentiment analysis of the word ‘change’ on the subject of climate change impacts, local climate innovation and development path change. The aim of the study was to address the lack of agreement among policy makers and climate researchers over the meaning of change, and further enrich the understanding of the stance of local governments vis-à-vis change and the changes in development paths.

As part of the Meeting the Climate Change Challenge research project (mc-3.ca), 11 case study communities exhibiting leadership on climate action were selected, namely: the cities of Victoria, Vancouver, Prince George, Dawson Creek, North Vancouver, Campbell River, Revelstoke, and Surrey, together with T’Sou-ke First Nation, West Vancouver district municipality, and the Kootenay Regional Districts. Expressions with an attitude regarding the target object ‘change’ were assorted in 12 major topics: (1) changes in natural environment, (2) integration of the climate change agenda and intra-organizational collaboration, (3) changes in leadership and staff champions, (4) changes in strategic planning, (5) measures implemented - including (6) mitigation measures, (7) changes linked to residential development, and (8) adaptation measures - , (9) perception of climate change in the local government, (10) perception of climate change among community members, (11) avoiding climate change related terms while focusing on co-benefits, and (12) behavioral change towards climate change.

Only two communities - Campbell River and Dawson Creek - presented a higher number of negative sentiments than positives. Outcomes on the number of positive sentiments concerning change in 10 out of the 12 topics were superior to their opposed attitude, almost doubling them. Facing the impacts of climate change, most interviewees related the observed and projected changes in nature with negative sentiments. Horizontal integration and staff quality were linked to the most positive sentiments, whereas barriers to behavioral change and the limited pace and scale of change – by focusing on small achievements (low-hanging fruit) and measures driven by co-benefits - were associated with negative sentiments. Subsequently, the causes and effects that these sentiments implicate were discussed. The present analysis contributes to the understanding of several drivers and barriers to change at the local government level. We argue that targeting ‘hotspots’ where negative changes are taking place and drawing upon experiences in areas where positive changes were expressed would be fruitful for future studies and policy makers.
Informal Solutions Towards Personal Net Zero

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For years there has been a disconnect between the concern we feel about climate disruption and other environmental issues, and our unwillingness to act, leading to societal guilt and angst. We propose informal solutions aimed at helping to overcome that disconnect and reducing the level of angst. This paper presents a high-level analysis of what it could take for an individual to achieve ‘Personal Net Zero’ defined as meeting three objectives: zero use of grid electricity; zero use of fossil fuels, and zero waste directed to a landfill. It is a systematic attempt to answer the question ‘what can a motivated individual do?’ We investigate this question by identifying mature technologies in the form of solar energy, electrified transportation, and recycling and composting systems to fulfill the three objectives. For each potential solution, we identify structural barriers, financial barriers, and societal barriers, if any.

As an alternative to grid power, we investigate the capabilities of solar power technology and compare this to the average electricity consumption to define feasibility of replacing grid power with solar power on a personal basis. We similarly assess the consumption of fossil fuels compared with the use of electric vehicles for transportation, and with geoxchange for heating and cooling.

For landfill waste elimination, we investigate three categories of materials in the individual waste stream; compostable materials, generally accepted recyclables, and those materials that are not either of these categories. For each of these categories, we examine the effectiveness of structured recycling programs in order to identify gaps in perceived versus actual outcomes. For cases thus identified, we propose actionable steps that could be taken by a motivated individual to either eliminate their own use of problematic materials, or to work towards effecting changes in the supply chain.

Solar energy can replace grid electricity within the financial capacity of the motivated individual. Personal fossil fuel consumption can be generally eliminated for local and regional transportation, and for heating and cooling requirements. Elimination of fossil fuels for international travel is problematic but a ‘net zero’ basis can be achieved through offset schemes. Issues remain related to eliminating waste, principally in disconnects in the structured recycling systems where what is assumed to be recyclable actually ends up in landfills.
The United States and Canada both have rapidly increasing populations and their energy use is expected to increase along with this growth. Although each country could work separately to meet their respective energy needs and thereby claim energy independence, there are substantial advantages to integrating their energy systems to allow for coordinated operation as is done in many cases already. This will become increasingly important as cities implement requirements for variable renewable energy installations as part of updated building codes.

We use the OSeMOSYS Open Source Energy Modelling System to evaluate the impact that energy independence policies may have on the current integrated energy system and how these policies may reduce the ability for variable renewable energy to contribute. The British Columbia electricity system is incorporated into an existing energy model of the United States to evaluate the impact of the British Columbian governments’ energy independence policies. The model is first run with British Columbia’s electricity system isolated from the United States, then again with the current transmission capacity and finally with a doubling of that capacity. The system advantages are then evaluated to determine the impacts of energy independence on system operation, cost, and CO2 emissions.

California’s large installed solar generation capacity produces significant over-generation during sunny periods but lower renewable generation during nighttime and cloudy periods. We find that British Columbia’s flexible hydro resources allows BC to provide arbitrage for this intermittency with increased transmission capacity. Energy independence policies that eliminate this electricity trade increase system costs and CO2 emissions.

These results demonstrate the benefits of regional integration of energy resources in order to maximize utilization of variable renewable energy resources. California’s recently announced mandate requiring solar panels on all new homes will create an additional influx of intermittent energy into the system. Rather than restricting trade with energy independence policies, encouraging and enabling British Columbia’s trade with California has the potential to reduce the impact of this intermittency, benefiting the system and consumers in both locations. Though the benefits have been investigated, there is significant uncertainty in the cost of transmission between California and British Columbia and further work is needed to quantify this cost. Moreover, although the current study focuses on the benefits to California and British Columbia, the benefits to other parts of the system also need to be evaluated.
Informality in the Production of Open Green Space in Kampung-kota, Indonesia

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Kampung-kota as an inseparable part of Indonesian urban landscape dominates much of the cities built-environment, where it provided the much-needed housing for the low-income community that the government and private sector could not fulfilled. Pressure due to rapid urbanisation and growing income inequalities, coupled with limited urban space to grow has pushed kampung-kota into higher densities, which often sacrifice the existing open/green space that resulted in the reduction of communal public space in the settlement. Join community effort to improve the living quality in kampung-kota is conducted in numerous areas, where the provision of open green space has been the forefront in their agenda as a mean to create a liveable living quarter for it’s urban dwellers. The initiative is done through informal decision-making process and active role of each stakeholder, where small communities in kampung-kota have succeeded in reclaiming, providing and managing greenery for their community within the boundaries of their living quarter. Using kampung-kota located in South Jakarta as the case study, this article tries to unpack the informality process in the production of open green space within the global south context. To better understand the nature of the phenomenon, qualitative approach incorporating semi-structured interview and observation is used in this research. The research finding shows that community leader that is mostly driven by woman leadership plays a significant role in the green place-making process in kampung-kota, aside from community willingness to actively participate in the whole process.

Keywords: Informality, open green space, kampung-kota.
Climate change is affecting cities over the world, especially vulnerable communities as many cities in Colombia. These cities can be affected by scarcity, availability of water, high temperature and other effects of climate change, whereby is necessary to develop adaptation and mitigation projects in this territory. The implementation of green infrastructure is an opportunity to mitigate and adapt to climate change.

The present research shows a state of the art on the design parameters of green infrastructures, which favor the sustainability of the hydrological cycle and also analyze climatic variables such as temperature, rainfall, and satellite images of the Montería city and compares this with territorial planning plans, urban and master plans. The data was obtained by the IDEAM and from the public administration. With this analysis was possible to identify how infrastructure and existing projects stimulate the implementation of green infrastructure and the areas that contribute to the normal development of the hydrological cycle and the zones and infrastructures that they do not contribute.

Using SIG were built maps that show the result of this research such as public parks and zones that stimulated the implementation of urban infrastructure in which they can make the most of the water resources that the city has and mitigate the risk in the flood zones.
Biochar: A Renewable Carbon-based Material for Passive Remediation of Stormwater Runoff

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Renewable energy production from biomass through thermo-chemical processes (e.g., pyrolysis) has gained significant interest for sustainable urban development. To improve the product efficiency of pyrolysis process, potential applications of by-products are gaining further attention from both economical and environmental perspectives. Biochar, a by-product of the pyrolysis of biomass, is a renewable carbon-rich material with significant potential in different adsorption-specific applications such as water treatment.

Stormwater runoff treatment is one of the crucial water management issues of urban cities. In the present study, biochar produced from wood-waste is investigated for passive remediation of stormwater removing zinc and selenium as priority pollutants. The porous structure of biochar is tailored through a novel method to provide different pore sizes for adsorption of metallic contaminations. This can enhance the removal of metallic ions by immobilizing them onto the porous structure of the modified biochar. Moreover, the surface chemistry of biochar is enhanced through functionalization with iron for improved metallic adsorption. The effects of surface chemistry (functional groups) and physical properties (surface area, pore size, and particle size distribution) of modified biochar on the removal capacity of zinc and selenium is studied. Modified biochar showed considerable activity in removal of both zinc and selenium. Biochar can potentially introduce an effective and economic passive adsorption treatment for stormwater runoff as a value-added by-product of pyrolysis.
Developing a Decentralized and Integrated Water Management System for Neighborhood Communities Within Indonesia’s Informal Urban Settlements

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Decentralized water management systems can be a viable solution to the sanitation problems of informal urban areas. To be successful, they have to be tailored to the specific context of an area by using its social and cultural potentials instead of thinking in solely technical system measures. This is shown for the example of Kampung Tamansari, an informal settlement located at a riverbank in Bandung, Indonesia. The area’s water issues relate to problems that occur in many parts of the country’s metropoles, making an exemplary solution approach a possible tool to deal with areas that cannot be connected to a central sewage system. First, a quantitative and qualitative analysis of existing water sources and uses reveals that the current handling of water has a destructive impact on human health and the environment, primarily caused by the lack of safe drinking water and contamination by sewage water that is led directly into the river. At the same time, rain water as a clean water source is not used and unsustainable behavior due to a lack of knowledge increases the existing problems. Based on field research, the potential of community institutions and involved stakeholders in Tamansari is examined, identifying neighborhood communities, their leaders and religious institutions as most promising catalysts for the implementation of a new system. A high level of self-organization, strong social cohesion, democratic mechanisms and educational infrastructure within neighborhoods are to be mentioned. In a next step, three case studies are compared in terms of their technical systems and implementation strategy. Their relevance lies in creating synergies between technical components and public space, using religious institutions to improve water use efficiency and creating an extendable bottom-up system. Finally, a decentralized and integrated water system is proposed. The cluster system for one neighborhood of approximately 500 people consists of rainwater collection, storage, septic tanks and vertical flow constructed wetlands as main components. The implementation, management and water education is realized through the use of the identified potentials within the community. Interdependent relationships and mutual benefits for all involved stakeholders ensure the system’s stability as a result.
Global communities seeking dynamic and efficient approaches to sustain their economies introduced commerce and industry as boosters of distribution and conversion of agro and mineral products into finished commodities necessary for better and modern lives of the people. These efforts troubleshoot into land, sea, air and noise pollution that now threatens our very living and earth’s sustainability. Today, the world exists in worrisome competition between expanding land developments, sustaining the ever-growing populace and battling against global warming, climate changes, insecurity, and peaceful living. In this paper, the researchers aim is to advocate mandatorily all-inclusive involvement in de-carbonation of our cities through possible natural and helpful manmade reinforcements of planting/replanting policies. It suggested new proactive policies and strategies and discussed their cost-benefit implications to city health and economic sustainability discussed. The opinion of academic and non-academic professionals in Nigeria’s built environment was sought through focused group discussion among members of NITP, NIESV, NIOB and NIA for balanced assessment of climate change agents, effects and impacts, and sustainable policy design based on collective contributions of these experts. In the course of the study, findings revealed harsh impact of politics in governance, social imbalance in housing, conflict of interests between professionals of the built environment, and avoidance/shifting of responsibilities for city development faults as crucial actors on our dying earth. It concluded that climate change and economic growth are necessary contestants on earth’s space; for us to achieve more stable eco-balance in-which development and city living must not affect global safety, both the developed and developing nations must accept to take some difficult tasks on enforcing, monitoring and periodically evaluating planting/replanting policy at all levels of physical developments. This paper recommended a resolve between governments and key professionals of the built environment to setup autonomous stakeholders committee on regional and inter-local urban rebalancing for sustainable and healthy living.
Eco-Districts as an Example of Transformative Change? An Investigation of Energy Use in Parc Marianne, Montpellier and Olympic Village, Vancouver

Ms. Dominica Babicki

On 8 October 2018 the International Panel on Climate Change published a Special Report stating that governments around the world must take “rapid, far-reaching and unprecedented changes in all aspects of society” to avoid disastrous levels of global warming. According to the Panel, limiting the global average temperature rise to 1.5°C is still possible; however, it requires “unprecedented” transitions in all aspects of society including prioritizing the transformation of energy systems and integrating climate action into broader public policy and development frameworks.

Buildings are responsible for between 30 to 40 percent of global human generated CO2 emissions. Emissions resulting from the consumption of fossil fuel-derived energy are the principal cause of increased global anthropocentric CO2 emissions, which in turn are the main drivers of climate change. My research focuses on the energy consumption, and more specifically CO2 emissions, of residential buildings within eco-districts, which are an often referenced as examples of successful climate action.

The issue of climate change adaptation and transformation towards sustainability is investigated by providing an assessment of two eco-districts (Parc Marianne, Montpellier, France and Olympic Village, Vancouver, Canada) from an energy use perspective. While these urban housing projects share some similarities, they also exhibit important differences and thereby provide key insights for assessing the effectiveness of this form of local climate action. Eco-districts typically consider a broad range of sustainability issues like environmental preservation, transportation and social diversity; however, the focus here is to assess to what extent energy systems in eco-districts are rooted, or territorialised, in the local community. This lens is used because communities where energy is locally produced and consumed with awareness, can provide powerful examples as to how buildings can both reduce CO2 emissions and build resilience to climate change at the local level.

Using qualitative and quantitative data gathered through in-depth interviews and energy consumption data, I investigate how energy is used and understood by both the developers of eco-districts and their residents in the two case studies. By understanding the different processes and underlying factors that support energy use in eco-districts, we better know the role that these urban developments have in reducing our carbon emissions. In essence, the central question then becomes: are eco-districts simply a new form of housing for elites, providing negligible improvements in energy consumption, or are they a veritable example of transformative change and the transition to a more sustainable energy path?
Reconnecting with Nature: Building Cities and Developing Urban Spaces in Balance

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Climate change is occurring around us and impacting on our daily lives, meaning that we have to deal with our cities in a different way. There is also increasing awareness of the need for daily contact with green spaces and the natural environment in order to live a happy, productive and meaningful life.

This reflective essay tells the narrative of how urbanisation has been disconnecting humans from nature. Non-sustainable, non-resilient patterns of urbanisation, along with the neglect of inner-city areas, have resulted in fragmentation and urban decline, led to a loss of biodiversity, and caused the deterioration of ecosystems and their services. Urban regeneration projects allow us to ‘repair’ and restore some of this damage whilst enhancing urban resilience. Connecting existing and enhanced ecosystems, and re-establishing ecosystems both within cities and at the peri-urban fringe is vital for strengthening ecosystem resilience and building adaptive capacity for coping with the effects of climate change.

Cities worldwide need to look for suitable solutions to increase the resilience of their urban spaces in the face of climate change. This essay explores how this can be achieved through the integration of nature-based solutions, the re-greening of neighbourhoods and by correctly attributing value to natural capital. Transforming existing cities and neighbourhoods in this way will enable ecosystems to contribute their services towards healthier and more liveable cities.

Every city is unique. Cities not only differ in their size, density and population distribution, but also in their location and in the ways in which they are vulnerable to climate change. When it comes to strategies to increase resilience, what works in one city may not work in another. Urban regeneration projects allow to ‘repair’ and restore some of the damage caused to ecosystems whilst enhancing urban resilience. Even when change is acknowledged as necessary, it can be a daunting prospect. Facing the need for change on a large scale it can be helpful to remember that cities are never finished; cities are constantly undergoing transformation. What is needed now is to nudge that transformation in the direction of sustainable and resilient solutions, making the most of opportunities for re-greening, using resources efficiently and acknowledging the value of natural capital.

A good example for such a project is the author’s international research project the author is currently working on: Crunch – the Food-Water-Energy Nexus explores these issues in greater depth using integrated methods (see: www.fwe-nexus.eu).
Tough Clients/Complex Sites: A University-led Community Conversation Strategy to Build Public Trust

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This is the true-life success story of how the area’s major employer ended up working hand-in-hand with the community on future plans for an important 356-acre property. The property was uniquely located, had existed agriculture and recreational uses, and needed to be well planned for its future use. Through a tightly structured design process, our team worked with a non-profit organization, community-group leaders and municipal officials, the general public, university leaders, and faculty and students to provide a range of viable options for the property in question. The process entailed a deep study on the area, its history, the regional context, and how the land is currently functioning.

Key influencers and stakeholder groups are identified and all will participate in facilitated workshops to assess community values and needs. The workshops utilize GIS data and the latest online analysis tools to create dashboards that provide real-time feedback. This enables participants to see the impacts their choices have in their desired criteria for the property and how alternative options compare with each other.

This talk highlights the process for how geospatial tools, including ArcGIS Pro, GeoPlanner, and Geodesign Hub, are used to help decision makers and land owners make hard decisions regarding complex land use and development issues. The process is structured to ensure that the design decisions are influenced by the values of the people of the place and reinforced by the data to support the decisions. Lessons learned and final outcomes of the process (completed by May 2019) will be shared in this talk.
AC.08B.02

Urban and Peri-urban Agriculture in Sao Paulo City: Under the Scope of Climate Change and Health Risks

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São Paulo is south-America’s largest metropolitan region, experiencing the intrinsic dynamics of urbanization: such as environmental pollution, limited resources and food provisioning. Besides the provision of food, urban and peri-urban food systems are considered to be providers of ecosystem services.

The role of urban and peri-urban agriculture has taken relevance for research in the last years, due to its role on improving resilience of cities by improving food security, generating income and providing ecosystem services.

The aim of this paper is to present a comprehensive analysis of the different types of urban and Peri-urban agricultural practices in the mega city and the identification of opportunities and challenges. This analysis intends to provide science-supported information to support policy makers in developing actions and strategies oriented to enhance urban food systems.
BCIT’s Burnaby Campus: a Contrast in Urban Soils

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There was virtually no information on soils on BCIT’s Burnaby campus up until 2016 when BCIT’s Sustainable Resource Management and Fish, Wildlife & Recreation students carried out soil surveys. The survey objectives were to gather baseline soils information, to investigate the distribution of different soils, and to give students experience describing soils. BCIT staff led and supervised data analysis, interpretation, and mapping. Soils are markedly different in the north of the campus, where they are thin topsoil overlying compacted fill, compared to the south, where they are mainly scalped and otherwise disturbed remnants of former forest soils. Many soil physical and chemical properties are similar for topsoils in the two areas but soils greatly differ in bulk density and rooting depth. Soils in the north could benefit from aeration and drainage improvement measures. Establishment of natural vegetation would require tillage, addition of organic matter, and, in some places, drainage. Soils in the south now support naturally regenerated, mainly deciduous, seral forest of mostly native tree species, including riparian forest along Guichon Creek. The forest could be improved through vegetation management.
Municipality Research Center, an Essential Organizational Structure to Achieve Sustainable Development in Cities

Dr. Elham Fallahmanshadi

Tehran Urban Planning And Research Center, Port Coquitlam, Canada

While municipalities have a crucial role in creating sustainable communities based on their functions in the city, they do not have institutional and organizational capacity to direct sustainable development. Problems of sustainability often involve uncertainty and risk and so it needs a more flexible and innovative structure to be able to manage new and more complex problems that need new procedure and actions.

It seems to have sustainable development we require a new organization to conduct to municipality activities toward sustainability. In other words, we are looking for a new knowledge-based organization which is innovative and flexible to direct and conduct municipality activities comprehensively. This organization is called Municipality Research Center in this research.

While there are similar cases all over the world (APUR in Paris, IPPUC in Curitiba, TUPRC in Tehran and others), analyzing the organizational structure and main goals of these cases shows the diversity and fundamental differences between them. Talking about Vancouver, this diversity makes it more crucial to find out which type of research center and organizational form help municipalities in Vancouver to achieve more sustainable cities.

This research debates two main subjects:

1. What is the main goal and duties of a Municipality Research Center?
2. What is the appropriate organizational structure of the Municipality Research Center?
AC.08C.02

Nudging a Campus Toward Sustainability Utilizing Student Led Research Teams

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\textsuperscript{1}BCIT, Burnaby, Canada

The goal of this project was to have teams of students in Business classes immerse themselves in a primary (quantitative) research learning module focused on sustainability for a single term. This module wove Nudge Theory (a theory designed to influence decision-making by making subtle adjustments to the environment and advanced by Richard Thaler who was awarded a Nobel Prize in Economics in 2017 for the work) with making the institute and its surroundings a more sustainable place to live, work and study. The student teams were encouraged to select issues on (and off) campus that they perceived to be sustainable and valuable - and would like to see spread and/or improved upon; unsustainable and problematic - and would like to see eliminated; and then build a nudge idea around these aspirations. In the initial pilot of this project, 31 student teams created research studies focused on such topics as reducing pedestrian traffic on campus, reducing the time for students to enter in and out of lecture halls, increasing students hand-washing behaviour after using campus washrooms, increasing the use of stairs over elevators on campus, reducing the idle time of buses servicing the campus by increasing the speed by which students get on the buses, increasing the efficiency of student parking etc. For each of the student lead research projects, the student teams were responsible for integrating and summarizing the relevant literature (secondary research), developing hypothesis (creativity and innovation), building methods (problem solving and project management), analyzing results (applying math and statistics) and presenting their findings (analysis, deduction, integration and writing skills) in an APA formatted paper. Of the 31 teams who took part in this pilot study 17 reported statistically significant results which could be utilized by on (and off) campus decision makers to enhance the quality and environmentally sustainable life of the campus and the surrounding community. This project is important as it exposes students experientially at BCIT to primary experiential research. As the project is focused on “nudging” the campus and community towards sustainability, all of those who attend or work at BCIT benefit from an improved campus if the successful nudges (changes) are implemented. The sustainable focus of the nudges also aligns with BCIT sustainability goals of “our commitment to sustainability encompasses everything from advancing the state of practice through education and research, to improving the efficiency of campus operations, to engaging the community across the institute”.


The University of British Columbia’s Approach to Measuring Progress on the Sustainable Development Goals

Mrs. Elham Haghbin¹

¹UBC,  

One of the primary goals of UBC is to transform its campus into a vibrant, connected and complete sustainable community by going beyond minimizing harm to become net positive contributors to human and environmental wellbeing. UBC has recently aimed to align itself with the United Nations’ Sustainable Development Goals (SDGs). In doing so, UBC is one of three institutions in the world in delivering on the United Nations’ Sustainable Development Goals, which aim to contribute to create sustainable communities, protect the planet, and ensure that all people enjoy peace and prosperity in a community.

UBC plans and policies play an important role in delivering these goals, they are guiding the university to reach sustainability at the heart of teaching, learning and research, operations and infrastructure, and community. For this reason, it is essential to evaluate the UBC plans and policies and amend where necessary to make them applicable and effective. The purpose of this research is to propose a framework to evaluate UBC plans and policies to understand relationships and identify potential gaps and synergies toward the United Nations’ Sustainable Development Goals (SDGs).

This study shows that SDGs are broad but relatively shallow goals, however, they can be made more applicable to cities by merging them with the EcoCity Standards and organizing them in Ecocity pillars. On the other hand, EcoCity standards, the same as SDGs, do not have measurable indicators to allow users to track how well they are doing. This study also shows that sustainable rating systems are one of the sources for defining potential indicators to make SDGs and EcoCity framework more effective. The study outcome is a new framework with potential indicators for UBC Campus and Community Planning to both measure the effectiveness of current policies and plans, as well as to guide the development of new plans moving forward.
Exploratory Design Strategies Applied to Coastal Communities Affected by Climate Change to Adapt to Sea Level Rise and Changing Environment on a Personal Level. a Case of Study in Rockaway, New York.

**Miss Andrea Cisneros**, **Miss Karina Davila**, Miss Marlyn Martinez

\(^{1}\)dxp-org, Quito, Ecuador

Ocean levels are rising. Sea level rise is caused primarily by two factors related to global warming: added water from melting land ice and the expansion of seawater as it warms. Today, many cities on the U.S. East Coast are already dealing with the effects of sea level rise in the form of tidal flooding. The objective of the study is to find additional actions coastal communities can take on an individual level to adapt to their changing environments and co-create a sustainable future for themselves.

The study was conducted through exploratory design strategies in Rockaway, which is situated in the southern portion of Queens, is one of the most at-risk communities in New York City for sea level rise. It is floodable by two areas—Jamaica Bay and the Atlantic Ocean—making the communities in this area the city’s frontlines to sea level rise and affected inland as well.

Identifying existing daily problems in the community that residents could relate to, and were exacerbated by tidal flooding, they can make a personal connection to sea level rise and identify actions they can take in regard to flooding in their neighborhood. The research findings indicate that one of the biggest problems in the area is trash. Apart from trash being very present on the peninsula, we also found that it was clogging a lot of the catch basins. By creating a communication network more people in the community would report trash and learn about sea level rise. The network was oriented to help the Rockaway community to understand the problem, take a specific action and start preparing to take other actions that will help them deal with further climate change. The study has demonstrated that it is an opportunity to raise people’s understanding of the problem, high tide cannot be solved and sea levels will continue to increase, however, keeping trash away from the street and into the sewer can be.
The IDEAL CITY System with Tripartite Programming - High-Performance Economic City, a Health Sustaining City and a Mitigating Ecological uniting all the Ecocity Themes with a Paradigm Shift in Reality

Mr. Robert Daniels

1In-Harmony Foundation, Miami, United States

The IDEAL CITY System is a series of innovative, unique solutions all back-cast together in an Urban Ecology Systems Design to seamlessly integrate a healthy physical realm with strong socio-economic self-sufficiency.

Cities maintain a balance with a Circular Economy to recycle and repair many necessities while maintaining a balance of trade with certain specialty items useful in regional, national and international trade. These items would be internationally recycled when possible to supply raw and finished materials needed for repair and re-assembly.

As global temperatures continue to rise, Climate Change effects observed most notably in the Arctic Region are causing adaptive measures to accelerate from retrofitting of existing cities to creation of completely new cities like the IDEAL CITY that is much more compact, resilient and ecologically benevolent.

The climates and weather have become hostile, causing minimally-made buildings to collapse under the actions of wind, rain and snow. Air pollution, including pollen, are causing speculation regarding the breathability of the fresh air coming in our windows.

Drinking water is suspect in a majority of cities due to over 10,000 chemicals being dumped into the ground which end up contaminating our water. Current filter systems are inadequate to correct the damage.

New IDEAL CITIES are designed for Net-Zero Water use from groundwater supplies. They will recycle and recharge their water system from rainwater, storm-water and snowmelt filtration.

IDEAL CITIES will have a closed air system that filters particulates and purifies all germs throughout the ducting system. Humidity from sweat and breathing will be dehumidified. CO2 will be piped to the Indoor Farms. Oxygen will be injected to supplement inadequate levels. All air will be extensively monitored for quality.

A massive on-site indoor food system will replace imported food whose health and continuity may be in question within the near future. A new health program will be instituted that monitors all citizens to provide higher nutritious foods and promote greater physical activity. This food system will be grown from recycled waste nutrients that are routed from nearby city buildings in a closed loop manner.

An entirely new energy system based on a local micro-grid with clean energy supply in each IDEAL CITY. This is composed of Renewable wind and solar fed into a base-load small modular Generation IV Advanced reactor all underground. These new systems cannot meltdown and produce virtually no waste. They will power the buildings, transportation and the indoor food production.
Use of Biochar to Improve Stormwater Runoff Quality

Ms. Samira Jalizi¹, Dr. Ken Ashley¹, Dr. Colleen Chan¹

¹British Columbia Institute Of Technology, Burnaby, Canada

Stormwater runoff from roads and parking lots often contains toxic pollutants which may pose significant risks to biota in receiving aquatic systems. Low impact development (LID) designs such as rain gardens and infiltration swales can be used to improve stormwater quality prior to discharge into the receiving water. There is an increased interest in the use of biochar as a soil amendment, or as a stand-alone filtration layer in rain gardens/infiltration swales in order to enhance pollutant removal efficiency, and to increase the longevity of removal performance. Biochar exhibit surface properties which allows for high sorption of many inorganic and organic toxic pollutants such as heavy metals, petroleum hydrocarbons and pesticides. Biochar is cost effective to produce and can potentially be an environmentally sustainable, cost effective technology for the removal of toxic pollutants in stormwater.

The objective of this paper to investigate the efficacy of biochar in removing naphthalene, copper and zinc found typically in a heavy use parking lot located in Burnaby, B.C., Canada. Sampling of stormwater runoff for multiple precipitation events from a heavy use parking lot was conducted to determine environmentally relevant concentrations for the lab scale column filtration experiments. Commercially available biochar was used as the filtration media, while sand was used as a benchmark filtration media. Ten lab scale columns were used to perform the filtration experiments. Effects of runoff pH, contaminant concentrations, total organic carbon (TOC) concentration and biochar size on removal efficiency, were examined. Filtration experiments using biochar showed high copper and zinc removal similar to sand (median =59% for copper and median =78% for zinc). However, biochar filters showed a higher naphthalene removal efficiency (median= 82%) compared to sand (median= 20%). Results from the study showed that biochar is a promising filtration media for LIDs in storm water source control designs.
PRACTITIONER PRESENTATIONS
S.01A.01

Ecocity Emerging: The Evolution of Regional Strategic Planning in the Vancouver Region, from “Cities in a Sea of Green” Through “Creating our Future” to the Livable Region Strategic Plan

Mr. Ken Cameron¹

¹Simon Fraser University, Vancouver, Canada

For many years, the Vancouver region has been known for its outstanding quality of life based upon plans that respect its spectacular setting and espouse the objective of a city in harmony with nature. The origins of this approach lie in two factors: (1) the imperatives of a challenging landscape with finite land resources and (2) early leadership which serendipitously put in place a commitment to planning and cooperation on a regional scale. The last 70 years have entailed a creative tension between efforts to protect and enhance the region’s quality of life for all species and the pressures for economic development through exploitation of the abundant natural resources of the region and its hinterland. Against this backdrop the region has developed a robust commitment to democratic local self-determination through a series of strategic-level plans combined with bold initiatives such as the prohibition of urban development on productive farmland and the rejection of freeways as part of the urban transportation system. Regional planning and cooperation are part of the “secret sauce” that has made today’s Vancouver markedly different from other North American cities and from it would otherwise have been. Its challenge now is to move on from this base to create an urban region that fully reflects eco-city principles while also responding to the challenges of the Anthropocene age. While the Vancouver region has much to contribute to global understanding of ecocity principles mean on the ground, it also has much to learn from the experience of other leading edge cities. This is a story of leadership energizing participatory processes to produce inspiring, value-driven plans at a general level that leaves plenty of space for innovation, creativity and cyclical renewal.
Charting the Inter-connections among All Urban Open Spaces Provides Context for Sustainable City Renewal: An Example from Seoul

Dr. James Thorne¹, Dr. Hyeyeong Choe², Dr. Dongkun Lee³

¹University Of California, Davis, Davis, United States, ²Kangwon National University, Chuncheon, South Korea, ³Seoul National University, Seoul, South Korea

Cities recreate themselves. Therefore redevelopment can be used to create a linked network of beneficial urban open spaces during renewal. For maximum utility, open space networks should include not only green spaces such as parks, but empty lots, space associated with different building types and densities, and space associated with linear features such as roads and streams. Here we use an urban metabolism framework to chart the connectivity among all open spaces for Seoul, South Korea, a city of 10.3 million inhabitants. We used Omniscape, a tool from conservation biology, to quantify the strength of all open space connections in Seoul, a city of 10 million people. We analyzed the relative level of open space of 69 land use/land cover classes in Seoul's landuse map, and used Omniscape to chart the level of suitability and resistance of every grid cell to every other grid cell using a moving window. This is an omnidirectional continuous approach that does not require open space “cores” or least-cost “paths”. We modeled two scenarios, one where open water is a barrier and contributes little to open space, and the other where open water is considered an attractive element to open space.

The resulting maps show the flow of open space. Here we show how they provide city-wide context for four urban sustainability objectives: retention of open space stepping stones; new urban park locations; district-level zoning to protect open space connections; and transportation corridor redevelopment or day-lighting of streams that dissect dense urban areas, improve neighborhood-level open space access, and connect to larger open spaces.

Further, because governance of large cities requires local planning and administration, and most cities contain nested levels of government, the open space flow maps also provide opportunity for coordinating urban planning and development among 25 district governments, which can benefit by the broader perspective supplied with the open space flow analysis for the whole city. We provide district-level relative permeability scores that the 25 district governments can use in assessments and to incentivize cooperation to improve the city's overall open space connectivity. The comparable metrics permit inter- and intra-district assessments to improve open space access and flow.
City of Vancouver Responds to the Climate Emergency

Mr. Doug Smith, Mr. Matt Horne

City of Vancouver, Vancouver, Canada

City of Vancouver Responds to the Climate Emergency

In January 2019, Vancouver City Council unanimously approved a motion recognizing the climate emergency the planet faces; acknowledging that Vancouver needs to do more to reduce carbon pollution in response to that emergency; and asked City staff for recommendations on how to ramp-up the City's climate actions in line with efforts to limit global warming to 1.5°C.

The threat of climate breakdown has been clearly documented by the world’s scientists. Vancouver is already experience the impacts of 1°C, including more severe storms, flooding, and forest fire smoke.

To minimize the risk of climate breakdown and limit global warming to 1.5°C, the world needs to reach net zero carbon emissions by 2050, and net negative emissions in the second half of the century.

Vancouver is no exception to this global picture. To align with 1.5°C, Vancouver’s emissions need to drop by an average of 92,000 tonnes per year over the next decade – a five-fold increase from the past decade.

To achieve these reductions Vancouver will need to:

- Make most neighbours complete and walkable
- Dramatically reduce the number of vehicle trips by switching to active transportation and transit
- Replace gasoline cars with electric cars
- Ensure heavy duty trucks are switching to renewable fuels
- Replace furnaces and boilers with heat pumps

To reduce an additional 92,000 tonnes every year, the City will need to pursue all of these opportunities and more. Vancouver also needs to look beyond the carbon pollution from buildings, transportation and solid waste that have been the traditional focus of the City's climate plans. Priority new areas of focus are transitioning to lower carbon building and construction materials, encouraging residents to shift to more plant-based diets, which are less carbon intensive to produce, and supporting projects that remove carbon pollution from the atmosphere.

Join us for this presentation where Matt Horne will describe the science behind Climate Emergency Response, the consultation and engagement process and how the City plans to implement this ambitious work.
Planning for Carbon Neutrality in Oil Country - The City of Edmonton Acts on Climate Change and the Story of Blatchford

Mr. Christian Felske, Mr. Mike Mellross

1City Of Edmonton - Energy Transition Unit, Edmonton, Canada, 2Associated Engineering, Vancouver, Canada

The City of Edmonton is establishing itself as a leader in municipal climate action in Canada. With strong support from its Mayor and Council the City has launched its Change for Climate - a community mobilization campaign and has been actively encouraging residents to take action on climate change. With incentive programs for energy efficiency and renewable energy, building energy labeling programs, a comprehensive action transportation strategy, the development of Property Assessed Clean Energy (PACE) financing, and a corporate climate leaders program, Edmonton is gearing up to achieve major change.

The City is also acting as the developer of the Blatchford neighbourhood. Blatchford is being planned to be a carbon neutral community for 30,000 residents that will use 100% renewable energy. Using transit oriented design principles Blatchford will achieve higher densities than what is normal for new development in Edmonton and the buildings in Blatchford will exceed the performance requirements of the building code. In order to provide sustainable energy to the residents and businesses, City Council put in place the Blatchford Renewable Energy Utility, which is initially operated to provide the energy for heating, cooling and domestic hot water through an innovative District Energy Sharing System. The system utilizes an ambient-temperature distribution system, with geoxchange as its primary energy source. In the future it will include sewer heat recovery.

In this session you will initially learn from City of Edmonton staff about the City’s overarching climate goals and programs, cascading into the development of Blatchford and its Renewable Energy Utility. The City’s consultant Associated Engineering will then provide some in-depth technical information on the District Energy Sharing System.
Metro Vancouver’s Climate 2050 Strategy

Mr. Roger Quan

Metro Vancouver is a regional government in British Columbia, Canada that is home to 2.5 million residents, which is more than half the population of the province, but contained in less than 0.5% of the province’s land area. With many coastal communities, it is particularly susceptible to the impacts of a changing climate, but Metro Vancouver also has unique opportunities to respond to climate change because of its role in managing air quality for the region, in regional planning, and the provision of utility services like drinking water, wastewater treatment, and solid waste management.

Implementation is underway on its Climate 2050 Strategic Framework, adopted by Metro Vancouver’s Board of Directors in 2018. Climate 2050 builds on work already underway within the region, and considers both medium term and long term climate actions out to 2050. Climate 2050 will include a series of roadmaps on ten “issue areas” that recognize major greenhouse gas sources and mitigation actions, and key areas of adaptation. These issue areas align well with EcoCity standards and the achievement of reductions in emissions, waste, and resource demands.

Climate 2050 will guide our region’s policies and collective actions to transition our region to a low carbon future, increasing the health, well-being and prosperity of Metro Vancouver residents. Ultimately, it will map out how the Metro Vancouver region can achieve low-carbon lifestyles to stabilize climate at 1.5 degrees Celsius, consistent with the findings of the recent IPCC special report on Global Warming of 1.5 degrees C. However, recognizing the need for a longer term planning horizon, Climate 2050 will use an adaptive approach that is informed by performance measurement and is responsive to evolving science and technology.
S.01C.01

Human Trafficking and the Ecological Impacts That Increase Risk for the Vulnerable

Ms Tara Wilkie, Ms. Sheila Early

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Human trafficking embeds itself into every facet of civilization, from the individual to relationships, the community, and society as a whole. As cities evolve and strive to enhance wellbeing, quality of life, and a healthy equitable economy for all, insight into the hidden crime of human trafficking must be an integral part of the movement to support ecological and economic growth.

Human trafficking is one of the most heinous human rights violations occurring worldwide. It thrives in communities lacking infrastructure to eliminate push and pull factors that enhance vulnerability-push factors like poverty, unemployment, lack of education, gender-based inequality, and violence within the family or the environment and pull factors such as promises of a better life, financial gain, material rewards, telecommunications/internet, migration, and the demand for cheap labour and sexual services. Men, women and children who are trafficked endure extreme forms of violence and trauma before, during, and even after the trafficking process. The aftermath of human trafficking is catastrophic, destroying human potential and impacting communities for long after.

The issue of how to address human trafficking is typically associated with policing and prosecution, but equally as important are prevention-based initiatives that build awareness, stop the demand for sex and cheap labour, and eliminate vulnerabilities like poverty, marginalization and violence.

This presentation builds awareness on what human trafficking is on a local, national and international scale, uses the ecological framework to identify vulnerabilities to being trafficked, and plants the seed for how we as citizens can contribute to growing communities that have no space for violence.
The recent rise of sustainable cities, green cities, resilient cities and eco-cities has driven research to analyse their purpose, processes and degrees of success. The studies have tended to focus on the effectiveness of technical solutions and/or governance as carried out by distinct actors (government, businesses, NGOs, citizens). Interestingly, despite the large and ever-increasing presence of migrants in urban spaces, there is insufficient research on migrants as a category of social actor in ‘green cities’. Not only are migrants neglected as viable actors in combating climate change, they are often seen as a problem to sustainability and as competition for scarce resources. My research objective considers whether migrants can be understood as eco-actors in cities and as part of the urban solution for climate change. Empirical studies including in-depth interviews and ethnographic fieldwork takes place in Singapore. The city is recognised internationally as a sustainable city, it self-promotes as a ‘smart green city’, and an estimated half of the population are foreign-born. Migrants make up a significant proportion of the workforce in Singapore, and are crucial to the operations of the city, including infrastructural provisioning. Through the study of migrants as eco-actors in cities, the research seeks to go beyond existing perspectives of multi-level governance and socio-technical approaches of sustainable cities. This study proposes that the green city agenda can instead be understood through an urban machinistic lens. Conceptualising urban social life through the hybrid interactions between migrants and city infrastructure re-imagines urban environmental sustainability as relational between humans and the entity that is the city.
Putting a Monetary Value on Green Infrastructure In Support of Better Public Policy - The Case of Toronto, Denver and Washington DC

Mr. Steven Peck¹

¹Green Roofs For Healthy Cities, Toronto, Canada

Eco-cities cannot possibly be fully realized without significant investment in multiple forms of infrastructure, such as wastewater treatment plants, public transit and housing. One form of infrastructure that is often forgotten is living green infrastructure, which is tremendously important to have healthy and resilient communities.

Living green infrastructure is comprised of natural and engineered vegetative systems, and the technologies that support them such as irrigation systems, cisterns and engineered soils. Natural green infrastructure includes parks, forests, wetlands, prairies, and riparian zones. Engineered green infrastructure includes urban trees, bio-swales, green roofs and green walls.

As cities become more populated, we need to use all of the available space to provide ecosystem services and support healthy, just and equitable societies. In order to accomplish this, we need to look at green infrastructure through the same lens that we see traditional grey infrastructure, such as bridge construction. Questions about such topics as capital costs, maintenance costs, job creation potential, water and air quality benefits, energy savings and more need to be included in the cost-benefit analysis. All too often, the benefits of green infrastructure are not factored into decision making about land use or building design.

We have been working for more than 10 years to identify the biophysical impacts of green infrastructure, most notably on green roofs and walls, and to translate these benefits into monetary values in a way that reflects local economic and environmental conditions. This involves the use of market and non-market mechanisms, such as hedonic pricing.

We are currently running an innovative program that utilizes the monetization of green infrastructure and applies it to specific types of green infrastructure in land areas in six different cities. City officials, designers and communities representatives spend the day completing a green infrastructure design charrette. Afterwards the results are subjected to an aggregate cost-benefit analysis. Often, if we get the economics of ecosystem services right, or at least factor them in, we are able to get better, more efficient and effective decision making.

This presentation will present the methods used to monetized green infrastructure costs and benefits, and provide examples of how the values generated have helped to positively influence public policy in Denver, Washington DC, and Toronto Canada. The adaptability of this tool to local conditions and a wide variety of projects suggests that it has the potential for broad application in support of the greening of cities around the world.
Green Roofs: Making the Business Case for Building Owners and the Public

Mr. Rohan Lilauwala

Green Infrastructure Foundation, Toronto, Canada

Green roofs offer immense potential to turn underutilized space in our cities into productive landscapes that provide building owners and the public with many important social, economic, and ecological functions.

An important step to unlocking supportive policy and implementation of green roofs on a large scale is to build a strong business case for them. This presentation outlines strategies for building this business case, one that can be made to a building owner or developer, and also to the public sector to support green roof policy.

Topics addressed include:
- Finding synergies and integrating systems to reduce costs
- Monetizing multiple revenue and savings streams
- The basics of economic analyses: principles, methods, tools, and applications
- Articulating the value of green roofs to elected officials, other policy makers, and the public
- Case studies of private projects where a strong business case has informed the inclusion of a green roof
- Case studies of municipalities where cost-benefit analyses have led to strong green roof policies

Learning objectives
- Understand why making the business case for green roofs is an important step to optimize outcomes
- Learn the principles and methods behind economic valuation
- Understand the many possible streams of revenue and savings possible using green roofs, and how to monetize them
- Identify and understand how cities like Toronto, San Francisco, and Denver used economic analyses to inform green roof policies
Assessing Urban Forest Values Using a Combination of LiDAR, TSI, and i-Tree Eco Field Data

Mrs Laurie Stott¹, Ms Julia Alards-Tomalin³, Mr Jace Standish⁴, Mr Mike Parlow²

¹BCIT, Burnaby, Canada, ²Object Raku, Victoria, Canada

In 2015 and 2016 and 2018, students in the Renewable Resources (RENR) and GIS programs at the British Columbia Institute of Technology participated in a series of iTree inventory and urban forest assessment projects in partnership with the City of Maple Ridge. RENR students used GPS and GIS systems and a digital version of the iTree Eco survey form to map several urban forest areas. Sites with variation of land use, built environments and forest system types were selected to assess both forest canopy and efficacy of the iTree tool and GPS equipment in a range of forest and land use environments. Field data was used in project work by BCIT GIS interns at the City of Maple Ridge. These students prepared and processed the data with the iTree server and produced a series of ecosystem service reports and presentations for City staff.

BCIT students and faculty partnered with Object Raku Technologies, a private company who has developed a tool for tree species identification and assessment based on an analysis of LiDAR data for forested areas. This technology had been used mainly in commercial forestry applications and this study has been a test for its use in urban environments. Preliminary studies using data from 2015 inventory indicated that that the integration of these technologies is possible. The main focus of the work completed in 2017 and 2018 is the test and study of the efficacy and accuracy of LiDAR results for several urban areas surveyed in 2016 and 2018. Students and staff from the RENR collected random grid samples in several locations using the i-Tree 20 metre by 20 metre grid plots where 100% of trees within each grid is recorded using GPS technology and a digital survey form. In 2018, the LiDAR data was incorporated as field reference with canopy segmented and tree height and species included in the background field map for navigation and reference in each grid plot.

A series of field studies with students, staff and the City of Maple Ridge will allow us to investigate the feasibility and potential for this application. If successful, this method and integration of technology could greatly aid urban land managers and resource management professionals in the assessment and management of urban forests. It will also promote a greater understanding of the ecological services and benefits provided by trees and urban forested areas in the lower mainland area.
Unaffordable housing is a condition currently experienced across all tenures in many urban centres around the world. Financially and socially unsustainable norms of constant price inflation and 30-year mortgage schemes have led to unjust housing terms for lower- and middle-class households and an intergenerational gap regarding ownership and housing opportunities. As a response, civilian driven initiatives such as intentional communities including ecovillages and the Baugruppen (self or group-build) model as well as scarce government-led examples like the de-commodification of housing in South Korea have tried to address the problem. Still, they are yet to be acknowledged as viable alternatives supported by legislation and trusted by prospective occupants.

This paper examines the potential of environmentally and socially sustainable housing options based on the Baugruppen (self or group-build) model in Australia. The case study method was employed in order to detect the existing issues negatively impacting renters and homeowners in Australia and explore possibilities of change by looking into a prospective project in Queensland and completed projects grounded in the Nightingale Housing model in Victoria. For the purposes of this study, primary data were collected through interviewing members of the Queensland project, which is still in its planning phase. To map the existing problems of the housing landscape in Australia, secondary data were used from scholarly and media publications, contemporary market trends, land use planning and building regulations. Furthermore, secondary resources were employed to examine the Nightingale Housing model through completed projects and their delivery in terms of access to amenities and commuting, enhancing community development and responsible use of energy and environmental resources.

The findings of the study are discussed in respect to the practical feasibility of environmentally and socially sustainable projects, including the Nightingale Housing model, under the current political, economic and socio-ethical conditions in Australia. What is also stressed in the discussion is the role of community opposition and its connection to occupants’ perceptions of risk and existing lifestyle constructs. The paper concludes with suggestions on how to enable a housing paradigm shift in tune with the problems and needs of the examined context.
West Coast Fusion of Social Housing + Community Health & Detox Center

Ulrich Geissler\(^1\), Ms. Emme Lee\(^2\)

\(^1\)HDR Architecture Associates, Inc., Vancouver, Canada, \(^2\)BC Housing

A partnership was formed by the City of Vancouver, Vancouver Coastal Health, and BC Housing to develop a new type of facility which would address the two crisis currently in Vancouver: The Housing Crisis and the Opioid Crisis. This is the first large facility of its type in Western Canada and is breaking new ground. The goal of the project is to address both the urgent housing needs of CBC and the health needs of the people living with addiction issues. Through a mixed-use development, the project will provide homes for the people who need it most, while also reaching out to the larger community with essential addictions services, resulting in long-term and comprehensive solutions for people in Vancouver.

A new evidence-based withdrawal management centre within the planned complex will include a range of enhanced services such as inpatient and outpatient withdrawal management, and sobering and at-home withdrawal management, which are trauma-informed and culturally appropriate. This state-of-the-art community health approach is also proven to be a more cost-effective model of providing care than the current urgent care approach.

Approximately 20 new spaces of short-term transitional housing are also included in the plans for people who have completed detox, so they can continue receiving access to supports and health services while they transition into longer-term housing and treatment for substance use.

The proposed mixed-use redevelopment is a collaborative response to the housing crisis and the health-care needs of the community. It will serve low-to moderate-income people, and include a social enterprise space for local residents, focusing on Indigenous healing and wellness through employment and alignment with culturally informed treatment.

The design incorporates rooftop green space which provides needed community open space in this tight urban site, and also provides garden space for tenants to grow and source their own food.

A presentation would include perspectives from the partners including BC Housing, City of Vancouver, Vancouver Coastal Health and HDR Architecture.

OPTIONAL ADD-ON: Another aspect of this project is the Integrated Project Delivery model of Construction. All owner, design and construction partners enter into a multi-party agreement and agree to work collaboratively at cost within a set budget goal. The partners involved will only receive profit if the project comes in within or below the construction budget.
Making the Invisible Visible - Innovative Structure Monitoring Solutions to Advance Sustainable Buildings and Sustainable Living

Mr. Jason Teetaert

SMT Research, Vancouver, Canada

Safe, energy-efficient and sustainable buildings is fundamental to sustainable living. However, defining or evaluating a safe, energy-efficient and sustainable building can be very challenging, as structural health of buildings and construction deficiencies are barely visible until the building failure becomes detrimental to the environment and urban living. Innovative monitoring technologies enable building owners, operators, and scientists to predict and prevent future damages through knowledge of what was once invisible - hidden in the walls, roof and foundation of a building - empowering the industry to develop safer, healthier and more sustainable buildings.

This presentation will allow the audience to gain a better understanding of innovative structure monitoring technologies that have been developed for quality assurance, risk mitigation and innovation support in construction and building management, so as to advance sustainable development.

The speaker will highlight the benefits that innovative structure monitoring technologies bring to make a more sustainable construction industry. Selected case studies of various types of buildings - including residential, commercial, institutional and municipal development - and innovative structures (i.e. mass timber building) will be illustrated to elaborate on significant technologies applied to specific structural parts, before, during or/and after construction. In addition, real-time data analysis and data visualization tools have been developed to expand the intelligence of sustainable solutions assisting construction firms, architects and engineers, building managers and owners, research & development institutions, and quality assurance programs; allowing the construction industry to validate designs, materials, and methods to develop safer, more efficient and sustainable buildings.
Ecocities as Water Stewards: How Cities Must Mobilize Others to Achieve Clean and Safe Water

Mr. Alexis Morgan¹

¹WWF-Germany, Canada

Clean and safe water is one of the Ecocity standards. Yet as a common pool resource, water is shared. Water is also the sharp edge of climate change - from floods to droughts, water is a critical dimension of climate change and at the heart of urban resilience.

To safeguard source waters, enhance resilience and ensure residents benefit from water resources, cities must go beyond managed infrastructure, and work through collective action. This presentation will unpack WWF’s new city water stewardship framework, along with case study examples of how WWF is working with business and investors to mobilize grey and green infrastructure in service of clean and safe water through various financial instruments. Building off of WWF’s work on water risk and One Planet City Challenge, the session will identify specific shared opportunities to grow Ecocities around the world in places where water is a current and growing challenge - in particular in Asia, where rapidly growing cities present considerable water challenges and opportunities. Lastly, the presentation will also outline how achievement of clean and safe water can also act as a core strategy for climate resilience, enhance biodiversity, encourage wellbeing, and can be achieved in bankable manner.

Miss Sydney Moss1,2, Miss Sofia Castro2, Mr Oscar Eduardo Angulo Núñez2,3, Mr Mirbel Epiquien Rivera2, Mr Jose Luis Alarcón Tello2,5, Mr Javier Antiporta2,4, Mrs Anita Azucena Arrascue Lino2

1Ecocity Builders, , Peru, 2Academic Research Group: Territory, Socio-Ecological and Ecosystem Services (TSESE) from INTE-PUCP (Instituto de Ciencias de la Naturaleza, Territorio y Energías - Pontificia Universidad Católica del Perú, Lima, Peru, 3National Superintendence of Water Services (SUNASS), Lima, Peru, 4Condesan, Lima, Peru, 5Global Water Partnership of Peru, Lima, Peru

Perú’s water security is highly vulnerable to the impacts of climate change. Tropical Andean glaciers are melting at an accrescent rate. Increased frequency and intensity of floods, landslides and drought are creating unexpected destabilization of potable and non-potable water in urban and rural centers throughout Perú. Furthermore, the intensified severe weather and natural disasters are reducing flow of and increasing sediment in the already scarce water resources.

Peruvian decision makers and water professionals representing institutions such as the Ministry of Environment (MINAM), National Authority for Water (ANA), National Superintendence of Water Services (SUNASS), and the Sanitation and Water Services Providers (EPS) are working to organize human and financial resources to develop local and national strategies to protect water security.

However, these key stakeholders often lack the information or human resources needed to secure water resources against the increasing impacts of climate change. Many regions lack the basic geospatial information and/or technological expertise needed to conduct proper analysis and projection modeling to develop strong water resource management strategies. Financial resources are available via a recent water tax model and a Peruvian Law of Retribution Mechanisms for Ecosystem Services (MRSE), but these resources are often inefficiently applied or go unused due to inadequate technical expertise and/or information which hinder effective planning processes.

Through an initiative funded by the U.S. Embassy Regional Environmental Office in Lima, Perú, Ecocity Builders teamed with the Territory, Socio-Ecological and Ecosystem Services (TSESE) research group from Pontificia Universidad Católica del Perú (PUCP). TSESE is a multi-stakeholder research group housed in PUCP’s Scientific Institute of Nature, Territory and Energy. Ecocity Builders and TSESE developed a five-part webinar series where Peru water professionals and decision makers participated in technical trainings by their U.S. counterparts such as NASA, the Wildlife Conservation Society, and hydrological academics and practitioners.

Approximately 200 webinar participants divided into 23 bioregional groups based on Peruvian watershed boundaries. Through several guided technical activities, the groups documented a comprehensive inventory of information and human resource gaps in their region. TSESE conducted a final analysis of the 23 regional reports and developed a final report to be used by key stakeholders as a roadmap to strategically invest in technical trainings and data generation based on the specific needs of each region building robust human and information resources with which to make effective decisions and mitigate the effects of climate change on Perú water security.
Green and Blue Tenants: Redefining the Relation Between People and Nature By Structuring Water Management Through Landscape Infrastructure In Informal Settlements in Bandung, Indonesia

Ms Boomi Kim, Dr Nico Tillie

Delft University Of Technology, Netherlands

Slum population has increased continuously in global south. It expands onto precarious land such as floodplains and lagoon areas, leading to detoriation of natural systems and its core functions.

Bandung is the third most populous city in Indonesia with around 26,000 slum dwellings. Kampung Tamansari is most dense informal settlement located along the Cikapundung river. During the Dutch colonial era, this area was a part of the green corridor and Garden city scheme. However, with population growth, also these areas were occupied and have become more dense.

Lack of infrastructure in informal settlements and densification has led to environmental degradation and disconnected people from their traditional relation to the natural environment. The river serves as an open sewage, people directly discharge their waste into it. Clogged ditches with garbage, as well as cemented pavements prevent water from going into the soil which result in flash floods. Nature and human activities enter a vicious cycle which require a redefining of this relationship.

The research aims to reconnect people and nature by improving their living quality through ecosystem services. It is based on two main research fields. The Ecopolis strategy gives a structure to create self-governing ecologically sustainable city. Tjallingi’s Ecopolis strategy helps to look into the site based on three different perspectives: area, flows and (actors) participation. Further, Kampung Naga is used as a case study to understand how a traditional Indonesian cultural landscape creates and uses a circular water system. Next, Kampung Tamansari was object of study to apply these ideas. It shows how people can change their recognition of the potential of nature and how their activities can positively influence change.

The design strategy starts from how people recognize ecosystem services and take care of their surroundings. Following this idea, this resulted in a strategy with three different layers, which are the productive, recycling and networking landscape.

The productive landscape is designed for few households. It could be inserted between houses and offers benefits as rain harvesting, kitchen gardens etc. Waste from productive landscape can be processed in a recycling landscape located in each community. Water is purified to provide leisure activities and to enrich biodiversity. Lastly, the networking landscape via linear structure – the urban river and streets – link the two landscapes & bridges the gap between formal and informal settlement.

To validate this approach the different ecosystem services and aspects of quality of life were tested.
Demand Side Management and Water Conservation as Climate Adaptation Tools

Mr. Raymond Fung

As a municipality within Metro Vancouver, the District of West Vancouver is aligned with the regional approach to utilizing demand side management to operate within the capacity of existing watersheds. Climate change increases the complexity of water management, as weather patterns may bring more intense rainfall in winter but less snow pack, and hotter, drier summers resulting in summer drought conditions.

Universal water metering, as part of a comprehensive water conservation strategy has been a key component in shifting residents’ mentality from a supply-side orientation, where drinking water was supplied through a flat-fee structure, to a demand-side orientation where households pay for the amount of water consumed.

Various incentives for water conservation have been implemented to drive down average consumption over time towards the goal of a level that can be sustained long-term. For example, by providing on-line feedback, as well as through quarterly utility billing, residents are able to determine whether they are heavy or light water users. This feedback provides both a sense of social norming and a prediction of what water charges would be if they continued to use water at their current level. Through an inclining rate structure, households using more than the average are charged more per unit of water, while “water savers” are charged less per unit. This rate structure provides a continuous incentive to use less, thereby bringing the average down over time.

However, for some residents with a high ability to pay, financial incentives are not always effective. In these cases, regulatory authority may need to be applied. When households pay for a municipal service, such as drinking water, there is a risk of changed expectations, such as a transition away from citizens sharing access to a community resource to clients paying for a service. In this type of situation, the risk is that those with an ability to pay expect to receive service regardless of the community’s need to communally conserve through rationing. In these situations, courage is required to impose regulatory authority for the preservation of the commons.

This presentation explores various regulatory, financial, and communications tools, as part of a comprehensive systems approach to “clean and safe water” as an essential bio-geo physical condition of an ecocity.
S.02C.01

Democratic Urbanism & The Future of Practice

Mr. Joel Mills¹, Mrs Erin Simmons¹, Mr Todd Scott²

¹American Institute of Architects, Washington, United States, ²King County, Seattle, United States

When urban democracy expands, cities flourish. In recent years, the field has witnessed a discernable trend toward the retrenchment of autocratic approaches to city-building and more passive approaches to public participation in major planning and design work about the future of the city. Too often today, expensive public processes are failing to result in popularly supported policies and plans. A growing chorus of notable city-building professionals have expressed frustration with the public backlash to their work, decrying the spread of NIMBYism and denigrating the citizenry they are reliant upon for support. Ironically, this trend runs parallel to an ever-increasing public appetite for meaningful involvement in decision-making processes. As a result, major planning and design initiatives have seen a marked increase in conflict, controversy and distrust as the quality of public processes and civil discourse has declined. Preparing urban designers for the 21st century requires an education in democratic techniques. Well-designed public processes that involve citizens in city-building pay huge dividends. This session will present a number of case studies from the AIA’s design assistance program that demonstrate the value of democratic approaches to city-building. These communities have applied democratic urbanism to achieve remarkable transformations across a variety of contexts. Some of these stories are young, representing nascent efforts, while others show impacts lasting over decades. Collectively, they form a hopeful narrative that demonstrates our civic capacity to overcome the stark challenges of the 21st century and reinvent our communities. They also illustrate the advantages of a democratic method for city-building that is broader than conventional practice, one based in a collaborative approach to governance that offers guidance to local leaders across the world working on the front lines of change today.
Ensuring Synergy among Environmental and Economic Sustainability: Developing Eco2 Cities in the Himalayas

Dr. Ravinder Nath Batta

With the rising urbanisation and increased pressure of economic activities in the Himalayas, tourist cities in the region are facing severe problems of infrastructure insufficiency and environmental degradation. There has been a trend in the recent past to declare most cities as smart cities, little realizing the conceptual nuances of the term and the requirements of the city for following a sustainable pathway. While terms smart city and eco city have mostly been used interchangeably, the new concept of Eco2 cities remains yet to be explored and adapted to the Himalayan context.

During the course of this research, a study of Shimla city was carried out which reveals that the city administration today faces serious limitations arising out of fragmented responsibilities with those responsible have incomplete perspective on urban resource use and costs, and funding mechanisms fail to address the urban system as a whole by linking program objectives to the priority issues in the city. Complicated political and administrative decision making processes, inability to bring all stakeholders on board, and narrow accounting formats that ignore indirect costs and benefits, and absence of mechanisms to separate capital costs from operating and maintenance costs; all add to the woes of the city. Worst still is that the city administration has little concern for capital assets in its diversified forms (natural, physical, human and social capital): the system only acknowledges the financial capital. Being a tourist centre, the problem of frequent infrastructural collapses and demand supply gaps are imposing huge livelihood costs in terms of lost business opportunities.

Planners have been advocating the case for making Shimla as Eco2 city to save the age old glory and the tourist destination status. The concept of Eco2 city covers economic sustainability with ability to reinforce the environmental sustainability that lies at the heart of the concept. This study carries out analytical analysis of the key environmental and economic attributes of Shimla and offers an operational framework that can be applied and contextualized to the particular challenges of the Shimla city. The framework includes methods and tools that make it easier to adopt the Eco2 approach as part of city planning, and development. The four fundamental principles of Eco2 approach: a city based approach, an expanded platform for collaborative design and decision making, a one system approach, and an incentive framework that values sustainability and resiliency; befit the Shimla city problem diagnostics and future challenges.
S.02C.03

You’ve Got The Power - Planning, Legislative and Policy Tools that Empower Cities to Facilitate Sustainable Development

Ms. Emily McClendon¹, Ms Pam Jefcoat¹, Ms Rina Thakar¹

¹Civic Legal LLP, Vancouver, Canada

In 2018 the United Nations reported that two out of every three people are likely to be living in cities or other urban centres by 2050. With this population growth comes a need for increased development and infrastructure to address housing, transportation and other service needs. Facing the realities of climate change and its impacts, cities are recognizing that they have an important role to play in ensuring that this increased development is also sustainable. This session will outline some key urban planning, legislative and policy tools that cities and other municipalities in British Columbia can use to facilitate sustainable development and reduce greenhouse gas emissions, including alternative transportation features, renewable energy sources and green building features, and will also examine how different levels of government can and are working together to achieve sustainable development goals, including the implementation of the Province of British Columbia’s CleanBC Plan. This session will encourage audience discussion and participation, with time allocated for Q&A at the end.
Green Community Developments: Using Ecological Footprinting to Guide Private Sector Development Decisions

Mr. Steve Dulmage¹, Mr. Jonathan Laski²

¹Urban Equation, Ottawa, Canada

At the city-scale, developer’s choices matter - because developers create the conditions and buildings where people live, work and play, and their decisions can “lock-in” either high-carbon or low-carbon lifestyles.

New, private sector developments, if designed well, can provide opportunities for citizens to reduce their carbon footprint. Through energy efficient building design, construction and operation; on-site renewable energy generation; promotion of active transportation; and other decisions around waste management, local food and so on, a developer’s choices can either help citizens achieve a reduced ecological footprint, or do the opposite.

Windmill Development Group, working with Urban Equation, the City of Guelph and BCIT is piloting a new approach to community building; one that uses ecological footprinting to inform design strategies to ensure the ecological footprint of those who will live in this future development improves upon the ecological footprint of the average Guelph citizen.

In this presentation we will share the work undertaken to measure the ecological footprint of the average Guelphite and the resulting design strategies that are being considered in order to reduce the ecological footprint of the future Baker District resident.

Attendees to this presentation will learn the following:

1. How the private sector, city staff and partners can work together to measure and then make informed development decisions to reduce the ecological footprint of residents and visitors to the future development;

2. How ecological footprinting can play a role in the design of new, sustainable mixed-use communities;

3. How the private sector community could be encouraged to use ecological footprinting as a means to setting targets, and informing design;

4. The potential role of municipalities to facilitate this process; and

5. What early lessons have been learned from the Baker District project in Guelph

Urban Equation is a sustainability and real estate consulting company with offices in Ottawa and Toronto. We work with developers on projects across the country to achieve low-carbon sustainable, mixed-use development.
Correlating Resource Flows to Sustainable Urban Design in the Kathmandu Valley, Powered by Data Analytics and Local Community

Mr. Andy Likuski¹, Ms. Kirstin Miller²

¹State Of Place, Natick, USA, ²Ecocity Builders, Oakland, USA

State of Place and Ecocity Builders present a joint project to quantify urban design and visualize resources flows in the Kathmandu Valley of Nepal. During this year they shall compare historical, sustainable settlements of the region to the new development that has arisen in the wake of the devastating 2015 earthquake. Their work combines two revolutionary forms of data analytics, State of Place’s software platform that quantifies 290 urban design variables per street block and Ecocity Builders’ Urbinsight metaflow tool that geospatially displays and quantifies the lifecycle of resources such as energy, water, and pollutants using Sankey diagrams.

The project is a groundbreaking endeavor to collect urban design data and resource flow data over a representative sample area of settlements, comprising an urban, rural, and in-between region in the Kathmandu Valley. Each of these settlements has a traditional core as well as recent development. The primary goal of the project is to correlate the quantity of resource consumption with State of Place’s urban design index to compare the impacts of traditional and new developments. The analysis will allow mayors and other government officials to make the data-backed case for development that is sustainable and maximizes quantifiable indicators of quality of life, such as health, safety, and fiscal savings. The correlation of development practices with resource flows is urgently needed to halt local pollutants in Nepal that are damaging health and the innate ability of the Himalayas to temper climate change.

State of Place and Ecocity Builders shall collect resource and urban design data for this project by partnering with the engineering department of the local university as well as centuries-old Nepalese community groups. Both Ecocity Builders’ metaflow data and State of Place’s data are collected by vigorous standardized processes that maximize accuracy and are specially tailored to enable participation and expertise from the local community with minimum training. State of Place is additionally implementing visual machine learning to automate the collection of urban design data for entire regions that can be correlated to more dispersed resource flows. The combined software product of this project will be reproducible in other settlements around the world. Ecocity Builders and State of Place already use their analyses independently in a dozen developing or developed countries. Their collaboration will allow them to offer a data-backed, visually persuasive web-based sustainability tool to dozens of other countries and potentially thousands of regions.
How the Ecological Footprint Can Help to Better Manage Our Infrastructure?

Professor Claudiane Ouellet-Plamondon¹, Dr Jennie Moore²

¹Ecole de Technologie Supérieure, Montreal, Canada, ²British Columbia Institute of Technology (BCIT), Vancouver, Canada

A common challenge for cities is to manage mounting costs for asset renewal and maintenance. Over the last 30 years, ecological footprint analysis gained prominence as a tool for measuring human demand on natural capital. The original method for estimating an ecological footprint (EF) relies on a top-down approach that assesses total energy and materials demand of a population at the nation-state level relying on national production plus imports, minus exports. Regionally specific data for energy use, and related carbon emissions, are then integrated to address demand for waste sinks. The resources for gross fixed capital formation (GFCF) and the services from governments are integrated in the EF, when calculating the Consumption Land Use Matrix (CLUM) from the Global Trade Analysis Project (GTAP) database. A subsequent method for estimating an ecological footprint takes a bottom-up approach that calculates the energy and materials from direct measurement of energy and material flows at the city scale, supplemented by regional or national consumption data, measured in units of actual consumption (e.g., tones, cubic metres, etc.) and then estimates the per capita footprint at the individual citizen level. Each approach delivers unique benefits for the analysis of human demand on biocapacity. Bottom-up and top-down provide complementary approaches to target actions that can be achieved through citizen and city-level actions or national interventions, respectively. Bottom-up measures target household and municipal actions to effect changes in various consumption components, such as food, buildings, consumables and waste, transportation, and water. Top-down measures target national and sub-national level actions. For example, the energy mix for electricity production is a major influencer of the EF values at the city level. National policies can also be implemented to change food production and reduce emissions from vehicles. In Canada, the GFCF is around 30% of the EF and cities can aim to track and reduce this portion of their EF using a top-down approach. An ecocity approach that aims to restructure cities in tightly compact, walkable environments can reduce the GFCF.
Buildings offer the most diverse, effective, practical, and profitable opportunities to tackle climate change. And, whether we like it or not, we live most of our lives indoors, so buildings also shape our social interactions, how we consume food and water, and even how we interact with the air and the natural environment. If we want better lives and better cities, then we need better buildings. But what’s “better” about one building compared to another?

Welcome to the world of high performance building standards. These voluntary programs live between the building code and market forces of the day, shining a spotlight on what is possible while nudging us out of our comfort zones. Old habits are hard to break, and these programs and standards have contributed significantly over the years through both incrementalism and radical reinvention of building design and construction.

Join this presentation for case studies that will take us on a journey that explores a personal history with high performance building standards over a 20-year career in design and construction in Canada. This will include case studies covering many incarnations of LEED, the Living Building Challenge, Net Zero Buildings, Passive House, WELL, One Planet Living, and more.

We will thoroughly explore:

- How some of these programs were successful while others were not;
- How they have contributed to real, positive outcomes across various indicators of sustainability;
- How they have changed the industry;
- What we have learned; and, importantly,
- What is still needed to get us to the next stage in the evolution of building performance.

The audience should come away with a better understanding of these standards, their similarities and differences, and the gaps that we need to address as citizens, policy makers, owners, and practitioners alike.
Cities around the world have made great strides and done impressive work in implementing sustainability policies and programs to mitigate the impacts from climate change, counter ecological degradation and improving the quality of life of their citizens. Yet it remains unclear whether or not these actions had the desired impact and represent real progress on the ground in cities around the world.

What is missing is a unified global system or approach to measure progress towards sustainability objectives, compare and recognize achievements and communicate successes.

The LEED for Cities and Communities certification program is a foundational building block to accelerate the implementation and verification of city-scale sustainability. The program provides a framework for measuring and managing the performance of social, economic and environmental conditions on a city-wide or community level. This sets the stage to develop responsible, effective and targeted plans to improve sustainability outcomes and much more: quality of life, health, prosperity, equity, access, empowerment, safety, education, resilience, infrastructure, and energy. LEED for Cities is designed to support continuous improvement through measurement, verification and benchmarking to accepted sustainability metrics.

LEED for Cities builds on the success of LEED (Leadership in Energy & Environmental Design) which is the most recognized and widely used global standard in green building certification. LEED has transformed the global real estate sector with 90,000 projects in 165 countries with enhanced environmental, financial and social performance. Find out why more than 90 cities and communities around the globe have chosen LEED for Cities to guide their sustainability paths forward.
Regenerative Urbanism - Platform for Next-Generation Practice

Mr. Scott Edmondson¹, Ms. Kirstin Weeks³, Mr. Charles Kelley²

¹Sf Planning, San Francisco, United States, ²ZGF Architects, Portland, USA, ³Arup, San Francisco, USA

Sustainability practice is facing a potential effectiveness challenge. Will our ad-hoc sustainability-as-usual approach be capable of producing sustainability, especially in time, given the accelerating existential threats of climate change and other socio-economic-environmental trends? If not, what do we do?

Enter “regenerative urbanism” emerging from the innovation occurring across our plan, design, and build professions, and which leading-edge cities are advancing around the world.

Urban development that “makes” more than it “takes” - regenerative city-regions of inclusive prosperity and well-being is the necessary innovation required to scale sustainability to the next level of environment, economic and social health performance required for 21st century urbanism.

With cities and the built environment being the spatial dimension of our economy, how the built environment is planned and designed fundamentally determines or “locks in” urban sustainability performance levels for the next 50-100+ year period before replacement at the end of the “useful life.”

Regenerative urbanism plays a formative role in creating a circular economy of inclusive abundance that is the necessary material basis for sustainable and equitable cities and society. Our routine approach to sustainability only slows the rate of impact with net-negative mitigation. Regenerative urbanism eliminates impacts at their source and produces inclusive abundance (net positive). This is accomplished with on-going innovation focused on achieving the imperatives of sustainable regenerative systems performance.

The panelists will present and then open the floor for discussion of their research and studies on projects in San Francisco, Sacramento, Los Angeles, Ottawa and others. These multiple projects are pursuing certifications like Living Community Challenge (Sacramento Valley Station Master Plan), One Planet (Zibi Community, Ottawa), Regenerative “Living” Districts & City (San Francisco) to inform and establish the absolutely necessary game-changing rules of 21st century urbanism.

This panel will illuminate the key features of the regenerative urbanism theme, response, and practice emerging from innovation across our plan, design, and build professions to make it more accessible to others, to advance the conversation, and to accelerate innovation and practice.
As we seek to develop ecologically sustainable cities around the world, we will require additional resources to achieve this goal. Today, demand for mineral resources is greater than ever before and increasing. At the same time, the past century has seen the closure of many large mines that provided for much of this demand. With a better understanding of the requirements for environmental assessment and community engagement, the time to develop new resources has greatly increased. Moving to the future more world class mineral deposits will need to be discovered to satisfy the world’s needs. Artificial intelligence and big data provide a solution to this problem through better identifying the mineral deposits that can satisfy this demand. Artificial neural networks can be used, with a variety of inputs, to identify and rank exploration targets which warrant further investigation. Beyond identification of mineral resources needed to satisfy demand, this technology has secondary benefits. Mineral exploration is an extremely carbon intensive process, has significant reclamation requirements, and can be very disruptive on wildlife. The use of this technology to better identify the targets that can provide economically viable resources will reduce the environmental impact in each of these areas. This solution is a multidisciplinary approach, involving not just geologists, but mining engineers, geostatistans, and experts in artificial intelligence and machine learning. Using innovative solutions such as this we can solve tomorrow’s problems today.
On March 20th 2019, 30 students from the MSc program in Ecological Restoration and the Mining and Mineral Resources Engineering program at BCIT toured a sand and gravel mine in Sechelt, British Columbia. After a guided site visit, working teams, including students from both programs, brainstormed ideas on how to reclaim selected areas of the mine and developed a reclamation plan. This collaboration project challenged students to design and implement best practices from both disciplines aiming to enhance processes and protocols common in the mining industry. This project centered around Ecocity’s core themes: bio-geophysical features (e.g., cleaner air and water, healthy soil, responsible mineral extraction) and ecological imperatives (e.g., healthy biodiversity and ecological integrity). The ideas developed by the students included diverse end land uses such as forested areas, grasslands and meadows, wetlands, ponds, camp sites and ziplines, among others. The planning included considerations for slope stability, water management, dust control, soil building, revegetation, invasive species management, and cultural and social responsibility. In addition to the scientific and technical knowledge acquired and applied by the students while working on their reclamation projects, the teams had a first-hand experience on how mining and reclamation/restoration professionals work together. This experience closely mimics the real-life situations where professionals from diverse disciplines collaborate throughout the mine life cycle, (i.e., planning, operation, progressive reclamation and closure). This collaborative experience helped students build a better understanding of each discipline’s perspective and how can they be used to enhance mining practices. During the scheduled presentation in this symposium some of the ideas and experiences gained through the collaborative effort will be showcased.
Impact and Value of Geo-Resources Underneath Cities for Resilient Urban Design

Mrs Katherine Ascott¹, Ms. Stephanie Bricker², Professor Jon Coaffee¹

¹University Of Warwick, United Kingdom, ²British Geological Survey, United Kingdom

The general trend in cities around the world is that urbanisation is on the rise. As a result of this, cities are becoming increasingly reliant on geo-resources to support their everyday services and expansion. Geo-resources are naturally occurring assets of the Earth that can be harnessed to create something functional for our consumption, including; geo-materials, sub-surface space, groundwater and geothermal energy. Above ground space, ground properties (permeability, stability, etc) and topography can also be considered valuable geo-resources that have sometimes been overlooked in city development. As our dependency on these resources has increased, also has our responsibility to manage them sustainably, although we have achieved this to varying levels of success. There has been misuse and overexploitation of some geo-resources which has contributed to limited sustainability and resilience of urban areas. For example, the use of the sub-surface for underground infrastructure has been poorly managed over time which has led to congestion in near-surface soils and may limit the extents to which new underground structures can span in the future.

Urban design integrates the various aspects of a built environment that make the essence of a place. This is therefore a key component to develop sustainable and resilient cities.

This study is investigating how the use of geo-resources can enhance the resilience and sustainability of cities. Current perceptions and practises of utilising geo-resources are being reviewed, as well as an examination of the current resilience and sustainability assessment methods proposed in cities today. Ultimately, a geo-resource site specific indexing tool is envisioned to propose a way forward to resilient urban design.
Starting the Conversation: Transitioning Canada to a Wellbeing Economy

Dr. Yannick Beaudoin¹

¹David Suzuki Foundation, 

Ask an average Canadian what the current purpose of the Canadian economy might be, and the answers typically resemble those a corporate CEO would provide describing their company goals; more growth and job creation often top the list. Ask an average Canadian what they aspire to and you get much more human and nuanced answers like prosperity, fulfilment, increased quality of life and well-being, a healthy future for generations to come; answers very similar to the model of Fundamental Human Needs developed by Chilean economist Manfred Max Neef. And here lies our aspirational paradox: Canadians have aspirations that are not compatible with the fundamental workings of our contemporary economics. In other words, we have a core societal operating system informed by an economics (i.e. the systems code) that is not designed to deliver what we actually want.

Innovating that operating system is by no means easy even if in many ways it is technically simple. In other words, it’s not a lack of knowledge or other ways of doing things that prevents change. It comes down to a question of faith. You see, contemporary economics has in many ways, come to be defined by qualities more typically attributed to a belief system that has helped keep debate and innovation (in economic thinking) at bay. The faith in its ‘trickle down’ promises has seen Canada as well as the global community adopt without question a material growth-at-all-costs policy. This quantitative growth-first pursuit blinds us to its effects by relegating our natural world as well as the social qualities that make life worth living, to the realm of mere ‘externalities’.

With the recent increased visibility and conversation around the many wicked challenges affecting our natural and social landscape, Canadians now have a creative opportunity born out of the failing economic theory that drives and amplifies these challenges. Going beyond quantitative growth into forms of qualitative growth, opens up new horizons for all Canadians. Whereas today, the majority of Canadians currently serve a system that produces lots of stuff, but has no real purpose, we now have all the necessary ingredients to design a system that unleashes our full potential; a system that serves both people and planet. But like all belief systems, change starts with awareness. As more of us learn about the inner working of old economics, we will be empowered to enable a ‘new’ economics, one fit for and with purpose.
Since every day we face a wide range of critical issues and challenges calling out for our attention, it is imperative that we not sacrifice one worthy goal (for example, reducing inequality) in our attempts to address another one (for example, climate action). Can we go even further and find synergies that enable us to solve or at least address multiple challenges with limited resources? This presentation will review our international experience to date using a multi-objective “community capital” framework and toolkit to support integrated community decision-making. We will then explore how this toolkit can be adapted and further developed to enhance sustainable community decision-making. Attendees will gain insights into how to avoid false trade-offs and into finding those sweet spots where a single well-crafted solution can have multiple benefits.
Natural Asset Management and Canada’s Accounting Framework: The Emerging Evidence

Ms. Isabel Gordon

Canadian local governments are starting to account for and manage natural assets such as forests, wetlands and foreshores to provide cost-effective and reliable service delivery. Municipal natural asset management is becoming ever more important as climate change, population growth and land intensification pressure Canada’s aging stock of engineered assets. But what does this mean from a financial planning and reporting perspective given the challenges in thinking about nature as an ‘asset’ from an accounting perspective? This session will explain recent developments and challenges.
Literally Living in a Tree House: Living Trees as a Building Material

Dr. Yael Stav, Mr. Ezekiel Golan

Invivo Design, Vancouver, Canada

Although we are accustomed to the natural shape of trees, we can, by growing soft tree roots, bending, pleaching or shaping trees, create objects of utility in controlled forms that are living systems. There are also ways to retrofit natural ecologies into the concrete urban jungle. When you create or retrofit a building into a living organism, it will self-repair, sequester carbon, meanwhile allowing not only human inhabitants to enjoy it, but other tree canopy dwellers such as birds, squirrels, lizards, as well as underground ecology to thrive. Buildings that, instead of timber or concrete, use living trees as their structure, will use locally available zero-waste building materials, reconstruct ecology in an urban environment, and take advantage of the built-in ecosystem services of a forest.

In this talk we will briefly present a few methods for building with trees (including willow tree biotecture and arborsculpture) focusing on ‘Treenovations’, a recent method for growing living structures using scaffolds that allow predetermined shape. We will describe a few patents, research and design stories, that demonstrate how this hyper natural building system can be applied in the city and the potential it proposes for solving the conflict between anthropocentric development and ecological conservation.
Metro Vancouver’s Urban Forest Climate Adaptation Initiative

Mr. Edward Nichol

Metro Vancouver, Canada

Climate change can significantly impact natural systems (and the benefits those systems provide) within cities. Metro Vancouver – a federation of 21 municipalities, one Electoral Area and one Treaty First Nation that collaboratively plans for and delivers regional-scale services – has identified the importance of climate adaptation in building and maintaining a livable region. Metro Vancouver is incorporating climate change adaptation into plans, policies, and initiatives. The urban forest – which includes trees in parks, around buildings, lining the streets and in backyards – provides essential ecosystem services that help buffer climate change impacts and contribute to the health and well-being of our communities. These forests cool streets and buildings, improve air quality, intercept rainwater, store carbon, and provide habitat, refuge, and forage opportunities for species. To provide these benefits, the urban forest must be healthy. The lifespan of a tree is typically much lower in an urban environment than it is in a natural setting, and the urban forest is susceptible to climate change impacts such as drought, higher temperatures and extreme weather events. To ensure our urban forests remain healthy and continue to provide us with benefits in the future, we need to make good choices about how we select and manage trees in our communities in the context of climate change. In the Metro Vancouver region, practical guidance on how to plan and manage urban forests in a changing climate was lacking. To address this knowledge gap, Metro Vancouver convened an advisory panel of academic experts and government staff to collaboratively develop the Urban Forest Climate Adaptation initiative. The initiative was developed to assess the risks and predicted changes to the region’s urban forest, and the outputs of this initiative provide practical guidance and tools to help member jurisdictions adapt to these changes.

The initiative has produced three main products so far. The Climate Adaptation Framework was created to help identify future climate risks, and potential solutions (such as management guidelines) that can help to reduce vulnerability. The Tree Species Selection Database allows the user to select tree species that will be well-adapted to a future climate and the intended planting site. The Design Guidebook can be used to maximize climate adaptation benefits across different urban landscapes. The Urban Forest Climate Adaptation initiative uses the most recent climate science and provides regionally-specific guidance to help practitioners incorporate climate change considerations into urban forest planning and management decisions.
S.04A.01

Designing for Future Mobility: Developing a Framework for the Sustainable Future City

Mr. Aaron Knorr

Perkins+Will, Vancouver, Canada

We are experiencing today a technologically-driven shift in the transportation industry – including autonomous vehicles, networked mobility, shared transportation, and electrification – that is transforming the way we move, and live, in cities. Studies suggest that the impact of future mobility on climate-altering greenhouse gas emissions could be reduced by half—or result in a 100% increase!—depending on the factors that come to dominate urban transportation.

This presentation summarizes a recently released report which aims to define future mobility principles that will support sustainable city goals through a series of proactive, present-day design opportunities for designers and policy-makers. The research behind the report is based on an extensive literature review of current trends, projections, and impacts in the realm of urban transportation and livable city criteria.

In order to formulate principles and solutions that respond to these mobility trends, broadly accepted goals for livable and sustainable city have been used to inform the way we might evaluate decisions about the future of mobility. The approach is founded on a “triple bottom line” approach to sustainability that encapsulates social, economic, and environmental well-being. These livable city goals are then evaluated against future mobility trends to inform a values-based approach to guide decision-making, urban design, and policy. Fundamental to all of these principles is focus on supporting low-carbon and equitable modes of transportation—focusing on how we move people, not vehicles; creating social space instead of storing cars; giving people choice and promoting healthy lifestyles; and prioritizing modes that result in a cleaner and more sustainable environment.

These future mobility principles are then applied to a range of urban typologies. The opportunities included in the report represent strategies for the implementation of present-day design opportunities, informed by research, into urban design, planning, and architecture projects which best support sustainable city goals.

It is critical that designers, planners, and policy makers understand and evaluate mobility trends while taking steps to proactively shape the future in a positive and purposeful way. In order to achieve the best environmental outcomes for cities, we need to re-frame our approach to urban mobility by focusing on sustainable principles; then leveraging emerging technologies, through design, to support this vision.
S.04A.02

Why No High Speed Rail in North America?

Mr. David Hoff

1Ledcor, Vancouver, Canada, 2VIA Rail Canada, Montreal, Canada

- High speed passenger rail (and high frequency PR) is a missing element in the development of North America’s major urban centers.

- The absence of HSR and the NA preference for airlines and airports has a significant and on-going impact on city design, function and development

- There are many barriers to the development of NA HSR - historic, economic and primarily political

- The concept of HSR has more social support in NA than political support largely due to the power of vested interests

- Changing public attitudes toward environmental and energy consumption of transportation systems have given HSR solutions a new life in NA

- HSR is better suited for intermodal transportation links than airlines and airport systems, thus extending its positive environmental impacts

- Major challenges for HSR in NA include, rail freight and trucking, competing manufacturing industries, federal government indifference, lack of expertise and experience and perceived cost

- Major opportunities for HSR lie with major cities, the technology industry, environmental movements and European and Asian investors.
Personal Carbon Trading as a Solution for Tackling Local Mobility Emissions. Demonstration of the CitiCAP-mobile Application.

Miss Anna Huttunen, Miss Saara Vauramo

City Of Lahti, Lahti, Finland

CitiCAP project has developed a personal carbon trading model and mobile application for tackling mobility emissions. The big launch for Lahti citizens is in September 2019.

The overall aim of the pilot has been to co-create together with citizens an incentive system for more sustainable mobility in their daily trips within urban area Lahti. Participation is voluntary-based and emphasizes incentives over penalties. PCT model of Lahti promotes also activity and public transportation use.

How does it function?

Carbon cap of the PCT system is defined based on the emission reduction targets set by the city of Lahti and adjusted by the amount of participants. Carbon cap stands for the total amount of carbon allowances, which are allocated to the participants. Citizens are engaged in deciding the allocation principle.

Transport mode tracking is done with PCT mobile app, which can automatically identify different types of mobility and calculates the CO2-emissions, time and distance travelled. When user manages to save carbon allowances, he/she earns in virtual euros that can be used for benefits and services on the app's marketplace. Users are not punished for surpassing the amount of carbon allowances, but it increases the carbon price at the market. Carbon price increases, when collectively more users surpass rather than save their allowances. In the vice versa situation, carbon price decreases accordingly. This is directly reflected on the price of different modes of transportation, and hence act as an incentive to choose a low-carbon mobility option.

Car driver can earn PCT credits too by reducing the travelling distance, using carpooling or changing to an electric or biogas vehicle. Carbon cap can be lowered after a certain period, which will raise carbon price. It is also possible to incite citizens to reduce their carbon emissions through temporary campaigns during which the carbon price is significantly higher than usually, e.g. during the cycling week.

Lahti PCT model is co-created from the start with the city’s decision-makers, residents, local businesses and collaboration partners.

In the Ecocity World Summit conference we would organize a workshop to demonstrate the use of the mobile application and a possibility to discuss the further development and scaling up of the application, the model and cooperation possibilities with fellow cities, organizations or companies.
City of Vancouver - Embodied Carbon Policy

Mr. Patrick Enright1

1City Of Vancouver, Vancouver, Canada

The City of Vancouver’s Zero Emissions Building Plan (ZEBP) seeks to reduce the operational emissions of new construction in Vancouver to zero by 2030 or sooner. This means that the embodied emissions of the building – all the emissions that take place to produce the materials and assemble and replace them on site – will become the only source of emissions from new construction. There are a range of options available today to designers to reduce embodied carbon in construction, but information on those options, including their effectiveness, costs, and other challenges, are not readily available to the design community.

Current City policy requires all new construction undergoing a rezoning to estimate their embodied carbon impacts using Life-Cycle Assessment (LCA), and submit a brief report to the City. Looking to the future, the City has set a goal of introducing a requirement to reduce embodied carbon in the next version of the Green Buildings Policy for Rezonings, likely to come into effect sometime in 2021.

This presentation will cover the City’s targets for embodied carbon reduction, the draft policy for reducing embodied carbon as it stands, as well as how other life-cycle indicators, material re-use, and prescriptive measures are included in the draft policy. Finally, it will also cover recent research on the effectiveness, costs, and challenges of measures to reduce the embodied carbon and other environmental impacts of construction available to designers today, and make the case implementing these measures today.
S.04B.02

Holistic Carbon Reductions for Major Infrastructure Developments – Going Beyond Operational Carbon Reductions to address Embodied Emissions for the YVR CORE Program

Ms Quin MacKenzie, Mr Kevin Welsh

Integral Group, Vancouver, Canada

Vancouver International Airport (YVR) is in the process of building a new central plant to heat and cool their existing 350,000 square metre terminal building as part of the larger CORE Program. The Program is designed to shift YVR towards new low-carbon energy efficient systems with a 33% reduction in greenhouse gas emissions during a time of unprecedented growth and demand.

As building operations have become more carbon and energy efficient, building materials continue to represent a greater piece of the carbon emissions pie associated with the global impact of new building projects. Reaching beyond goals to reduce carbon emissions associated with the operations of YVR, the CORE Program is also focusing on the embodied emissions associated with major building materials and making reductions where possible to address the holistic carbon impact of this major infrastructure development.

This session will cover how the project team has evaluated the entire “Cradle-to-Grave” life cycle of materials, allowing for comparative design decision making, finding the compromises between costs, environmental impacts, functionality and aesthetics in attempts to support holistic carbon reductions and drive down the embodied carbon emissions associated with the YVR CORE Program.
Building materials are loaded with embodied carbon as a result of the effort exerted through resource extraction, refinement, fabrication and transportation prior to their incorporation into construction and eventual reuse or disposal. The use of whole-building lifecycle assessments (LCA) as an internationally accepted science has been adopted as a means to quantify potential environmental impacts of buildings to inform planning, design and construction choices. However, in the developing field of LCA there is scarce available information which contributes to a significant effort and cost associated with conducting assessments to inform carbon sensitive green building decisions. With limited resources, practitioners are challenged to determine what materials should get counted and what should be ignored as insignificant contributors to embodied carbon for both new green buildings construction and renovations. It is well understood in building sciences that there is diminishing returns with increased detail to every estimate created in the planning and design phases which certainly also applies to LCA. It’s no surprise that the drywall screws don’t need to be counted or quantified, but what about the drywall itself? It’s typically assumed to not varying between construction types as a finishing material, but the LCA analysis can be askew if a tripling of the thickness of the drywall is required to provide fire resistance as a result of selecting a low embodied carbon mass timber construction form. Needless to say, LCA is still a complicated and contextual science.

In order to implement a campus wide net positive carbon contribution policy by 2035, the University of British Columbia undertook a holistic review of policies, standards and regulations. The current ad-hoc, scope based on budget, and varied methodologies had led to unpredictable results and costs which only further complicating climate sensitive building decision-making. The intent of this policy analysis is to inform, routinize, and bring consistency to the methodology for LCA which is informed by best practices and available tools. Understanding the required information and effort required to integrate a meaningful LCA into building planning is critical for achieving sustainability goals.
Compounding problems of global climate change, depleting aquifers, erosion of top soils, loss of habitat & species, and dis-equitable distribution of resources require fast-paced, collaborative, action to solve. Work-integrated learning with a focus on sustainability provides a platform for the transformation that must happen in business, education, and communities. The Interprofessional Applied Projects (IPAP) initiative is enabling students to approach these problems through supportive, multidisciplinary, and work-integrated learning environments.

A project coordinator was hired to identify industry-sponsored projects that aligned with the International Ecocity Standards, and substantial time was given to face-to-face meetings with faculty and, subsequently, teams of students. This approach achieved high levels of engagement and interest from participants. After uncovering a company’s values, the coordinator would help design a project that addressed one or more of the Ecocity Standards and then assign these ecocity projects a multi-disciplinary student team. For example, Construction Management and Business students worked together on an Environmental Management System to help a construction company achieve its B Corp status.

IPAP projects are not only more rewarding to a client, but the students also gain a wealth of experience. Previously, students only had access to uni-disciplinary projects most of which were unrelated to sustainability. Now, with IPAP, BCIT students can work on multi-disciplinary teams to solve sustainability challenges and support the Ecocity Standards. By doing so, we are helping build community capacity as well as a healthy and equitable economy as many of these projects have a business lens. Students receive enhanced work-integrated learning experiences that broaden learning outcomes, thus resulting in high faculty support for these projects.

With an increase of new collaborations and communication, IPAP enables ecocity-inspired information to heavily impact BCIT and its community. IPAP is enhancing sustainability education at BCIT and empowering students to run towards the problem and provide solutions for our communities and businesses.
Re-envisioning BCIT Campus as an EcoCity: A 2 Day Challenge Project

Ms Phyllis Chong¹
¹BCIT, Burnaby, Canada

In the 21st century, education must adapt to an ever-changing landscape. It is crucial to foster student-focused problem solving, encouraging collaboration and innovation. The School of Construction and the Environment (SoCE) at British Columbia Institute of Technology (BCIT) supports this endeavour by hosting the 2 Day Challenge student competition, bringing together students from the departments of Fish, Wildlife and Recreation, Forest and Natural Areas Management, Ecological Restoration, Geomatics, Civil Engineering, Architectural Science, Environmental Engineering, the School of Business, and the Indigenous Centre to build a collaborative and connected network within BCIT and to promote and establish ties with the larger community in the Lower Mainland. The 2 Day Challenge creates a learning environment where students apply their own knowledge, while simultaneously identifying what it is they can learn from others, and how they can fill that knowledge gap. Interdisciplinary collaboration between students promotes culturally-sensible and innovative solutions to addressing real-world, land-based issues.

In anticipation of the Ecocity 2019 World Summit hosted by BCIT School of Construction and the Environment, the focus of the 2 Day Challenge held in Spring 2019 will be on the development of a conceptual design and plan for upgrading the BCIT Burnaby Campus South, applying Ecocity principles.

The Official BCIT South Campus Vision identifies the need for additional rental housing for faculty, staff, and students; a major central park that adds new outdoor recreation and relaxation opportunities; space for industry partners; and expansion room for BCIT educational facilities. In addition, the BCIT community has expressed a desire for better retail, food, fitness and recreation options; better transit, cycling, ride sharing opportunities while maintaining sufficient parking facilities; reduced energy consumption and better recycling systems; sustainable buildings and infrastructure; and enhancement of Guichon Creek. The identified needs directly match Ecocity Standards, with a particular focus of this Challenge on the following eight Standards: Access by Proximity; Safe and Affordable Housing; Green Building; Environmentally Friendly Transport; Quality of Life; Healthy Biodiversity; Healthy and Accessible Food; and Responsible Resources/Materials.
Collaborations in the Classroom - Enhancing Student Perspectives to Aid Future Sustainable Development of the Natural Resource Industry

**Ms Olga Kosarewicz¹, Mrs Anayansi Cohen-Fernandez¹**

¹BCIT, School of Construction and the Environment, Burnaby, Canada

Mining and Mineral Resource Engineering is the newest Bachelor of Engineering Degree Program at BCIT, having only graduated its first class in June 2018. With the development of the new curriculum, the faculty challenged themselves to ensure innovation in mining was woven throughout many of the courses in order to ensure students learn the most current practices and trends. Natural resource development including mineral extraction, particularly when done near to urban areas, has come under much scrutiny in recent years. Thus, doing business as usual is no longer acceptable and mining companies and communities of interest are realizing their interdependence and the need to strive for innovative, mutually beneficial solutions. BCIT’s diverse educational program has provided a unique opportunity to explore establishment of a new collaboration project between the Mining and Ecological Restoration Programs. This inaugural project took place in Spring 2019 at a nearby mine, providing students from both programs an opportunity to work together on cross-disciplinary teams, striving to find a win-win solution.
S.05A.01

Increasing Access to Safe and Affordable Housing in Urban Settings Through an Integrated Systems Approach

Mr. Steven Weir

Steve Weir, Habitat for Humanity’s Vice President for Housing Innovation will provide a concise overview of Habitat’s strategy to assure that low-income households are able to experience improved housing conditions. Highlights of Mr. Weir’s presentation will include:

• Examples of multi-partner initiatives that integrate community-based approaches, private sector innovation, and public sector capacity to achieve resilient, sustainable housing solutions in a range of settings and contexts (Liberia, REELIH, etc.)
• Illustrations of how such initiatives align with major global development frameworks including the SDGs and the New Urban Agenda
• Themes that will shape the planning and design of sustainable housing strategies in cities around the world in the next 5-10 years
Designing Affordability: Developing a New Ecosystem for Equitable Housing, Vibrant Communities and Empowering People

Ms Amina Mirza

Office Of Metropolitan Design, Lahore, Pakistan

This paper aims to identify policy gaps in the current ‘National Housing Policy 2001’ of Pakistan so that ecologically sustainable human habitation imperatives can be integrated along with the development of sectoral policies. In 2018 the newly elected government launched ‘Naya Pakistan Housing Project’ to meet the shortfall of over 10 million houses. The government had outlined six main points, primarily relating to home financing and construction. A Task Force (TF) was set up to define a way forward comprising of industry professionals, politicians, and bureaucrats which would ultimately lead to formulation of an autonomous body to implement the projects. Upon the request of TF this study was done. The relevant subject data available locally and internationally was collected and analysed in view of the prevailing situation. As a case study the historic city of Lahore, located in agricultural plains of Punjab, Pakistan is examined. The challenges faced by the city are identified. A set of recommendations highlighting the need to create and engage a core team of experts comprising of design professionals and policy experts who will act as lead; working in tandem with experts from finance and legal to address policy gaps. Identifying gaps such as, and evaluation, environmental considerations and absence of transitional housing, social housing. To develop an integrated policy with long-term national housing strategy addressing the key considerations for human habitation, based on social and demographic trends, forecasts, as well as on culture and tradition. Stimulate the job creation and livelihoods by creating a model of interdependency on local industry. Legislate for land acquisition. Regularise informal housing. Set appropriate housing standards.
Canada’s National Housing Strategy Fosters Innovative Solutions for Affordable, Sustainable and Inclusive Housing

Ms Elizabeth Tang

Canada Mortgage and Housing Corporation, Vancouver, Canada

Canada’s first ever housing strategy, representing more than a $40 billion investment over 10 years, has a vision that “Canadians have housing that meet their needs and that they can afford. Affordable housing is a cornerstone of sustainable, inclusive communities and a Canadian economy where we can prosper and thrive.”

This workshop will share information and insights about the investments and funding programs under the National Housing Strategy (NHS), and how it encourages collaboration in new ways with more partners to innovate and improve housing in Canada. The panelists from Canada Mortgage and Housing Corporation (CMHC) and community housing sector will provide the audience with the information on:

1. The National Housing Co-investment Fund, a cornerstone initiative and investment for the construction of new and preservation of existing affordable housing, and its sustainability and inclusiveness criteria;
2. The Innovation and Research funding initiatives under the NHS that support research and innovation to rapidly incubate and scale potential solutions to chronic housing issues, with a highlight on two projects that are funded by the NHS 2018 Demonstrations funding program; and
3. Key findings from CMHC’s research on socially inclusive housing and communities to help housing providers in their planning, designing, construction, operation and renewal activities aimed at supporting and enhancing a sense of inclusivity for people in need.

Participants will come away with the knowledge of how to access funding for the development and renewal of housing, and for supporting their research and innovation to make communities more inclusive and sustainable.
Community Sharing of Renewable Energy via Blockchain

Mr. Eric Hawthorne

British Columbia Institute Of Technology, Burnaby, Canada

It is essential that electric power grids be adapted quickly to replace fossil-fuel generation with clean renewable energy sources such as solar and wind. This presents challenges for keeping the power grid balanced so that power supply equals power demand at all times, since renewable energy is intermittent. We explore a technology solution to this renewable grid balancing challenge.

What if community members (homes and businesses) could share and trade their own renewable energy generation and energy storage, as well as their willingness to temporarily reduce power demand. What if they could share energy within the community, and pool this resource to be offered for sale as a grid balancing service to the larger power grid operator. We describe a blockchain-technology solution which implements smart contracts between individual electric power “pro-sumers”, large businesses wishing to optimize their electric power costs, and power-grid operators who need additional energy generation or power-demand reduction on short notice to balance the grid. The blockchain solution keeps fine-grained track of each party’s contribution to an overall generation surge or consumption reduction, and compensates that party fairly with a portion of the price that the power grid operator pays for the grid balancing service. Thus even small energy management participants, like individual homes, can be incentivized to invest in more smart and renewable electric energy systems, like time-delayable heat pumps and water heaters, solar PV, home-scale smart batteries, or time-managed EV chargers.

A blockchain-based energy pool orchestrates the operation of these individually insignificant distributed energy resources, to provide a single large-scale energy resource to the power grid. The blockchain-based energy pool provides to the power grid operator a simple and relevant economic and technical interface (API), through which the grid operator can contract with the pool for a well-defined set of grid balancing services with performance guarantees.

We will outline the technical and economic concept of a blockchain-based grid-balancing-service energy pool; how it would work for participating communities and power utilities, and will describe the results of software prototype development and simulation testing.

Virtual smart energy pool services, once proven, can displace the need for GHG-emitting gas thermal power plants, while increasing the capacity of the grid to maintain stability with much more clean renewable power generation in the mix. Empowering individual community members to contribute to the power grid can thus get us to a zero-carbon energy system faster.

Jeff Peters

The City of Vancouver is a pioneer in adapting new renewable energy technologies. In 2008, the City partnered with BCIT and BC Hydro to trial standalone solar street lights in Vancouver parks. At the time, solar and LED technology had not yet advanced to where it is today. Gruja Blagojevic, an engineer in charge of electrical design for the City of Vancouver, described them as “pricey symbols of leadership by the city.” (https://www.bchydro.com/news/conservation/2008/solar_streetlamps.html)

Over the past decade, standalone solar lighting has advanced to a point where modern systems are less expensive and can deliver many times the light output of previous generations. This efficiency gain and cost reduction has been driven primarily by increases in LED efficacy, with additional gains coming from ever-increasing solar panel efficiencies.

With this in mind, the City of Vancouver decided in 2017 to light a section of the newly constructed Arbutus Greenway with standalone solar lighting systems. Urban Solar was awarded the contract for the design, engineering, supply and installation of these systems following a competitive solicitation process.

From the City of Vancouver website: “The Arbutus Greenway is a future, north-south transportation corridor that will connect people, parks, and places from False Creek to the Fraser River.”

“It will reimagine a historic rail corridor and will provide a high-quality, accessible public space for walking, cycling, and rolling. It will be a destination that fosters both movement and rich social interaction – inspired by nature and the stories of the places it connects.”

Following a major trend in urban improvement, a former rail corridor was decommissioned to create a place for all citizens to participate in all forms of active transportation. Lighting the Greenway encourages non-vehicular commuting during non-daylight hours, encouraging environmentally friendly transport and improving citizen quality of life.

This presentation will provide an overview of the benefits that Vancouverites have received from their well-lit Greenway. Furthermore, it will describe the challenges that the Urban Solar team had to overcome in designing and installing solar lighting in the heart of a Pacific Northwest city. We will also touch on other Urban applications for standalone solar lighting that reduce environmental impact and encourage environmentally friendly commuting and improve ROI of existing infrastructure.
Reducing Our Reliance on Fossil Fuels Through Local Heat Recovery and Energy Sharing

Mr. Andrew Byrnes

Pinchin, Richmond, Canada

With increasing requirements for high performance building envelopes, heating energy use intensities are falling. Air conditioning is becoming more important in a modern, urban, high-efficiency building design.

Application of a heat pump based heating system, coupled with a source of low-grade carbon-neutral thermal energy, can meet the heating and cooling needs of residents and produce substantial reductions in fossil fuel use for buildings. This approach focuses on recovery of locally-available thermal energy resources at the building, city block, or district scale thereby reducing reliance on imported fossil fuels. Reusing free, on-site generate waste heat helps building owners decouple their energy costs from market prices. At the district scale, this approach reduces the need for imported energy as communities are design to generate and share energy between buildings.

This session will present results of operating one such heat-pump-based energy center at Marine Gateway in Vancouver where nearly 90% of fossil fuel use has been eliminated. This session will describe opportunities to achieve similar results around BC and across Canada.

Mr. Maciej Golaszewski

1Stantec Consulting Ltd., Vancouver, Canada

Growing energy demands, lack of basic energy literacy and rising greenhouse gas emissions challenge today’s cities in their sustainable agendas. Energy Pop-up Park, or E-Pop is a prototype design that connects people with innovative and renewable energy technologies to learn about basic energy concepts through gamification. At the park, people will use human movement, sensory skills, and intelligence to create and manipulate energy in nature. This energy is then expressed with real-time interactive lighting and infographics displayed at the park to help people contextualize and learn about the energy they are generating. All in an effort to help people make smarter daily energy choices so we can increase urban resiliency and build more liveable and low carbon cities.
International Climate Justice: The Birth of the Bangladesh Youth Climate Network

Ms Debra Efroyson

Institute Of Wellbeing, Dhaka, Bangladesh

Bangladesh is one of the countries hardest hit by climate change despite contributing only nominally to greenhouse gas emissions. A focus on climate mitigation ignores the fact that potentially 20% of the tiny and densely populated country is likely to go under water, leading to even greater over-population in the cities and a devastating loss of land and livelihood for millions. Emboldened by the inspirational actions of Greta Thunberg, Bangladeshi youth have begun a network to try to convince those most responsible for climate change to change their behaviors, particularly to dramatically reduce car use. Messaging focuses on the responsibility of “benefit-takers” to change their lifestyles in order to lessen the impact of climate change, but also on the potential benefits of those behavior changes, in terms of cost savings, healthier lives, and stronger communities. A further and often neglected aspect of climate justice is in acknowledging the lessons that people in the “low consumption” countries could offer in terms of achieving minimal per capita greenhouse gas emissions. This also requires a revised understanding of “development” which is otherwise a straight track towards higher consumption, more waste, and greater emissions. The potential for quality of life with less consumption needs to be more broadly discussed. Bangladeshi youth hope to be at the forefront on these issues and offer positive messages and modeling for other countries to follow. How the network came into being, its current activities, and future plans will be discussed.
Creating Universal Access to Zero Waste Educational Programs

Ms Mikaila Johnson¹

¹BCIT, Burnaby, Canada

The City of Vancouver is currently producing an astronomical amount of municipal solid waste per year. At the rate it is being produced, our landfills are expected to reach maximum capacity by the year 2026. To counteract this, I have designed a Zero Waste Awareness Center (ZWAC), which is a proposed informational hub intended to educate the public on the current issue of excess waste production in Metro Vancouver. Through interactive galleries, workshops, and lectures, users will gain a breadth of knowledge on how to participate in eliminating waste, and on what resources are available in Metro Vancouver that can help support a transition to a zero waste lifestyle. ZWAC will provide the public, businesses, and students access to lifelong educational programs which will continue to evolve with our climate and our city. Its purpose is to bridge the knowledge gap that the majority of the public faces regarding sustainable innovation, namely zero waste initiatives, creating an ecologically sustainable city. The center’s goals align with the City of Vancouver’s Zero Waste 2040 Plan and wish to work alongside city officials to ensure a united and holistic approach to educating the public on the city’s goals. In addition, the center has been meticulously designed to be a green and user focused building by implementing sustainable materials, therefore creating a healthy and inspiring learning environment to further encourage the public to feel inclined to explore what zero waste initiatives are available. By transitioning to a zero waste community, our city will not be overcome with waste, the impact on our environment will decrease, and it will create a cleaner and more sustainable environment for our citizens. It is apparent that a global switch to a circular economy needs to occur – this starts with a zero waste philosophy, ensuring that the maximum amount of material is redirected from landfills and reintroduced back into society in a different form. This in depth research and design project has enlightened my views on the influence that proper education has on the implementation of city goals. My project aspires to provide universal access to this information in order to allow the public to understand their crucial role in creating future sustainable cities.
Buildings and cities affect us psychologically. We cannot lose sight of this as we strive for environmental performance, or else the unintended consequences - isolation, crime, illness - will result in social dysfunction that has a greater cost socially, economically and environmentally, than mere building inefficiencies.

Social isolation is now recognized by urban authorities as a major risk factor for many illnesses. How can design counter this? We know that even the simple act of paying attention to way finding can reduce the “social stress” that contributes to this isolation and its subsequent health consequences. Urban environments, to be successful, have to be designed to reduce stress and create more than superficial social interactions.

Vancouver, while consistently rated by multiple surveys to be among the most livable cities in the world, harbours Canada’s poorest urban neighbourhood (noted for it’s drug use, crime, mental illness, and homelessness) and is also the epicenter of the opioid crisis in Canada. What is Vancouver doing right, and wrong, to give it both of these distinctions?

What are the characteristics that socially successful buildings and communities share? Vancouver has examples to offer on what to include and avoid, with lessons drawn from the Athletes’ Village and over a dozen social housing sites within the city to illustrate the principles of “neuro-architecture” - the study of the relationship between space and emotional and physical health. A discipline anticipated by Winston Churchill’s prophetic, and oft quoted phrase “We shape our buildings; thereafter, they shape us.”
Interdisciplinary Design Approach for a resilient, adaptive and sustainable (re)development of Everglades City

Mr. Jean Pierre Droge¹, Dr. Nico Tillie¹

¹Delft University Of Technology, Netherlands

This paper describes the results of an interdisciplinary design research. It is based on the restorative ecological capacities and principles of Everglades National Park on the large scale and zooms in to Everglades City. The project addresses a multitude of challenges that can be related to the environment, economy and the community in South-Florida. The Comprehensive Everglades Restoration Project (CERP), a large hydrologic restoration project, already deals with many of these challenges. However, as it mainly addresses environmental and economic aspects on a larger scale, there is little connection to the local community and design solutions at local level such as in Everglade City are still to be developed.

Everglades City recently got destroyed by hurricane Irma and is threatened by sea level rise in the near future. Its economy is based on tourism solely depending on threatened ecosystems in its surroundings. By linking the fields of landscape architecture, urbanism, ecology & governance through an integrated design strategy, a better understanding of the system, key components and aspects on different scales was accomplished. Ecological, hydrological and geological dynamics in South Florida were studied, and principles were derived and used in the urban set up of Everglades City, being exemplary to other coastal settlements in the area. Conceptual design solutions and a conceptual master plan of Everglade city were the base to get in touch with local stakeholders and boost community participation. After aligning the stakeholder outcomes, with the urban environment and its surrounding ecosystems a regional vision was created which formed the context for local interventions in Everglades City. The result of this interdisciplinary design approach can be an example for resilient, adaptive and sustainable development, which can make an impact on multiple scale levels as well as for similar coastal settlements in the area.
S.05D.01

Advancing the Circular Economy via Industrial Symbiosis: Lessons from the NISP® Canada Pilot

Ms Tracy Casavant, Mr Timo Makinen

1National Industrial Symbiosis Program (NISP) Canada, Vancouver, Canada

Industrial symbiosis has been recognized as a key mechanism for advancing business towards a circular economy. The award winning National Industrial Symbiosis Program (NISP®) model has been adapted in more than 35 countries due to its success at catalysing the most symbiosis the fastest within a region.

A NISP® Canada pilot launched in October 2017 in Metro Vancouver and Greater Edmonton. In just 18 months, NISP® Canada engaged more than 300 businesses, the majority of which are SMEs, identifying 3500 potential symbiosis opportunities. Based on early data, NISP® Canada could catalyse at least $1.5M in economic benefit to businesses all while diverting 129,000 tonnes from landfill and avoiding up to 140,000 tonnes of GHG emissions.

This presentation will provide an overview of the NISP® model and NISP® Canada pilot operations, including a frank discussion of lessons learned and implications for the circular economy. The presentation will also cover funding challenges, research gaps, and the role of the waste management and recycling industries in the circular economy will also be discussed.

NISP Canada is grateful for funding from Western Economic Diversification Canada; Metro Vancouver, Cities of Edmonton, Surrey, and New Westminster; BC Agriculture; BC Energy, Mines & Petroleum Resources; BC Municipal Affairs; and Innovate BC.
The Power of Sustainable Procurement Processes and Use of Non-Virgin Materials

Ms. Brianna Bishop, Ms. Katie Hikida

BCIT Sustainable Business Leadership Alumni Professional Development, Vancouver, Canada

Context:
The post-secondary institutions of Canada, and specific to this project – British Columbia, hold some of the largest contracts for the procurement of office supplies compared to other industry purchasers. With this comes a lot of power to create positive change through purchasing power, and the opportunity for these institutions be leaders in sustainable innovations. This BCIT Capstone project was created to see how sustainable procurement processes were being utilized across post-secondary institutions in British Columbia.

Purpose & Methods:
Through the help of our project partners, Vancouver Economic Commission and B.C. Net, initial contact was sent to the procurement or sustainability officer at most post-secondary academic institutions in British Columbia. Initial points of contact were asked to participate in a 10 questions survey regarding the sustainable procurement practices of that specific institution, allowing the survey to be sent via email or through a phone interview. The team was successful in conducting interviews with one-quarter of all institutions.

The purpose of the interviews was to better understand how colleges and universities in British Columbia prioritize sustainable practices in their procurement processes and the importance on mitigating impact as a whole. Many of the questions placed importance on alternative to virgin materials and wood based products, and the impact of using those products.

Findings:
The primary research findings indicate that academic institutions have created internal procurement processes that are silo to independent departments. This disables institutions from creating cross-department procurement processes, which through implementation, would allow for more sustainable purchasing patterns.

Conclusion:
The publication of project results aims to provide valuable information to large institutions of any industry, and to inspire them to consider implanting cross-departmental sustainable procurement plans, given their potential to contribute more substantially to sustainability objectives such as those relating to climate change and the circular economy.
Our buildings and operating cities are out-of-balance with nature and natural systems. The system of take, make, use, and waste is causing destruction of the ecology that supports us during extraction, releasing pollution and toxins during production, emitting toxins during use, and remaining with us for many generations after we throw these materials away. Every North American carries a body burden of toxic substances from our daily exposure to materials we surround ourselves with. We treat our bodies and ecosystems as massive sinks for the global emission of toxins resulting from the production of the materials we build with.

Based on concerns for personal and employee health, there has been progress to clean up the interior environments in our working and living spaces. Green building imperatives have motivated designers to clean up the interior environments that we occupy, while the impacts of the production and extraction of materials have received less focus and interest. The benefits from the end product to users of are out of balance with the cost borne by other members of global society. People living near sites of extraction or production have an unequitable burden of exposure to toxins from materials that ultimately used thousands of kilometres away. Everyone deserves to be able to live a dignified life free from consequences of exposure to toxins. Many communities in proximity to the production facilities are experiencing higher rates on life-changing diseases and conditions, but the rest of society benefits from aesthetic experience or cost of the material.

The role of public engagement is critical to solving this challenge as government is too slow to move quickly to solve the challenge we face. We need to take action and demand better products. We need product manufacturers to reassess the ingredients they are using. It is not just or equitable if people get sick so that we can build sustainable building and cities. We need re-cast the way we produce materials, the way we build and what we build with so every step of materials production, use, and resource capture has a positive effect on life and living systems. We need to design for the benefit of life.

This presentation will discuss this imperative, examples of healthy design solutions, and the shifting role of industry.
We set out to create an urban homestead in North Vancouver to raise our family and prototype a mindful, post-carbon lifestyle that can be easily replicated by others. Our process followed these principles:

- Collaborate with nature to optimize the flows of energy, water, waste and food.
- Eradicate all fossil fuel use.
- Eliminate waste.
- Retain embodied energy.
- Regenerate native biodiversity.
- Grow food.
- Connect with nature to create meaningful family rituals.
- Use familiar local materials in unexpected ways.
- Favour a simple, uncluttered aesthetic.
- Control costs and optimize value.

The solution was to upcycle the 60’s bungalow we purchased rather than demolish it and start from scratch. This diverted tons of waste from the landfill, shaved months off the construction schedule and saved considerable expense.

The result is Colibri House, our home, which came into being through the following strategies:

- Removal of the gas service and replacement of the gas furnace with an air-to-air heat pump, re-using the existing ducting.
- Removal of walls in the kitchen and dining room to create a great room, anchored by a kitchen island and wood fireplace in Vancouver Island marble.
- Construction of a three tiered deck to provide a view of the Salish Sea and a suite of outdoor spaces for year-round connection to nature.
- Installation of a bio-filtered pond to harvest rainwater from the roof and provide habitat for plants, fish, birds and amphibians, as well as a visual amenity for contemplation and recalibration.
- Creation of a food garden in the front yard with over 250 square feet of raised beds providing local organic food, a regular fresh air element to our lifestyle and the opportunity to interact with neighbours.
- Introduction of a bee hive placed strategically above the front door, overseeing the garden but out of reach of the black bears that sometimes stop by...
- Retention of the existing trees in the back yard and replacement of the lawn with “bee turf” incorporating
many species of flowering ground cover for pollinators.

- Native plant communities installed on green roofs and living walls above the front and back doors.
- Installation of photovoltaics on the roof, providing 50% of annual electricity consumption.
- Replacing our gas car with an electric car.

These carefully coordinated, but easy and accessible, strategies are the basis for transitioning our cities to a post-carbon footing.

You may view a short film of this project at the bottom of the link below:

https://www.mindfulhomes.eco
Cities are at the forefront of reducing Greenhouse gas emissions by implementing improved, energy efficient building codes and standards. However, despite their best efforts, cities face a challenge with existing buildings, which account for a large portion of GHG emissions, due to their inability to mandate energy efficiency improvements and GHG reductions on existing buildings. In Metro Vancouver, existing buildings account for an estimated 29% of the GHG emissions. Although the construction industry has developed various technologies that can greatly reduce GHG emissions from buildings, less than 3% of all buildings have implemented these technologies due to the high up-front costs and lack of incentives.

To overcome these challenges, and support governments in their emission reduction goals, eStream Energy Partners is proposing an innovative new approach that separates the ownership of an energy system in large buildings from the ownership of the building itself. By allowing building stakeholders, such as developers, owners, and occupants, to obtain a financial interest in the energy system, they become incentivized to maximize their financial returns through reducing both energy consumption and GHG emissions. eStream Energy Partners’ hopes to demonstrate the positive economics of creating an energy system—known as an in-building utility, the potential financial savings for the end-users, and the potential reductions in energy demand and GHG emissions that could be achieved.

Under eStream Energy Partners’ approach, the in-building utility would finance 100% of the costs for improving the building’s energy infrastructure. It then recovers the costs by charging the building’s energy users for the energy they consume. A combination of energy controls, in-suite metering, energy recycling, and building envelope improvements would be used to reduce energy consumption and GHG emissions. Additionally, the utilities’ end-users will pay less for energy than in a comparable building.

From research and expert interviews completed by BCIT Sustainable Business Leadership students, it has been determined that the British Columbia Utilities Commission, the regulator, allows for a system as described. Local municipal governments are also supportive of this model if it can accelerate the reduction of GHG emissions, particularly emissions from the existing 95% of buildings built with outdated building codes.

In this presentation, eStream Energy Partners, with the support of the BCIT student team, will describe how the model could simplify and incentivize energy efficiency in buildings, achieve GHG emission reductions, create skilled green jobs, help tenants/property owners reduce their energy bills, and fosters greener cities.
The BC Energy Step Code as Catalyst towards Net Zero Energy Ready Buildings

Ms. Emily Sinclair¹, Mr. Adrian Mohareb¹

¹Building And Safety Standards Branch, Ministry of Municipal Affairs and Housing, Victoria, Canada

The BC Energy Step Code is an optional compliance path in the British Columbia Building Code (BCBC). Introduced in April 2017 and updated in December 2018, the BC Energy Step Code provides an incremental and consistent approach to achieving more energy-efficient buildings that go beyond the requirements of the base BCBC. It does so by establishing a series of measurable, performance-based energy efficiency requirements (or ‘steps’) for new construction that are progressively more energy efficient. Industry must demonstrate compliance with the steps by achieving building envelope, equipment and systems, and airtightness testing performance requirements. Step 1 entails modelling energy performance and measuring airtightness to ensure that a building will meet or exceed the minimum energy-efficiency requirements in the base BCBC. At the opposite end of the scale, the highest step represents “net zero energy ready” performance. Local governments may use the BC Energy Step Code, if they wish, to incentivize or require a level of energy efficiency in new construction that goes above and beyond the requirements of the base BCBC. Builders may also voluntarily use the BC Energy Step Code as a new compliance path for meeting the BCBC’s energy-efficiency requirements. The BC Energy Step Code has requirements for smaller residential (Part 9) buildings, and more complex (Part 3) residential, office and retail buildings. The BC Energy Step Code facilitates the Province of British Columbia’s commitment that buildings be net zero energy ready by 2032, with increases to the base BCBC in 2022 and 2027.

This presentation will discuss the history of energy performance requirements in the BCBC, the development of the BC Energy Step Code, its content, requirements and future developments, and provide examples of how buildings are already achieving different steps of the BC Energy Step Code.
Enforcement of Energy Codes Is One of the Most Impactful Strategies Cities Are Using to Curb GHG Emissions.

Ms Hilary Firestone¹

¹Natural Resources Defense Council, Washington, United States

The buildings sector is the largest energy sink in the U.S., comprising 50 to 75 percent of carbon emissions citywide in many cities, and contributing upwards of 40 percent of nationwide carbon emissions. And with cities accounting for 70% of greenhouse gas emissions worldwide, the urban buildings sector represents an area of incredible potential when considering how cities can be part of the climate solution.

For years, organizations like the Natural Resources Defense Council, through partnerships with other industry leaders like the Institute for Market Transformation, have worked to develop commonsense, market-based solutions to reducing the carbon footprint of buildings. What’s more: cities around the United States are more committed than ever to fighting climate change locally, and mayors understand that buildings are a key component of that fight. Now, Bloomberg Philanthropies’ American Cities Climate Challenge – which awarded 25 of the largest U.S. cities as winners last year – is combining city-level action with the expertise of our organizations to advance policies and programs to systematically reduce the carbon footprint of urban buildings.

The solutions being tested through the Climate Challenge are a wide range of policy-based actions, including: the implementation of robust benchmarking for city buildings; energy efficiency programs for commercial and residential buildings; increased enforcement of existing building energy codes, and; the introduction of transparency initiatives to ensure buildings are accounting for their emissions regularly and accurately.

The American Cities Climate Challenge awarded winners based specifically on their plans to reduce emissions from transportation and buildings, the two single greatest contributors to city emissions. As a result, several of the winning cities – from Cincinnati, OH to Albuquerque, NM to Austin, TX – already have buildings-specific policies outlined in their climate action plans. And, as representatives from the organizational partners that are working directly with cities to implement their plans, we are prepared to share the key learnings, insights, wins, and challenges that we’ve taken away from our work thus far. The lessons extracted from our experience with the American Cities Climate Challenge can help other cities and organizations develop the best, most effective, and most politically and economically feasible solutions to emissions reductions in buildings.
S.06A.04

The Building Efficiency Accelerator Program in Costa Rica: A Successful Experience worth to Replicate

Mrs. Ana Quirós Lara

Green Building Council Costa Rica, San Rafael de Escazú, Costa Rica

The Building Efficiency Accelerator (BEA) program, promoted by the World Green Building Council (through the Americas Regional Network, ARN), the World Resources Institute and other important stakeholders, is a “public-private collaboration that turns global expertise into action to accelerate local government implementation of building efficiency policies and programs”. As such, BEA, promotes the active involvement of local governments that can provide incentives and innovative local policies, to effectively further market transformation towards green and responsible building, with the ultimate goal to be replicated and finally adopted at national/federal government level.

In Costa Rica the municipalities are the form of administrative organization with the most direct and profound effect in the development of their local communities, both urban and rural, having several attributions, e.g. urban planning and local infrastructure. Alongside these opportunities, most of Costa Rica local governments have diverse and profound challenges yet, in the more recent years, the municipalities are strengthening capabilities and developing collaborative alliances to adopt and implement programs and initiatives to advance towards ODS country commitment and in the past months to comply with the National Decarbonization Plan.

In this context, the GBCCR has been strategically contributing to implement the BEA program in Costa Rica, in order to help speed up the adoption of efficient buildings, promote effective use of resources, establish sound policies and incentives to further strengthen municipal governments and to achieve national goals.

In this presentation GBCCR will briefly introduce the BEA program and its current successes worldwide and specifically for Latin America cities, mainly in Mexico and Colombia. To set the frame of work for the work done in Costa Rica starting with the national and international strategic collaborative alliances with for example, FEMETROM, the city of Vancouver and BCIT and moving forward towards the implementation process with the first city, to date, to adopt BEA program in Costa Rica and the Central American region.

The presenter will showcase this pilot project, highlighting the lessons learned to date, the road map towards replicability in other municipalities at national and Central American region and the challenges and opportunities that this program offers towards climate change mitigation and the COP25, which is being co-hosted by Costa Rica and Chile governments. The BEA program is expected to provide resources for the WorldGBC participation COP. Pre-COP will be held in San Jose, Costa Rica from Nov 23rd to Dec 1st, 2019.
How a Seed Library Can Build Community and Encourage Local Bio-diversity, One Carrot at a Time.

Ms Alison Griffin¹, Ms Celia Brinkerhoff², Ms Melissa Smith³

¹BCIT, Burnaby, Canada, ²Kwantlen Polytechnic University, Richmond, Canada, ³University of British Columbia, Vancouver, Canada

The concept of a seed library is very simple. Much like a traditional library, patrons “borrow” seeds in the same way that they might borrow books and are free to plant them in their own gardens. Patrons are then encouraged to save seeds to return to the library for future users, but there is no obligation to do so. Ultimately, seed libraries embody a goal of contributing to learning, experimentation, and community. As users learn about seed saving, they return seeds for others to use, promoting healthy biodiversity and accessible food.

While relatively new, the seed library concept is growing quickly. Mostly this is in response to a concern about the risks of the global agri-business model and its focus on monocultures, but also with the goal of building local knowledge and increasing access to healthy foods. There are, of course, much larger efforts in place to preserve seed varieties in the case of massive crop failure, but these are preserved in climate-controlled vaults, only to be brought out in the event of dire catastrophe. Surely something more can be done at the local level to simply encourage communities to grow a greater diversity of crops in their own backyards and balconies.

As part of the seed library movement, campus seed libraries promote food security in their communities through the preservation and exchange of locally grown and harvested seeds. By keeping heirloom and open-pollinated varieties active in the community, seed libraries promote a more sustainable and biologically diverse food system. Seed libraries also believe that by growing food independently, saving seeds, and sharing knowledge with one another, we can help make positive changes towards a sustainable future.

Many of these grassroot efforts have sprung up in individual communities, but slowly these libraries are starting to join together to improve the scalability of this idea. One such example is the partnership of three local post-secondary libraries in Vancouver to jointly promote and support each other’s seed library initiatives to build a stronger, healthier growing community in BC.

In our session, we plan to discuss how each of our seed libraries were first conceived and outline the benefits we have seen on our campuses in building community as much as in growing food. Libraries are universal open sources of learning, experimentation and community, and seed libraries continue to expand these values while also providing healthy biodiversity and accessible food along the way.
How Can I Reduce My Carbon Footprint?

Miss Munifa Ahmed

Food production industry accounts more than quarter of global warming and livestock accounts for 14% from that, which is more toxic than transportation sector. Yes, it is curial to reduce our usage of fossil fuel but if meat industries are not held accountable from policy makers, our hard work is counter balanced by the ever-increasing meat production. Did you know that three meat companies – JBS, Cargill and Tyson – are estimated to have emitted more greenhouse gases last year than all of France and nearly as much as some of the biggest oil companies like Exxon, BP and Shell? Source Guardian News

Did that turn you off! Good. Now we know that reducing our meat consumption is as important. China in 2016 had taken initiative and introduced meat dietary restriction to reduce meat by 50%. Their research shows that by 2030, this would reduce 1-billion greenhouse gas emission. Thus, this shows that meat reduction is a concrete part of the solution. Using design thinking and understanding the hopes and the pains of user is how we approached the problem. Providing feature and services that address there need and assist them in 1% behavioural change. And that is where that gap exist, the empathic communication from both end, the government and public.

Currently, our team is developing a web application, SmartMeat App, that combat further climate change by helping us to easily manage our meat product intake. By providing a relevant data of our food choice and services to enhance to eco-friendly diet. I envision the app beyond just addressing a global issue. But changing and enhance the dialogue of conversation between the government and public. By proofing that engaging, encouraging and empowering could be our systematic approach for changing the situation. That is exactly what our survey result had showed, more than 80% of our app tester responded that they are ready to start reducing their meat product intake if it had positive impact on climate change.

By the end, this is not to make things so fancy or complicated. We are just trying to address global issue by changing the dialogue of conversation. Instead of blaming and putting finger on government and developed countries only, how about I change myself. And imagine if good number of us is working toward same goal. Imagine millions! That would create a change.
Authentication of Medicinal Herbs Grown in an Urban Agriculture Setting

Dr. Paula Brown¹

¹Bcit, Burnaby, Canada

Urban agriculture is now considered to be integral to the sustainability and livability of the urban environment and includes food production in vacant areas [1] as well as in and on buildings using recycled resources such as waste water, waste heat and organic waste [2]. Vegetables, including leaf crops, vine crops and culinary herbs, comprise the bulk of food produced because they are well suited to urban growing conditions [1]. This means that medicinal herbs can be produced in these settings and potentially become an important source of ingredients for locally produced Natural Health Products (NHPs).

For this to occur, it will be necessary to authenticate the plants being grown and to ensure their purity and potency. BCIT’s Natural Health Products and Food Research Laboratory (NRG) was developed to address these issues.

Traditional approaches to authenticating botanicals is to select appropriate phytochemicals and measure against those specifications as a determinant of quality. While numerous publications describe procedures for determining compounds of interest in plant species, few methods have been systematically evaluated for accuracy, precision, or reliability and often the analysis of finished products is not within the scope of the method. This approach is further challenged by difficulties related to selection of marker compounds and a lack of reliable reference materials, both botanical and chemical.

NRG has mitigated this problem by using a holistic approach to authenticating plant materials by measuring the chemical profile or “fingerprinting”, an approach that is now feasible because advances in bioinformatic software have facilitated the application of chemometrics to botanical profiles resulting in very elegant quality assurance tools. Regardless of the analytical approached adopted, methods must only be employed within their defined scope & applicability as determined through rigorous method validation.

NRG will provide examples of how this approach has been used on various medicinal herbs including goldenseal and ginseng.

References


In the next decades, the main challenge for a sustainable urban development will happen in developing and emerging countries, knowing that 90% of the process of urbanization will challenge Asia and Africa where less than 50% of population live in cities presently.

The paradigm of the future city in the South is the following one: 1) the urban change in Southern countries will have a major impact on the future of the whole planet; 2) two main dimensions characterize a large majority of Southern cities: territorial fragmentation and social disparities; 3) the urban integration of poor takes place through a multitude of informal activities.

In response to this situation, it is imperative to develop innovative urban planning aimed at territorial and social coherence for a more inclusive city.

Numerous studies have shown that the reproduction of planning models inherited from the North does not correspond to these objectives at all.

Along the last years we studied this question of urban sustainability and planning in diverse small and medium sized cities in Southern countries (Burkina Faso, Brasil, Argentina, Vietnam) in order to investigate how the planning process is actually set up by the public authorities, with which resources (human and financial), within which collaborations and with what results. In majority of cases, local authorities don’t have sufficient financial budget to resolve all the problems they face, the public administration misses competent staff to head the creation and follow up of urban master and sectoral plans. And they are dependant of external decision makers (national and regional governments, private companies, international cooperation agencies).

The aim of this participatory research (with municipalities and civil society representatives) is to discern the major urban development deficits in habitat, infrastructures and collective services, to understand the role of informality in urban management and reinvent planning with the perspective of reducing social and economic inequalities, alleviating poverty, preserving the environment, and fostering a more inclusive governance.

From several examples recently studied in Vietnam, Burkina Faso and Latin America, we will discuss a few paths to follow in this area, through better adapted technological instrumentation, a more active citizen participation in the planning process and a more democratic governance of the urban development.
Supporting Informal Areas Resilience: Reinforcing Hidden Green Potentials for a Better Quality of Life

Professor Heba Allah Khalil\textsuperscript{1}, Dr. Sherin Gammaz\textsuperscript{1}

\textsuperscript{1}Department of Architecture, Faculty of Engineering, Cairo University, Giza, Egypt

Climate change is the current focus of urban debates, as it is becoming a reality and not just an anticipation. Urban areas are both major contributors to the phenomenon and victims of it. Major urbanization activities take part in cities of the Global South, where informalization is synonyms to urbanization. Aspiring to be equitable, cities should balance the needs of their various inhabitants securing the prosperity of both affluent and vulnerable groups. For many years, slums and informal areas have been seen as geographies of blight and despair. However, these areas efficiently provide needs, amenities and affordability to vast groups who, otherwise, were not addressed by their governments. This paper studies informal areas and highlights their hidden green characteristics through analyzing their compliance with the principles of sustainable urbanism. Furthermore, the paper investigates what is the green performance of such areas according to green rating systems focusing on energy performance. Additionally, the paper explores what quality of life do these areas provide to their dwellers according to the criteria defined by a number of indices that measure quality of life as well as prosperity. Four informal districts in Greater Cairo Region are investigated as case studies to validate results and provide more practical insights. The paper then deduces several strategies that can assist informal areas to be more resilient in the face of climate change, with its associated increased heat stress, and improve quality of life.

Key Words: Informal Areas, Quality of Life; Energy Efficiency; Sustainable Urbanism; Cairo.
Ecuador has 14 indigenous rural communities, most of them face economic problems due to the lack of opportunities in their area. Young people migrate to the cities under the assumption that in the city, Quito, they will find more opportunities, only 3% of them succeed. One of these communities is Mariano Acosta, where 65% of its population has migrated and they seemed uncertain of the causes. The root cause of migration in this town is the administration of its resources, this problem could be shifted and give the community a new perspective and co-create solutions with their resources.

The objective of this study is to find innovative, local and sustainable strategies in Mariano Acosta, that could create new opportunities for the youth and develop economic diversification and preventing the massive migration of young adults in the areas. Through social innovation tools and design strategists, we conducted workshops to develop solutions with the communities and using their available resources in their system.

The research findings indicate a three-phase project that tackles the use of resources, decision-making system and how to best use a donated lot. Each phase was developed through a participatory process involving the community, its leaders, government agencies, NPOs. A replicable model was created that can be implemented in other rural areas of South America facing similar problems to diversify their economy through a sustainable approach.
YVR: How A Governance Structure Can Support Both Sustainability and Innovation

Marion Town

The Vancouver Airport Authority, familiar to many by its call letters “YVR” is a community based non-government organisation that reinvests all of its profits back into the airport and region. As Canada’s second largest, and one of North America’s fastest growing airports, it is YVR’s unique operating model that has supported expanded operations and improved customer experiences, while also decoupling environmental impact. While passengers grew from 17.6 to 25.9 million between 2012 and 2019 YVR was successful in cutting their greenhouse gas emissions by 11%. Programs to reduce the airport and their business partners potable water consumption also resulted in in a 37% decrease per passenger over that same period. Located at the mouth of the Fraser River, the Vancouver airport’s investment in natural capital regeneration earned it the world’s first Salmon Safe certification in 2016. Innovative solutions to support greater accessibility, improve customer experience through the creation of new border kiosks, provide seamless rapid transit to city centres, and still provide over $1 million in donations to local charities and organisations are all rooted in a governance model that reflects its community.
A Review of Municipal Plans that Integrate Global-level Biodiversity Outcomes

Mrs. Jennifer Pierce¹, Dr. Jennie Moore³

¹Urban Biodiversity Hub, Vancouver, Canada, ²University of British Columbia, Vancouver, Canada, ³BCIT, Burnaby, Canada

If cities are to be ecologically-minded, they must consider their own direct and indirect impacts beyond their physical borders (Kissinger 2008). The concept that the environmental impact of a particular area may occur at a distance and even at a larger scale than is immediately apparent is called telecoupling (Liu et al. 2013). Folke et al. quantified the impact of cities to be 500-1000 times larger than their legal boundaries (1997). Global level initiatives such as the Aichi Targets and measurement tools such as the ecological framework (Rees and Wackernagel, 1996; Rees, 2008) are intended to aid cities in making connections with larger scale impacts. But, are cities using these tools in their ecological planning?

This research project identifies how cities worldwide make the connection between local biodiversity plans and biodiversity outcomes beyond their borders. The primary research question is “How are cities considering the implications of their biodiversity planning on a global scale?”

The outcomes of this research include a typology of approaches taken by cities and the identification of those approaches that have promise in terms of taking a more comprehensive approach to larger scale impacts and connecting to global indicators.

We found that while it was relatively uncommon for cities to discuss global level impacts or concerns. We will review those exceptional cities who have expanded their focus to the broader area, such as Saskatoon and Nagoya and discuss their varied approaches.

Our findings reinforce the theory of a gap between biodiversity actions at the local level and outcomes and actions at the global scale. Based on these findings, we would encourage more cities to consider their impact on a global scale, and to link their activities to global targets and national strategies. Our findings also suggest that global and national initiatives may not sufficiently consider local concerns and context, and thus may contribute to barriers cities face to integrate global concerns into local planning.
Metro Vancouver’s Ecological Health Framework

Ms Laurie Bates-Frymel

Metro Vancouver, Canada

Metro Vancouver is a federation of 21 municipalities, one Electoral Area and one Treaty First Nation that collaboratively plans for and delivers regional-scale services. Its core services are drinking water, wastewater treatment and solid waste management. Metro Vancouver also regulates air quality, plans for urban growth, manages a regional parks system and provides affordable housing. The regional district is governed by a Board of Directors of elected officials from each local authority.

As a public entity, Metro Vancouver has a variety of ecological health-related responsibilities, from protecting lands through its regional parks function to minimizing impacts on the environment through its utility operations. Adopted by the Metro Vancouver Board of Directors in 2018, the Ecological Health Framework encapsulates Metro Vancouver’s collective efforts around ecological health and provides guiding principles, goals, and strategies to help achieve the vision of a beautiful, healthy, and resilient environment for current and future generations. Specifically, the Framework:

- Identifies Metro Vancouver’s role in protecting and enhancing ecological health as it relates to its services and functions;
- Provides a foundation for integrating ecological health into Metro Vancouver’s corporate decision making;
- Identifies how Metro Vancouver will report on ecological health-related initiatives across the organization; and
- Supports regional efforts to protect and enhance ecological health.

The Framework also sets the following high-level goals for ecological health to guide corporate actions:

Goal 1: Build ecological resilience and minimize impacts
Goal 2: Protect natural areas and conserve ecosystem services
Goal 3: Nurture nature within communities

This presentation will provide an overview of Metro Vancouver’s Ecological Health Framework and highlight a few key projects underway in 2019.
Rebuilding Wild Salmon Populations with New Approaches to Flood Control

Ms Lina Azeez

Watershed Watch Salmon Society, Coquitlam, Canada

Our communities live in interdependent relationship with the ocean, waterways, fish, mammals, and many other species that make up B.C.’s diverse ecosystems.

The lower Fraser River was once one of the world’s richest mosaics of Pacific salmon habitat. Currently, over 600 km of dikes restrict the free movement of Fraser salmon to their historic habitats. Flood mitigation projects rarely consider fully the impacts on ecosystems. New approaches to flood control infrastructure that protect and enhance natural processes can benefit both natural and built environments.

Flooding will certainly affect our everyday lives in the near future, and our flood management solutions must not overlook the impacts on native habitats. This presentation will discuss the challenges and solutions of utilizing gray or green infrastructure and bioengineering techniques to modernize the way we manage for floods.

Who are the primary actors? What does the legislation say? How can cost-benefit analysis be used to identify the multiple benefits of greening flood infrastructure? These are some of the themes addressed through this presentation.
S.07A.01

Vision and Experiences of Vehicle-Sharing Systems in Taipei

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Transportation in cities is one of the key issues related the efficiency of local economic activities, environmental quality and, in the long run, the competitiveness of an specific area. In Taiwan, the number of motorcycles and scooters powered by fossil fuel are about half of the population, meaning every 2 citizens are owning one two-wheel vehicle. Because of the high volume of motorcycles and scooters, the complicated vehicle types in streets resulted in the difficulty of traffic control and bad air quality. In Taipei as an example, the Mass Rapid Transportation system has been under construction since early the 1990s. The completed Taipei MRT network so far has significantly reduced the needs for private transportation and improved the air quality. However, scooters are still popular for young generations and lower income families. Therefore, in addition to the welcomed bike sharing system in many cities since the early 2000s, sharing of electric scooters has also expanded its usage as a welcomed business model recently in Taiwan. Besides, car sharing service is also available in cities. Thus, combined with the MRT and public bus systems, vehicle sharing systems are important for lower-carbon cities in Taiwan. But more effective efforts should also be put into force to encourage the uses and applications of sharing systems in the future, which relies on the education to give up personal transportation, and efficient and effective operation in all systems to greatly benefit all system users.
S.07A.02

Fuel Cell and Hydrogen; A Compelling Value Proposition for Zero Emission Heavy Duty Transportation

Mr. Nicolas Pocard

Ballard Power Systems Inc., Burnaby, Canada

Many cities and bus and truck operators are struggling today with the currently conflicting objectives of shifting to zero emission vehicles while keeping operational flexibility and maintaining budgets under control. We will look at the current market drivers; regulations as well as incentives which are driving the electrification of heavy duty transportation.

With the rapid progresses of battery technology and cost reduction of electric drive train; electric buses and trucks are starting to be deployed in our cities. However there are unique challenges with heavy duty transportation that battery alone might not be able to solve; range (over 200 miles), vehicle weight versus payload, refueling time versus vehicle utilization as well as charging infrastructure scalability and cost.

The hybridization of fuel cell power modules and batteries may solve those problems and provide fleet operators with zero-emission vehicles which will meet their operational requirements. Hydrogen fuel cell technology has come a long way from the early days. This proven technology is now hitting the road and delivers new opportunities for mass transit including rail and freight applications.

The combination of battery with on-board fuel cell power generator offer many advantages to bus and truck fleet operators including longer autonomy; route flexibility and much faster refueling while providing all the advantages of electric vehicles (reduce GHG, improve urban air quality, low noise and comfort of driving).

Fuel cell electric bus technology is maturing rapidly while moving in-step along a descending cost curve. There will be over 1,000 fuel cell buses on the road in the next 18 months with a very strong demand from China. We will highlight the value proposition of fuel cell electric buses through the case studies of Transport for London(UK).

We will finally look at the refueling challenges; deployment of large fleets of electric buses and trucks will create challenges for the electric grid infrastructure as well as for the operators. How to recharge many very large batteries in a short time in one location? Hydrogen as a gaseous fuel (like CNG) can be produced from excess renewable energy and provide scalable infrastructure for large scale fleet depot to refill a bus or a truck in less than 10 minutes.
The Acoustic Bus Stop as a Proposal for Ecocity Builders 2019

Ms Linda Ximena Torres Gutierrez¹, Mrs Javier Camilo Guevara Rodríguez²

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According to the World Health Organization (WHO), traffic noise is the second factor that most affects the health of populations and generates more air pollution. This organization recommends that noise in residential areas should not exceed 55db at day and 40 db at night. In the case of Colombia, the maximum noise emissions are regulated by Resolution 0627 of 2006 which establishes a maximum threshold of 65 db by day and 55 db at night for residential areas, schools, universities and parks. That is, the WHO recommendation is below Colombian regulation.

In Colombia, the highest levels of noise pollution are found in Bogotá. According to the citizen perception survey of 2018 by the program Bogotá Cómo Vamos, there is a high level of dissatisfaction on the part of citizens. 71% of the dissatisfaction corresponds to the high levels of noise. The Secretary of the Environment points out that one of the main reasons is the excess of noise and the regulatory noncompliance of the maximum emission standards expressed in decibels by the industrial, commercial, transport and service sectors.

The highest levels of noise are found in residential areas in the south and west of the city, which have between 70 and 80 decibels, produced by vehicles, especially buses and trucks. As a result, the streets with the greatest noise impact from vehicular traffic are Avenida Caracas, Calle 13 and Carretera Sur with Avenida Boyacá, which affects the population.

In Bogotá, 58.6% of the population exposed to noise suffers from hearing loss. The main public health problems generated by noise pollution are: stress, irritability, interference of spoken communication among the inhabitants of the sector, fatigue and tension.

As a strategy to mitigate this problem, we propose a new concept of urban design to bus stops, whose main objective is to mitigate the noise generated by traffic and commercial activities for users of urban transport. The intention is to create a zone of acoustic protection for pedestrians and residents who take public transport with an urban furniture called ACOUSTIC BUS STOP.

The ACOUSTIC BUS STOP will have a structure of native vegetation located 5 m from the sound source on the road with high vehicular traffic. The ACOUSTIC BUS STOP will work as an urban furniture that, through digital devices and thermoacoustic materials, will reduce between 10 and 25 decibels of noise from the urban context.
Realizing Decarbonized Cities: Getting the Planning, Implementation, and Financing Right

Mr. Jeremy Murphy1

1Sustainability Solutions Group, Vancouver, Canada

Cities are scrambling to mitigate and adapt to climate change. The challenge is daunting and the path to decarbonization is elusive. This presentation highlights the successes of several leading cities in modelling actions, prioritizing strategies, and determining financing options and timing for their decarbonization roadmaps. Small and large city examples will be discussed. The capabilities of SSG’s open-source, sophisticated energy, emissions, and financing tool, CityInSight, will be on display, showcasing its ability to model holistic, city-wide scenarios. The scenarios address buildings energy use and efficiency, energy generation and transmission, transit and transportation, liquid and solid wastes, land-use, forest and agriculture, and renewable energy generation and storage technologies, as well as climate action co-benefits such as energy poverty, equity, transportation access, and health. The presentation will engage the audience on their challenges with municipal climate action and decarbonization strategies, matching them with possible approaches used in other cities.
S.07B.02


Mr. Svend Andersen¹, Ms. Bora Youn

¹GHG Accounting Services, Vancouver, Canada

The world’s leading EcoCities are looking to implement innovative solutions that achieve meaningful reductions in emissions and waste, while successfully bending the urban appetite for resources.

In 2015, Canada and 192 other United Nations (UN) member states unanimously adopted the United Nations 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs). Governments, businesses and citizens are mobilizing efforts to achieve the Agenda by 2030, meaning that we all have a role to play. Today’s changing landscape is characterized by a complex mix of risks and opportunities. Whether an organization is faced with new and disruptive technologies, or stakeholders demand for greater transparency on progress towards environmental and social goals, organizational leaders are increasingly becoming aware that a short-term vision is not enough because environmental impacts need to be incorporated into long-term planning to ensure prosperity in the future. Organizations that understand this challenge are taking concrete action by embodying sustainability into their strategic priorities and operations. For organizations seeking to embody sustainability widely into their operations, a comprehensive understanding about how to operate more sustainably will enable organizations to implement innovative solutions to achieve their SDGs.

GHG Accounting has conducted a comprehensive research into the best practices of GHG emission reduction and renewable energy generation projects across Canada. With the wealth of information available to them, cities can leverage the best practices developed by other local governments to address climate change and navigate the transition to a low carbon economy, all with a view to creating vibrant and healthy communities for people to live, work, and play.

GHG Accounting’s study was conducted based on publicly available resources, which provide unique insights into examples of best municipal climate practices and actions. The public availability of this information was identified as a key criterion because transparency lends credibility to the information. All project documentation was reviewed against strict validation criteria ranging from additionality to effectiveness. The resulting analytics provide extremely valuable insights into the pathway trends of local climate action. The analytics also show how projects relate to different policy applications at a provincial level. While many studies typically focus on more obvious European examples, this study focuses on Canadian solutions. With a wide range of socio-economic and climatic differences across remote and urban communities across the country, Canadian projects tackle a diverse range of issues that provide insights that will be relevant to an audience beyond Canadian borders.
S.07B.03

Climate Change and Free Trade a Challenge for North America a Legal Approach

Professor Alfonso Magaña

Universidad de Guadalajara, Guadalajara, Mexico

CLIMATE CHANGE AND FREE TRADE
A CHALLENGE FOR NORTH AMERICA
A LEGAL APPROACH.

ALFONSO MAGAÑA ASCENCIO
UNIVERSITY OF GUADALAJARA
GUADALAJARA, JALISCO, MEXICO
MARCH 31, 2019

There are for the commercial partners in the North America region, goals to achieve, commitments to be fulfilled, but also, challenges and challenges to face together and get ahead; issues such as development, economic growth, prosperity, security, energy, environment, migration, are within the political, academic agenda, in the economic and productive sectors, as well as in civil society; but without a doubt, the biggest challenge facing not only the region but also the international community is Climate Change. Today we can not talk about trade, investment, economic growth, development and prosperity without assuming responsibility for the implications of Climate Change, today, Climate Change must be part of the trade equation, nowadays Climate Change it brings with it the need for paradigm changes in all areas and at all levels, including in the Free Trade Agreements, today requires commercial treaties with a new version, in which there is a real, responsible and efficient link; between trade and natural resources, the environment and climate, to face climate change, as a commitment to survival. Today also Climate Change represents a challenge for the social sciences including the Law for the consolidation of a Multilateral Commercial and Climate Legal Framework, regional and internal systems in this regard.
Establishing Common Practice to Monitor and Safeguard a Positive Transition to Circular Economy for Work and Workers

Ms Joke Dufourmont⁴, Mr Esteban Muñoz²

¹Circle Economy, Amsterdam, Netherlands, ²UN Environment Cities Unit, Paris, France

The circular economy has the potential to provide for the societal needs for all within the boundaries of our planet by decoupling welfare creation from resource extraction.

Various studies indeed point to the huge potential for innovation and job creation of the circular economy. While the circular economy offers a great prospective to achieve a more inclusive economy that serves the needs of all people, this potential needs to be safeguarded.

It is therefore necessary to keep a close eye on the distribution of wealth and jobs of the transition to circularity. In order to do so, the need for a shared understanding and metric of employment in the circular economy arises; bringing together the currently heavily fragmented narrative into an internationally validated and uniform monitoring practice.

UN Environment Cities’ Unit and Circle Economy are therefore collaborating to develop one standard to monitor employment in the circular economy. This standard gives insight into both the magnitude and nature of the circular labour market, but also identifies the potential of sector transitions to circularity. The standard has been tested and validated in four cities around the world, and refined to fit the limitations and opportunities of both data scarce and -rich environments.

This standard is now robust for and validated by these pilot cities, and can be rolled out for policymakers around the world to steer a positive transition to circular economy for work and workers.
From Circular Economy to Eco-cities: The Visions and Experiences of Smes in Taiwan

Dr. Lih-chyi Wen, Dr. Chun-hsu Lin

Center For Green Economy, Chung-hua Institution For Economic Research, Taipei, Taiwan

With the fact of resource scarcity on the earth, Circular Economy is an ideal economic development model for sustainable development and environment-friendly life styles. While Circular Economy is also currently a top priority policy of the central government in Taiwan, it is still more a concept than a practical process. Therefore we believe circular economy development needs practical guidelines for producers and consumers, especially for small-and-medium-sized enterprises.

In the past three decades, Taiwan’s national recycling framework provided a good foundation for further developing circular economy. On the other hand, flexible manufacturing capability of Taiwan’s SMEs is also an advantage to develop Circular Economy. We therefore in 2018 proposed a forum-typed platform with communication, R&D, training and competition functions that benefit the society to move forward. After one year of practice, the first Taiwan Circular Economy Awards held by the Green Economy Initiative of CIER has provided the SMEs with concrete assistance in developing their own capacity in circular economy through a series of activities. Moreover, this process also can be further modified and applied to other societies around the world.
Redefining Economics to Achieve Just and Sustainable Cities

Ms Debra Efroymsn

Institute Of Wellbeing, Dhaka, Bangladesh

The continuing obsession with economic growth as defined by GDP makes it impossible to achieve sustainability. A broader understanding of existing economic myths is needed in order to challenge them to create the socially just and ecologically sustainable cities that we need for our present and future survival. In addition to learning about an economics of wellbeing, we need to find ways to share that knowledge more widely so that those concerned about the planet and all its inhabitants can strongly counter the arguments that prevent social and ecological justice from becoming our main goal. The many important initiatives towards new, green/ environmental, feminist, and Buddhist economics need to move rapidly from the fringes to the mainstream in order to prevent the worst effects of climate change. The field of economics also cannot continue to be separated from real life concerns involving economic and social justice and environmental sustainability.

Years of experience researching, writing, and teaching from a book (Beyond Apologies, Defining and Achieving an Economics of Wellbeing) have shown that young adults are the most receptive to positive messages and the most willing to think differently about economics. The basis of economics needs to be just distribution of resources while minimizing waste. We need to redefine high standards of living, emphasizing community connections rather than mindless consumption. An economics of wellbeing is not only possible but the only hope for sustaining life on this planet. If ecological activists become more confident in discussing economics and in countering economic myths, we will achieve greater success in our activism and in promoting ecological, just, and truly sustainable cities.
An ‘Interregional / Interspatial’ Analysis of ‘urban Metabolism’ as a Framework for Advancing Sustainability in an Interconnected World

Professor Meidad Kissinger1

1Ben Gurion University Of The Negev, , Israel

As the dominant form of human habitat, most of the world’s natural resources and related by-products discharged into the local and global environment are either directly or indirectly related to cities. The objective of the presented research is to examine the extent to which selected existing and potential measures within and outside urban boundaries can reduce the urban environmental reliance and impact and increase its sustainability. Changing the way cities are using materials and energy require the integration of various measures such as policy and planning, behavioral change, and technological developments, that have to be implemented at various spatial scales.

‘Urban metabolism’ approach quantifies the amount of direct and embodied energy and materials flows through a city and its related by-products. The presented research embraces an ‘interregional / interspatial sustainability’ approach to quantify the resources and waste flows to and from a city on the local, regional and global scales. It then uses that analysis to examine the potential contribution of several existing and suggested measures to change that metabolism.

The presentation will focus on the city of Tel Aviv-Jaffa, Israel, metabolism over a year. It will first present an interspatial analysis of the overall urban metabolism, identifying various routes of energy and materials flows used by the city. The analysis will include such urban consumption categories as food, water, consumables, electricity, transportation and more. It also will present an analysis of the spatial sources of each related direct and embodied flows. Based on that analysis, the potential implications of implementing selected measures at various spatial scales will be presented. It will include the potential contribution of existing policies, the implications of continues urban growth as well as more advanced far-reaching measures. It will also explore some of the linkages and tradeoff between selected measures and components of the urban metabolism. The contribution of each will be quantified and the integration of a multi scale efforts will be assessed alongside its interspatial implications for sustainability.
Ecocity Footprint: A Method for Measuring and Closing the Sustainability Gap by Integrating Urban Metabolism and Life Cycle Assessment with Carbon and Ecological Footprint Analysis

Dr. Jennie Moore

1British Columbia Institute Of Technology, Burnaby, Canada, 2One Earth, Vancouver, Canada, 3Ecocity Builders, Oakland, United States of America

With climate change, species extinction, and resource scarcity issues coming to a head globally, cities are seeking fast action to reduce impacts and build resilience. An integrated assessment of the difference between a city’s current demand on nature’s services to supply energy and materials and what would be needed to stay within ecological carrying capacity is fast becoming of interest. An integrated urban metabolism, consumption-based greenhouse gas emissions inventory, and ecological footprint helps cities understand their energy and materials flows as well as demand on nature’s services to both supply those flows and assimilate associated wastes, mainly in the form of carbon sequestration. This combined method of analysis is called Ecocity Footprinting. It starts with an energy and materials flows analysis of a given population in a discrete geographic area, scalable from a neighbourhood to metropolitan region. The annual demand for resource supply and waste sequestration by nature is achieved using a combination of life cycle analysis, consumption based greenhouse gas emissions analysis, and ecological footprint analysis. The Ecocity Footprint method is unique in that it combines multiple analyses taking a bottom-up approach that enables local authorities to clearly understanding how policy and planning at the local level affects global ecological outcomes. This understanding helps inform further analysis to locate the changes needed in policy, planning, city operations, citizen lifestyles, and senior government activities to bring energy and resource demand in-line with planetary boundaries. The Ecocity Footprint method was developed in Vancouver, Canada and has been piloted in cities around the world with good results. It has also been successfully piloted at the neighbourhood level. In all cases, participating agencies gain insight and interest in the initiative, which is critical to sustain ongoing efforts aimed towards managing demand in-line with global resource and biocapacity supply. This presentation presents the Ecocity Footprint method and discusses the findings in terms of outcomes and impacts with an eye towards its ongoing refinement and dissemination. Case studies from Canada and jurisdictions in other countries will be presented.
The Sustainable Lifestyles Accelerator: Opportunities for Fostering Sustainability Transition on Municipal Level

Dr. Michael Lettenmeier¹,³,⁴, Dr. Torsten Massek², Viivi Toivio³

¹Aalto University, Espoo, Finland, ²Polytechnical University of Catalunya, Sant Cugat, Spain, ³D-mat ltd., Helsinki, Finland, ⁴Wuppertal Institute, Wuppertal, Germany

The paper describes and analyzes the cooperation of the Sustainable Lifestyles Accelerator with Finnish and Spanish municipalities. The Sustainable Lifestyles Accelerator is a three-year program for upscaling sustainable lifestyles in Finland, Spain, Germany, Switzerland, Denmark, Mexico and India. It is based on the four steps of the transition cycle comprising problem analysis, vision development, experimenting and up-scaling. In the Sustainable Lifestyles Accelerator problem analysis means the calculation of the lifestyle carbon and material footprints of the participating households, vision development the co-creation of individual roadmaps towards 1.5-degree lifestyles by 2030 for each participating household, and experimenting a one-month phase where each participating household tries out several measures out of their roadmap. Up-scaling happens by extending the number of participating households per country from 5-10 in 2018 to 500 in 2019 and 10,000 in 2020. In addition, up-scaling means increasing the number of municipalities cooperating with the Sustainable Lifestyles Accelerator.

The participating municipalities in 2018 were Porvoo in Finland and Sant Cugat del Vallès in Catalunya/Spain. Additional municipalities have joined in 2019. The Finnish city of Porvoo has committed itself to become carbon-neutral by 2030. Sustainable lifestyles are one of four focus points of the new city strategy adopted in 2018. In 2018, for example, eight households from Porvoo participated in the Sustainable Lifestyles Accelerator in 2018. In addition to the municipality, more than ten mostly local or regional companies participated by facilitating households’ experiments or implementation. The participating households were able to drop their average carbon and material footprints by 25 per cent during the experimental phase. In addition, the households provided plenty of feedback to the municipality on critical points for improving the ability of inhabitants to make their lifestyles more sustainable.

The paper concludes that a cooperation of municipalities of households like in the Sustainable Lifestyles Accelerator can provide municipalities crucial feedback on how to improve sustainability and how to approach their carbon-neutrality targets. Municipalities can facilitate the sustainability of their inhabitants’ lifestyles thus not only improving living conditions but also sustainability-oriented local business.
QuadReal and Oakridge Centre - Sustainable Urban Living

Mr. Matthew Strand, Ms. Rosemary Freeman, Ms. Chrystal Burns

Quadreal, Vancouver, Canada
QuadReal And Oakridge Vancouver

Background

Oakridge Mall was originally opened in 1959 by Woodward Stores which was the anchor tenant until it was sold to Hudson’s Bay in 1993. QuadReal purchased Oakridge Centre in 2017 as it saw a groundbreaking way to address the most pressing issues in sustainable urban living. This project is couched within QuadReal’s broader commitment to reduce absolute greenhouse gas emissions by 30% below 2005 levels by 2030.

Highlights

After more than a decade of planning, construction has begun at Oakridge Centre with an expected completion date 2025. This project is the transformation of a 28.5-acre property from a traditional parking lot mall to a Live-Work-Play Centre. The goal is to situate Oakridge as a focal point in the broader context of Vancouver’s goal to reconstruct itself in balance with nature. This project aligns itself with the City of Vancouver’s Greenest City 2020 Action Plan.

Safe and Affordable Housing

Approximately 6,000 people will live in 2,600 residential units and dedicate 290 units to rental housing and 290 units to social housing.

Green Building

On the roof of the mall there Oakridge will have a nine-acre public park operated by the Vancouver Park Board with 1,400 trees, opportunities for urban farming alongside paths for running and cycling.

Environmentally Friendly Transport

Oakridge is located on a public transportation hub and will benefit from capacity improvements to Skytrain service including a proposed expansion of Oakridge-41st Station and the new B-Line rapid bus service connecting East Vancouver to the University of British Columbia and Joyce-Collingwood Station in 2019. In addition, 6,000 parking stalls are planned - all outfitted with electric vehicle chargers.

Clean and Renewable Energy

By adopting a district energy system, Oakridge will produce 70% fewer GHGs than comparable projects.
Healthy Culture

Oakridge will have a market with over 100,000 square feet of curated culinary space and one of Vancouver’s largest community centres. Moreover, the total public art program budget for Oakridge has been set to surpass $7 million.

Quality of Life

Open rooftop space will also double as a large music venue for up to 3,000 attendees. The floor area of retail at the new multi-storey shopping centre will increase to about one million square feet which will include pedestrian-only, outdoor high-street. A new office space with large, open floor plans will be geared for 3,000 employees in the tech and creative industries.
Greenest City Reflections

S.08A.02

Mrs Jennifer Wahl¹, Mr Brad Badelt

¹City Of Vancouver, Vancouver, Canada

Nearly a decade has passed since Vancouver’s City Council unanimously approved the Greenest City Action Plan (GCAP), which set an ambitious aspiration to be the greenest city in the world by 2020. In many ways, GCAP has been a major success. The creation of the plan galvanized public support for sustainability. The plan’s measurable targets helped drive—and adapt—actions over time. GCAP has also contributed to a healthy sense of competition globally, garnered over 50 international awards, and is the subject of nearly 50 published academic research papers world-wide.

With 2020 now at our doorstep, we have an opportunity to reflect over the past ten years to identify what worked well, and what we might do differently next time. To inform our plans beyond 2020, insights were collected through interviews and surveys with staff, elected officials, key stakeholders, and other leading cities in an effort to evaluate what GCAP was able to accomplish and how, and identify how we can make our next environmental plan even more impactful.

We found several elements of GCAP that Vancouver should carry forward into our next environmental plan. GC is seen as a bold, ambitious, aspirational, and evidence-based plan with a credible brand. Strong targets and reporting structures, implementation structures, and leadership were instrumental to the plan’s success.

In other areas of the plan, opportunities for improvement were identified, as well as gaps to be addressed. Notably, the strong public engagement during GCAP development could have been continued more cohesively throughout implementation. Similarly, strong collaboration with community partners during the plan’s development could have been continued more consistently during implementation, such that Vancouver’s non-profit ecosystem played a more hands-on role. Another area for improvement relates to embedding more support for learning and experimentation to expand focus beyond targets.

There are also ways Vancouver could do things differently, primarily stemming from changing global and local contexts. The mounting global environmental crisis and new City priorities around reconciliation, affordability, and equity create a more complex landscape when compared to that of 2009, when the original direction was established. The plan could be expanded to include emerging environmental issues while deeper systems change could support alignment across City policies.

This is an exciting time for Vancouver, to learn from our past and to set a new environmental plan for our city to 2050. Much of our learnings will likely be applicable to other cities tackling similar challenges.
Lifescape: A New Approach to Urban Life

Will Craig

More and more people live and work in towers and dense urban areas. These places serve their function but rarely feel grounded in community. People come down to ground level to walk, socialize, shop, dine or simply stroll. Lifescape is a new way of thinking about how to holistically design and curate experiences at the ground.

It is at the intersection of people and place that we create catalysts for connection. We expand on thinking about life in the in-between, in the places and spaces at the ground level and exploring what unites people and place - turning the landscape into a LIFESCAPE. Technology has become convenient for us, however we are still social beings and continue to crave those person-to-person connections. Now more than ever, the quality of our experiences is a differentiator.

Through Lifescape, what emerges is a new approach that sees cities as platforms for human interaction and places that spur social activity, blending in landscape and nature in places that make people feel good. Working from the ground up, we perceive a remarkable opportunity to uplift the human dimension and reduce the footprint on society. We look at the hardware and software of places, and everything in between, constantly exploring how every element at the ground level contributes to creating complete, human-oriented places.
How Effective Are Awareness Campaigns at Changing Plastic Waste Behaviour?

Ms. Jiaying Zhao\textsuperscript{2}, Mr. Jeremy Douglas\textsuperscript{1}

\textsuperscript{1}Ocean Wise, Vancouver, Canada, \textsuperscript{2}UBC, ,

Plastic pollution is entering our oceans at the unprecedented rate of one dump truck every minute. Once there, it can be harmful to seabirds and animals, who can get entangled by it or suffocate when they mistake it for food.

At the same time, awareness of the ocean plastic problem is at an all-time high. As is the desire for people from all walks of life to do something about it. That’s why Ocean Wise launched the Plastic Wise campaign: to create a sea of change, starting with individuals pledging to shift their behaviour.

But with all the increased awareness and campaigns, how do we know what is actually getting people to act differently to stop plastic pollution?

That’s what we sought to understand by partnering with the UBC Psychology department and KPMG to undertake a practical, real-life study of how different messaging can change plastic waste behaviour. The study was designed to test different types of messaging (“interventions”) and see which one is most effective at preventing plastic waste.

In this talk, we will share the findings of this study, which are significant because they will be able to help cities, businesses, governments and other organizations know what type of messaging and communication is most effective at reducing plastic waste.
Shifting the Focus of Circular Economy from the Environment to People

Mr. Andy Chou¹

¹Drinkfill, Vancouver, Canada

It goes without saying that our current economy is linear – purchase, consume, and dispose. While growing demand has prompted new explorations into circular economic models, these endeavours are too focused on environmental issues. This is because it places the intended users too often as a secondary or after thought. Whether it’d be policy or innovations, this solution risks poor adoption. This leads to our belief that the term, circular economy, should be redefined as being “circular” around the user. In fact, if you looked at the definition of economy or economic, you would often see the keywords: “social science” and “behaviours and interactions”.

The reason why environment-centricity may lead to poor adoption is that most people do not place sustainability at the heart of their everyday decisions. And while there are many green lifestyles that have strong followings, the majority of global consumers have not yet adopted them. Unfortunately, at the current trajectory, it will not be enough to prevent some of the worst environmental outcomes.

So how do we create a truly circular solution that focuses on the user while remaining true to sustainability? Through human-centred design principles, universal truths, and start-up methodologies. This means placing people at the heart of every single thought and decision.

This philosophy starts by deciding on a particular environmental issue we want to address. It quickly then goes into the most important part: mapping out the user and their world. It examines questions such as who they are, why they act the way they do, what they want, and how they meet their needs. The next step then looks at new possible solutions, and focuses on how to each one meets universal needs (ex. convenience, affordability, quality, attractiveness). Lastly, we begin rapid experimentation through a “build-test-learn-iterate” model. At any part, if that there is a mismatch between user and solution, we may pivot the concept or even change the challenge we want to solve.

Without such a process, the growing circular economy risks being only a movement of a small community rather than of the global consumer. This philosophy has a higher success because it looks exactly at a person’s pain points then creates a solution that solves it in a sustainable manner. More importantly, it saves precious time that can then be invested to prevent environmental catastrophe.

Circular economy isn’t broken, but we can tweak and optimize it.
Consumables and Waste account for 14% of Vancouver’s ecological footprint (0.41 gha/ca) and are “... dominated by upstream impacts, namely the energy and materials that go into producing the goods that are consumed in the city.”. As such, a reduction in consumption needs to be prioritized over waste management. The repair of products to extend their usable life is an untapped circular economy opportunity that could reduce the need for new products and prevent waste. A BCIT Capstone project for the Advanced Certificate in Sustainable Business Leadership with Vancity and One Earth as clients explored key barriers and opportunities to amplify repair in Greater Vancouver with a focus on small repair businesses, consumer attitudes and investment opportunities.

A landscape scan across Metro Vancouver classified repair businesses by product type and exposed geographic patterns. Interviews with small repair businesses will provide insight into their capacity to provide repair services, market dynamics and risks and knowledge of influencing trends. A survey conducted at four Vancity branches and a City of Vancouver Zero Waste Repair Workshop uncovered citizen motivations, interests, and willingness to pay for repair. Key informant interviews with Vancity explored their micro financing capabilities for small repair businesses.

Citizen survey results indicate that a lack of knowledge about how to repair items is the largest barrier, followed by a lack of tools, and then cost. When a household item is broken, 41% of people are likely or very likely to repair, donate, or recycle it even if it means dropping it off at a depot versus 24% who are likely or very likely to discard it as garbage. Consumers are most willing to pay for the repair of IT electronics and furniture, paying up to 15% of new purchase price the majority of time.

Preliminary conclusions indicate that increasing repair education is key and that business and investment opportunities are greatest for furniture and IT electronics. The landscape scan shows that repair businesses are relocating to cheaper suburban locations. The small business interviews are yet to be completed, however, initial insights indicate the key barriers they face are from producers not providing necessary repair manuals and tools for repair at a reasonable price.
Transdisciplinary practice will be crucial to overcome the complex, multi-faceted problems of the future. The Living Pavilion project explored how Indigenous-art-science collaborations can inform public engagement that catalyses agency, adaptation and resilience in cities. The Living Pavilion used a practice-led research project to identify new forms of environmental communication that engages global narrators, unites diverse perspectives and mobilises an increasingly despondent public. The Living Pavilion – a temporary event space that celebrates Indigenous knowledge systems, ecological science, sustainable design and participatory arts – took place at the University of Melbourne Parkville campus during May 2019. It brought together leading Indigenous and non-Indigenous thinkers across science, technology and the arts. It revealed new pathways for practice that bolsters stewardship in cities.
Factor Four: The Campus as an Ecocity Fractal

Ms Sarah Campbell¹, Mr Alexandre Hebert¹, Mr Colin Chan¹

¹British Columbia Institute of Technology (BCIT), Burnaby, Canada

In 2009 the School of Construction and the Environment (SoCE) at the British Columbia Institute of Technology (BCIT) initiated a project on the North end of campus aimed at creating an ecologically sustainable microcosm. The plan was developed at a workshop facilitated by Ecocity Builders focused on transforming our campus into an Ecocity Fractal. Working as a living lab project we demonstrated sustainable practices on campus, providing opportunities to engage students in the transformation of the built environment as an ecologically sustainable learning space. The goal was to reduce our footprint while maintaining services. Through energy efficiency improvements, six buildings have reduced their greenhouse gas emissions by 50%-75%. This session will showcase the sustainability work in the Factor Four area. This includes the successes and challenges in energy reductions, cross departmental collaboration, and engagement. In addition to reducing our carbon footprint we are working towards the ecological restoration of the area. Projects have been done in collaboration with Campus Development and Facilities, and have included hundreds of students and faculty from over a dozen programs. The co-benefits of pursuing sustainability on campus have been numerous and provide a model for other communities. Students reported higher levels of satisfaction and improved workplace quality. We have improved health and safety, air quality, classroom delivery, campus look and feel, and improved the sense of pride and ownership in our educators.
The Story of Vancouver’s Solutions Lab: Exploring the Potential for Public Sector Social Innovation Labs to Make Transformative Change Toward a Healthy + Green City

Ms Lindsay Cole¹²

¹City of Vancouver, Vancouver, Canada, ²University of British Columbia, Vancouver, Canada

Can governments innovate, experiment, and learn? This presentation will explore the transformative potential of Public Sector Innovation Labs as a response to complex sustainability challenges, using the City of Vancouver Solutions Lab as a case study.

Many governments are establishing Public Sector Innovation Labs (PSILs) as a new approach to working on complex challenges. With the increasing pressure that governments are facing to address complex challenges like climate change, equity, and many others, it’s becoming clear that governments’ industrialization-era structures and processes are not able to adapt quickly enough to get ahead of these complex challenges at the pace that is needed. Increasingly citizens are demanding that their governments collaboratively, systemically, transparently and effectively respond to complex challenges in order to improve the lives of current and future generations, and restore a relationship of care with the land, water and people. These pressures are catalyzing a proliferation of responses, and PSILs are one response that is gaining momentum.

PSILs are defined as “a semi-autonomous organisation/structure that engages diverse participants - on a long-term basis - in open collaboration for the purpose of creating, elaborating, and prototyping radical solutions to open-ended systemic challenges”. PSILs are distinct units created by governments to bring creativity and innovation into these typically risk averse cultures. Of the estimated 500+ international PSILs, most are in federal governments with many now emerging at sub-state levels, and most have begun in the last five years.

The City of Vancouver Solutions Lab is a 2-year old PSIL focused on achieving meaningful transformation toward the Healthy and Greenest City vision and policy. During this time the Solutions Lab has worked on eight different complex challenges using processes designed to build social innovation capacities, competencies, and infrastructure. Each lab challenge is co-creative, working with City staff and community partners. The Solutions Lab also includes a community of practice for City staff to learn and practice social innovation and design theories and methods in their work. This presentation will share the theories, frameworks, and methods being used in Vancouver’s Solutions Lab and the learning we have generated over our first two years of experimentation. The presentation will be interesting to those who are trying to find different processes to catalyze innovation through experimentation and learning in their organisations.
YVR Airport Authority – Musqueam Agreement: Stewarding Resources for Mutual Benefit

Mary Point

Vancouver International Airport and Musqueam Indian Band are located in the same community on land that is Musqueam traditional territory. Musqueam have played an integral role in YVR’s business and operations. On June 21, 2017, the Musqueam Indian Band - YVR Airport Sustainability & Friendship Agreement was signed. It constitutes a thirty year agreement based on friendship and respect to achieve a sustainable and mutually beneficial future. The agreement includes a number of scholarships and new jobs, one per cent of annual revenue share from YVR, identification and protection of archeological resources and support for ongoing operations and long-term development at the airport.
Taza - Something Amazing is Coming

Mrs. Joanne Sawatzky\(^1\), Mr. Dan Van Leeuwen\(^2\), Ms. Christina Radvak\(^3\)

\(^1\)Light House Sustainable Building Centre, Vancouver, Canada, \(^2\)Canderel MDC Development Mgmt, Calgary, Canada

Taza is a one-of-a-kind community being developed on the Tsuut’ina Nation bordering Southwest Calgary, Alberta. Taza is a partnership between the Tsuut’ina Nation and Canderel. At full buildout, Taza will feature over 25 million square feet of mixed-use development employing the best sustainability practices. Taza will provide economic vitality to the region while honouring the Tsuut’ina Nation’s culture and traditions.

The Tsuut’ina Nation and Canderel have taken a collaborative approach to develop Taza. This collaboration is founded on Tsuut’ina’s values– to respect nature’s interdependent relationship with Mother Earth, acknowledge their ancestors and provide economic vitality for the future. The cumulation of this vision is the Taza’s Design and Sustainability Guidelines defined in the Sustainability Scorecard. The Scorecard, developed in conjunction with Light House Sustainable Building Centre, defines the project’s sustainability targets and goals ensuring criteria related to Energy and Carbon, Waste Management, Water and Stormwater Management, Transportation, Urban Agriculture and Health and Wellbeing are addressed.

To preserve and feature the Tsuut’ina’s cultural heritage, Taza has developed a Cultural Handbook integrated into the development approval process. The Handbook instructs developers how to draw inspiration from the Tsuut’ina Nation’s culture and history while ensuring influences are represented in the built landscape.

This presentation details the overall vision for Taza with a focus on the community’s development approval process with the lens of sustainability. The unique approval process employed at Taza requires a baseline of sustainability and cultural criteria for any project. The development criteria reflects the community’s Design Guidelines while ensuring a long-term commitment to sustainability and accountability for developers and property owners in the future.
What is a Regional Growth Strategy?

A regional growth strategy is a strategic plan that directs long-term planning for a regional district and its members. In Metro Vancouver, the regional growth strategy is titled Metro Vancouver 2040: Shaping our Future, often referred to as “Metro 2040”. Regional growth strategies promote human settlements that are socially, economically and environmentally sustainable and that make efficient use of public facilities, land and other resources to support and enhance regional sustainability and resilience. The development of a regional growth strategy is a collaborative process. A regional growth strategy is initiated, prepared and enacted by a regional district, with the required involvement and approval of its member jurisdictions, provincial agencies and others.

Governance

Metro Vancouver is a federation of 21 municipalities, one Electoral Area and one Treaty First Nation that collaboratively plans for and delivers regional-scale services. Its core services are drinking water, wastewater treatment and solid waste management. Metro Vancouver also regulates air quality, plans for regional growth, manages a regional parks system and provides affordable housing. The regional district is governed by a Board of Directors of elected officials from each local authority.

Metro Vancouver 2040: Shaping our Future

In 2018, Metro Vancouver was home to 2.57 million people. The region is expected to continue to experience significant growth, adding another million people by 2040. Adopted in 2011 by Metro Vancouver, all member jurisdictions, TransLink and adjacent regional districts, Metro 2040 sets out five goals – each with related strategies and policy actions that identify the actions expected of Metro Vancouver and member jurisdictions to guide the future growth of the region and provides the land use framework for other types of planning including transportation, economic, housing, utility, environmental and climate change.

The goals of Metro 2040 are to:

- Contain growth within the region’s Urban Containment Boundary and direct it into a network of vibrant, livable Urban Centres and along frequent transit corridors;
- Support the region’s economy, by protecting important lands like industrial and agricultural areas, and ensuring their continued and efficient use;
• Protect the region’s natural environment and support land use and transportation patterns that improve the region’s ability to adapt to climate change;

• Build complete communities with affordable and diverse housing, employment and amenities, with good transportation choices; and,

• Integrate land use and transportation planning to help get people out of their cars, support the safe and efficient movement of goods and people, and reduce greenhouse gas emissions.

Regional Context statements, developed by member jurisdictions prepare, describe how local aspirations, as expressed in Official Community Plans, support and align the regional objectives as expressed in Metro 2040. These are adopted by both members and Metro Vancouver. Amendments to Metro 2040 are proposed by member jurisdictions and Metro Vancouver. A tiered amendment process, set out in the Strategy, establishes separate voting thresholds and processes by type and significance of proposed amendments.

Metro 2040 Update

Metro Vancouver is conducting a comprehensive update to Metro 2040, building on its strengths. The update is being undertaken to consider significant drivers of change (e.g. climate change, equity), integrate with the update to the Regional Transportation Strategy, and to implement policy improvements. Metro Vancouver is committed to working in close collaboration with member jurisdictions, TransLink, the Province, adjacent regional districts, and other regional agencies throughout the update to Metro 2040.
Participation of Citizen in Urban Planning Process in Lahti Finland

Mrs Johanna Kilpi-koski, Mrs Essi Artima-Sulkinoja

Lahti Region Development Ladec Ltd, Lahti, Finland

Introduction

The city of Lahti is currently actively developing its urban areas and has major land-use planning projects in different parts of the city. City of Lahti forms an innovation platform for sustainable urban planning.

The strategic environmental targets of City of Lahti are to be a climate neutral by 2040 and to be a waste-free and complete circular economy city by 2050.

To be climate neutral city, Lahti is drafting a sustainable urban mobility plan in cooperation with a broad base of stakeholders and citizens. The sustainable urban mobility plan is closely linked to the city’s on-going Master planning towards year 2030.

City of Lahti has developed a continuous city planning method, how to incorporate citizens of Lahti into the urban planning process. Citizens’ needs and wishes will be taken into consideration before any practical decisions will be made. How to involve them? How to create something they can benefit from? How to encourage them to change their behavior? Understanding the motives behind peoples’ decisions is a big piece of the planning process.

Method to gaining the citizens’ perspective

The Model of Citizen Participation Process was built by the Summer 2018 in the CitiCAP – Citizens’ cap-and-trade co-created project, funded by EU Initiative Urban Innovative Action Program. CitiCAP project concentrates on enabling and enhancing sustainable mobility in the city of Lahti.

The Model describes how the different target groups participate in the design and promotion of sustainable mobility. This model contained different co-creation workshops. A total of 12 workshops were completed during the Autumn 2018. About 2000 citizens participated and tested different co-creation tools. Workshops were organized by City of Lahti, Universities and Lahti Region Development LADEC Ltd. The results of the sustainable mobility workshops are analyzed and reported in Sustainable Urban Mobility Plan (SUMP).

Result and Discussion

During the CitiCAP project results of the 12 workshops is utilized. Based on workshops citizens are willingly more often to consider other travel mode choices like public transportation, car sharing and bicycle. Citizens are more concern environment issues and climate change.

To improve the citizen awareness of their carbon footprint, the CitiCAP project has developed a real-time tracking and visualization app where can be traded their carbon allowances and gain benefits for services such as public transportation or sports.

It is important to communicate with citizens because they are motivated to improve their living environment and curb climate change.
Amsterdam City Doughnut

Matthew Fraser, Ms Annerieke Douma

Circle Economy, Amsterdam, Netherlands

City planners need new ways to develop more holistic city strategies. Policy-makers need to integrate the societal, environmental and economic challenges into a coherent (circular) plan for their cities.

Amsterdam-based Circle Economy, a social impact organisation focussing on the practical and scalable implementation of the circular economy, is collaborating with Oxford economist Kate Raworth, author of Doughnut Economics, to co-create a new model and framework for city officials. Working with a team of 40 city officials, the Amsterdam City Doughnut project is a blueprint for cities to unlock synergies and remove barriers to more integrated planning. This innovative approach enables collaboration between city functions, and co-creation of a shared operating space within planetary boundaries.

In a series of four workshops, hosted by Kate Raworth and facilitated by Circle Economy, officials spanning every Amsterdam municipality department mapped the city’s 49 agenda priorities for this term against Raworth’s acclaimed Doughnut Economics model of ‘a safe and just space space’. This approach reveals the inter-dependence, synergies and potential unintended consequences, to create a holistic agenda and relevant targets for city decision-makers.

In this talk, Annerieke Douma, director of Circle Economy’s Cities Programme, describes the development process and outcomes from a doughnut model for cities. By mapping local and specific city priorities against the global framework of the ‘doughnut’, city officials developed a ‘roadmap’ of circular strategies for Amsterdam. With emphasis on design thinking and gamification, this ‘ground up’ approach to co-creation reveals the inter-dependence and inter-play of (previously) separate city functions.
Haida Gwaii: Shining Light

Mr. Michael Caditz¹,², Mr. Adrian Kanjer¹,², Dr. Patricia Keen¹,², Ms. Mahkameh Rezai¹,²

¹Third Transition Media, Nanaimo, Canada, ²New York Institute of Technology (NYIT), Vancouver, Canada

This is a research, feasibility, and capacity building community involvement project to be documented in film. We show how a transition to clean energy in a rural community will further the following Ecocity goals:

- Clean air
- Responsible resources/materials
- Clean and renewable energy
- Community capacity/governance
- Healthy and equitable economy
- Healthy biodiversity
- Earth’s carrying capacity

Moreover, healthy culture will be promoted because ecological integrity is central to historical indigenous cultural values.

We are aware of small-scale deployments of solar panels on Graham Island, Haida Gwaii, British Columbia—which is neither connected to the mainland electricity grid nor the piped gas grid. Such deployments are at individual sites (e.g., residences and community centres) but do not feed energy into the local microgrid.

However, in our research, our group sought to determine the feasibility of large-scale transition to sustainable energy on Haida Gwaii. We modeled a solar PV farm as an energy-producing node on the existing Sandspit microgrid. Customers on this microgrid are currently serviced by BC Hydro, which generates a substantial portion of supplied power from diesel-burning power plants. The fuel is transported by tanker from the mainland, at considerable expense and risk of accidental spills. At least ten million litres of diesel fuel is burned annually.

Our research concluded that a PV plant could meet all the customer load demand for seven months of the year, however other sources of clean power would be required during the winter months if we wish to eliminate the diesel plants altogether. In the continuing expansion of our project, we explore the feasibility of using wind and tidal power to make up the deficit left by the PV plant.
We collaborate with indigenous Haida colleagues to develop our model in a way that furthers their conceptions of reduced dependence on diesel for power production, rather than imposing a predetermined model upon them. We document our research showcasing our interactions with the local community (particularly youth) in a film entitled Haida Gwaii: Shining Light. The overarching aim of the film is to garner public enthusiasm and support for the sustainable energy model for Haida Gwaii, and to bring it closer to deployment.

In this presentation, we will review the research we have already accomplished and showcase our model. Further, we will describe our activities yet to be completed towards preparing Haida Gwaii for an inevitable clean energy transition. We will entertain questions and discussion about our project.
Energetic Implications of Solar Energy in the Lower Mainland - OASIS as a Case Study

Ms Karen Kan\(^1\), Mr James MacLean\(^1\)

\(^1\)British Columbia Institute of Technology, Burnaby, Canada

Although photovoltaic cell (PV) energy sources emit no carbon during operation and gather energy from the sun that is free, depending on the insolation at the installation location, there are studies that indicate that the energy payback of PV installations is longer than their lifetime in some cases. The Open Access to Sustainable Intermittent Sources (OASIS) project at the British Columbia Institute of Technology, a joint project with BC Hydro, is designed to test the operation of a system of PV solar cells and batteries in a working micro-grid. In this paper we calculate the energy return on energy invested for the OASIS system to determine if the energy produced over the life of the cells is greater than the energy used to produce the solar cells and batteries.

15-minute generation data from the PV array gathered from the operational system is used to determine the average energy output over the course of a year. The expected energy production is then extrapolated to the 25-year lifetime including consideration of the degradation of the solar panel output over time. The expected energy production is then compared to the embodied energy of the solar cells and batteries based on previous life cycle analysis studies of such systems.

We find an energy payback period of between 9.75 and 12.4 years depending on embodied energy and replacement period of the batteries. With an expected life of 25 years for the PV array, we find that the system has a positive energy return on energy invested, providing about double the energy that was invested to build the system. Although beyond the scope of this study, future work could examine the carbon dioxide equivalent emissions during manufacture and compare that to the emissions offset by the energy produced by the OASIS project.
Wood Waste Heat: Closing the Loop for Social, Climate, and Educational Benefits

Mr. Colin Chan

1British Columbia Institute of Technology, Burnaby, Canada

In pursuit of reducing greenhouse gas emissions, showcasing environmentally sustainable projects for widespread use, and incorporating sustainability more broadly in curriculum, British Columbia Institute of Technology (BCIT) has created a closed-loop biomass district energy system.

This project was borne out of a concept from BCIT instructors that would allow woodworking shops in remote areas, many of them on First Nations reserves, to heat their building while relying less on costly and polluting fossil fuel energy sources. Implementation of this technology at BCIT will improve accessibility to the regional woodworking industry, providing a hands-on example to foster broader deployment.

The BCIT Carpentry and Joinery programs create wood waste from off-cuts and sawdust, which historically have been disposed from campus using external waste haulers. Additionally, the wood shops have been historically heated using natural-gas-fired appliances, with a significant associated greenhouse gas emission footprint. Repurposing the wood waste as fuel for a biomass boiler, energy is generated which is then used to provide space heating for the two program buildings. This both greatly reduces external energy source flows via natural gas displacement, as well as cost and emissions associated with hauling wood waste off-site for disposal.

The success of this project required a major collaborative effort across multiple stakeholders, including senior management, the Facilities and Campus Development department, faculty, students, local environmental regulators, consultants, and suppliers. Working together, a project was completed that serves as a core part of BCIT’s plan to reduce campus greenhouse gas emissions by 33%, improves energy security, and provides a sustainability teaching resource for both our woodworking students and wood shop owners/operators in the industry.

This presentation will detail the journey from idea conception, to collaborative implementation and operation. Benefits, challenges, and lessons learned will be shared to facilitate similar project development for audience members.
S.09C.01

NorLand Limited’s Journey to Creating a Sustainable Culture

Miss Sydney Wanchulak¹

¹NorLand Limited, Burnaby, Canada

NorLand Limited is a multi-business enterprise servicing a variety of aspects of construction-related industries and comprises fourteen semi-independent operating businesses geographically dispersed throughout BC, Alberta and Quebec. At NorLand, we recognize the opportunity for companies in our sectors to do better business – to the benefit of all stakeholders.

We started our sustainability journey in 2017 when our CEO, Dave Reynolds, attended an Impact Conference and was introduced to the concept of benefit corporations and how B Corp is being utilized as a force for good. After completing the Quick Impact Assessment from B Lab that same year, we undertook the Full Impact Assessment through B Lab in 2018, hosting three professionally facilitated Impact Workshops over that summer to raise awareness and develop an Impact plan at NorLand.

In January 2019, we launched the first of a series of impact cohorts, using the B Lab Assessments as the principal tool for measuring impact and fostering a cultural shift towards sustainability in our construction industry; to-date, five of our fourteen businesses have been involved in this process.

Our ultimate objective is to shift employee and societal thinking from “construction creates a negative impact” to “construction can create a negative impact when done incorrectly; when done correctly, construction broadens our reach to others through Sky Trains, connects us with nature through roads, and allows us to help build enduring communities that people can live, work, learn and play in.”

This is a mindset change that must start from the companies working on the sites with their boots on the ground. We must understand our impact on our job sites, community and earth. Today, we do not fully understand the positive and negative impacts our work creates within the communities we operate in, with the workers we have on site, or within our own offices. This is where the B Impact Assessment helps us determine these impacts and what we can work on to make ourselves better.

Our ability to communicate the impact we have to other stakeholders first depends on us understanding our own impact. As we learn more, we will be able to share this knowledge throughout NorLand, with community members, project owners, and other stakeholders. This is the beginning of a wider cultural shift, and we believe it has the potential to create a ripple effect within the construction industry to move towards a more sustainable future.
Auroville: The City the Earth Needs - ‘City as an Open Learning Curriculum’

Mr. Lalit Kishor Bhati

Executive - PATH Architects & Planners, Auroville, India

Auroville, established in 1968, is an intentional cultural township near Pondicherry, South India, has 3,000 residents representing over 55 nationalities. Auroville is based on the ‘vision’ of Sri Aurobindo and The Mother which apart from many aspects talks about living a conscious life & thus creating and sustaining an inspiring collective integral living ecosystem.

With ‘Human Unity’ as stated vision for Auroville, few hundred motivated volunteers from different countries & Galaxy Plan as its ‘city plan form reference’, Auroville’s pioneering act of planning was to create a habitable living environment first by transforming barren land into a lush green forest within a small period of 20 years. Being engaged in diverse range of activities like soil & water conservation, afforestation, sustainable planning & development, architecture & alternative construction technology, wide ranging outreach activities within its bio-region, alternative education, economy and self-governance & more, these applied research practices, guided by Auroville’s Vision and Charter, have created an experimental model of inclusive community living & a learning Society where entire city is a ‘living Curriculum’ and acts as an open UniverCity.

Community Participation is a way of life here and efforts are made to bring diverse viewpoints into an evolving & dynamic ‘harmonizing framework’ & this ‘consensus building aspect’ brings forward very challenging circumstances and demands deeper engagement with collective living & governance.

While on one hand, like many other previous endeavors in history of mankind, planning in Auroville too faces the ever growing challenge of ‘sharing & sustaining common & higher vision & collective decision making’ which are the key elements to build the foundation of ‘an inclusive society’, on the other hand, slow population growth & emergence of many critical development challenges within its surroundings is creating conditions for Auroville to work proactively & in an efficient manner harvesting its own vast pool of energies.

Auroville is just 50 years young, active and creative ground for innovative experiments for holistic learning & living in real life community building. People have been the biggest asset & they have been learning from their living experience and applying their findings to meet the ever changing needs of growth. For humanity, Auroville remains a truly inspiring case study as a ‘ray of hope’ towards wide ranging issues like climate change mitigation, human nature change, co-existence & to walk on the path of being a ‘true learning society’. It belongs to whole of Humanity.
The Salmon Ride: A Virtual Geoglyph

Mr. Tristan Bobin¹

¹Bcit, Vancouver, Canada

This artistic project aims at challenging one's perception of Metro Vancouver’s geography. By using the road network, a bicycle, a GPS receiver, and GIS software, a ‘virtual geoglyph’ of a Sockeye Salmon spread across the Burrard Peninsula can be drawn. Even restricted by the modern road network, a fractal of those swimming upstream can emerge. Indeed, by crossing this land in a particular mindset, although the path in essence being arbitrary, triggered a strong desire in me to educate myself on the non-settler history of this place.

To be used as a strong visual cue, this project aims to build a web map displaying the image of a sockeye salmon, in addition to data layers representing Metro Vancouver’s old streams.

Fitting into Ecocity’s “Socially Just and Ecologically Sustainable Cities” theme under “Healthy Culture”, this project seeks to provide the public with an alternative perception of Vancouver from which one can learn about the importance and perseverance of salmon in this region, referred to by bioregionalists as ‘Salmonopolis’. By engaging with this map, I hope that the inhabitants of this land can better appreciate the role salmon play, especially since the various species of pacific salmon still spawn in the surviving creeks of the Burrard Peninsula.
Nepal Ecocity Network — Mainstreaming Low-Carbon Sustainable Lifestyles in the Kathmandu Valley

Mr. Pradeep Amatya

1Lalitpur Metropolitan City, Hattiban, Lalitpur Metropolitan City, Nepal

On April 25, 2015, a major earthquake struck Nepal, causing thousands of casualties and widespread destruction of buildings and infrastructure. The total disaster effects (or damages and losses) were estimated at over US$ 6.5 billion.

Through its Nationally Determined Contributions (NDCs), the Government of Nepal sees the post-earthquake reconstruction phase as an opportunity to “build back better”. For example, as part of their NDC commitment, the government is investing in ‘smart-city’ planning, building on the ongoing decentralization effort as it transitions to a federal form of government. ‘Smart cities’ are now a priority for mayors, but there is a need to further define what this means for Nepal. It is particularly important given that at the international level, the smart city concept has been criticized for not involving communities and disregarding environmental goals.

The Nepal Ecocity Network project is tackling this dilemma by ensuring that citizen participation, environmental concerns, protection of culture and heritage, and improvement in overall quality of life, are priorities in the local ‘smart city’ movement.

With the overarching goal of mainstreaming low-carbon sustainable lifestyles throughout Nepal, starting with the 18 municipalities in the Kathmandu Valley, the project will bring sustainable lifestyles and Ecocity planning and principles squarely into the center of Nepal’s urban agenda, ensuring that community well-being and a built environment conducive for sustainable living is enabled.

The project additionally aims to achieve significant GHG emissions reductions in three wards in the Municipality of Lalitpur by focusing on “greening” the residential sector in conjunction with the rebuilding efforts, providing education to accelerate the shift to sustainable lifestyles, and linking these realignments to local green jobs, products and services that build a local green economy.

This project’s ambition was shaped as an outcome of the October 31st, 2018 government-hosted National Consultation on Promoting Ecocities in Nepal. 17 out of 18 municipalities of the Kathmandu Valley were in attendance, represented by either a Mayor or Vice Mayor. The participants pledged to continue to work together to form a national Ecocity Network and the Municipality of Lalitpur pledged to lead the initiative.

The foundation of the project’s approach is built on replicable and scalable methods to sustainable community development that focus on citizen, government, academic and private sector stakeholder engagement. Lessons in Nepal will enrich this methodology which will be disseminated further around the world.
How Do Cities Welcome More People and New Homes in our Older Neighborhoods?

Dr. Marilyn Hamilton¹,², Ms Beth Sanders³

¹Integral City Meshworks, Forres, United Kingdom, ²Royal Roads University, Victoria, Canada, ³Populus, Edmonton, Canada

2 hours to 1/2 day format
Could also be Presenter Presentation
VCC location

When was the last time you heard your engagement partners say this?

“The process was welcoming, inclusive and allowed us to learn from others’ perspectives. The range of methods used generated positive commentary that was used. The time, money and energy spent on this was worthwhile.”

Join Dr. Marilyn Hamilton and Beth Sanders to explore how Edmonton, Canada, developed an action plan for city government to support the city’s efforts to grow “up” instead of “out”. Learn how the stakeholders responded positively to making the city more densely populated and become more fiscally and ecologically responsible.

From Marilyn Hamilton, Founder of Integral City, learn the framework of 4 Integral City Voices that enabled conversations between citizens, civic managers, community organizations and the business community. From Civic Nestworker, Beth Sanders, learn how she designed the sequence of conversations to hear the 4 Voices specifically, then the process to find the actions while integrating the perspectives so all could see what each other was looking for – and what city government was committed to do (and not do).

Learn how the Edmonton co-researchers co-developed a solid, responsive action plan that you can use to design for change in your place with full consciousness and a wider range of city systems.

Also gain strategies for when the action plan makes its way to Council, with the 4 Voices speaking to and supporting the process and the product.

Finally see, the outcome with a solid, responsive action plan being implemented that will change, the shared and older neighbourhood places for all 4 Voices of the City.
Subterranean to Skyline - Street Trees as Potent Boundary Objects and Change Agents in Transforming Street Section Design. Findings from the Hug the Streets, Idelab Project, Oslo.

Ms Deborah E. Davies¹, Ms Ida Nilstad Pettersen², Ms Hanne Johnsrud³

¹KiiT, Sogndal, Norway, ²NTNU, Trondheim, Norway, ³LINK Arkitektur AS, Oslo, Norway

Before we parked cars - we parked trees. These ‘parked’ verges, supplanted by parking places during the 1900’s, now present opportunities in cities such as Oslo, looking to cultivate car free, climate resilient communities. The prospect of re-parking street trees in these spaces has a poetic quality but, as we have already witnessed with the declining tree legacy of late 19th to early 20th century, our desire for more trees and need to make a similar investment for future urban generations, while ever pressing has not proven so tenable. Even though municipal and non-profit actors continue to champion tree ecosystem service concepts and the need to invest in and cultivate a healthy urban canopy; urban infrastructures, from the institutional to those in situ, are not easily transformed.

While street trees are often considered emblematic and intrinsic to urban liveability and intergenerational equity, a key but often overlooked attribute are the way street trees can connect and complement, as-well-as conflict with, other entities across the full profile of the street section - from the subterranean to skyline. It is this attribute, we argue, makes street trees a potent boundary object through which urban space above and below ground can be comprehended and diverse and dispersed practitioners connected. Drawing from qualitative interviews, participatory workshops, collaborative design experiments, and ongoing trans-disciplinary discussions, both in Oslo and Trondheim, we examine how the street tree, as initial inspiration and entry point into the complexity of the street-section, has evolved as interlocutor, fostering synergies and translation across disciplinary boundaries, thought traditions, and urban management remits. Street trees are more than a source of inspiration and irritation in our endeavours to build liveable cities, they are great infrastructural connectors, and we ask: Could seeing the street tree as living infrastructure rather than through the dichotomy of services and disservices, help address the urban infrastructure impasse? Could our perceived need for more trees, rather than being the final destination, be instead the step towards opening up the streetscape to more flexible and mobile infrastructure arrangements, with the potential to readdress environmental justice issues by providing ecosystem services where traditional street tree plantings have not typically been sustained?
And a Creek Runs Through It: Geodesign Helps a Small Town Create a Creek Walk

Mr. Shannon McElvaney

The City of Manitou Springs is planning a creek walk along Fountain Creek, an aspirational goal for over two decades. The question is: how to unite a diverse set of stakeholders with competing interests to agree on a preferred route, that incorporates their values and priorities? The answer was to use geodesign.

Geodesign is a powerful participatory planning method that uses stakeholder input and geospatial analytics to show the possible impact of design scenarios. It gets its strength in two ways: 1) from the diversity of participants—proving the adage that two heads are indeed better than one—and 2) from the power of spatial analytics, which allow the visualization of the world both as it is, and as it could be.

The presentation will focus on how geodesign methods were used to define stakeholder groups, clarify values and prioritize criteria to help decision-makers evaluate planning scenarios. Esri ArcGIS Pro was utilized to develop models—such as bikeability, walkability, ADA compliance, shade, proximity to business, proximity to nature, and ADA compliance—that were used to visualize and evaluate the impacts of each route segment.

The spatial analysis and participatory approach resulted in an innovative solution that addressed the concerns of all stakeholders. The creek walk became a system of trails all supporting the “8 to 80” goal that a trail should be walkable at all stages of life. The trail ties together three major parks while helping to protect remaining natural area. Low impact development interventions were chosen at key locations to lower the impact of run-off and erosion. The trail also ties to a regional trail, providing area residents a low-cost alternative method of transportation. Citizens strengthened the plan suggesting connections to loop trails and safe routes to schools, separation of bikes from walking for safety, and benches and access to water for play, rest and socialization.

What’s important to remember is that a plan is just that—a plan. Over time, it will change and morph as people come and go, but with the right values and rationale for decision-making, the next leaders will be able to pick it up, understand how decisions were made, and carry the project forward.

Attendees of this session will learn how to use the geodesign methodology to inform decision-making. More importantly, they will learn how to use spatial technology to guide conversations among diverse stakeholders to come up with plans that people understand and are happy with.
Re-imagining the Water System: From Infrastructure Master Plan to Construction on a Municipal Village Scale

Mrs Mackenzie Walker

University Of British Columbia, Vancouver, Canada

The case study will provide a sequential overview of the process a Village municipality in the Lower Mainland of British Columbia undertook from initiating an infrastructure master plan development process to replacement and reconfiguration of their water supply and distribution system within a three-year period. The system assessment and action plan required a collaborative and multidisciplinary approach to envision a water system reconfiguration which would meet the required level of service for the residents while being economically feasible and sustainable. Unique challenges of the project included; identification of assets with historical rationale but which were either currently inefficient or redundant, the assessment of system operation performance using hydraulic analysis for a network situated within high gradient topography and system configuration lacking water main loop connectivity, and the condition assessment of existing assets with limited resources by balancing the tradeoffs inherent within the strategic directions of investigation, analysis, remediation or replacement.

The development of the Village’s asset management plan will be discussed including rational for prioritization of the water system improvements over other identified deficient infrastructure. The case study highlights that like many municipalities across Canada, the existing annual infrastructure investment funding was insufficient to sustain system operation at current level of service how policy action was required based on the findings of the infrastructure master plan process. It will be shown how this information was presented and moved forward into a public education strategy which lead to a successful loan authorization vote and subsequently those funds being leveraged through successful acquisition of provincial and federal funding. Lastly, the case will also demonstrate that the challenges are not over after funding is secured since many factors including local market conditions, material constraints, design and construction issues, schedule, policy and politics can all provide obstacles which the case study project overcame through collaboration and compromise to lead to successful implementation of the reimagined system plan.
Urban Heat Island and the Climatic Impacts of Intense Development: Lessons Through a Landscape Lens

Ms Margot Long

Fellow Canadian Society of Landscape Architects, Vancouver, Canada

PWL Partnership is a leading Vancouver-based landscape architectural firm with over forty years of experience in public and private sector planning and design in urban contexts.

We are proud to work on projects that create spaces for natural systems to perform a wealth of ecosystems services, including the sequestration of carbon and the cooling of urban temperatures that continue to rise. These services are critical as the realities of climate change become increasingly apparent, costly and harmful to our health and the vibrancy of our built environments. In the face of these challenges, it is clear that all new development needs to not only demonstrate climate resiliency but also to actively understand, measure and quantify the environmental impacts of our growing cities.

As Landscape Architects and practitioners heavily involved in the design of our cities, we have a unique opportunity to contribute to this vital conversation. It is evident to anyone who experiences the transformation of a site that has introduced ecological systems that there are positive impacts for the environment, the economy and human happiness. However, we must be able to quantify those changes in a meaningful way in order to encourage action and policy change. It is increasingly clear that performance measures are essential to demonstrate impact and show how design solutions contribute to sustainability and resilience.

That is why, with the continued advancement of mapping technologies, PWL is committed to studying the measured reduction of heat island effect on urban sites that have been transformed through development. This presentation will illustrate - through before-and-after heat island maps – how Landscape design strategies are one of the key solutions to reducing the energy demand for cooling and for lowering levels of emissions and air pollutants. These impactful graphics will illustrate how design and planning solutions have made a measurable difference on various sites over the past 15 years of intense development in the City of Vancouver. It will compare diverse conditions (transportation corridors, neighbourhood developments, residential streetscapes etc.) and development approaches (green roofs, canopy cover and irrigation requirements) in order to learn by example what strategies have the most significant impacts.

We hope that the mapping and presentation will provide a critically optimistic outlook and help to explore how we can work together as city builders, city dwellers, and city leaders, to make significant and positive impacts on our urban environments.
Sound Quality – A Case Study for the British Columbia Institute of Technology North Campus to meet the IES Grade Ecocity Level 1 Benchmark

Dr. Maureen Connelly¹, Ms Negar Khalesi¹

¹British Columbia Institute Of Technology, Burnaby, Canada

At Ecocity World Summit, Melbourne 2017, the inclusion of ‘Sound Quality’ at a new standard was proposed. This presentation examines a supporting case study, the North campus of the British Columbia Institute of Technology. Sound Quality, as a Bio-Geophysical Condition in the International EcoCity Standards (IES), adopts noise criteria from the World Health Organization for the IES grade Ecocity 1. The maximum sound levels criteria for ecological sensitive &/or restorations areas, public green spaces and industrial area are 55 dBA, 60 dBA and 70 dBA respectively. In this case study the interventions for noise reduction to achieve Ecocity 1 uses the Awsonme wall system. The acoustical core of Awsonme is installed with public faces appropriate for various activity areas, acoustical environments, and site aesthetics. The options include a coupled 3D Frame to support growth of vine plants from the ground base, which further supports biodiversity and the sounds of nature.

Acoustical data collected at 37 major sources and random points on an active day during August 2017 generated baseline noise maps. The noise maps illustrate the existing acoustical environment and the prediction of the noise level based on BCIT’s 5-to-10-year development plan. Strategic location of the Awsonme system ranked the majority of the BCIT North campus noise levels in adherence with the IES grade Ecocity 1 standard. The use of Awsonme for the gouging booths at NE08 reduces the sound pressure level in the student work yard by four-fold. This 20 dBA reduction brings the student work yard in line with the criteria of 70 dBA. A series of Awsonme panels were modelled at the boundary between Guichon Creek and Canada Way, the results indicate a reduction in noise level that meet the 55 dBA noise criteria for ecologically sensitive sites. Modelling Awsonme, with visual transparent panels, in the front and back of the carpentry open workshop and in front of the automotive workshop predicts reduced noise levels in the proposed Yard to below 60 dBA. Additional panels around the biomass furnace site ensure the Campus Spine also meets the IES grade Ecocity 1 standard.

Achieving the Sound Quality Ecocity 1 benchmark not only mitigates high levels of disruptive noise on campus, but also celebrates the character of trades and technology student activities along with the restorative sounds of nature in green spaces and ecological restorations sites such as the Guichon Creek.
Beyond the Horizon: Sustainable Land Use in British Columbia

Dr. David Hendrickson

1Real Estate Foundation of British Columbia, Vancouver, Canada

British Columbia features astounding biodiversity, stunning natural landscapes, and rich cultural history. This presentation looks at planning strategies that promote thriving, resilient communities and natural environments for current and future generations.

The research identifies overarching challenges, including climate change, industrial development, and poor conservation practices. These issues suggest a sense of urgency in response to rapid change and the need to alter negative impacts, particularly in rural areas and backcountry regions. For instance, climate change and forest mismanagement caused two of the worst wildfire seasons on record in 2017 and 2018. Since 2017, costs associated with firefighting and forest management have reached close to $1 billion.

Other land management challenges include fragmented governmental decision-making, as seen in some attempts to address cumulative effects. Provincial and federal governments are sometimes perceived as ineffective at protecting the environment, such as in the Mount Polley mine disaster. First Nations and rural local governments, responsible for managing the province’s largest land bases, are often plagued by a lack of capacity. Another important issue involves implementing economic development opportunities with land use, such as through eco-tourism.

Research included a literature review, interviews with 12 land use expert advisors, and a survey of 54 land use professionals and practitioners, as well as secondary results drawn from a public opinion poll of BC residents (N=1,658).

Findings are organized into seven themes and five priorities. They indicate that BC is facing significant challenges, such as the loss of vital ecosystems and increased vulnerability to drought, wildfires, and a changing climate. However, examples and trends also showcase positive change, such as Indigenous-led land use planning initiatives and innovative stewardship practices.

A series of recommendations illustrate and outline a pathway towards economic prosperity and sustainable land use in BC. They set future directions to help maximize sustainable land use impacts and are categorized by priorities and lead agencies when appropriate.

By the end of the presentation, participants will be able to:

1) Identify top trends and emerging issues in sustainable land use in BC.
2) Understand public values and opinions relating to land use, sustainability, and decision-making.
3) Determine which words and terms resonate with the public (e.g. “sustainable” vs. “ecosystem-based”).
4) Understand regional challenges and priorities.
5) List strategies and opportunities for engaging with the public, collaborating with other decision-makers, and charting a path forward.
The challenges and problems brought forth by the process of urbanization should not hamper but rather should be part of a city’s development toward a sustainable region. Thus, it is imperative that the local government unit (LGU) come up with management strategies that will specifically address the challenges as well as measures that will mitigate the undefined risks brought about by urbanism. The local government should not be limited to the conventional practice of issuing resolutions and ordinances that are curative and prescriptive in nature. Creative thinking must be given priority to come up with preventive measures in conjunction with the anticipated effects of urbanization in the future. Better ideas on how to maximize the use of the raw materials in the city and transform waste materials into new products must be generated to instigate a better economy and environment for its constituents.

It is within this context that this study was conducted in order to better understand the resource flows of the city through an urban metabolism analysis. The study looked specifically at the flows of water and food in the city. Through an analysis of these flows, the research shows possible intervention points and provides recommendations on action points that the city could take in order to stem the tide of unsustainable urbanization.

The methodology applied in this study follows the framework of Barles (2009) and the Statistical Office of the European Communities (Eurostat, 2001). However, it focuses only on food and water, and the materials related to its production and consumption in the city. It must be pointed out that the Eurostat 2001 methodology was designed specifically for country-wide accounts. Thus, terminologies and definitions from the original methodology were adapted or adjusted to this application. A common example of this is the confusion by the city stakeholders about exports and imports. The usual notion of “imports” are goods coming from outside of the Philippines. But in the case of this analysis, exports and imports pertain to goods and resources leaving or entering the city boundaries regardless of whether they come from a neighboring town or country. A similar clarification ought to be explicitly stated for “local or domestic extraction.” Local extraction hereby refers to food resources produced or extracted within the city boundaries, while food entering the city from neighboring towns are considered as imports. This analysis excludes several indicators that Barles and Eurostat espouse owing to the lack of data that could be used to compute the said indicators.
In less than a century, our food system has been transformed into a complex network of global-industrial supply chains increasingly disconnecting people from the places and processes that provide their daily sustenance. Transnational corporations exert hegemonic control, and the vast wealth generated in the system predominantly accrues to them. A myriad of detrimental social, environmental, and economic costs emanating from this system are externalized; the list of transgressions is long and familiar to us. Thus, our food system exists primarily to meet the short term business interests of a handful of corporations and is for the most part imperious to citizen and community interests. For these and other compelling reasons (e.g. dependence on fossil fuels and excessive greenhouse gas generation) the global-industrial food system is unequivocally antithetical to our sustainability imperative.

There is an alternative. Many, envision, advocate for, and work to advance food systems that are attuned to, shaped by, and nurturing of the environmental and cultural-community character of our life-places. However, the discourse regarding local-regional focused food systems as opposed to an export commodity focused system remains largely conjectural or anecdotal.

The Institute for Sustainable Food Systems, Kwantlen Polytechnic University is working to develop tools and methods to robustly elucidate the potentials of bioregional food systems, for food system design and planning. Our method centres on utilizing a computational model that assesses food self-reliance level, and optimizes land allocation to maximize food self-reliance. Other food system modeling outputs include GHG emissions, overall food ecological footprint, impacts on natural habitat/carbon sequestration, and nutrient (N and P) balance between livestock waste with crop need. Contribution to the economy is calculated using the provinces Input-Output model. Economic impact estimations include job creation, income generation, tax generation and contribution to Gross Domestic Product (GDP). We are now working to integrate post-production capacity requirements (aggregation, processing, storage etc.), community social capital development, comprehensive waste cycling, and policy and strategic planning, into our bioregional food system design methodology.

Our food system modeling methods can be used compare food system futures reflective of planning and development choices that can be made. In essence it enables ‘what if analysis” and provides data driven information for policy makers, planners and community activists so they can make better informed arguments and decisions.

For the Southwest British Columbia Bioregional Food System Design project, we modeled dozens of food system futures for the year 2050 when the population is expected to double. Modeling outcomes for five 2050 scenarios, including ‘business as usual’ versus ‘expanding local production for local consumption’, will be discussed and compared.
Challenges and Opportunities for Information and Institutional Coordination for Sustainable Cities

Dr. Adel Abdel-Kader

Trend Green Knowledge, Toronto, Canada

Cities are complex systems that require knowledge and robust-informed institutional coordination to be sustainable and be eco-friendly. Achieving sustainable development goals and making cities resilient is challenged by the lack of adequate information and knowledge and the lack of effective institutional coordination. It is challenging for a city to catalog, index and query highly heterogeneous information coming from complex systems. It is also challenging to bring together a wide range of institutions and agencies working in a city, having different objectives, overlapping and/or conflicting mandates, programming cycles, competing for financial resources, etc. The objective of this presentation is to highlight what are the critical challenges for city information sharing and effective institutional coordination and identify some of the opportunities arising from the challenges. The objective is also to promote and catalyze city authorities to create information and data frameworks and platforms, and to adopt effective institutional coordination mechanisms. The ideas presented are based on literature reviews of the best available published work on city information systems and institutional coordination. Cities are required to develop data and information strategies and open data policies to achieve sustainable cities and communities. They are also expected to mobilize institutional coordination around the SDGs to improve their functioning and promote horizontal and vertical coherence. All city stakeholders should be engaged in the process including government (local municipalities, planning, design, finance, sectoral agencies, statistics office, etc.), civil society, the private sector, academia, media, and the citizens, in addition to experts, practitioners and multilateral and bilateral agencies. Each city is unique and should find its tailored approach in making information available and accessible to all the stakeholders and finding the right coordination mechanisms, which provide the best functioning of its systems. A city may adapt existing institutional mechanisms or establish new institutional mechanisms and coordination structures, or a combination of both. The presentation will also provide a conceptual framework for information platform for cities to gather and manage data and information for sharing amongst all stakeholders, which support making cities sustainable, as well as a conceptual framework for an institutional coordination mechanism. Sustainable cities require sound and robust information platforms and effective institutional coordination mechanism to sustainably function and achieve their sustainable development goals. Cities are encouraged to strengthen effective Public Engagement and use trending innovation to achieve their goals.
A Stakeholder Analysis of the Sino-Singapore Tianjin-Binhai Eco-city

Ms Isabel Qi

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Considering the negative impact of urbanization on the natural environment, appropriate planning for cities is critical to solve environmental issues today. Eco-cities are cities that are planned and run in ways that support ecological, social and economic sustainability. The Sino-Singaporean Tianjin Binhai Eco-city (SSTEC) is a collaboration between the Chinese and Singaporean governments that started in 2007. Built on what was once wasteland, it is the first comprehensive eco-city in China that is resource efficient, environmentally friendly and socially harmonious. This study investigates design and planning features that support eco-city goals as well as the commitment of different stakeholders to sustainable urban planning. The study identifies the different goals and aspiration that each stakeholder has for the SSTEC: China’s central government wants the SSTEC to become a model for sustainable development and as a way to show China’s leadership in sustainable urbanism on the global stage; the Tianjin local government hopes the project could attract investments and greater visibility to the sea-side city; real estate developers see an opportunity to earn profit from developing on what was once wasteland; architects and planners hope to experiment with the cutting edge technologies in the designs and constructions; finally, residents of the eco-city, many of whom migrated from nearby cities, see it as an area where they can raise a family or retire in a cleaner environment. The study concludes with the following: first, the interactions of the different interests result in some features, such as green buildings, to be more successfully implemented than other features, such as non-gated communities. Second, out of the various stakeholders, real estate developers and potential residents of the city largely determine what could actually be implemented in the eco-city. Finally, many ecological goals are still limited by costs even with support from the central government.
Developing an energy efficient culture within organizations is a vital driver to increasing energy efficiency and reducing greenhouse gas emissions. British Columbia’s electricity and natural gas utilities, BC Hydro and FortisBC, are working together in a unique partnership to support a network of over 40 organizations across 6 sectors: the Energy Wise Network. Now in its fourth year, the program is designed to deepen energy conservation engagement and behaviour change and accelerate collaboration by supporting networking opportunities, peer-to-peer learning and training support.

Energy Wise Network participants learn and practice strategies involving broader organizational change and policy development to implementing creative energy conservation campaigns. Utilizing program and campaign level engagement frameworks, the Energy Wise Network breaks down complex concepts into manageable, easy to implement steps. Whether they are engaging hospital employees or government executives, the Energy Wise Network provides a platform for sharing organizational and sector-related insights and interventions that could apply to anyone working to build a culture of energy conservation.

Prism Engineering works closely with BC Hydro and FortisBC to deliver the Energy Wise Network program and incorporate the latest research on engagement, behaviour change and communications. Together in the first 3 years of the program, they have hosted 7 summits, 9 webinars, and developed 14 campaign toolkits for organizations to grow their capacity.
The Vancouver Fraser Port Authority (VFPA) and the Vancouver Board of Parks and Recreation, in collaboration with the Musqueam, Squamish and Tsleil-Waututh Nations, worked together to restore habitat in New Brighton Park in Vancouver, British Columbia. The project was delivered by VFPA’s Habitat Enhancement Program, which is focused on providing a balance between a healthy environment and future development projects that may be required for port operations.

The goals of this project were to enhance fish and wildlife habitat in Burrard Inlet, and to increase public access to nature.

The project enhanced approximately two hectares of historically filled foreshore to provide high-value habitat for fish, birds and other wildlife. A constructed wetland re-opened the area to tidal influence for the first time since the 1960s. The saltmarsh and associated habitats provide refuge for a range of species, including juvenile salmon migrating through Burrard Inlet during a critical life stage, and waterfowl and marine birds seeking protected water during the winter.

Every spring since construction completion, juvenile salmon have been observed using the restored wetland. Kelp and other marine vegetation have quickly colonized the restored marine aquatic areas.

Public access to nature was improved through the addition of park features such as viewing decks, picnic tables, benches, gravel pathways, a fenced dog off-leash area, and ecological/cultural signage installed along the wetland. Project partners, Indigenous community leaders and dozens of park users and media members attended the park re-opening event in September 2017. Public feedback regarding the project has been overwhelmingly positive.

Project construction took nine months at a cost of approximately $3 million. Subcontracting, employment and training opportunities for Indigenous community members were a key component of project delivery. For example, the planting component of the project was awarded to Inlailawatash LP, an Indigenous-owned business, and included the installation of 25,000 salt marsh plugs, 200 trees and 4,000 coastal shrubs.

In 2018, the project received a gold rating under the Stewardship Centre for British Columbia’s Green Shores for Coastal Development program, which demonstrates the highest possible achievement of project environmental goals and leadership in shoreline stewardship. This gold rating was based on a number of factors including excellence in rehabilitation of coastal habitat, innovation and climate change adaptation.

The successful project clearly demonstrates an EcoCity approach to restoring shoreline habitat in a busy port environment in order to create a vibrant, healthy place for people to live, work and play.
Applying Envision® for Sustainable Design to Achieve Gold-level Performance on the BCIT North Campus Infrastructure Project – a First for Education in Canada

Ms Quin MacKenzie1, Mr. Daniel Clement2

1Stantec, Vancouver, Canada, 2British Columbia Institute of Technology, Burnaby, Canada

The Institute for Sustainable Infrastructure’s Envision® framework is an internationally-recognized system to guide infrastructure performance throughout planning, design, construction, operations, maintenance, and deconstruction. Envision examines the impact of sustainable infrastructure projects through five distinct categories: Quality of Life, Leadership, Resource Allocation, Natural World, and Climate and Resilience. These key areas contribute to the positive social, economic, and environmental impacts on a community.

Envision also provides an opportunity for independent verification of project performance. There are four award levels: Verified, Silver, Gold, and Platinum. To reach Gold status, a project must demonstrate that it delivers a heightened range of environmental, social, and economic benefits to host and affected communities.

Throughout early design, the North Campus Infrastructure Project was identified as having strong sustainable performance potential. An integrated design process was implemented, allowing for early contractor involvement and stakeholder collaboration. After two BCIT staff members attended a Stantec-hosted Envision training, the project was identified as a prime opportunity for BCIT to pilot Envision, as it closely aligned with project and institute sustainability objectives.

The project team provided submittals for 39 of the 60 Envision credits. To achieve points for a credit, the project team had to demonstrate strong deviation from business-as-usual. Key project sustainable performance areas include:

- Significant stakeholder collaboration through implementation of an integrated design process including project alignment with the development of a larger Campus Plan. This resulted in incorporation of new cycling paths; additional pedestrian-oriented spaces on campus; more covered outdoor spaces to sit, eat and socialize; and more dedicated parking for car share vehicles.

- Consideration for projected regional climate change impacts including warming temperatures; longer dry spells in summer months; more precipitation in fall, winter, and spring seasons; and more frequent and intense storm events. To address these, the project was designed for resilience including use of high solar reflectance index (SRI) value materials for more than 60% of project surfaces to keep surfaces cool in the presence of solar radiation and mitigate localized heat island effects.

- Consideration for electrical resiliency, designing the system to complement and enhance BCIT’s and BC Hydro’s initiative to design and construct Canada’s first Smart Power Microgrid. Microgrids can function independently and collaboratively, helping to balance power generation with demand and reducing potential for blackouts in extreme weather events. It will be able to integrate current energy sources such as hydro and natural gas, with alternative sources such as biomass, solar and wind.
Climate Adaptation at Capilano University: A Case Study on Community Risk Planning

Ms Julia Stafford\textsuperscript{1}, Mr Jeff O'Driscoll\textsuperscript{1}, Mr William Demopolous\textsuperscript{2}

\textsuperscript{1}Associated Engineering, Vancouver, Canada, \textsuperscript{2}Capilano University, North Vancouver, Canada

CapU is a small, community focused university passionate about its accountability for managing climate change. CapU is already pursuing aggressive climate emissions reduction targets for mid century, and is now focusing its efforts on assessing the resiliency of its campus infrastructure to the impacts of climate change. Nestled in the forest at the edge of the Coast Mountains in North Vancouver, the main campus staff are already familiar with managing climate related impacts such as wildfire risks, high intensity rainfall and runoff events, and wind storms. Satellite campuses in the communities of Sechelt and Squamish are also vulnerable to sea level rise and flooding. To assess the impact of the climate on the infrastructure at these three campuses, our multidisciplinary team of engineers, climate scientists, and planners completed a unique risk assessment developed by Engineers Canada.

The PIEVC Protocol is a procedure to develop relevant information on the elements of the climate and the specific attributes of the infrastructure that interact to create vulnerability. The Protocol describes a step-by-step process for defining, analyzing, evaluating and prioritizing information about the impact of climate change on infrastructure. The observations, conclusions and recommendations arising from the use of this protocol provide a framework to support effective decision-making about infrastructure operation, maintenance, planning and development. We used a ‘light’ version of the Protocol to inform our assessment. The advantage of this version is that CapU could develop a robust overview of risks to campus infrastructure to inform future planning, without the need for extensive analysis.

Through use of the PIEVC Tool, our team worked directly with campus staff to complete the risk assessment through a site visit with interviews and a collaborative workshop. We completed an assessment of relevant climate parameters and trends for three time horizons, and recommended high-level adaptation strategies for creating a sustainable campus.

Adapting to climate change is a challenging task without an obvious road-map forward. Capilano University’s project serves as a valuable case study on both an efficient, replicable tool on addressing risks due to climate change, and how small organizations can lead the shift to resilient communities.

Note: Our presentation can be modified for 1-3 presenters for a range of time slots from 15-60 minutes.
Adaptation Towards Low Carbon Resiliency in Existing Buildings

Sarah Smith, Mrs Ainaiz Bozorgzadeh

Prism Engineering, Burnaby, Canada

Thinking beyond energy efficiency today, a rapidly changing climate presents new challenges and potential risks for our built environment in the future. While the importance of managing energy efficiently is a critical part of mitigating climate change, many organizations are now recognizing that we also need to plan for the future; that is, how to adapt our built environment to a changing climate.

From record setting temperatures, to increased smoke from forest fires, and flooding events, the realities of a changing climate can be challenging for our buildings, as well as those who occupy them. Preparing buildings for the known and anticipated impacts of climate change helps ensure business continuity, as well as occupant safety and comfort, as our communities face increased climate uncertainty.

Climate vulnerability risk assessments and integrated climate adaptation plans help reduce the potential financial and infrastructure loss in the near and long-term, and help ensure building operations are ready to respond to current and future climate change impacts.

The presentation will review:
- The impacts of climate change on existing buildings, and how are they quantified
- The integration of climate adaptation work as part of energy management planning
- Where to begin for vulnerability and risk assessment in buildings
- When to retrofit building systems for adapting to future climates
- How to incorporate adaptation in the most energy efficient manner

The presentation will include case studies of existing facilities that have incorporated climate adaptation planning, and potential retrofits for incorporating climate resiliency in existing buildings.

Participants will leave the session with a better understanding of climate adaptation in existing buildings and how can be applied to their facilities.
POSTER PRESENTATIONS
A major focus of the UN-Habitat in the last decade has been on saving the human communities from global warming. Many sustainable technologies have been developed, suggested and tested especially in the developed nations where every single environmental action is marched with optimal evaluation cautiously. It is inevitable that as more cities are created, real estate growth continue to emerge and the ecosystem compromised for economic sustainability; the challenging tasks before every city remains how best to reduce the unbearable products of human-induced climatic changes. Recent studies produced findings that even in some nations that made efforts to create green cities, poorly monitored population growth and poorly monitored public investments could pose huge problems against her cities achieving quality and sustainable eco-city infrastructure to better the lives of the growing populations and the growth of financial returns from the real estate subsector. Besides government-community partnership in building resilience for sustaining both the ecosystem and human capital development has remained difficult. These experiences have resulted in negligible impacts of professional efforts to grow most economies. In this paper, the researchers’ main intent is to recommend important ways by which the impact of the academia could be practically and dynamically felt in the quest of emerging economies to develop and sustain eco-friendly cities in the face of high socioeconomic activities, population drifting, housing and industrialization puzzles. It therefore evaluated the numerous factors of city growth, examined the challenging conditions emerging from city functions, and gaping factors of eco-city development that propels harsh climatic changes in our emerging cities.
Green Construction Materials: Geopolymer Sustainability and Adaptability of Construction Markets

Mr. Richard Hannis Ansah¹, Prof Xueqing Zhang¹

¹The Hong Kong University of Science and Technology, Kowloon, Hong Kong

Modern construction is becoming a dynamic and complicated sector. Construction projects are increasingly becoming more technically sophisticated and environmentally threatening, requiring the balance between the built environment and ecosystem, and lower costs due to market demands, globalization and construction activities on the environment. Construction materials are increasingly depleting the natural environment, and it is estimated that the ordinary Portland cement (OPC) industry accounts for 5-8% of the global CO2 emissions, and that globally, the building sector alone generates about 40% of total primary energy use and 24% of carbon-dioxide (CO2) emissions due to non-consistent sustainable initiatives, neglect of sustainable building standards, and lack of energy efficient material usage. In contrast to OPC which requires high-temperature kilns, carbon dioxide production, and with a large expenditure of fuel, the geopolymeric cement manufacture is considered the suitable energy efficient material to achieve both project aims and sustainability goals of construction organizations. However, geopolymer research remains largely ignored, less explored, and theoretically underdeveloped for applied purposes. Most geopolymer approaches have concentrated on the commercial and technical aspects such as the mechanism formation, chemical process, durability and strength development, engineering properties, structural behavior, etc., rather than a careful consideration of how the drivers and barriers of the market, and the impacts on the users and the ecosystem. It is contended that sustainability efforts are driven by competition and market requirements rather than passive design systems and therefore without a clear distinction of these issues, the realization of sustainable goals will be complicated. Even so, the contribution of the geopolymer to improve sustainability is largely precluded due to the limitations to understand to what extent and how precisely the geopolymeric material impacts on the social, economic and environmental aspects of construction organizations and societies. This study aims to find the answer to these questions with the derived objectives: (a) to develop a predictive model based on the drivers and barriers of the market using weighting factors from users and decision makers; and (b) to determine technical and managerial activities amenable to interventions for geopolymer sustainability and adaptability of construction markets. The underlying goal is to measure geopolymer materials’ receptiveness and sustainability. With such a perspective, this paper contributes to geopolymer research and the findings could enhance future implementation and research works. Hence, leading to a significant achievement of project objectives in terms cost, quality, and sustainability of the built environment.
Smart Cities and Open Educational Resources: An Approach to Make Education and Lifelong Learning Cost-effective and Sustainable

Dr. Sanja Boskovic\textsuperscript{2}, Mr. Serhat Beyenir\textsuperscript{3}

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Smart cities use technology and data to improve the efficiency of city services, to reduce resource consumption and costs, and to address societal challenges. As the smart city concept matures, it is evolving from being technology focused towards a more citizen-centric concept. This poster examines the potential use of Open Educational Resources (OER) as a solution to assist smart cities initiatives in the educational sector.

UNESCO defines OER as teaching, learning or research materials that are in the public domain or released with intellectual property licenses that facilitate the free use, adaptation and distribution or resources. Understanding of efficiency, effectiveness, sustainability and environmental operation of OER is becoming increasingly important as more faculty and students use OER in the classroom. Properly licensed OER, as originally stated by David Wiley, provide users with free and perpetual permission to engage in the 5R activities: Retain - the right to make, own, and control copies of the content. Reuse - the right to use the content in a wide range of ways. Revise - the right to adapt, adjust, modify, or alter the content itself. Remix - the right to combine the original or revised content with other material to create something new. Redistribute - the right to share copies of the original content, your revisions, or your remixes with others. (http://opencontent.org/definition/)

OER have been used, shared and adapted in the digital environment. BCcampus calculates that British Columbia students have saved at least $10M on textbook costs since the open textbook project started in 2012. At BCIT, faculty self-reporting to BCcampus estimate that 1,435 BCIT students have saved $158K. Every school at BCIT now has at least one class using open education materials and at least one faculty member who has received an open education grant. Using approaches demonstrated by BCcampus and BCIT, OER are sustainable and inherently renewable, this poster will present various projects such as Simulator Laboratory: Sim Labs for Thermodynamics and Thermal Power Plant Simulator, Clinical Procedures for Safer Patient Care and Graphic Design and Print Production Fundamentals.
Showing the Way: Vancouver and the UN Habitat Story. How Human Settlements Became a Focus of International Action through the Leadership of Peter Oberlander

Mr. Ken Cameron1

1Simon Fraser University, Vancouver, Canada

The 1972 United Nations Conference on the Human Environment in Stockholm represented a turning point in the focus of international cooperation, a shift from the preoccupation with peace and underdevelopment to a recognition that humanity needed to work together internationally to address the root causes of the misery that often leads to conflict. Building on the recognition that a healthy environment is essential to developing human potential, Canada and other nations argued successfully at Stockholm for the inclusion of human settlements as a priority for international attention. Canada’s leadership on this file was a by-product of a decade-long experiment with engagement in urban problems by the Government of Canada through a Ministry of State for Urban Affairs, initially led by Dr. H. Peter Oberlander, a leading urbanist who was the first Canadian to earn a Masters and then a PhD in city planning from the Harvard Graduate School of Design and the founder of Canada’s first full planning program at the University of British Columbia in 1951. A key outcome of Stockholm was the decision to hold the first United Nations Conference on Human Settlements in Vancouver in 1976, which in turn led to the creation of the United Nations Commission on Human Settlements and its secretariat, the United Nations Centre for Human Settlements, commonly known as “Habitat.”

The intervening years have seen the evolution of Habitat’s perspective from viewing cities as a scourge and urbanization as a force to be resisted to one in which cities, appropriately-managed and planned, are seen as one of the keys to a sustainable future for humanity. Peter Oberlander continued to contribute to this evolution as an adviser to Habitat through a succession of major conferences and more minor meetings and events. The third of UN Habitat’s biennial World Urban Forums was held in Vancouver in 2006.” Habitat has facilitated the transformation of global thinking about cities from viewing them as the ultimate in local concerns to be left to national and sub-national governments to a recognition of urban management as a key to a sustainable future for humanity. Vancouver, Canada and Peter Oberlander are collectively a major contributor to this evolution. This recognition must be one of the keystones for the future if humanity is to be successful in addressing its self-generated existential crises such as climate change, protection of biodiversity and our role as the “sorcerer’s apprentice” in the cybernetic revolution.
Urban green space is under pressure as cities grow and expand. Research has shown that urban green space is positively associated with people’s health and well-being. One of the underlying mechanisms is that urban green space plays a role in stimulating physical activity (Hartig et al. 2014). In order to take these insights into consideration, a more function-oriented approach of urban green space is necessary (Ekkel and De Vries, 2017): what is activity-stimulating green space, how does it look like, what are its’ characteristics. Moreover, if one wants to study the activity-stimulating effects of new urban green space developed to do so, present activity data of people living in the city are necessary to start with. Such an approach will contribute to a more evidence based design of healthy urban green landscapes (Brown and Corry, 2011). The objective of this research is to study present activity levels of people living in the neighbourhood Spoorwijk, The Hague, The Netherlands. This study is part of a broader programme that aims to develop design criteria for healthy, activity-stimulating green space at the neighbourhood level. People’s behaviour was observed according to scientific behavioural standards (scan sampling and focal sampling) within the neighbourhood Spoorwijk in the autumn of 2018. Four different green spaces (parks, playfields) were included in the study. Results show that, for all green spaces and all scans, 74% of the time green spaces were not used at all. Minor differences were found when different periods (morning, afternoon) were compared. Children and adults were overrepresented, youth and elder people (55+) were underrepresented. Predominant behaviours were walking, using telephone, walking with the dog, talking and using the play sets or playing football. The results of the study will be used by the city of The Hague do determine in how the green spaces in the neighbourhood of Spoorwijk have to be improved in order to increase the activity of people in public urban spaces.
Masdar City: Showcasing a Sustainable Urban Development That Invokes an Image for Ecocity Advancement

Mr. Mustaffa Hamad¹

¹Environmental Engineer, , Canada

With the current Government’s approach and target goals on reducing energy consumption and GHG emissions, The World aims at proposing to develop an energy efficient environment that aims at improving energy efficiency, reducing energy costs and consumption as well as providing a healthy and green environment.

The focus of sustainable development focuses on meeting the development needs of today without impacting the future. With human activities impacting the earth’s sources, the implementation of sustainable development aims to focus on long term and short term impacts of environmental management decisions.

The future of Ecocities aims at providing a great quality of life that is clean, healthy green and produces minimal impacts on the environment.

Masdar City in Abu Dhabi is shaping up to be one of the World’s most recognized ecocities. Their ability to use their energy, air and water to its best advantages and creating social environments defends their ultimate goal of producing one of the most sustainable cities in the world.

The poster about Masdar City aims to describe the City’s ability to produce a neutral CO2 balance. It will demonstrate their techniques of reducing carbon emissions through their implementation of green buildings, and electric powered automobiles.

the poster will also aim at listing their new improving projects that many places can learn from and implement, in creating an advanced ecocity
Electrification of Garbage Trucks as a Cost-Effective Strategy to Accelerate Deployment of Electric Vehicles.

Mr. Bill McConnell

1Bcit, Surrey, Canada

Upgrading or replacing fossil powered garbage trucks with highly efficient electric drive trains, represents a fast and cost-effective method to improve health and life quality in cities. A side benefit is substantial reduction of green-house gas emissions.

Because of the stop and go operation of garbage trucks, they are a large source of air pollution, noise, and green-house gases. The air pollution contributes to asthma, lung cancer, bladder cancer, and simple nose and throat irritation. The noise contributes to high blood pressure and reduces quality of life.

Garbage trucks can be regulated by city governments, who usually either operate them or hire a contractor who does.

There is already commercially available equipment that can be paid for by the cost savings that it provides. Replacing a vehicle before its usual life-span represents a cost barrier. A new drive train can be installed any time with pay-back on fuel savings in five years. Such equipment is already being installed in China and in California.

Deployment of this technology in garbage trucks may encourage entrepreneurs to use this technology for other applications.
i-Tree as a Tool for Education and Collaboration

Mrs Laurie Stott\textsuperscript{1}, Ms Julia Alards-tomalins\textsuperscript{1}, Ms Stacey Auld\textsuperscript{1}

\textsuperscript{1}BCIT, Burnaby, Canada

From 2015 to 2018, students in the Renewable Resources (RENR), Architectural Science (ArchSci) and GIS programs at the British Columbia Institute of Technology participated in a variety of i-Tree inventory and urban forest assessment projects in partnership with several local governments in the Lower Mainland Region of British Columbia. RENR students used GPS and GIS systems and a digital version of the i-Tree Eco survey form to map several urban forest areas.

Field data from RENR students was used in project work by GIS students at the City of Maple Ridge to produce a series of ecosystem service reports and presentations for City staff. Architectural Science students used data collected from a heritage site in North Vancouver as part of a project for their course. The ArchSci students will use the data to adapt their building design to maximize effect of heritage trees on site, identify opportunities to add trees learn how trees affect energy on a site. RENR faculty are working to integrate i-Tree tools into a number of forest mensuration, digital field mapping, urban forest management and project courses for research, heritage tree, and urban natural forest fragmentation and natural capital studies.

This year, an annual challenge event that includes 7 programs from the School of Construction and the Environment will incorporate the i-Tree tool into an Eco-City based Challenge for the redesign of a portion of the BCIT Burnaby Campus.

The i-Tree tool suite has provided BCIT RENR students the opportunity to collaborate with other programs at the institute, industry partners and local governments. It has also provided BCIT with the opportunity to link the skills and knowledge of staff members to part-time studies courses and offer a training course for urban forest assessment which was a need identified by industry and local government. The opportunity to use i-Tree tools to study the ecological benefits of forests and connect these values to land use management, recreation and wildlife values is an exciting and valuable exercise that we will continue to develop and explore.
Building Energy Management & Controls: Moving Towards Sustainability

Ms Kerly Acosta Hitchcock

British Columbia Institute of Technology, Burnaby, Canada

This abstract will outline the form and flow for the Practitioner Presentation on Energy Management. Kerly Acosta Hitchcock will moderate a panel of experts from industry. Each panelist will be given ten minutes to present, and at the end of all the presentations (including the moderator’s time), a question and answer period will follow.

Energy management is the practice of energy conservation. Its aim is making sure the end-user is only using the energy needed and that energy is being used as efficiently as possible.

The Sustainable Energy Management Advanced Certificate (SEMAC) and Building Controls and Energy Management (BCEM) are educational programs to train Energy Managers. All the instructors who teach within these programs are experts in the field of Energy Management. This presentation will ask these experts to share their path to becoming an Energy Manager, and the benefits of receiving specialized training in energy management. These experts will share examples of conservation, efficiency, sustainability, and the use of building controls.

Both the SEMAC and BCEM programs are completely online and in a part-time studies format. These two programs consist of nine courses each (with four in common) that cover the technical aspects of energy management or controls along with the business aspects and human behavior aspects. This presentation will share some of the details of the SEMAC and BCEM programs that provide graduates with a well-rounded base for furthering a career in the energy management and controls industries.
Transboundary Policy Implementation Framework for Urban Environmental Sustainability

Mr. Richard Hannis Ansah¹, Prof Xueqing Zhang¹

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The challenges of urbanization represent an increasing global concern. To mitigate these challenges, government of nations have promoted sustainable development as a policy goal. This has been supported by a range of policies from international agreements, through regional programs, environmental laws, to national strategies and local plans. Despite these efforts, achieving environmental sustainability has been a difficult task due to policy implementation failures. Through a systematic literature review, this study identifies policy implementation failures and blends policy frameworks into a ‘transboundary’ policy framework. The selected papers that were analysed looked at the failure or success for attaining environmental sustainability in general. The success aspect concentrated on specific plans, policies or initiatives, and encompassed relevant areas such as water, energy, waste, air, agriculture and conservation, just as the environmental impacts of other initiatives including tourism, housing, transport, etc. The failure aspect focused on papers that identify some sort of failures such as failure to attain environmentally sustainable results with past and current initiatives, just as projected failings of future initiatives. Additionally, selected papers focused on developing models or frameworks to address the failures or enhance the success to achieving environmental sustainability. Predictive models that identify different scenarios to achieving urban environmental sustainability were also included. In like manner, the selected papers had to identify the cause(s) of failures in policies. From the analysis, it was identified that the basic susceptibility of policy failure on the environment is determined by a blend of factors including PESTLED factors (political, economic, social, technical, legal, environmental and discursive), Scope factors, and Implementation traps. Based on these intractable factors, we considered different frameworks, policy boundaries, stakeholders’ engagement, resources, etc. and mapped them to develop a comprehensive policy implementation framework. Here, a policy deployment strategy by Hoshin Kanri, PDCA (Plan, Do, Control and Act) by Deming, and DMAIC (Define, Measure, Analyse, Improve and Control) were blended into DIAS (Design, Improve, Act and Standardize). This premise lends support to the conviction of this study that notwithstanding the contrasts in policy frameworks at different levels, practices and frameworks are comparable because the focus and the overall agenda of environmental sustainability are related. Therefore, a transboundary integrated framework is critical to achieving urban environmental sustainability. In addition, this study stipulates that engaging sustainability-minded groups would be key to link sustainability agenda to experiences and practices.
Leading by Example: The Role of Municipalities in Climate Action

Mr. Joel Arthur\textsuperscript{1}

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While the Parties at higher levels of government push opposing priorities, there has been a progression of municipal action towards climate change mitigation. Much of the developed world accounts for more than its fair share of greenhouse gas emissions. Even Canada, with 0.5\% of the total world population, contributes more than 1.5\% of emissions to the environment; primarily sourced from buildings and transportation, which can be directly influenced by individuals. Individuals must be given the tools to influence change.

The City of Toronto introduced TransformTO, a multifaceted initiative with a goal of 80\% emissions reduction by 2050. Winnipeg’s Climate Action Plan also sets an 80\% emission reduction target by 2050; and, of course, Vancouver’s 100\% renewable energy target by 2050. These ambitious targets are supported by action plans that engage all areas of the municipal community; residents, businesses, and public sector stakeholders.

Municipalities must lead in their efforts toward climate change mitigation. Business-as-usual will not be enough to reach these goals that have been set. Transformative action will drive dramatic results towards carbon emission reductions; but only by taking those steps can municipalities lead the world where we need to go.
Providing Safe Drinking Water in the Himalayas: A Tale of Two Cities

Dr. Ravinder Nath Batta

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Himalayan region represents one of the most dynamic and complex mountain systems in the world and are extremely vulnerable to global warming. Climate change is severely impacting the hydrological cycle and, consequently, water management by substantially affecting both water resource availability and quality. Increased water-related risks associated with the changes in frequency and intensity of extreme events put additional strain on water resource management and increase uncertainty about quantity and quality of water supplies. Studies have shown that increase the health effects of water and in turn the morbidity-induced income and welfare impacts.

Focusing on the specific problems of water quality in the Himalayan region, this paper takes up two large cities in the western Himalayas namely Shimla and Kathmandu for an in-depth analysis. Both these cities have experienced rapid spurt in urbanisation due to rural-urban migration and tourism. Owing to their common geo-economic attributes (Himalayan landscape) and economic potentials (tourism centric economies), both the cities face a common predicament: water shortages and deteriorating water quality led morbidity and mortality. Among the factors that are responsible for this outcome are: primitive water treatment technologies, lack of good sanitary practices, lack of ecosystem focussed water governance, and absence of effective water quality monitoring and surveillance.

It is observed that following a policy of sound water governance is critical to both water supply and demand of water resources. Hydro-economic analysis offers the inherent benefit of integrating the costs, benefits and risks of various solutions aimed at enhancing the economic productivity of water. One major step in this direction is imputing an ecosystem value to the water resources to force the users to take into account the real value of water. For instance, the 80% of water used in agriculture could be largely saved by crop protection technologies and reducing over irrigation. These measures obviate the need for costly supply side interventions. Further, integrated decision making allows for an analysis of synergies and tradeoffs between water, agriculture, energy, environment and livelihood. Aimed at finding out workable solutions to the problems relating to water quality in these areas by going into the genesis of the problem, the paper identifies possible options for the future and makes a case for promoting them as Eco2 cities.

Professor Farrukh Chishtie¹, Dr. Shabeh ul Hasson², Mr. Mustafa Javed²

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Climate Change is one of the biggest challenges of the 21st century. Severe weather events are becoming frequent due to rapid urbanization and global warming. These severe weather events include floods, fog, cyclones, heat waves and tornadoes. In this work, we studied the urban heat island effect across urban centers of Pakistan. Urban Heat Island (UHI) effect causes the development of heat waves. The heat wave refers to a prolonged period of hot weather, which may be accompanied by high humidity. In the phenomena of urban heat island the temperature of the urban area is higher than its adjacent rural areas. Urbanized area includes road networks such as highways and buildings made up of concrete and asphalt. Urban land lacks vegetation and green areas and due to this reason the temperature of the urban area rises. Satellite remote sensing data is used to conduct the research by analyzing the effect of urban heat island. In this study we developed and analyzed the LST time series, using MODIS data for major urban centers in Pakistan from 2002-2016. We propose how such techniques can be used for monitoring and planning purposes.
Greywater Irrigation Can Be Used Successfully to Provide Plant Growth and Water Use in Climbing Plants for Green Façades

Ms Pei-Wen Chung1, Associate Professor Stephen Livesley1, Associate Professor John Rayner1, Dr Claire Farrell1

1The University of Melbourne, Burnley Campus, Richmond, Australia

Green façades with climbing plants have long been used to improve building energy savings. For green façades to effectively cool cities and buildings, they need to have good leaf coverage and/or high rates of evapotranspiration. Both characteristics will be impacted by resource constraints such as potable water availability. Greywater is being increasingly used as an alternative water source in urban areas to reduce potable water demand and alleviate pressure on sewerage systems. However, there are concerns that greywater irrigation could adversely affect plant growth due to salt accumulation in growing media. In terms of green façades, greywater has not yet been widely used to support climbing plant growth and survival. Therefore, this experiment was designed to evaluate whether greywater irrigation could be used to grow climbing plants. Three irrigation treatments were applied: (1) potable water irrigation, (2) greywater irrigation, and (3) greywater irrigation with a potable water ‘flushing’ once every three weeks. Synthetic greywater used in the study was formulated to conform with office building and household bathroom wastewater. This study was conducted from August to December 2018 (18 weeks) to examine the effects of greywater irrigation on the growth and water use of six climbing plant species. Our results revealed that for the six climbing plant species examined, both greywater treatments (greywater only and greywater with potable water flushing) had no significant effects on plant growth (biomass and leaf area) or water use. This indicates that domestic greywater can be used to irrigate green façades to reduce potable water use and cope with water scarcity, which also is considered as an effective means to improve the sustainability of horticulture. This has important implications for the expansion of green façades in urban areas as a climate mitigation strategy.
A Look into the Near-Future with the IDEAL CITY Organizational Structure and Transportation System.

Mr. Robert Daniels

In-Harmony Foundation, Miami, United States

The “daily commute” to work is more arduous than the jobs we have chosen to sustain our life. We can choose our work, but most people are stuck competing for precious space commuting on crowded surface streets. Congestion is making life unbearable, especially when stuck behind an accident or trying to find a place to park. A new way of movement needs to be implemented.

Join us in an exciting discovery how ecologically-oriented, IDEAL CITIES, not only mitigate environmental chaos but reorganize how we live and travel into a better way through a paradigm shift in Reality!

Instead of sprawling out, occupying every inch of space with roads and buildings, we learn from bio-mimicry of termites how to build giant skyscraper cities. Cities are treated as Super-organisms that produce order in our lives instead of stressful snarl of competing with each other to reach proximate destinations all at the same time. Our old polluting square cities are changed for circular cities that are high-density, walk-able, transit-oriented and non-polluting with access to all.

Studies have shown that over 50% of our travel is local; to take kids to school, getting food, local work, meeting with friends; as well as sports and entertainment. We put all of this within a 5-10 minute walk.

We re-organize how cities are arranged so we can live harmoniously with up to 2.5 million people in one city while filling it with mostly nature. Over 1 million people can have a leisurely commute of walking or riding to work within 15-20 minutes while passing by beautiful forests and lakes.

Most cars, trucks and 98% of all roads are eliminated.

A Layered Transportation Corridor gives people six choices of travel to connect to mixed-use transit nodes destinations, called Micro-Cities. These are small affordable, highly efficient LEED buildings with scalable costs.

The Corridors creates safe, separate levels of travel for walking, bicycling, elevated mass transit and the top level for autonomous, and two underground levels for a walkway tunnel and subway. All powered vehicles are electric yielding zero GHG emissions.

All six levels provide a controlled environment to protect against Climate Change and other weather events that interfere with travel to other cities. There is no more exposure to wind, rain, snow, and heat. Travel to work will be enjoyable, and makes you healthy through use of your body instead of driving through stressful traffic jams.
Carfree Cities: Reduce Emissions, Increase Quality of Life

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Focusing on single issues and technological solutions has helped create the mess that we are in. A broader approach could help us reduce multiple problems simultaneously, thereby achieving genuine improvements in quality of life across a broad population while reducing both inequality and emissions. Ending our reliance on most motorized transport (other than public transit) could greatly reduce national and individual transport spending while delivering a more efficient, cleaner, safer, and healthier transport system. Carfree cities could deliver more equitable, sociable, and less polluted cities with a greater stock of affordable housing and more community resilience. They could also mean significant progress in reducing carbon emissions.

This presentation will cover the main advantages of carfree cities as well as an update on initiatives to promote the concept in Dhaka and other cities. It will discuss some of the lessons learned in terms of gaining the attention of architects, planners, media, government officials, and the broader public and in reviving an international alliance for carfree cities. It will also introduce some of the public events that carfree cities advocates are using to promote the concept in densely populated, polluted Asian cities.

Carfree cities are the radical approach we need to the radical crises we are facing. Working together with optimism, creativity, and strategic thinking, we can achieve them.
How Does Climate Change Affect Health Related Illness in a Healthy Bio Diversity?

Mrs Hiba Ghori

1Doha Planners, Doha, Qatar

Extreme heat and humidity can cause diseases such as heat stroke, in which the body overheats and literally gets cooked. Heat stroke can result in permanent damage to brains and nerves as well as death.

Death from heat exposure is rare. More often, exposure to heat makes existing disease worse. Heat can promote dehydration which makes a wide range of diseases worse, including many heart and lung diseases such as asthma, chronic obstructive pulmonary disease, and heart failure, as well as diabetes. Heat also can make it harder to think and has also been shown to decrease productivity.

Heat waves can be fatal for many reasons. Hearts, brains, and lungs are all sensitive to heat stress and when they get overheated they fail. Higher mortality during heat waves has been attributed predominantly to failure of these organs.

During heat waves, emergency room visits rise for a variety of heat-related conditions such as heat exhaustion and heat stroke, heat cramps, dehydration and electrolyte disorders, cardiovascular and cerebrovascular diseases, respiratory disorders, acute renal failure, neurologic conditions, and mental illnesses.

Our bodies are able to lose heat in four ways:

1. Conduction involves losing heat through contact with something colder than our bodies. For instance, if you sat on a giant block of ice, your body heat would melt the ice and you would be cooled. But if you sat on a hot iron, conduction would convey heat into your body and possibly burn your skin.

2. Radiation is why the sun makes you feel warm - the electromagnetic radiation that the sun lets out warms our bodies and everything else from the outside. When it gets hot out, our blood vessels dilate and allowing greater radiation of heat from our bodies into the air and helps cool us down. When the temperature outside is warmer than our body, radiation increases our body temperature.

3. When you turn on a fan that blows across your skin on a hot day and you feel cooler, convection is at work. Cooling by convection only works well if the air outside your body is cooler than your body.

4. The fourth way our bodies lose heat is through evaporation. When it’s hot, we sweat. The heat on our skin gets transferred to the sweat and it evaporates which results a net loss of heat for our bodies.
A Review of Biodiesel Production Processes: Increasing production Yield

Mr. Mustaffa Hamad

Environmental Engineer, Canada

With the current Government’s approach and target goals on reducing energy consumption and Greenhouse Gas (GHG) emissions, the need for renewable energy sources have since increased. The need for reducing GHG emissions reflects on climate change legislation for protecting our environment.

The reality of diminishing fossil fuel reserves keeps industry motivated to find an alternative fuel source. The most adaptive fuel source in diesel and petroleum engines is proving to be biodiesel and biofuels.

Biodiesel is a clean-burning, non-toxic, biodegradable, more environment-friendly than petroleum diesel and can be used in regular diesel engines with little or no modification. Biodiesel is a renewable fuel made from a variety of feedstock including canola and other oilseeds that can be grown over and over, unlike non-renewable petroleum.

Since economic viability of biodiesel production will rely on different factors that include feedstock used as well as the catalyst along with proper procedures for setting up the reaction, this project proposes to investigate the efficient pathways in biodiesel production that will enhance production yield. The goal is to study a cost-effective, yet efficient mechanism that will increase production yields.

Biodiesel has the potential to help decrease the dependence on petroleum fuels and provide a clean source with lower GHG emissions as an alternative. Traditionally, Biodiesel is produced by a process known as transesterification reaction. Commonly, canola oil is the feedstock significantly used with the aid of homogeneous catalyst. However, canola oil has been deemed controversial as a food source being used for fuel and such process requires steps to purify and dry the final product, which can affect the overall yield of the Fatty Acid Methyl Esters (FAME) and the total economy of the process. A homogeneous catalyst is also not reusable.

The use of alternative feedstock and a heterogeneous base catalyst mitigates these problems while maintaining good FAME yields. The use of a support column to pack the catalyst in will be investigated for providing a setting of better reaction. Based on Literature review and Journals accessed, two different types of feedstock and catalysts will be explored for biodiesel production and will be compared to the traditional method. This Poster study will help us determine the alternative factors in biodiesel production that would increase production yield.
The Environmental Threats of Nonrenewable Energy Consumptions in Rasheed City

Mr. Rashed Kamel

Cairo University, Cairo, Egypt

Abstract—Rasheed city was known as the city of strategic geographical location, in terms of natural sources production either, Agriculture, fishing, gas and oil production. This paper illustrates the state of energy system in Rasheed city and its environmental, economic, and social impacts. It’s exploring also the threats of the nonrenewable energy consumption in the city and how it affects environmentally on the sea water level rising. Also it appears the issue of water level rising in the next 50 years and how most of agriculture land will be floating. Furthermore it’s finding the environmental impacts of natural gas stations which are located in the sea and they affect directly on the fishing, it’s one of the main source of economy in the city. Moreover the paper is presenting how the world is attempting to change the direction of energy consumption through reducing the ratios of depending on nonrenewable sources to renewable energy sources. The study is based on data collection and statistics from variable sources, such as city walking observation and Governmental Ventral Agency for Public Mobilization and Statistics (CAPMAS).
The 1.5-degree Lifestyles Puzzle: Interactive Tool for Dropping the Carbon Footprint of Private Households

Dr. Michael Lettenmeier¹²³, Sonja Nielsen¹², Viivi Toivio¹²

¹Aalto University, Espoo, Finland, ²D-mat ltd., Helsinki, Finland, ³Wuppertal Institute, Wuppertal, Germany

The paper presents a prototype of an interactive household tool, the “1.5-degree lifestyles puzzle”, that has been developed during a research project on 1.5-degree lifestyles. The purpose of the tool is to help households understand the idea, opportunities and challenges of 1.5-degree lifestyles, as well as to inspire and enable them to move towards low-carbon lifestyles. The tool thus intends to make complex climate targets approachable and understandable to households and also other stakeholders in order to foster discussion and action around the required systemic changes to enable 1.5-degree lifestyles.

The 1.5-degree lifestyles puzzle presents squares for the carbon footprint of present consumption, targets and options for footprint reduction. In the first phase, the participants are given the size of their current carbon footprint, visualised in a square. Inside the square, there is a smaller square indicating the 2030 target (2.5 tonnes), i.e. the sustainable level of lifestyle carbon footprint in 2030. Hereafter, the participants are given a collection of “puzzle pieces”: squares in different sizes that represent different actions that the household can take in order to lower its carbon footprint. The participants then choose relevant actions to fill the gap between their current carbon footprint and the target for 2030. When the gap between the present footprint and the target for 2030 is filled, the participants are asked to place the options chosen on a timeline from the present until 2030.

In the third phase, the participants are asked to think about which options they can realise directly, and which options should be especially promoted by others in society, like municipalities or private companies. To indicate their decisions, the participants distribute tags of different colour to any of their actions. After this, the participants are asked to choose actions that they would like to start experimenting with or implementing immediately.

The first prototypes of the tool have been tested in different contexts and several countries in order to gauge the feasibility of the tool and to receive feedback from different potential users of the tool. The paper summarizes the feedback from different user groups and concludes on how to further develop the tool in order to increase its impact.
A Journey from Online Class to the Field; or My First Energy Audit

Mr. Franklin Liao

London Drugs, Burnaby, Canada

Taking climate action is of paramount importance, and there is a pressing need to identify clean technology solutions and to assess the benefits to the companies and individuals who want to implement the technology.

The Sustainable Energy Management program at the British Columbia Institute of Technology (BCIT) provide students with insights on change management, energy audit as well as operational management of energy demand in infrastructural facilities.

The energy audit is tasked with finding out where, when, how and why the energy is being used. This audit is the best way to illustrate if a building benefits the environment as it should while meeting the human occupants’ health requirements by showing which processes within the building could use improvement, which aspects meet expected metric if not excel at them, so that building managers can reduce energy footprint as to better utilize resources. The audit also opens the door for concrete energy conservation actions as it identifies what energy management opportunities exist and how to exploit them.

An audit involves the collection and the review of data, survey of the site and assessment of the system within the building, analysis of the data and the observation as well as a review of the operational practices on site. It is important to define the scope, complexity and deliverable of the audit to maximize its effectiveness.

This presentation is structured around how I saw that the classroom learning may be leveraged as the key to better engage myself with my company on further climate change action as I’ve engaged with London Drugs from 2018 to 2019 on sustainability initiatives, which eventually led to proposing and execution of an energy audit at one of their retail stores.

The presentation will look into this personal journey where I had to engage with the company over where the sustainability management program would be relevant within the corporate sustainability umbrella, the company’s priorities and organizational structure with respect to climate action and building, as well as the kind of communication that took place in the course of two years.

Some of the findings from the preliminary audit will be discussed, although the focus will be on the journey of engagement instead of the derived metrics from the audit.
Analysis of Flooding in Onitsha, South East, Nigeria

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TOPIC

ANALYSIS OF FLOODING IN ONITSHA, SOUTH EAST, NIGERIA.

BY

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ABSTRACT

This paper interrogates the alarming occurrence of flooding in most cities across the globe. In Africa constant rise in rainfall has led to flooding all year round in the cities. While there is shortage of portable water, there has been constant increase in the volume of water on the earth surface. This has led to flooding, overflowing of river bank and rise in sea level, which in turn led to the washing away of top soil of the earth crust, leaching, destruction of properties, poor yield of agricultural produce and distortion of farming/planting seasons. This is a threat to food security. Yet, existing research has not extensively considered food security in their analysis. They have laid much emphasis on the Government involvement and less emphasis given to the communities. Most researchers did not place combating flood as a priority for food security. Onitsha has been on the danger list of both international and local organizations due to the catastrophic nature of the flood which had led to the environmental degradation, devastation, impoverishment and threat to the balance of the eco-system. The menace had succeeded in dislodging both human beings and animals and had posed a great danger to environmental sustainability. Most studies about the city focus on trade and investment with less attention on environmental development and sustainability. Using the 2018 flooding case, this paper explores a proactive planning strategy for a more dynamic mitigation of flooding in Onitsha, South-East Nigeria. The analytical cross sectional survey research design was employed to ascertain information on population changes, extent of urbanization, prevailing attributes of climate change and the influence of flooding on the study area. It recommends a long-term lasting solution that will fill the knowledge gaps and abate future hazards that may emanate from the climate change.

KEYWORDS: Climate, Flooding
Energetic Analysis and GHG Emission During Wood Pellet Production and Combustion

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Densification can resolve the logistical challenges encountered when large volumes of biomass are required for conversion processes to benefit from economies-of-scale. However, palletization is an energy intensive process, mainly due to the required drying and densification of biomass. The benefits gained from enhancing the physical and energy density of biomass can offset extra energy input and associated costs, especially when the hydrothermal pretreatment of biomass is considered prior to the densification as a way of drying. In this study, mass and energy balances and energetic analysis of the pellet production and combustion were done. The energy inputs in case of different hydrothermal treatments were calculated and compared to the energy input for untreated pellets in a combustion process. The energy ratios reported based on the untreated case. From various hydrothermal treatments explored in this research, superheated steam pretreatment has the lowest energy ratio. Subsequently, the emission of greenhouse gases (CO2, CH4 and N2O) during all involved unit operations was calculated theoretically and reported as CO2eq.
Every day, a tremendous amount of warm water is used once before ultimately being discarded down the drain. In fact, the United States Department of Energy estimates that the equivalent of 350 billion kilowatt-hours of hot water, is lost down the drain every year in the U.S. alone. Wastewater provides the ultimate renewable energy source, with an inexhaustible supply of thermal energy. Wastewater heat recovery is a process that can recover the heat energy from all that hot water and use it to heat buildings, cool them, and heat the domestic hot water supply. The PIRANHA is a self-contained thermal energy recovery system designed to heat domestic hot water by re-using thermal energy contained in wastewater. Using a specially engineered heat exchanger, the PIRANHA has been optimized for 50 to 300-unit residential buildings and stand-alone commercial applications. The PIRANHA is easily installed in new and retrofit construction projects. The PIRANHA is highly efficient: for every dollar spent, it produces $4 to $6 in zero-emission heat energy. The larger SHARC system provides domestic hot water preheating and space conditioning for multi-unit residential (300+ units), commercial buildings and district networks. Like the PIRANHA, the SHARC is easily installed in new and retrofit construction projects, contributes to LEED® credits, and has a robust lifecycle of 25+ years.
A Catalyst for Transformative Change: Delivering Low Carbon Buildings at a Meaningful Scale

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¹Perkins+Will, Vancouver, Canada, ²Delta Land Development Ltd., Vancouver, Canada

Often innovation and leadership in sustainability is offered by projects led by governments, institutions, or major corporations who have aligned values and a desire to demonstrate leadership. More seldom do private real estate developers initiate speculative projects for the market that attempt to go well beyond a predictable (or mandated) range of acceptable performance. As the most significant players in the construction of buildings, developers carry the greatest ability to be catalysts for transformative change and deliver a low carbon future at a meaningful scale.

In the context of Vancouver, British Columbia, private real estate developers lead the local construction industry where market-oriented housing predominates, with mixed-use projects and office-focused developments occurring in significant numbers, but to a lesser degree. Increasingly, construction in Vancouver is required to seek greater energy performance with aggressive performance targets for many projects, including Passive House certification for some. In a market where the cost of energy is relatively low, the benefits of conservation are primary in avoided greenhouse gas emissions. In this regard, the financial benefits for developers are limited, particularly when operating costs are assumed by the purchasers. While developers must comply with the minimum standards, rarely are they exceeded. As one of the greatest sources of greenhouse gas emissions in the world, buildings must necessarily be expected to not only to minimize their energy use and emissions, but to seek avenues to overcome and begin to create net positive effects.

This presentation will share the journey of a private developer intending to transform the local industry where broad sustainability objectives, using passive house as the foundation, are sought, with the intention to create influence beyond. By prioritizing broad sustainability goals within the context of passive house performance, the intent is to demonstrate that a comprehensive approach to sustainability is not only possible, but feasible in a developer-led undertaking. The intention is that such an approach will constitute a meaningful transition toward providing the marketplace choice that recognizes an environmental imperative.

Two projects will be presented as cases to this approach to advance the construction industry. First, an off-grid mass timber house intended to demonstrate how prefabricated timber homes built to passive house standards may be a model for minimally impactful development today. Second, a tall mixed-use timber-hybrid building with broad sustainability goals including zero emissions. Attendees will understand the challenge of pursuing ambitious goals from the perspective of the developer, and architect.
Is There an Impending Li-ion Battery End-of-life Crisis? Mitigation Strategies and Solutions Towards a Circular Economy

Mrs Joey Dabell\textsuperscript{1}, Mr Mark Dabell\textsuperscript{2}

\textsuperscript{1}BC Institute Of Technology, Smart Microgrid Applied Research Team (smart), Burnaby, Canada; \textsuperscript{2}KMD, Vancouver, Canada

Electric vehicles and solar energy technologies are seen to be vital pieces in any set of solutions available to society in combating climate disruption. Both technologies rely on li-ion battery systems.

There has been rapid growth in the adoption of these technologies and a reliance on continued growth to allow society to meet carbon reduction goals. A potential barrier exists where, for instance, many electric vehicles are reaching a mid-life point and the need for battery replacement causes current and potential new owners to alter decision making. Adding quantities of spent battery systems to the waste stream may result in a degradation of the apparent attractiveness of the over-arching technologies from society’s perspective.

This paper investigates the effect that the need for such early replacement, and the ultimate recyclability of Li-ion battery systems, may be expected to have on sustained growth in uptake of electric vehicles and other critical new technologies.

Electric vehicles are the focus of the investigation; reference is made in the outcomes where similarities with solar energy storage technologies are identified.

We approach the problem in three parts: defining the issue, assessing the impacts, and offering solutions that tend to mitigate these impacts. We define the nature of the issue through a high-level look at battery systems life-cycle and of their recyclability. We use this to determine time frame and costs as they need to be replaced. We assess the impact this need for replacement may have on technology uptake through discourse with current vehicle owners, potential new owners, advocacy groups and vehicle manufacturers. We look to identify potential areas where solutions to or mitigation of these impacts may exist in the context of a circular economy analysis and a design-for-recycling paradigm.

Replacing a battery system at the half way point in the life of an electric vehicle is likely to have a significant impact on the decisions new adopters make. Replacement battery systems cost as much as 30% of a new car. Cost effective replacement scenarios need to be identified.

Currently, recycling of li-ion batteries are cost rather than value processes and most batteries are directed to landfills. This will likely lead to push back from authorities. Extended producer responsibility was felt to be a good fit for battery systems as a way to limit collection and transportation costs and to make recycling more viable by injecting scale into the process.
Water Needs Assessment in Ezinihitte LGA, Imo State Nigeria

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ABSTRACT

The study entitled Assessment of Water Needs in Ezinihitte LGA is an attempt to address various problems associated with water supply and needs in order to identify solutions to address the gaps. To do this, issues including whether the water supply is evenly distributed, whether the water needs of the people are met are raised. Equally raised is whether the quantity of water supplied is accessible. To operationalize this aim, objectives are listed. Some of them are to determine the quantity of water for various uses by households, to determine the quantity of water needed by households, to determine the main source of water supply in Ezinihitte LGA. The hypothesis which when tested can aid the objectives are posited. It states that the quantity of water currently used for various purposes has no relationship with the quantity of water required for various purposes. The basic literature is on water needs. The questionnaire survey method provides instrument for data analysis. The multi-stage sampling technique was used, and the sample size is 416. Data from the questionnaire are collected, tabulated into frequency distribution table and analyzed by using correlation technique. While testing the hypothesis, it is found that the quantity of water supplied is insufficient in the study area. Data from different sources shows high positive correlation coefficient of variables indicating significant relationships between the quantities of water currently consumed and required to be consumed. It is also found that the water consumption is below WHO standard. The study is concluded by proffering recommendations that can help in addressing gaps in water supply and needs.

KEYWORDS: WATER NEEDS
Existing Buildings Keep it Real

Ms Jessie Stenftenagel¹

¹DIRTT, Vancouver, Canada

Our buildings are a dirty big secret.

The construction and operation of them, are responsible for more greenhouse gases than the entire transportation industry. Worse – we’ve made them disposable. We keep knocking them down and building again. Even though the concrete, brick, wood and steel should last hundreds of years.

By tearing down buildings when they no longer suit our societal and technological needs, we make our cities less livable. We lose our sense of place. We’re often priced out of neighbourhoods where there’s infrastructure for friendly, public transportation, accessible food and proximity to our needs for education and healthcare. Now we must move because we can’t afford to stay. All because the new building is supposed to bring in new money. Ironically, the materials used to construct the new building are of lower quality than the original.

Buildings are hard on the environment too, because of what’s inside them. We are. We’re the ones who say it doesn’t work for us. We’re the ones who endanger them because we cored through the floors too many times, bringing up cables and wires to create a 21st century interior. We’re the ones who determine it’s out of date. We’re the ones who won’t lease an ugly building that can’t keep up with us.

What if we could make interiors adaptable to all our utilitarian needs and aesthetic desires, never putting the building in jeopardy? Without destroying and then replacing the interiors themselves? What if the insides of all buildings could be ready to welcome a great idea for the community? Without knocking down what’s there now?

Thanks to technology, we can. Occupants design, explore and change their space in a virtual experience and a factory makes exactly what they want to fit the original base building perfectly. The construction is like a LEGO® experience where everything is quick-connected and erected. After move-in, the space responds to whatever the people inside—or the people moving in—need it to be.

The neighbourhood culture is kept intact. Every building is ready for high- or low-cost organizations to move in. Fewer construction waste bins litter the sidewalks. Less noise fills the air. Little material waste is sent to the local landfill. More diversity is allowed. More community is grown with deeper roots.
Building a Bridge: Business Is a Fundamental Building Block of the Ecocity

Mr. Richard Vurdela¹

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An Ecocity, as defined by Ecocity Builders, is a human settlement modeled on the self sustaining resilient structure and function of natural ecosystems (an environment consisting of all organisms living in a particular area). In an urban ecosystem or the global supply chain, businesses, predominantly small businesses, are a fundamental building block. As a predominant force, both from the perspective of productive output and tax base, these businesses must be leveraged to ensure positive change for the environment.

Ecosystems do not ensure survival for any organism.

This is as true for the black rhino as it is for the small manufacturer. For the black rhino survival is predicated on its energy budget, for the business it is the financial budget. All system constituents will act to ensure survival and in the existing system only financial unsustainability is fatal. Positive change requires the ability to leverage this drive for individual survival.

The Business Operations Management Program completes approximately 40 student consulting projects per year. This applied research provides an opportunity for unique insight to current business problems, driving motivations and commitment to change as well as great learning opportunities for students, business and faculty. A review of these projects provides several clues to bridging these fundamental drivers.

The initial gateway to change in these organizations is financial.

Based on a review of these projects however, it is clear that sound operations management can provide both an increase in financial performance as well as environmental performance. Eco-efficiency is, at least initially, a by-product but one that can be used to build a bridge to more deliberate action. Changing system conditions (customer demand, regulation, community incentives, etc.) as well as, evolving internal attitudes can elevate the by-product of environmental performance by creating opportunities beyond reduced cost, such as, reduced risk exposure and/or increased product/service value. This momentum can in turn encourage the business to pursue more advanced sustainability practices such as waste stream mining and eco-effectiveness/closed loop systems. Real world examples illustrate this evolution and provide opportunities to understand how this bridge can be built and creatively exploited.
Sweet Home Smart Thermostat

Mr. Peiman Dadkhah¹, Ms. Julie Lee¹, Mr. Kyle Yoon¹

¹BCIT, Coquitlam, Canada

Smart thermostats can add comfort, accessibility, and energy-savings to a home. These features come at a price, however, with the devices themselves being more costly to purchase and install. There is also limited product availability for devices that can be installed across multiple rooms and coordinate the control of multiple heating devices within a dwelling. For this project, our team has developed a prototype for a smart modular thermostat device and a software platform that can minimize consumption without the cost and complexity usually associated with installing isolated smart thermostats in each room. In case of Sweet Home Thermostat, there is one main module installed, then for a much lower cost modular units are added to each room, these thermostats are expandable, allowing the users to add as many units as needed to control various rooms or sections of an apartment or a house.

In preparation for this project, our team identified a lack of available smart thermostat devices suitable for apartment buildings using electric baseboard heating. The home automation market is rapidly growing, along with the desire for reduced electricity consumption overall. As such, we are confident that, by providing a simple, easy-to-retrofit, energy management systems for apartment buildings with electric baseboard heating, we are fulfilling an important niche in the market.

The Sweet Home Smart Thermostat system is designed with a single central controller and can have as many as 10 more modules connected to it. Leveraging modern machine learning techniques, this system can adapt to users’ schedules in order to improve their energy savings without sacrificing overall comfort. Controls, historical data and statistical reports can also be accessed online for the convenience of the tenant or building manager; this includes reports on estimated energy (cost) savings which will help to encourage this behaviour. These features, along with the market niche being targeted, make the Sweet Home Smart Thermostat an important proof-of-concept for future product development that can aid with global efforts to reduce energy consumption.
Retractive Development - Why the IDEAL CITY Is the Only True Form of Sustainable Development

Mr. Robert Daniels1

1In-Harmony Foundation, Miami, United States

The most precious commodity on Earth is wilderness land! It is finite and disappearing through Human Bio-Engineering at an astonishing rate. City and farm development are consuming the remaining natural forests and prairies causing a huge Loss of Habitat that forces the Anthropogenic Extinction into high gear across the globe. How do you place a value on a wild animal whose lineage goes back hundreds of thousands of years? How do you value Gaia’s Creation that has fought for life and the right to exist amongst the other wild creatures in that forest?

Bio-diversity is lost because development deems it more important to make a shopping center complete with a big parking lot to accommodate a thousand cars? More habitat is lost to low-density, single-family homes with long access roads and big driveways to handle the ownership of many cars, trucks or SUVs. These types of developments are not Sustainable!

Retractive Development says that cars and trucks are not needed and that Urban Forests complete with wild animals are much more important for our long-term existence. We are saying that Gaia’s Creations have a right to exist and that we must learn to share the Earth with them by living differently.

Instead of sprawling outward, occupying as much land as possible, including an over 25% land surface just for roads and parking area, we live in mixed-use skyscrapers. This new civilization would emulate the African Termite with mount skyscrapers in a form of bio-mimicry. We return as much of the land between our towers to untilled wilderness forests preserve complete with the best restoration techniques available.

In addition to upward development, layering of connecting transportation corridors are used to reduce the footprint to 2% surface space area.

We also require the creation of 10 story or greater Vertical Farms within each IDEAL CITY with a footprint equal to 10% of the total cityarea. This will reduce external farming by producing 90% of the food needed by the IDEAL CITY from inside of the giant hydroponic farms.

The same facility recycles solid and liquid waste below ground to eliminate most human presence on the land.

Our goal is to operate the IDEAL CITY with an Ecological Footprint of under 0.4 hectares. This gives other life forms 0.6 hectares to flourish and with full regeneration of lost biodiversity and introduction of new biodiverse variability thus reducing entropic forces.
Creating a Culture of Democracy in the Ecocity: An Interactive Workshop

Mr. Joel Mills¹, Mrs Erin Simmons¹, Ms Paola Capo¹

¹American Institute of Architects, Washington, United States

City leaders across the world face an ever-increasing public appetite for meaningful involvement in decision-making processes about the future Ecocity. Many localities are struggling with limited capacity around facilitated public processes, leading to a marked increase in conflict, controversy and distrust as high stakes public conversations are often poorly designed or mismanaged. The resulting decline in the quality of public processes and civil discourse is adversely impacting our collective abilities to make key decisions to meet our core challenges, ranging from urban systems to housing to climate change. Leading the 21st century Ecocity will require building greater capacity to harness a variety democratic processes and techniques. In a rapidly growing and diversifying world, our communities are more complex than ever. Today, every community has a unique identity. Our people speak different languages, practice different religions, and observe a variety of traditions. If we want to grow a healthy democratic city, the field needs adaptive processes that embrace a variety of cultural realities while responding to universal needs and expectations regarding public participation. Culture-Smart processes require an orientation that elevates democratic values within a variety of cultural contexts, creating culturally competent and inclusive participation that becomes a celebration of community and an important cultural element in the narrative of place. Using a wide range of case studies and examples, this workshop will use exercises, short films, and interactive discussion to explore a variety of ways that we can create a culture of public participation by adapting process to place.
Role of Informal Legal Institution in the Settlement of Disputes in the Urban Areas of Nigeria.

Mr. Nnadozie Onuoha

Imo State University, Owerri, Owerri, Nigeria

Role of Informal Legal Institution in the Settlement of Disputes in the Urban Areas of Nigeria.

BY

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ABSTRACT

The purveyance of the rule of law in developing countries frequently associated it with the positive and cordial relationship it will enthrone. At its core, this argument misses a fundamental yet widely recognized tangent to the rule of law, which is the role of informal legal institutions. The perception of legal systems perpetrated by the state formal legal systems is negative in many developing countries. Corruption, high cost of litigation and lengthy periods for issue resolution, limit the ability and willingness of many citizens especially the urban poor, to access to justice via the state. Accordingly, informal mechanisms are frequently relied upon by urban residents to litigate property disputes, enforce contracts, regulate labour relationships, marital issues and address a variety of other legal issues in the urban areas. The aim of this study is to examine the roles of informal legal institutions in dispute resolution in the urban areas of Nigeria. To actualize this aim, objectives were formulated. The data for the study was generated from survey of 400 randomly selected urban residents and organizations in the three key towns of Imo State of Nigeria with the questionnaire, interview guide or schedule and group discussions as data collection instruments. The probability sampling method and multi-stage sampling technique were adopted in the selection of areas and districts from the towns and presenting the questionnaire to the respondents selected. The Special Package for Social Sciences (SPSS) version 20 aided in data analysis. Findings revealed that the informal legal institutions in the towns serve the residents in the settlement of various cases which they could not have afforded if the formal system was accessible. Recommendations includes the formulation of both strategic policies for the integration of these informal legal institutions into the urban development policies of the Local Government Areas, the State and Central Government as well as tactical policies to tackle the findings and conclusions from the study.

KEYWORDS: INFORMAL LEGAL INSTITUTIONS, SETTLEMENTS OF DISPUTES
Effects of Informal Transport Activities on the Development of Urban Areas in Imo State, Nigeria.

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Effects of Informal Transport Activities on the Development of Urban Areas in Imo State, Nigeria.

BY

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ABSTRACT

This study on the “Effects of Informal Transport Activities on the Development of Urban Areas in Imo State,” is an investigative analysis of the contribution of informal transport activities in urban development. The aim is to assess the effect of informal transport activities on the development of urban areas in Imo State. To actualize this aim, four objectives and four research questions were formulated for the study. The three key towns of Imo State, Owerri, Orlu and Okigwe are the study area. The sample size for this is 300. Data extracted from the questionnaire and interviews were collated and arranged into frequency distribution tables and analyzed using descriptive statistics such as percentage ratios and inferential statistic such as T-test, and Analysis of Variance Models. The results obtained show that informal transport activities is male dominated (98% in Owerri, 99% in Orlu and 100% in Okigwe) and a major provider of job to the youthful population in the Urban Areas. The activities are mainly sole ownership in form, adopt the stationary style of operation and have various means of finance. The study concluded that there is a strong relationship between informal transport activities and urban development through employment creation, income generation, improved standard of living and investment in diversified areas by the operators in the study area. The study recommends that baseline studies should be conducted by Government towards formulating policies and programmers’ that will enhance the effectiveness of the informal sector including informal transport activities.

KEYWORDS: Informal Transport Activities, Development
Discover Digital Marketing Success Strategies for Ecocities

Mr. Steven Poe

Translumin Productions, Emeryville, United States

This presentation provides urban planners and urban service providers with results driven information and training in designing and implementing successful digital marketing campaigns. There’s never been a better time to leverage this proven system to aim for higher incomes, audience growth, faster conversions, and more cost effective marketing.

In our “always on” media-saturated society, getting your message noticed is a monumental challenge. There is also the perception that urban planners and urban service providers have complicated messaging that requires too much time and effort to grasp. Put these two problems together and you’re missing out on significant business growth opportunities. There is, however, a predictable way of filling up your sales pipeline with new qualified contract prospects, including exponential growth of an audience and their participation.

By the end of this presentation you’ll learn how to reach your ideal high-value customers with repeatable results. The presentation starts with a review of basic but important human psychology. For example, the human brain is designed to conserve energy (since it never knows when more fuel is coming). The minute something looks confusing or too complex the brain typically moves on or gets distracted.

We will explore how using your brand story to place your ideal customer as the hero on their journey, and you (your firm) as their guide, can get your clients from where they are now to their higher aspiration of where they want to be. Understanding story and where your target market is on their journey is the key to timely, actionable messaging.

Once we have an effective method for creating relevant messaging, this presentation will show how to use a proven system for digital marketing campaigns with Facebook and Google. Participants will learn about lead generation funnels, automated messaging resources, and tools for optimizing KPIs (key productivity indicators) so that their marketing campaigns are always delivering results within budget. The course will also show how to measure, improve, and optimize the campaign to get the results, when the KPI’s are not on target.

This presentation is about value creation — how urban planners and urban service providers can solve problems and add value to people’s lives by systematizing and automating their ecocity marketing with predictable results.
Curbing Urban GHG Emissions Through Innovative Energy Efficiency Retrofits

Mr. Brad White

SES Consulting, Vancouver, Canada

Existing buildings are responsible for the majority of GHG emissions related to the built environment and represent the greatest opportunity for emissions reduction. Looking beyond simple end-of-life system upgrades, and seeing buildings as a whole, reveals opportunities for combining energy conservation opportunities in innovative ways that can lead to dramatic emissions reductions.

In this presentation, Brad White, President of SES Consulting, will showcase two projects that changed the status quo for energy efficiency upgrades. In one project, SES was engaged by Vancity to replace its aging boiler plant in their headquarters and proved it was feasible to capture waste heat from its data centre to heat the entire building. The project had to overcome some unexpected barriers to achieve this. For instance, a heat recovery chiller, designed to boost the low-grade heat generated from the centre, was hoisted 12 stories into the air and through a 32-inch doorway. The waste heat recovery retrofit reduced the natural gas consumption of Vancity’s headquarters by 5,000 GJ and GHG emissions by 75%, resulting in a six-year payback. Another project involved a substantial retrofit on a municipal recreation centre housing 5 pools, an ice rink, and a fitness centre. Heat pump technology was used to recover heat from the ice plant and natatorium exhaust to provide the majority of the heat to the pools and domestic hot water; loads that were previously met by natural gas fired boilers. These changes, along with other measures to optimize equipment operation, reduced the Centre’s GHG emissions by 50%, accounting for $120,000 in annual savings for the entire building.

The success of these projects highlights just how big of a role innovative approaches to energy efficiency can play in achieving dramatic emissions reductions in our existing building stock and developing the world’s ecocities.

SES Consulting is an energy efficiency engineering firm with a mission to fight climate change by reducing greenhouse gas emissions. Our ambitious goal is to help our clients collectively save 1 million tonnes of GHGs in a year. We’re starting now by measuring impacts and setting team targets that will grow each year until we reach our goal; because business as usual isn’t enough.
Due to increase in population, industrialization the water is getting polluted. Therefore, it is necessary that the quality of water should be tested, because the contaminated drinking water human can suffer from water borne diseases. Also there is the need of purification of the contaminated water before drinking. So renewable energy sources have been used directly or indirectly for the treatment of water. There are different methods for water purification using solar system:

**Solar still**

In solar still solar radiations are absorbed by the glass heating the water inside the chamber and causes water to evaporate. The evaporated water rises above the surface. Once this vapor cools down to its dew point, condensation occurs, and the fresh water is collected. This process is having disadvantage that the process is very slow and amount of water produced per day is very low as it is not sufficient for one family for a day. As the solar energy is having certain drawbacks due to its dependence on geographical conditions. So, it becomes quite important to utilize the solar energy efficiently. So, the concentrating technologies are becoming more prominent in these days.

**Solar Collector (using reflector)**

In Concentrating Solar Power (CSP) technology the incoming radiation is tracked by large mirror fields which concentrate the energy towards absorbers. They, in turn, receive the concentrated radiation and transfer it thermally to the working medium.

But there are some problems with parabola concentrators. They are very bulky, having problem in transporting, high space requirements, etc. In concentrating technologies Fresnel Lenses recently becomes one of the best choice due to their small volume, lighter weight, more production with low cost as well as increase the energy density. Outcome required are: To analyze the Physico-Chemical properties of water samples. study Different minerals like Mn, Cu, Fe, Zn, Mg, pH, DO and BOD. in water samples 2. To calculations for the thermal conductivity of the model are carried out. Material for the development of system is required. 3. System is designed and developed in the workshop. Depending on the tilt angles Linear Fresnel Lens is situated. Data is calculated for the sunny days 4. Performance evaluation of the designed system. Sun tracking system is installed for better efficiencies. In Indian conditions near about 5 litter water is purified in sunny day, 3.3 litter of water in partially cloudy day and 2.5 litter water in cloudy days.
Does Western Red Cedar Effect the Occurrence of Forest Floor Mosses?

Mr Jace Standish1, Ms Julia Alards-Tomalin1

1BCIT, Burnaby, Canada

Forest floor mosses are an important component of forest ecosystems in many interface forests in Greater Vancouver and the Fraser Valley. Mosses comprise up to fifty percent of the ecosystem biomass and contribute to crucial ecosystem functions, including biodiversity and biogeochemical cycling. The combined challenges of urban expansion and climate change require understanding of moss ecology in order to maintain and restore interface forests. For example, what environmental variables are affecting the presence and abundance of dominant forest floor mosses? Studies by students in BCIT’s Forest and FNAM and FWR programs led us to investigate local relationships among humus groups, pH, and moss occurrence at BCIT’s Woodlot in Maple Ridge, B.C.

Step moss and lanky moss occurrence is strongly correlated with humus group and with proximity to, and size of western red cedar trees. Oregon beaked moss is strongly correlated to humus group and distance from western red cedar.

Multiple environmental variables, including humus type and thickness; light; moisture; humus and air temperature; canopy throughfall quality; and litter quality, are known to affect moss occurrence. Our study site is ecologically uniform; humus group and association with western red cedar trees are the most important environmental influences on local-scale moss occurrence. Along with other literature, our study suggests that increasing tree species diversity results in increased diversity of dominant forest floor mosses and may contribute to increased overall floristic diversity.
Neighborhood Upgrading in Tunisia: Connecting Informal Housing with Basic Services

Ms. Wendy Yao1, Ms. Kirstyn Koswin2, Mr. Bruno Camara Pinto3, Ms. Cadhla Gray4, Ms. Tina Vulevic2, Dr. Joseph Wong2

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Around the world, cities are growing rapidly. According to UN-Habitat, in 2015 four billion people were living in urban areas. It is expected that the number will grow by another billion by 2030. In this context, some residents struggle to find affordable housing with basic services such as water, sanitation, and access to other infrastructures such as roads and drainage systems. Our research is focused on Tunisia’s neighbourhood-upgrading programs that extend the reach of infrastructure and basic services to informal neighbourhoods that lack them. The upgrading process aims to address the features of informal neighbourhoods that negatively affect residents’ health, economic opportunities and well-being without forcing residents to relocate—a rights based approach that preserves residents’ existing networks and livelihoods. We sought to understand how the Tunisian Urban Rehabilitation and Renewal Agency (ARRU) and the various other stakeholders have worked together to design and deliver the country’s neighbourhood upgrading programs. Our research draws on literature reviews from September 2017 through May 2018 and fieldwork in Tunisia in April 2018 where we conducted interviews with academics, policy makers, and program administrators.

Our research shows that successful delivery of services on the execution level can exist, even while policy complications and systemic problems persist. After 30 years and 5 iterations, the programs themselves appear to perversely incentivize the continued expansion of informal neighbourhoods. Citizens continue to build homes on inexpensive and irregular land, with the confidence that ARRU will eventually provide them with service connections and infrastructure at no cost. To counter the limited administrative capacity to address the issues of incentivising informal growth, an adaptive pilot program implemented in Sousse takes a proactive approach. Through the pilot, ARRU works with municipalities to prepare plots of land for residential building before houses are constructed—a move to actively provide and predict infrastructure and basic services rather than addressing expansion after it has happened. At large, our research demonstrates that while programs like ARRU’s neighbourhood upgrading can be effective at delivering basic services, they can overlook deeper structural problems, like incentives that encourage residents to build on irregular land, complicating the kinds of solutions sought in the development sphere.
Student-focused Citizen Research: What Is the Real Story of Recyclables?

Miss. Maria Bushmin2, Mrs Sandra Jette1

1BC Institute of Technology, Applied Research Liaison Office (ARLO), Burnaby, Canada, 2British Columbia Institute of Technology, Smart Microgrid Applied Research Team,

We often-times resort to aspirational recycling, wanting to do our part, believing that an item should be recycled, unsure which bin to use, and relying on the program to do the right thing.

It is particularly important to understand what within the recycling chain gets shipped out of the Canadian jurisdiction and overseas. Taking care of our own waste instead of shifting the burden elsewhere is both socially just and ecologically responsible. This issue is underscored by the recent China ban on import of certain materials, and which has led to many communities struggling to keep programs afloat and/or directing recyclables to landfills. Another consideration is whether items classed as recyclable may actually be promoting the use of certain materials to such a degree that if these items are not actually turned into something else of value, the result is a recycling program that effectively contributes to waste in our landfills and oceans.

This work aims to improve general recycling literacy and provide informal solutions to empower motivated individuals and help drive change. The documented research is a student-focused ‘citizen research’ effort to clarify the life cycle of waste products in an attempt to answer the following research questions:

1. What is and what is not actually recyclable as opposed to our perceptions?

2. For those items that are assumed to be recyclable, which if any leave Canadian jurisdiction and for those that do, which are recycled and not just treated as waste in some other jurisdiction?

3. For those items that are determined to be non-recyclable, what alternatives may be developed, either on the producer side, or on the disposal side?

Individual students investigated two items that form part of the waste stream. One item chosen from regulated recyclables, for example plastic containers, the second those items that have an unknown disposition or which may cause confusion in their disposal, for example, candy wrappers. Students present investigations that trace the life cycle of the chosen items, document the outcomes, and develop informal solutions to help address the research questions.
The Study of the Green Remodeling for the Administration Building in Seoul

Dr. Haejin Kang

Seoul Institute Of Technology, Seoul, South Korea

Countries that have experienced serious climate and environmental changes, as well as resource depletion due to the increasing global greenhouse gas emissions, have signed the Paris Convention through the United Nations Framework Convention on Climate Change (UNFCCC) in December 2015. Korea aims to reduce greenhouse gas emissions by 37% by 2030. Looking at Korea’s GHG emissions in 2013, energy sector accounts for 87.3% of the total, and 75% of the total energy consumption in the domestic building sector is consumed in residential buildings.

Therefore, improvement for energy saving of administration buildings is required. However, administration buildings have low insulation performance and high energy loss. Therefore, the Korean government and local governments are carrying out projects to improve the energy performance of old buildings such as green building business and green remodeling business. Through this, the governments are implementing policies to reduce greenhouse gas emissions, create a pleasant indoor environment, and reduce energy consumption costs. In addition, insulation standards have been raised recently due to the strengthening of energy conservation design standards for buildings. Energy remodeling that meets these standards can be expected to enhance energy efficiency. However, the current energy saving design standards for buildings are targeting new buildings, and the remodeling projects that are underway are currently being conducted for apartment houses. Therefore, it is difficult to effectively manage the energy lost in the existing administration buildings. Therefore, in this paper, we present the planning factors of energy-saving remodeling and analyze the effect of remodeling by applying the proposed factors to analyze the energy performance, economy, and comfort. Through this, the purpose of this study is to contribute to the revitalization of the remodeling project by presenting the direction of establishment of the performance standard suitable for the remodeling of the administration buildings. In order to find a suitable performance standard for remodeling, Korean energy saving design standard, German EnerPHit standard and passive house standard were applied. Also, THERM 6.3 and PHPP 2013 program were used to analyze the effect of remodeling according to each standard.
PRACTITIONER WORKSHOPS
WS.01

Driving Carbon Reduction Through Sustainable Consumption and Lifestyles

Ms Cora Hallsworth1, Dr. Jennie Moore2, Dr. Halina Brown3, Dr. Philip Vergragt3

1Cora Hallsworth Consulting, Victoria, Canada, 2BCIT, Vancouver, Canada, 3Clark University, Worcester, United States

This workshop will explore lessons learned working with cities to develop consumption-based emission inventories (CBEI) and urban metabolism (UM) studies, and how this information can be used to inform planning at the city level.

Pioneering cities are seeking to tackle one of the root causes of global ecological overshoot and climate change: individual and collective consumption choices and habits. To support these efforts, new metrics and assessment tools are evolving. The CBEI evaluates the emissions that arise in producing the goods and services consumed within a region, regardless of where they are produced. This encourages emission-reduction strategies that maximize global, not just local, reductions.

Dr. Moore and Ms. Hallsworth have worked with numerous cities to create CBEIs based on an urban metabolism study, using the tool created by Dr. Jennie Moore – the ecoCity Footprint Tool, which is a core component of the Ecocity Standards. Concurrently, C40 Cities created CBEIs for 79 of their members.

In this workshop, lessons learned in working with and applying the results of CBEIs will be explored. For example, City of Vancouver have used results from their ecoCity assessment to inform their lighter footprint goal; District of Saanich and City of Victoria are exploring inclusion of consumption-based metrics in their climate action efforts; District of Saanich is using results to engage stakeholders in creating One Planet Action Plans; and City of Victoria is exploring how an understanding of its urban metabolism can support zero waste and circular economy objectives.

The workshop will also include presentations by Prof. Halina Brown and Prof. Philip Vergragt from Clark University and representing SCORAI (Sustainable Consumption Research and Action Initiative) who will outline the challenges of communicating CBEIs to policy makers, business stakeholders, and youth representatives; and explain how reframing the issues (for instance as “embodied energy in building materials and consumer products”) may help such communication processes. In addition, a representative of C40 will be invited to share outcomes of their CBEI assessments.

Ms. Hallsworth and Dr. Moore will engage workshop participants in exploring how this broadened understanding of impacts can inform policy and planning, what leverage points can be tapped to reduce consumption-based emissions and how local governments can streamline the creation of consumption-based emission inventories and urban metabolism studies.
Emerald Corridor Collaboratory (ECC) is a network of city-university partnerships based in the Pacific Northwest of the United States and Canada and supported by the Bullitt Foundation. It brings together university researchers and students with city leaders and professionals to leverage the complementary expertise and experiences of academic and civic institutions to respond to the collective and interconnected challenges facing cities in the 21st century.

Every city and town in our region is facing a similar set of intersecting challenges: reducing and mitigating the impacts of climate change, protecting green spaces and promoting infill and affordable housing, developing and encouraging active and multi-modal transportation options, and ensuring that responses to these challenges are informed by principles of equity, justice, and inclusion. These challenges span geopolitical boundaries and cannot be fixed or solved by any one city on its own, but must be addressed at a regional scale.

Launched in 2018, the ECC is working to strengthen individual city-university partnerships and build them into a broader coalition, bringing together leaders in a regional network that has the capacity to catalyze and implement change in a coordinated and more effective manner.

This session will engage civic leaders from around the world in discussing strategies, challenges and benefits of developing and strengthening partnerships between cities and their local academic institutions, and in scaling those partnerships to address their own regional issues.

The session will begin with an overview presentation on the Emerald Corridor Collaboratory, including the background and process of establishing the ECC, as well as challenges encountered and lessons learned along the way. The work will be illustrated by case studies of four pilot projects run by the city-university partnerships of Portland/Portland State University, Seattle/University of Washington, Bellingham/Western Washington University, and Vancouver/University of British Columbia.

Facilitated discussions will address participants’ experiences with climate change impacts, land use, housing, and transportation issues in their own cities. Participants will be asked to identify opportunities and challenges for addressing their local issues at a regional scale – e.g. what are shared issues in their regions? Which cities and universities should be included? What types of expertise and experiences could they draw on? How might community groups be involved? How will equity and inclusion be addressed?
WS.03

Shatter Your Lens and Sharpen Your View: Rio de Janeiro’s Favelas Will Make You Question Everything You Thought You Knew About Sustainable Cities

Dr. Theresa Williamson

1Catalytic Communities, Rio de Janeiro, Brazil

The workshop will engage the public in three activities designed to shatter their traditional thinking and renovate their perspectives on sustainable urbanism, to help them think outside their traditional disciplines and contexts, a necessary skill as we work together to develop the highly creative solutions we need moving forward.

The three activities involve (1) sharing stories of horrible failures that result from good intentions, due to a misunderstanding and poor appreciation of the “beneficiaries” in question; (2) identifying sustainable attributes of informal settlements and brainstorming what formal and highly regulated environments could do to enable these attributes, and where it would be helpful to do so; and (3) engage in a theoretical discussion of the role of choice and our obsession with the measurement of financial value in our inability to recognize the value of informal settlements.

Woven between these three group activities will be presentations providing thought-provoking, little-known context on the scale and role of informal settlements (¼ of urban humanity already; ⅓ of all humanity by 2050), tools and divergent perspectives from Rio de Janeiro’s Sustainable Favela Network where communities are working to develop their own model of sustainability, built on their qualities and assets.

The idea is a South-North and South-South exchange of knowledge to support a greater subtlety, sensitivity and diversity in approaches to sustainability everywhere. The end result: participants will be more open-minded and have a broader skillset to take to their daily activities, particularly in cases where they are seeking to engage traditionally marginalized or skeptical populations in achieving a more sustainable urban world.

Rio de Janeiro’s favelas offer an exceptional laboratory from which to reflect on the nature of multi-generational self-built development of informal settlements, to consider what the world might learn from these settlements, the relationship of housing to belonging and sustainability, and to use this knowledge to create more flexible, adaptive, singularly diverse, creative and resilient cities—all qualities of informality that are conspicuously absent from most formal environments.

Through a social justice lens on history, the workshop presentation will include an assortment of personal stories from favela residents and community organizers; research findings; theories on complexity, community organizing and the qualities of informality; and tried and tested grassroots development strategies, from nineteen years’ work alongside hundreds of favela organizers in dozens of favelas, resulting in a unique look at Rio’s favelas as a source of inspiration for resilient and adaptable urbanization.
Urbinsight: A Bottom-up Approach to Community-based, Data Driven Sustainable Planning. A Comparison of Urbinsight Implementations Across Six Cities to Share Lessons Learned, Project Successes, Strategies to Optimize Impact and Engagement, Integration of Data and Ideas into Municipal Planning, and Academic and Community Ownership of Project Data and Reports from Santiago De Los Caballeros, DR; Lima, Cusco and Santa Eulalia, Perú; Medellín, Colombia; And Santa Fe, Argentina.

Miss Sydney Moss\(^1\), Miss Sofia Castro\(^2\), Mrs Daritza Nicodemo\(^3\)

\(^1\)Ecocity Builders, Oakland, United States, \(^2\)Academic Research Group: Territory, Socio-Ecological and Ecosystem Services (TSESE) from INTE-PUCP (Instituto de Ciencias de la Naturaleza, Territorio y Energías - Pontificia Universidad Católica del Perú, Lima, Peru, \(^3\)Centro de Estudios Urbanos y Regionales (CEUR), Pontificia Universidad Católica Madre y Maestra (PUCMM), Santiago de los Caballeros, Dominican Republic.

In this panel discussion Urbinsight project implementers will share best practices in participatory action research, participatory GIS, community engagement, and community level sustainable planning learned through Urbinsight implementation in six Latin American and Caribbean (LAC) cities: Santiago de los Caballeros, Lima, Cusco and Santa Eulalia, Medellín, and Santa Fe. Presenters will introduce the Urbinsight approach as well as compare and contrast these project iterations throughout the LAC region, reflecting on project successes, lessons learned and impacts on sustainable planning in the various project locations.

Urbinsight is a global initiative that facilitates local, community based, data driven sustainable planning with a goal of developing community-led interventions to improve environmental health and quality of life. The Urbinsight participatory action research approach facilitates collaboration between community members, local academic institutions, and governments. Urbinsight uses GIS data, community surveying and mapping, the International Ecocity Framework, and urban metabolism information systems to diagnose existing environmental and infrastructural conditions. Urbinsight maps, resource flow diagrams and community data are then used by stakeholder groups for planning to develop viable, sustainable solutions to improve existing conditions and the quality of life within the community.

All project products and outcomes are developed in collaboration with local and national government so that they meet local standards and can be effectively used for research, urban and rural planning, and disaster risk strategy development by local and national government and academic institutions. As many communities within a city or even across countries have common archetypal characteristics, governments can apply successful solutions to other communities sharing similar characteristics to scale up the impact.

The Urbinsight project has been implemented in cities across the world as a full length academic course for professionals or graduate level students. Since 2015, Ecocity Builders has implemented Urbinsight nine times in six cities and four countries throughout Latin America and the Caribbean (LAC). The project resources and approach are highly adaptable and are tailored to each city for successful local implementation. In an effort to increase project impact and success, Ecocity Builders has partnered with local Urbinsight project implementers to encourage information sharing between international implementers in the LAC region.
Sound Quality, a 2019 Bio-Geophysical Condition

Mr. Steve Meszaros, Dr. Maureen Connelly¹, Mr. Lee Beaulieu²

¹British Columbia Institute Of Technology, Burnaby, Canada, ²City of Vancouver, Vancouver, Canada

At Ecocity World Summit, Melbourne 2017, the inclusion of Sound Quality in the International EcoCity Framework was proposed. The premise is an Ecocity in which citizens experience sound quality in buildings and outdoors that is conducive to good health. The overall rational is that reducing excessive noise levels will reduce the burden of disease and exposure to the sounds of nature will support health, and that an ecologically balanced soundscape will support a diversity of culturally unique sounds and ambient sonic backgrounds. Sound quality as a Bio-Geophysical Condition was evaluated within the Ecocity framework for synergies with the four pillars of sustainability to advance the vision of ecologically-restorative sonic environments. This imperative standard adopts noise criteria from the World Health Organization for the Ecocity 1 benchmark. Principles of ambient soundscape analysis conceptualize the Gaia Level Ecocity. Literature and examination determined that no one single existing standard could appropriately host Sound Quality as a subset within its definition as the comprehensive series of indicators are unique to each existing definition and to Sound Quality. As such, Sound Quality will be an additional Bio Geophysical Condition for inclusion in the forthcoming revision of the International Ecocity Framework.

The format of this workshop is three presentations plus a one-hour discussion between the presenters and workshop participants. Discussion topics include: how smart land-use decisions and building design effectively support Sound Quality as well as the principles of Clean and Renewable Energy and Responsible use of Resources and Materials; prediction of the zero-carbon city soundscape, without the masking sound of today’s combustible engine road noise, will the public transit train and buskers pierce an ambience of urban tranquility?

Dr. Maureen Connelly, Director Faculty, Acoustics Research Lab, BCIT Centre for Architectural Ecology, will present and examine the Sound Quality conditioned as authored and facilitate the discussion. Lee Beaulieu, Planner, City of Vancouver, will presents the noise control strategies in print and explore new policy options and planning and design strategies to ensure that the patterns and materials of the Ecocity mitigate activity based noise propagation.
This workshop will provide an introduction to eco-industrial park planning, including developments from ‘raw’ land and retrofits / revitalizations. ‘Industrial park’ can include concepts like industrial estates, research parks or free trade zones and can be home to businesses of all sectors and sizes. Discover how your city can pursue sustainability while embracing your industrial land uses, not in spite of them!

The eco-industrial park concept especially aligns with EcoCity standards for Green building; Clean Air; Clean and Safe Water; Responsible Resources and Materials; Clean and Renewable Energy; Community Capacity / Governance; Healthy and Equitable Economy; Healthy Biodiversity; Earth’s Carrying Capacity; and Ecological Integrity.

While the concept of an eco-industrial park initially referred to just industrial parks with some industrial symbiosis (with the wastes of one or more businesses being used by one or more other businesses), the concept has evolved to consider the application of ecological design and industrial ecology principles through the entire development cycle – from subdivision planning, to infrastructure design and construction, to building design and construction, to business operations. Eco-industrial parks can be built from scratch on a greenfield or brownfield site, or can be created through revitalization efforts targeting existing industrial parks.

The first half of this workshop will cover theory and examples, from northern Canada to Egypt. In the latter half, participants will get to try their hand at planning a new eco-industrial park or retrofitting an existing development. Participants are encouraged to table examples from their own cities for the working session.

Materials: Each participant is encouraged to bring his/her own laptop with wifi access. Participants wishing to table an industrial park example from their own cities are encouraged to bring relevant maps and photos and to contact the instructor ahead of time.
WS.07

Sustainable Lifestyles and Ecocities: Radical Reframing for Strong, Urgent Climate Action

Dr. Vanessa Timmer\(^1\), Dr. Lewis Akenji\(^2\), Ms. Anu Mänty\(^3\)

\(^1\)One Earth, Vancouver, Canada, \(^2\)Institute for Global Environmental Strategies, Hayama, Japan, \(^3\)SITRA - The Finnish Innovation Fund, Helsinki, Finland

2 hours

Vancouver Convention Centre

Sustainable lifestyles remain a political “hot-potato” issue, but also an inevitable part of creating ecocities. Although mainstreaming sustainable lifestyles is the essence of implementing the climate Paris Agreement and UN Agenda 2030, there is little evidence that practical efforts and political gestures are based on a clear interpretation of what is needed to shift the dominant urban consumerist lifestyles.

This interactive workshop brings together five international initiatives engaged in reframing our approaches to lifestyles as a key part of creating ecocities and sustainable societies. Workshop participants explore this reframing including how science inputs into solutions design for sustainable living.

Insights and speakers come from the following:

1. A project expanding solutions captured in the widely used IMAGE global climate model by adding actions on sustainable lifestyles – early calculations show that lifestyle changes could reduce emissions globally by 10 GtCO2-eq by 2050.

2. A new report on 1.5-Degree Lifestyles by IGES, Aalto University and D-Mat, financed by the KR Foundation and SITRA the Finnish Innovation Fund, demonstrating the magnitude of changes in lifestyles needed, and setting targets for sustainable lifestyles carbon footprints for 2030, 2040 and 2050,

3. SITRA’s transformative work on sustainable everyday living engaging hundreds of thousands of Finnish citizens,

4. The Envisioning Low-Carbon Future Lifestyles project highlighting transformative cases and imagining sustainable living futures, and

5. The Beacon on Sustainable Living project developing transformative communications on sustainable living that equip us to shift our discourse and mindsets.
Speakers / Facilitators:

Dr. Lewis Akenji, Director for Sustainable Consumption & Production, Institute for Global Environmental Strategies (IGES)

Dr. Vanessa Timmer, Executive Director, One Earth; Senior Research Fellow, Utrecht University

Anu Mänty, Leading Specialist, SITRA

Prof. dr. Detlef van Vuuren, Senior Researcher, PBL Netherlands; Professor, Integrated Assessment of Global Environmental Change, Utrecht University

Participants will engage on the following:

- Developing solutions that align with the underlying science on the urgency and scale of the challenge of engendering sustainable living,

- Creating compelling visions and scenarios of what future sustainable ways of living could be like,

- Drawing insights from attempted solutions, including: citizen-based approaches, changes in socio-technical systems that frame everyday decisions and ways of living, and emerging business models that challenge the more opportunistic and profit driven approaches over approaches that reinforce the wellbeing of people and the environment, and

- Identifying promising interconnections among sustainable ways of living and ecocities.
What You Need to Know About Building Successful Green Roofs

Mr. Steven Peck, Mr James Klassen1

1The Roofing Contractors Association of BC, Langley, Canada

What you need to know about Building Successful Green Roofs

Green roofs, also called living or vegetated roofs, offer one way for cities to address the growing issues of storm water infrastructure capacity, urban heat generation and retention, and the disappearance of connected natural spaces necessary for biodiversity in the urban environment. In many jurisdictions, green roofing is a component of a larger body of policy-backed visionary strategies to reshape the way cities are designed and inhabited. But for green roofs to be a successful part of any municipal program, that is, to have a lasting impact on their urban environment, they have to be carefully and intentionally designed, crafted and maintained.

Green roofs enjoy success in many parts of the world because they are built by people who are skilled and dedicated to their respective trades. Additionally, successful green roofs are constructed according to stringent standards, thoroughly verified during construction, and maintained by owners. But in many cities across North America, green roofs suffer a less than stellar reputation, in part because the drive for productivity forces the market to embrace the lowest possible price at the expense of quality, durability and ongoing maintenance. And green roofs, no matter how beautiful they may look when first new, will fail in short order and leak if they are poorly designed, badly built and compromised by expediency.

A successful green roof is the product of a quality-assured professionally constructed waterproofing platform that supports a quality-assured, professionally designed and constructed vegetated system. While clear, objective and demanding standards provide an essential benchmark against which to measure the quality of construction for both the roof platform and the vegetation it supports, they are insufficient unless underwritten by a guarantor and partnered with professional training, independent verification, select materials and a voluntary commitment to accountability made by both material manufacturers and the contractors who build each assembly.

Building Success for Green Roofs explores the key components of a successful green roof program, including the standards that elevate both waterproofing and vegetated roofing beyond good to the status of great and eminently successful.
Uprisings: An Interactive Workshop on Harnessing the Energy and Creativity of Citizen-Led Sustainability Projects

Mr. James Boothroyd

Boothroyd Communications, Vancouver, Canada
Facilitator: James Boothroyd

Partners/Co-Facilitators: Kirstin Miller, Ecocity Builders, Oakland; Robyn Chan, Evergreen Canada (Green Bloc Neighbourhoods), Vancouver.

Venue: Vancouver Convention Centre.

Introduction: Cities need to engage residents in support of systemic and behaviour changes if they are to reach ambitious sustainability goals. This workshop will trigger conversations about six successful citizen-led projects from the Americas and how local governments can enable the flowering of such initiatives in socially just and ecologically sustainable cities.

Learning Outcomes: Spark, and bring to scale more citizen-led projects; international networks of engaged citizens; increased popular support for urban sustainability goals.

Time slot: This half-day (145min workshop) would span two morning sessions on one of the first two days of the Summit. A 60- to 70-minute version could also be held once or twice, during the final three days (perhaps as a Practitioners Presentation).

Interactive, fun format: This workshop mixes elements of PechaKucha and “speed-dating”. It will begin in plenary with an introduction and PechaKucha style presentation of six citizen-led projects, each under four minutes (and fewer than six slides). Delegates will then move to one of six high tables, where they will discuss the different projects with project leaders. A bell will announce the beginning of the first date, and presenters will have 3 minutes to speak and pose questions, before delegates respond and discuss (10 min). A second bell heralds the end of the first date and delegates have two minutes to move to another table, where the “dating” is repeated. After five rounds (75 min), presenters and delegates reconvene in plenary to discuss overarching themes (30 min): e.g., the creative tension between municipal- and citizen-led projects; bringing projects to scale, etc.

Possible Projects to be presented:
Canada: Green Bloc Neighbourhoods (Vancouver); Lighter Footprint App (Vancouver); Solon (Montréal); SNAP (Toronto).
United States: Local Clean Energy Alliance, Oakland, CA; and projects in and around Detroit, MI:

- Hope Village Initiative: Ecodistrict, Model Net Zero Energy Home, Cool Cities Park, etc.
- Soulardarity: Energy Justice Cooperative
- Ecoworks: Services for community development, energy conservation, sustainability.
- Detroiters Working for Environmental Justice: Authors of Detroit’s progressive Climate Action Plan

Central / South America, Caribbean: Ecocity Builders projects in Santiago, Dominican Republic; Cusco or Lima, Peru; Medellin, Colombia, etc.

Attendance

For best results, we might wish to cap the number of delegates at 60 to 80; 40 or 60 for the abbreviated version.
Moving Climate Research Out to The Public

Professor Ann Dale, Dr. Jaigris Hodson, Ms Jaime Clifton-Ross

Royal Roads University, Victoria, Canada

Given the spread of misinformation and the challenges in effectively communicating research on climate change and sustainable development to the wider public(s), it is crucial for research to make a difference. Research curation is a new method to communicate research outcomes online to diverse audiences, building upon contemporary museum practices as well as best practices in social media marketing. It combines internet communication technologies (ICT’s) with select curatorial and communication frameworks for a wider dissemination of research outcomes. Based on a new research curation best practices framework (publication forthcoming), this practitioner workshop will inform participants how to develop a digital communication strategy, how to conduct audience research, how to write social media content, and how to personalize their work. As museums have a long history of educating and engaging the public, we will also outline two useful museum frameworks that can enhance web communication practices. Given the volume of information available online, it is important to create a smoke signal around your research. This workshop will conclude with tips and tricks on how to reformat and present research outcomes into engaging and user-friendly media formats.
Test-driving the National Industrial Symbiosis Program NISP®

Mr Peter Laybourn¹, Mr Timo Makinen²

¹International Synergies Ltd (UK), Birmingham, UK, ²National Industrial Symbiosis Program Canada, Vancouver, Canada

The National Industrial Symbiosis Program (NISP®) model creates financial benefits to businesses by establishing business-to-business synergies where ‘waste’ resources, such as materials, energy or water but also physical assets or expertise, from one or more business can be used by another to replace a virgin feedstock or even to support new product lines. Businesses only implement those synergies that have a business case for them i.e., that cut costs, increase revenues, or reduce risk. However, the synergies also create environmental benefits such as waste diversion or greenhouse gas emission reduction.

The NISP® model eschews cumbersome waste audits, and instead uses a regional facilitation model. The model relies on special workshops supported by full-time, dedicated and specially trained facilitators to work with businesses to implement opportunities identified at the workshops. The NISP(R) model also incorporates a robust software platform called SYNERGie, which, in its latest iteration, even helps facilitators identify more potential symbiosis opportunities. The NISP® model has been adapted to more than 30 countries worldwide, and has been endorsed by the EU Directorate General for the Environment, the OECD, WWF, and the G7-Alliance for Resource Efficiency.

This workshop will begin with an overview of the NISP® model and then will be structured like a National Industrial Symbiosis Program (NISP®) workshop. Participants will have the opportunity to see first hand how the NISP® model works. At the close of the workshop, we will work through the process of establishing regional NISP® models.
WS.AD01

Strengthening Communities in the Face of Climate Change: Mobilizing Building Adaptation and Resilience (MBAR)

Lisa Westerhoff\(^1\), Pamela Kertland\(^2\), Dr. James Lu\(^3\), Trevor Murdock\(^4\), Dan Sandink\(^5\), Remi Charron\(^6\), Angie Woo\(^7\), Ralph Wells\(^8\), Sadia Afrin\(^9\), Dave Ramslie\(^10\), Gary Hamer\(^11\)

\(^1\)Integral Group, Vancouver, Canada, \(^2\)Natural Resources Canada, ON, Canada, \(^3\)Vancouver Coastal Health, Vancouver, Canada, \(^4\)Pacific Climate Impacts Consortium, University of Victoria, Victoria, Canada, \(^5\)Institute for Catastrophic Loss Reduction, Toronto, Canada, \(^6\)New York Institute of Technology - Vancouver, Vancouver, Canada, \(^7\)Fraser Health, Vancouver, Canada, \(^8\)University of British Columbia, Vancouver, Canada, \(^9\)BC Housing, Burnaby, Canada, \(^10\)Concert Properties, Vancouver, Canada, \(^11\)BC Hydro, Vancouver, Canada

A full-day interactive workshop with leading building practitioners in Canada who are working to mobilize the construction sector’s capacity to improve climate adaptation and resilience in building design and renovations. Participants will learn how to improve buildings to mitigate the health and financial risks posed by climate change (such as flooding, overheating, severe storms, wildfire smoke) and to work towards a low carbon resilient future.

Moderator: Lisa Westerhoff, Integral Group

Part One (presentations): Climate Change Risks in Canada and BC

- “Building for the Future – Canada’s Climate Change Adaptation Platform” – Pamela Kertland, Natural Resources Canada
- “Designing Healthy Buildings in the Context of Climate Change” - James Lu, Vancouver Coastal Health
- “Weather Files for Future Building Design in B.C.” - Trevor Murdock (invited), Pacific Climate Impacts Consortium
- “B.C.’s MBAR Project” - Lisa Westerhoff, Integral Group

Part Two (presentations): Strategies for a Resilient Built Environment

- “Low Carbon Back Up Power Solutions” - Remi Charron, BC Housing
- “Adaptation and Resilience Planning for Health Facilities” - Angie Woo, Fraser Health

Part Three (workshop): Developing a Resilient Building Plan

- Breakout groups will combine information from the presentations with participants’ own expertise and experience and apply it in the creation of a draft resilient building plan.
- This interactive exercise will mimic an integrated design process and familiarize participants with the key steps and strategies that are required to design and execute a resilient building plan, from pre-design to post-occupancy.
Part Four (presentations): Improving Adaptation and Resilience

• “Modelling to Maintain Thermal Comfort in Buildings under a Changing Climate” – Ralph Wells, UBC
• “Practical Mechanical Design Considerations for a Changed Climate” – Sadia Afrin, BC Housing
• “Adaptation and Resilience for New and Existing MURBs” -- Dave Ramslie (invited), Concert Properties
• “Power Management for Low Carbon Resilience in NZE-r Housing” – Gary Hamer, BC Hydro

Part Five (workshop): Identifying and Removing Barriers

• Breakout groups will identify and discuss barriers to implementation (including practical, regulatory, perceptual, informational, and financial) and how they might be overcome, based on participants’ professional and personal experience.

• Participants will reflect on the overall process of developing a resilient building strategy, including the challenges and opportunities associated with implementation and the practical next steps for their own projects.
WS.13

Regenerative Relationships: An Interactive Workshop on Living Systems Engagement

Mr. James Godwin¹, Mr. Lucas Ozols-Mongeau¹, Ms. Emily Rennalls¹, Mr. Geoff Cox¹, Mr. Jason Heinrich¹, Mr. Esteban Matheus¹

¹DIALOG, Vancouver, Canada

This session demonstrates a stakeholder engagement exercise that uses the approach of ‘Regenerative Design.’ Regenerative design aims to foster a co-evolution between all living systems in the development of our built and natural environments. The approach allows design teams and stakeholders to consider the breadth of the ecological community affected by our decisions and actions, and to improve the quality and quantity of beneficial relationships formed by a project throughout the design process. This interactive exercise will guide participants through a process of role-playing within a speculative project to enable them to better inform future decisions towards the holistic benefit of all living systems.

To achieve this, we must understand the characteristics of a given place and the ecological community it contains, and then leverage the act of design as a tool for the formation of positive relationships between humans and ecological systems. This interactive workshop will introduce an engagement process that will challenge participants to step beyond their point of view and assume the attitudes, needs and values of a variety of biotic stakeholders within a given site. The session is relevant to all attendees whether engaged in private practice, municipalities, education, NGOs, or in advocate roles.

The status quo is to engage fewer voices in the beginning of the design process, many times with a privileged few driving design outcomes towards their own wants and needs. When the voiceless biotic perspectives are ignored, the direction of a project may become progressively more biased and curated toward less inclusive desires. To counter this, the traditional roles and expectations of design professionals, clients, and authorities can change to ensure that more voices are brought to the table.
Sustainable Community Energy Planning and Management

Ms Kerly Hitchcock\textsuperscript{1}, Ms Patricia Bell\textsuperscript{2}, Ms Maryam Rezaei\textsuperscript{3}, Mr. Areef Abraham\textsuperscript{3}, Ms Christine Thuring\textsuperscript{1}

\textsuperscript{1}British Columbia Institute of Technology, Burnaby, Canada, \textsuperscript{2}Community Energy Association, Vancouver, Canada, \textsuperscript{3}Community Power, Vancouver, Canada

Full day workshop/field trip

The two hour workshop includes presentations and participatory activities. Kerly Acosta Hitchcock, the Program Head for Sustainable Energy Management at BCIT, will facilitate this workshop with three experts: Patricia Bell from Community Energy Association, and Areef Abraham & Maryam Rezaei from Community Power.

According to QUEST Canada, more than half of Canadian communities are creating plans and programs for sustainability, renewable energy, and Green House Gas reductions. Some of these plans are more than ten years old with lessons we can draw from.

In this workshop we will:

- Describe the various meanings of sustainable energy planning and management
- Communicate community scale climate and energy topics to diverse stakeholders
- Develop an outline of energy and emissions plans that lead to implementation
- Evaluate finance options for implementing technologies such as district energy, electric vehicle charging infrastructure and renewable power and heat
- Assess ongoing municipal energy efficiency programs to residents and businesses
- Realize the economic development potential associated with renewable energy, energy efficiency and EV charging

Experts from Community Power will talk about their approach to energy management planning and implementation in First Nations communities in BC and share results of their work over a number of years with communities. Highlighting key elements of the successful transition between planning and implementation, the talk aims to emphasize the complementary roles of energy managers, local governments and funding agencies while involved in the implementation of community energy plans.

This workshop will be useful to:

- Federal, Provincial, and Municipal elected officials and staff
- Developers
- Utilities
- Consultants providing services to municipal government
- Indigenous leaders

Material will be supported by case studies.
After the workshop, one may join a three hour bike tour of the city. This tour invites participants to explore Vancouver’s progress towards its Greenest City Plan. It will showcase some of Vancouver’s projects that aim at ecocity standards, starting with Vancouver Convention Centre green roof, The Hive, Sorella Housing for Women, Classic Chinese Garden, False Creek bike path, Southeast False Creek Neighbourhood Energy Utility, Hinge Park, SEFC Creekside Community Centre, and Pollinator Garden.

Two cyclists will lead the tour. Each stop will be clearly marked with signage providing information about the site. Those who wish to participate but are not physically able to cycle can use the public transit system. A digital map will be given to all participants.
Valuing the Benefits of Green Infrastructure: Principles and Methods

Mr. Rohan Lilauwala

Green Infrastructure Foundation, Toronto, Canada

The benefits of green infrastructure (like urban trees, rain gardens, and green roofs) are well known and commonly accepted, but difficult to put a dollar value on. This difficulty creates an obstacle, where green infrastructure is often not considered when making important decisions around the future of our communities.

The goal of this workshop is to help participants to value the benefits provided by green infrastructure in their communities by providing context about such valuations, outlining principles, methods and best practices, and walking through examples of how economic analysis helped improve decision making.

Learning Objectives

• Understand the range of cost & benefits possible using different types of green infrastructure
• Learn the principles behind economic valuation of these costs & benefits
• Understand the methods used to monetarily value the benefits of green infrastructure
• Learn how to apply these methods to generate values for the benefits of planned and existing green infrastructure in your community
Biomass Strengths, Potential, and Challenges

Dr. Olga Petrov[^1], Dr. Deirdre Lynch[^1], Dr. Amir Dehkhoda[^1]

[^1]British Columbia Institute Of Technology (BCIT), Burnaby, Canada

The objective of this workshop is to inform on characteristics, applications and impacts of biomass.

The first part, led by Dr Olga Petrov presents an overview of biomass types and characteristics and its application in district energy systems. Since such facilities are located in communities, in a close proximity of people, possible impacts on local air quality and human health due to exposure to emitted pollutants will be addressed. Advantages of introducing biomass as renewable energy source in terms of GHG reduction, pivotal to climate change solution, will be discussed.

The second part, led by Dr. Deirdre Lynch will discuss a case study using poultry litter (a waste biomass) as an alternative fuel to provide on-site heat and power. Poultry litter (PL) is the organic waste produced in poultry production. Small-scale, on-site combustion of PL using a fluidised bed combustor (FBC) represents a closed-loop cycle where litter is not transported off site, but used as a valuable heat source in poultry production, offsetting fossil fuel consumption and eliminating a waste material. This demonstrates the suitability of PL as a replacement for traditional fossil fuels in poultry production.

Finally, Dr. Amir M. Dehkhoda, will present the product development of renewable energy generation processes from biomass (i.e., pyrolysis of wood waste). Biochar, a carbon-rich solid material, is one of the by-products of the pyrolysis of woody biomass with huge potential in different applications as a renewable carbon material. In this section, chemically modified biochar and its utilization in adsorption specific applications such as energy storage and pollution abatement (e.g., wastewater treatment) is reviewed. Performance of modified biochar in above-mentioned applications is compared to other carbon based material with costly preparation methods such as carbon nanotubes.

Upon completion of this workshop, learners will be able to:

- Understand characteristics and impacts of utilizing biomass as a renewable energy source with a focus on biomass gasification.
- Explain the importance of closed loop cycles in terms of biomass sustainability in the effort to combat climate change.
- Discuss the importance of process control and emissions control in minimizing the adverse impacts of solid fuel combustion.
- Understand the physical and chemical properties of biochar as a by-product of biomass pyrolysis.
- Describe pros and cons of using biochar as a renewable carbon nanomaterial for adsorption specific applications: energy storage and wastewater treatment.
- Discuss potential novel material production from biochar.
WS.17

Workshop on Integration of Renewable Energy Resources in the Power Grid: Challenges and Opportunities

Dr. Jeff Bloemink\textsuperscript{1}, Dr. Ali Palizban\textsuperscript{2}

\textsuperscript{1}BCIT, Burnaby, Canada

The electrical power grid, as a whole, can be considered as one of the largest feats of engineering ever undertaken: hundreds of thousands of assets all interconnected, sometimes across geopolitical borders, must function in perfect harmony in order to provide a reliable source of electric power. Availability and reliability issues can result in major reductions in economic productivity, loss of critical services, or have a tremendous impact on quality-of-life for populations.

Demand for electricity in developed countries is already high, and developing countries continue to increase at a rapid rate. This electrical energy is still largely generated by burning fossil fuels; a major source of greenhouse gas emissions and other pollutants. The adoption of renewable energy resources (such as wind and solar) is another solution to this problem that can meet increasing demand or replace existing conventional generation sources.

To properly integrate these resources on a large scale while retaining the harmony described above, many issues must be overcome. These renewable energy resources are indeed a disruptive technology, requiring changes in thinking and new solutions brought forward to the utility industry. In addition to technical issues, each jurisdiction brings unique procedural or political barriers. Despite these challenges, recent adoption of renewables has been tremendous with solutions being found at a rapid pace.

This workshop will give attendees an overview of the electrical power grid, the challenges associated with renewable integration, and the opportunities we must achieve significant penetration of renewable energy resources worldwide. The content is targeted towards those without an engineering background; as such, concepts relating to power systems operation and control will be introduced at a high level with more of a focus on identifying the challenges and solutions associated with renewable integration into the utility grid.

This workshop will be split into the following sections:

- The North American Power Grid: an introduction to the North American power grid and how it interconnects, operates, and who regulates that operation
- Renewable Energy Resources: an overview of renewable energy technologies
- Impacts of Renewables: a summary of the impacts associated with high penetration of renewables on the electrical grid
- Technical Solutions: an overview of solutions (technical or otherwise) that can help to accommodate increasing penetrations of renewable generation
- Opportunities: a look to the future - what opportunities exist if some of the major technical challenges are overcome and where do we go from here.
Challenging Assumptions about How the Transition to a Circular Economy Might Help or Hinder Prosperity

Ms Heather Rogers1, Mr. Aodhan Newsholme1, Mr. Santiago Perez2

1University Of Hull, Hull, United Kingdom, 2Université de Technologie de Troyes, Troyes, France

Duration:

2 hours

Facilitators:

Heather Rogers, Aodhan Newsholme, Santiago Perez

Rationale:

Circular Economy (CE) strategies are being developed across the globe in an effort to find solutions that support sustainable economic, environmental, and social goals simultaneously. There are many innovative, creative, and inspiring CE initiatives being developed and deployed around the world, therefore it becomes crucial to critically assess them in order to determine if they are indeed moving us towards a prosperous future. Focusing on the concept of ‘prosperity’, the content of this workshop will explore the ways in which current CE practices affect the economic, environmental, and social dimensions of a prosperous future. In addition, the workshop process will offer an example of a powerful participatory engagement tool to facilitate effective dialogue around complex topics which can be applied to future work.

Learning Objectives:

1. Gain a more multifaceted understanding of what societal prosperity is, and how participants can personally position themselves to help or hinder that prosperity.
2. Experience how dialogic participatory methods may be used in practice to facilitate meaningful conversations and co-create solutions.
3. Increase awareness of relevant CE initiatives being deployed in different socio, economic, cultural and environmental contexts.
4. Experience in critical examination of CE initiatives for their contribution to the transition to a sustainable future.
5. Develop introductory skills on systems thinking in order to analyse, assess and propose relevant initiatives in the realms of CE and Sustainability Studies.

Abstract Details:

The workshop will begin with a short icebreaker activity, and a framing of the workshop with specific emphasis on varied stakeholders’ understanding of prosperity. This will lead into a ‘World Cafe’, to explore participants
perspective on prosperity and their personal positioning towards societal prosperity. Participants will then, in groups, be lead through an exercise to explore a specific circular economy initiative case study. Each group will be guided through a process to assess the circularity, sustainability, and strategic nature of their designated case study, with opportunities to unpack how this assessment might be relevant to their own work. Finally, participants will feedback and discuss potential challenges with the wider group.

Workshop Interactivity:
This workshop will be interactive, with many opportunities to engage with other participants and cross pollinate ideas.

Location:
Vancouver Convention Centre

Room/Equipment needs:
Flip charts, chair for each participant, tables (1 for every 5 participants), markers, post-it notes (3 different colours), video projector and sound system.
Designing an Ecocities Fractal: Student Project Showcase

Mr Ron Kato¹, Ms Jody Patterson²

¹BCIT, Canada, ²BCIT, Canada

Vancouver is facing an unprecedented challenge to meet its vision of a bright green future. Blessed with a magnificent natural setting and mild coastal climate, the city has attracted much interest and a great deal of in-migration. With an investment-oriented development process in place, much of the city's central core area has already been densified – limited by the same natural edges that create such a desirable urban setting. For many years Vancouver has led the nation with the highest cost of housing, amid rising concern that this green city is economically unsustainable: becoming unaffordable to future generations undermines the very initiatives which aim to make Vancouver a world-leading ecologically designed city.

To address this fundamental imbalance and engage students in the real problems facing truly sustainable urban development, BCIT Architectural Science students were tasked with a critical question for one academic year: what would a socially just and ecologically sustainable neighborhood look like for downtown Vancouver?

Using the setting of the False Creek Flats – a remnant of Vancouver’s industrial past and the last large parcel of municipal land downtown, now entering redevelopment – students conducted research to propose and develop a masterplan of the Ecocities fractal, defining social and performance objectives for the neighborhood and for individual buildings. Each student proceeded to develop a unique high-performance building project based on their research addressing Ecocities principles and drivers, and Vancouver’s own design initiatives, including operational and embodied carbon responsibility.

To inform the development of the project within real world parameters and model an integrated design approach, course instructors engaged with expert industry professionals from complementary disciplines – urban design and planning, structural and mechanical engineering, building science and energy modeling – and the City of Vancouver (via CityStudio, a historical partner of the Architectural Science program).

The Student Project Showcase will exhibit the final year BCIT Architectural Science Graduating Projects: a socially just and ecologically sustainable neighborhood of high-performance buildings. Session will include a poster gallery of student work, presentation by course instructors, reflection on the academic applications of Ecocities principles, and open discussion with instructors as well as a number of students to present a vision for Vancouver’s False Creek Plats as a vibrant and broadly sustainable Ecocities fractal.
Cities have a large potential for experimentation to accelerate new forms of participatory-planning approaches and development models. In recent years, the municipality and its surrounding metropolitan area have undergone a process of transformation based on social planning principles that seek to give priority to the most vulnerable populations and territories. Medellin has been recognized as a front-runner in planning and management, evidenced in its inclusive urban growth improvements and improved quality of life indicators for residents. It is said to be “a window into the future of cities,” reflecting its rapid growth and informality but also hope for sound urban governance and citizen-centric solutions in responding to stresses.

While much focus has been on successful physical interventions serving these residents, like the Metrocable and green belt, Medellin has also been a hotbed of policy innovation in its response to environmental and social problems through participatory approaches to open data, building data literacy with both community residents and civil servants, and attempts to bridge territorial planning with community planning that introduce citizen-led interventions for their neighborhoods.

This two-hour practitioner workshop will introduce session participants to a range of collaborative design approaches being piloted in Medellin, all of which systematically involve multiple sectors, applied to “on-the-ground” interventions and solutions. Case studies will include: (i) the participatory engagement and use of citizen science in the development of a neighborhood sustainability plan (Sydney Moss, Ecocity Builders); (ii) human-centered design as a methodology for innovative, community-focused problem solving to address complex urban challenges in the Moravia neighborhood, where informal houses were built on a formal landfill (Holly Pearson, Independent Planning Consultant); (iii) the creation of an open-data strategy and open data portals for the municipality and Aburra Valley, catalyzed by a period of severe air pollution which led to a grassroots effort to increase air quality sensors and make their datasets publicly accessible (Paola Pollmeier, Open Data Specialist, Medellin), and; (iv) the pilot project on data integration for resilient cities for the International Science Council, around the self-selected themes of the links between air quality, public health, urban green space and social and economic outcomes, which was conducted collaboratively with a range of actors, including the novel Medellin Data Council, an informal, voluntary group of data scientists including concerned citizens, university researchers, civic tech entrepreneurs, and representatives from the municipality. (Stephen Passmore, Resilience Brokers).
WS.21

An Introduction to the Fascinating Field of Climate and Ecological Changes Themes Within Fiction: The Writer’s Workshop Shows Participants How to Get Creative and World-Build Stories That Will Inspire, Warn, and Give Hope to Readers.

Mrs Mary Woodbury¹

¹BCIT, Canada

The writer’s workshop will engage the community with creative and fun exercises showing how the written word, particularly in fiction and prose, can have a positive impact on culture, building healthy micro- and macro-communities dealing with change and loss in the planet’s rapidly shifting natural landscapes and climates.

The workshop is offered by Mary Woodbury, curator at Dragonfly.eco, which has explored the growing field of ecofiction for over six years. Ecologically oriented fiction covers such topics as climate change and sustainability. The importance of this fiction is that it provides social documentation of the harsh ecological changes of our times, helps readers cope with the devastating realities of planetary change, provides cautionary tales with ordinary heroes who inspire change, and gives hope to those who feel powerless in the face of incredible species and landscape loss.

The presenter will use visual aids and hand-outs to briefly introduce participants to historical and modern trends in environmental fiction—preaching vs. storytelling, major contemporary authors, the concept of local and world literature, and the diversity of styles used in ecological storytelling—in order to get participants up to speed for the workshop portion. The presenter will also read short examples of environmental novels and prose to give the participants ideas to consider for their own story ideas.

Next are three workshop portions. The first exercise consists of individuals writing down the titles of favorite novels, poems, or short stories they’ve read that would fall into the category of ecological fiction/prose. In the next exercise, individuals will brainstorm a first sentence of a story they would write and describe where that story might lead. The final workshop exercise will be a group activity that looks at each participant’s first sentence and picks one that engages the reader. The group will together write a rough outline of at least part of the story. The presenter will close this portion by reading common favorite works in environmental literature, from the individual exercises, and some of the favorite first sentences. A brief discussion among the participants and workshop leader will explore ideas gathered during the exercises. Paper, pens, and chairs will be provided for project activities.

The presenter will then briefly discuss the societal impact of fiction about ecological and climate change, and provide a handout with references to interdisciplinary studies combining fiction and the environment and other resources. Finally a QA session will close the workshop.
WS.22

Building Cross-Sectoral Networks to Achieve the Safe and Affordable Housing Objectives of the New Urban Agenda

Mr. Stephen Seidel\textsuperscript{1}, Mr. Steve Weir\textsuperscript{1}

\textsuperscript{1}Habitat for Humanity International

During this 2.5-hour workshop Habitat for Humanity will lead an interactive session that will equip participants with tools and methodologies they can deploy to develop local strategies for pursuing and helping to achieve the goals and objectives articulated in multiple global frameworks – especially the Sustainable Development Goals and the New Urban Agenda. This session is designed to align with the Urban Design Pillar of the EcoCity Framework, and the Safe and Affordable Housing Standard in particular.

Components of this workshop will include:

• Utilizing virtual platforms to build cross sectoral collaboration to improve the quality of housing practice in urban areas around the world

• Strategies for cities and local governments

• Participatory methodologies to build capacities of community residents to improve their own housing conditions

• Overview of recent “Promising Practices” – Innovative approaches to produce environmentally sustainable housing for the poor

At the end of the session, participants will articulate next steps they will take to implement the concepts discussed during the workshop.

Mr. Svend Andersen


The world’s leading EcoCities are looking to implement innovative solutions that achieve meaningful reductions in emissions and waste, while successfully bending the urban appetite for resources. By identifying suitable performance standards and rating systems, EcoCities can tailor and optimize their approaches to creating cities in balance with nature which provides vibrant, healthy and happy places for people to live, work and play. The International EcoCity Standards (IES) not only support existing systems and provide an innovative vision for ecologically restorative communities but also provide a practical methodology for assessing and guiding progress towards these goals.

The goal of this workshop is to provide participants with a foundation of knowledge that will enable them to implement sustainability initiatives in their communities, such as ecosystem restoration, community forest management, bio-matter management and wetland conservation. Participants will gain new insights and learn effective strategies to apply this knowledge for the benefit of their communities. In particular, this workshop will provide participants with the skills and practical knowledge to apply the principles and standards of carbon management, as well as Climate Lens and resilience funding requirements for the deployment of ecosystem management and restoration approaches. This skill set will then allow municipal staff to apply greenhouse gas assessment principles to the evaluation and design of ecosystem management and restoration programs. The workshop will consist of the following components:

- An overview of GHG quantification and assessment methodologies will be provided, including the updated version of the ISO14064 standard as well as the Climate Lens assessment and resilience criteria. The standards will be presented with a specific focus on their applicability to Municipal Natural Asset Management.

- The workshop will use two real-life project examples and allow participants to apply the quantification and assessment criteria in guided group work.

- The workshop will share lessons learned and provide an overview of useful resources for participants.

The insights gained by program participants will ensure that both the objective of effective climate action, as well as ecologically sound ecosystem management, go hand in hand in daily operations and that Climate Lens assessment and resilience criteria are incorporated into new projects. The ability to establish project performance indicators in these categories will also provide access to additional funding sources.
Accountant, Ecologist, Integralist – Design Ecocity & SDG Wisdom Economies with Integral City MetaImpact Systems

Dr. Marilyn Hamilton¹, Dr. ML Hamilton², Dr. Sean Esborn-Hargens³

¹Integral City Meshworks, Findhorn Forres, United Kingdom, ²Royal Roads University, Victoria, Canada, ³MetaIntegral Impact, San Francisco Bay Area, USA

2 hours to 1/2 day format

Could also be Presenter Presentation

VCC location

“To successfully navigate 21st century complexity we need non-reductive integrative ways of measuring impact and value exchange between individuals and systems.” SEAN ESBJÖRN-HARGENS PhD

Share the journeys of Accountant Dr. Marilyn Hamilton and Ecologist Dr. Sean Esborn-Hargens as they have mapped wellbeing in City and Regional Ecologies from triple bottom lines to environmental impact assessments into the first-, second- and third-person perspectives/metrics and 10 capitals of Integral City MetaImpact Dashboards. Learn how to use the Ecocity Indicators and SDG’s to design the greatest impact across four distinct types of impact with multiple perspectives and capitals. Find your natural next steps to city and regional wellbeing through ecological/socio-cultural/bio-geo/urban design. Bring your Ecocity Indicator and SDG challenges and we will workshop them together.

This workshop will be useful for:

1. Cities, Communities, Ecovillages, Spheres-of-Influence: Reframe indicator tracking into transformative learning for cities/organizations/ teams/collectives to demonstrate powerful and aligned systemic impacts.

2. Policy Makers: Tap into the sources of collective intelligence emerging from data mining to assist recalibration into multi-dimensional Wisdom Economies.

3. Prototyping, Modeling, Case Studies: Provide a framework for implementing Ecocity Indicators and how to apply 10 Capitals for stakeholders and periodic and integrated reporting.

4. Stakeholders wanting to make visible the impacts and exchanges between People and Operational/ Infrastructural Systems.


6. Integral City Meshworkers: Expand and align Ecocity vital signs measures for city Voices, Values, and Intelligences with the 10 Capitals of a Wisdom Economy (http://integralcity.com/voices-intelligences/)

Join Dr. Marilyn Hamilton (CPA ret) and Dr. Sean Esborn-Hargens and explore how to implement Ecocity Indicators and SDG’s with Integral City MetaImpact Systems. We will demonstrate how to select and implement Ecocity Indicators using the Wisdom Economy tools of 10 Capitals, 4 Impacts and 4 Bottomlines (https://www.metaintegral.com/wisdom-card-deck/). We will show how the integration of 1st and 2nd person (inter) subjective metrics can leverage 3rd person (inter)objective metrics of Ecocity Indicators and SDG’s for Integral City transformation. We will draw on our Meta and Integral City global practices including Iceland, UK, Europe, Australia, Brazil, USA Mexico and Canada.
Canada as a Case Study in Addressing Climate Change Displacement

Mr. George Benson1

1Climate Migrants And Refugees Project, Vancouver, Canada

As many as 200 million people globally may be forced to move because of climate change by 2050, according to the World Bank and IOM. Many if not most of them will settle in cities. This poses an incredible challenge as cities work to simultaneously decarbonize, regain balance with nature, and build resilience to climate change’s other impacts.

This interactive workshop is focused on solutions. Climate change displacement is a multi-scale, multi-causal issue, and it will take collaboration between all levels of government to begin to address it. Because of the leadership of many Canadians in addressing climate change, and in sponsoring conflict refugees, this workshop looks to leverage this experience to develop a case study that may inspire and inform others around the world working on displacement and resettlement.

PROPOSED AGENDA FOR FULL DAY WORKSHOP

Welcome and Overview of Day

Presentation — Overview of climate displacement at the international level, and current of social and scientific research

Presentation — Presentation by a young person living in Canada who has already been displaced because of climate change

Presentation — Breakdown of climate change displacement typologies and suggestions of the relevance that different types (e.g., disaster, or socio-economic losses) have to different levels of government

Networking Break 1

Table Conversations — Reporting out from actors on existing climate displacement work

Working Session 1 — Identify a guiding vision for addressing climate change displacement in Canada
Lunch

Working session 2 — Explore and prioritize needed actions to address identified relevant typologies of climate change displacement at a local and regional level within Canada;

Working session 3 — Explore needed actions to address influxes of persons displaced because of climate change outside of Canada who are seeking refuge, asylum, or are otherwise moving to the country; utilize scenarios to show the rate of influx, derived from recent research.

Working Session 4 — Develop a high-level roadmap of first steps and long-term actions for cities, regions, and other governments in Canada to respond to climate change displacement; highlight key research questions for academics.

Close — Next steps and identified movement forward, including potential recommendations to EcoCity Builders.

INTENDED WORKSHOP OUTCOMES FOR ATTENDEES

Understanding of theories and science of climate change displacement across its various types

Roadmap of quick start actions for governments, researchers, and civil society leaders

Recommendations regarding how the EcoCity Standards could incorporate displacement.
FIELD TRIPS
FT.02


Mr. Alexandre Hebert

1Bc Institute Of Technology, Burnaby, Canada

THE CHALLENGE

The province of BC is in the process of transforming its construction industry towards a future of extremely energy efficient buildings. The BC Energy Step Code, adopted in April 2017, establishes a clear set of performance-based standards that will ensure all new buildings are able to operate with zero energy input by 2032.

To achieve this ambitious goal, the way buildings are designed and built will need to change. Described as the “Envelope First” approach, building design will focus on thick, well insulated, airtight walls, while building construction will focus on craftsmanship, teamwork and attention to detail. Tradespeople will be instrumental in supporting this transition. To ensure performance requirements are met, tradespeople will not only need to learn how to build to the new standards. More than ever, they will also need to understand the scientific principles behind the design and construction of high performance buildings.

THE OPPORTUNITY

As the largest trades training institution in BC, BCIT’s School of Construction and the Environment (SoCE) is uniquely positioned to support the transition of BC’s construction industry towards the new Energy Step Code.

Created as the Learning Centre for Zero Energy Buildings (LCZEB), this innovative educational model combines traditional and non-traditional educational programs to not only deliver on desired learning outcomes, but to also serve as a marketing and business development tool.

THIS WORKSHOP

This half day workshop will be hosted at the Telus Science World (located at 1455 Quebec St, Vancouver, BC). The workshop will allow participants to experience various components of the innovative LCZEB model. Included in the workshop: Virtual Reality tour of the BCIT hands-on teaching lab, interaction with the ZEB Science Exhibit on display at Science World October to December 2019, hands-on fabrication of a real passive house wall assembly, and much more.

The workshop will be of interest to anyone involved with green trades education, green building design education, green building design, green building construction and STEM education in K-12 school districts.
Biodiversity in a Changing Climate: Mobilizing the University of British Columbia (UBC) Vancouver Campus for One-Planet Living

Ms Liska Richer, Dr Tara Moreau

University of British Columbia, Vancouver, Canada

The global crisis of biodiversity loss, exacerbated by urbanization and climate change, is threatening the ecological, social, and economic systems that sustain us. The complexity of this challenge demands new, interdisciplinary, and inclusive approaches to co-create solutions that maintain and enhance biodiversity in a changing climate. The University of British Columbia (UBC), with its Campus as a Living Laboratory (CLL) and extensive local and global networks, serves as a societal testbed where research, learning and engagement create transformative impacts towards advancing socially just and ecologically sustainability cities. Embedded within UBC’s internationally recognized SEEDS (Social Ecological Economic Development Studies) Sustainability Program, the Campus Biodiversity Initiative: Research and Demonstration (CBIRD) represents an innovative and interdisciplinary model of collaboration across 17 faculties and departments that cultivates innovative ideas, research and actions to advance scalable biodiversity policies and practice on campus.

During this ‘walkshop’ of the beautiful UBC Vancouver Campus, participants will engage in an interactive guided tour exploring innovative examples of applied and impactful research, learning and engagement. This walking tour will focus on sharing leading Campus as a Living Laboratory examples pertaining to biodiversity in a changing climate which delegates will have the opportunity to learn and experience firsthand. The tour will navigate from UBC Botanical Garden’s and the Greenheart Treewalk to various stops on campus where guests will explore topics affecting biodiversity in a changing climate. Key highlights will include learning about: plant conservation initiatives, valuing of biodiversity and trees, collaborative partnerships, biodiverse green building designs, innovative public outreach initiatives, bird-friendly buildings, climate friendly foods and more. Key tour takeaways include understanding UBC successes and learnings, exploring Pacific Northwest rainforest canopies, connecting with fellow delegates in nature and practical tips and tools to take home.
Building Community: Defining, Designing, Developing UniverCity

Mr. Dale Mikkelsen

Currently home to 5,100 residents, and preparing for another 4,000 by the year 2021, UniverCity on Burnaby Mountain has received more than 30 major awards – locally and internationally – for best practices and achievement in planning and sustainability. Led by SFU Community Trust, UniverCity boasts a community of firsts and the tour will include: the greenest childcare centre on the planet, the first LEED® Gold retrofitted school in BC, an award-winning stormwater management, district energy system, and homes ranging from family-friendly townhomes to concrete high-rises to mixed used developments. Sustainable green building and master-planning will also be featured in this field trip.

From its inception UniverCity began setting its sights on the highest standards for construction and was the first community in Greater Vancouver to devise Green Building Guidelines. Then, the Trust took it further by working with the City of Burnaby to preserve those standards in a set of the most ambitious green building bylaws in the country. Specifically, every building has been built to a standard that has exceeded the national building code requirements by 30 percent for energy and 40 percent for water efficiency.

UniverCity’s comprehensive stormwater management system is designed as a combination of community-scale facilities and on-parcel storage and infiltration. It’s also designed to mimic nature by returning nearly 100 percent of stormwater to the ground instead of into conventional drainage pipes. The objective is to maintain pre-development stormwater runoff quality so that downstream aquatic life is not adversely affected by the new development.

The University Highlands Elementary (UHE) School opened its doors in 2010 and was BC’s first LEED® Gold school renovation. The curriculum focusses on sustainability and community involvement as teachers take advantage of the opportunities of their surroundings to help students learn about their impact on the environment.

UniverCity’s district energy system provides centralized heat and hot water to the community, eliminating the need for individual buildings to have their own dedicated heating equipment. UniverCity’s energy needs are currently being met by two temporary energy centres which will be replaced with a permanent energy facility, the Burnaby Mountain District Energy Utility (BMDEU) later this year. The BMDEU will provide green energy to UniverCity and the SFU (Burnaby) campus and will reduce greenhouse gas emissions by 85 percent. This partnership between Corix, SFU, and the Trust demonstrates leadership and an innovative collaboration model that could be used by other communities.
Sharc Energy Systems Inc - Wall Centre Central Park Site Tour

Mr. Brock Trimble, Mr Lynn Mueller

1Sharc Energy Systems Inc, Vancouver, Canada

On this tour we would like to take a maximum 20 people to tour our system installation at the Wall Centre Central Park condominium complex. Wall Centre Central Park is a two-phase real-estate development in Vancouver, Canada. Phase 1 contains 700 residential units and incorporates a Sharc 660 system, commissioned in July 2017. Phase 2 contains 350 residential units and implements two Piranha T10 units, commissioned in July 2018. These systems use heat from the buildings’ wastewater to pre-heat incoming cold water. This helped to reduce the development’s energy demand and carbon footprint, thereby contributing to its LEED® Gold certification. Every day, a tremendous amount of warm water is used once before ultimately being discarded down the drain. In fact, the United States Department of Energy estimates that the equivalent of 350 billion kilowatt-hours of hot water, is lost down the drain every year in the U.S. alone. Wastewater provides the ultimate renewable energy source, with an inexhaustible supply of thermal energy. Wastewater heat recovery is a process that can recover the heat energy from all that hot water and use it to heat buildings, cool them, and heat the domestic hot water supply. The PIRANHA is a self-contained thermal energy recovery system designed to heat domestic hot water by re-using thermal energy contained in wastewater. Using a specially engineered heat exchanger, the PIRANHA has been optimized for 50 to 300-unit residential buildings and stand-alone commercial applications. The PIRANHA is easily installed in new and retrofit construction projects. The PIRANHA is highly efficient: for every dollar spent, it produces $4 to $6 in zero-emission heat energy. The larger SHARC system provides domestic hot water preheating and space conditioning for multi-unit residential (300+ units), commercial buildings and district networks. Like the PIRANHA, the SHARC is easily installed in new and retrofit construction projects, contributes to LEED® credits, and has a robust lifecycle of 25+ years.
Carbon Neutral Social Housing Walking/Rapid Transit Tour

Mr. Bill MacKinnon

BC Housing, Burnaby, Canada

Attendees will meet Bill MacKinnon, Senior Manager of the Energy and Sustainability team at BC Housing and join him on a half day walking/rapid transit exterior tour of BC Housing social housing sites. Along the way, participants will have an opportunity to view some of BC Housing’s Leadership in Energy and Environmental Design (LEED) certified, and BC Provincial Energy Step Code compliant buildings, learn about energy efficient building design, meet staff who deliver social programs and support services at the sites, and tour the surrounding neighborhoods including Olympic Village which has a low carbon district energy system!

The route: Participants will take the Expo Line SkyTrain line to Main Street-Science World Station, walk through Olympic Village (an energy efficient neighbourhood), walk along the scenic southeast False Creek seawall, and will take the Canada Line rapid transit system to return to the Convention Centre.

Start Location: The walking tour will start and end at the front of the Vancouver Convention Centre and will involve taking rapid transit. (Note: Attendees will be responsible for purchasing a DayPass Compass Ticket from a Compass Vending Machine). Pack comfortable walking shoes and a rain jacket/umbrella (just in case!)
Southeast False Creek Sustainable Community and Neighbourhood Energy Utility

Brad Badelt, Assistant Director of Sustainability with the City of Vancouver will host a half-day walking tour of Southeast False Creek and Olympic Village. Participants will have an opportunity to visit the Olympic Village, a LEED platinum neighbourhood, which has a low-carbon district energy system, along with viewing examples of innovative stormwater management and park design, as well as sustainability-related public art.

The route: Participants will take the Canada Line to Olympic Village station, walk along the seawall and through Olympic Village, along the scenic southeast False Creek seawall and through Olympic Village, and will take the Expo Line (from Main Street station) to return to the Convention Centre.

Start Location: the front of the Vancouver Convention Centre (Note: Attendees will be responsible for purchasing a DayPass Compass Ticket from a Compass Vending Machine). Pack comfortable walking shoes and a rain jacket/umbrella.
How does a simple end of life boiler replacement end up eliminating 95% of the building’s natural gas and 75% of its greenhouse gas emissions along with substantial amounts of domestic water consumption? It starts with vision.

Looking beyond a simple replacement, Vancouver City Savings Credit Union and SES Consulting had the shared goal of carbon neutral buildings and a sound business case. This led them to evaluate 9 different heating system options, including district energy tie-in’s. In the end, the most impactful project was a redesign of the heating and cooling systems to recover waste heat from a data centre and use it to heat a 12-story building at temperatures above 5° Celsius. There were significant controls and design hurdles to overcome, including installing a new chiller on the roof of the 12-story building with just an inch to spare on the penthouse doorway. The most significant aspect of the project was the collaboration and trust between the project team members.

Vancouver City Savings Credit Union and SES Consulting invite you to a guided tour of Vancity’s head office to learn more about this award-winning energy efficiency retrofit and the potential of waste heat recovery. Join Scott Sinclair, CEO of SES Consulting, and Vancity’s Environmental Management department to learn more about how the aging boiler was replaced with a heat-recovery chiller capturing low-grade waste heat from the data centre. For this work, SES Consulting won the 2016 APEGBC Sustainability Award
Assessing Virtual Reality Technology as a Tool For Energy Conservation and Participation in Governance, Education, and Cultural Proceedings

Mr. Matthew Rockall¹

¹British Columbia Institute of Technology, Burnaby, Canada

All around the world, academics are using their PD Funds and extra time to travel to conferences just like the EcoCity World Summit. This involves significant emissions of carbon. According to one calculation (CarbonIndependent.org), an hour of flying generates a ¼ tonne of CO2 per passenger. Yet we continue to attend conferences as they are important for us to share and distribute knowledge, to build connections, and to invigorate our own teaching and researching practice. What if we could achieve these goals without in-person attendance?

I propose a Workshop using Virtual Reality (VR) technology as a means to enhance telepresence. Several researchers are examining the use of VR in similar innovative ways: to facilitate environmental learning (Markowitz, et al., 2018); to support development of close relationships (Huang and Bailenson, 2019); and to influence behaviour (Bailey, et al, 2015).

I would like to investigate the requirements for establishing a real-time recording node or nodes in one or more conference locations for replay through a VR headset in another building location. It will be instructive to see whether it is possible to virtually attend primary conference proceedings or breakout sessions as they occur. It may allow assessment of options for interaction, such as an iPad with a speaker that allows people at the node to see and hear the virtual participant.

If this does turn out to be feasible, I propose a practitioner workshop that affords conference attendees the opportunity to experience and compare VR presence to less immersive web-based participation and telepresence technologies like Webex or even Skype.

If current technology or the data transfer capacity is insufficient to allow real-time VR telepresence during the conference, I propose a VR experience that showcases VR as a tool for participation and learning. Each attendee to participate would complete a brief questionnaire reflecting on their virtual reality experience.

If and when feasible, this technology could support progress along the EcoCity Standards spectra in various ways, but especially related to energy conservation and carbon emissions reduction, as people attend events virtually instead of using energy to travel in person. In addition, reducing barriers to access to conference and other proceedings could offer a significant benefit in terms of community capacity and governance, supporting participation by individuals excluded by physical, economic, or other constraints.

Mr. Duane Elverum, Ms Janet Moore

1CityStudio Vancouver, Vancouver, Canada

CityStudio is an innovation and matchmaking hub that distributes municipal problems to Vancouver’s 6 universities and colleges. City staff collaborate with teams of post secondary students, faculty and community members to develop create experiments and prototypes that lead to permanent solutions for Vancouver’s strategic goals and targets.

With CityStudio in the role of dedicated matchmaker between the City of Vancouver and its 6 post-secondary schools, the city is able to significantly and efficiently increase its problem distribution, widening the pool of potential problem solvers to include students and citizens. In this way, CityStudio addresses 3 civic needs simultaneously:

1) By working with faculty and students to deliver low-risk opportunities for experiments and solutions, CityStudio has increased the capacity of city staff to understand and solve problems. 222 city staff matches have been made since 2011.

2) Citizens are meaningfully engaged as community problem solvers and experts. CityStudio has developed 674 projects contributing to the livability and sustainability of the city, improving the daily life of citizens.

3) Through CityStudio, 5354 students have gained inner access to their city while working with city staff experts and faculty to solve real problems. These projects provide students with important work-integrated learning experiences and employable skills.

As the host between cities and academia, CityStudio helps the City of Vancouver open its doors to schools, youth, citizens and innovation in new ways. City staff can more easily undertake experiments and project prototyping, and new ongoing relationships have been developed between city staff and academic colleagues.

Previous collaborations between city staff and schools were reported to be infrequent and informal, but City Manager Sadhu Johnston notes that “CityStudio has brought together hundreds of City staff with thousands of students to help solve city problems. It’s become a real engine for innovation and urban experimentation in Vancouver.”

Brad Badelt, Assistant Director, Sustainability for the City of Vancouver describes CityStudio as having helped the City:
- Increase citizen engagement;
- Create low-risk proof-of-concept prototypes and experiments;
- Direct energy towards specific programs;
- Generate positive media;
- Shift culture inside City Hall towards innovation; and
- Retain talent and increase recruitment.

CityStudio is designed as a “plug-and-play” model for cities that includes a readiness assessment, licensing package, branding kit, starter documents, coaching and templates, as well as an evaluation framework. There are currently 9 CityStudios underway in Canada, as well as 2 in Australia.
Sustainability at BCIT: Campus Living Labs and the OASIS Microgrid System

Mrs Sarah Campbell, Mr. Alan Stewart

Tour the British Columbia Institute of Technology’s Burnaby campus and see how we innovate and teach sustainability, and demonstrate solutions for sustainable communities. Tour our microgrid and EV charging research facility, and a number of Living Lab projects.

The Energy OASIS (Open Access to Sustainable Intermittent Sources) facility was the first campus-based microgrid in Canada (September 2014). OASIS successfully demonstrates how a campus community can: reduce their carbon footprint (demand side management), reduce costs (peak-shaving), improve energy resiliency, and achieve overall improvement of energy management.

Living Lab highlights will include: Factor Four, a project that reduced greenhouse gas emissions by 50-75% in six buildings; a wood waste-to-energy facility; our High Performance Building Lab; and the elevated lab for our Centre for Architectural Ecology.

A light lunch will be provided, please wear comfortable shoes and dress for the weather.

Additional Costs: Participants will need a transit pass.
Urban Agriculture of Vancouver’s False Creek

Dr. Yael Stav

\textsuperscript{1}Invivo Design, Vancouver, Canada

How can fast-paced development and densification processes coincide with our goal of producing more local food? Are the formats of community gardens and urban farms sufficient for the future Ecocity, or should we be looking at other models of urban agriculture such as vertical farms, domestic micro-farming or indoor gardening? In this walk we will visit the inspiring project of Sole Food urban farm and understand its challenges to achieve both social and environmental goals. We will stop by three different community gardens at the Olympic Village and False Creek South, and discuss the various models of community/communal gardens and their place in the livelihood of the communities living in this area. We will also discuss the various typologies of integrating vegetation into high density residential neighbourhoods, and look at a few examples from the Olympic Village area.
Sustainable Urban Development: From Concept To Real World Execution

Mr. Kahlil Ashanti, Mr Gerben van Straaten

1World Of Walas, Vancouver, Canada

Sustainable urban development means more than just real estate and district design. It brings together the activities, desires and interests of people, companies and the cities they inhabit. It unites them into a living and a livable whole – economically, socially, sustainably, ecologically and financially. Attend this workshop to learn from Gerben van Straaten, CEO/Founder of World of Walas and a leading urban planner - on a range of practical applications for sustainable urban development, including but not limited to:

1. Waste management, biomass and renewable energy, highlighting how planning for the future begins with a holistic understanding of how neighborhoods interact and perform

2. First In Last Out: How this philosophy and approach helps to reshape the future of cities for long term sustainability

3. Sustainable financial business models and how they can be most conducive to attaining real results with minimal need for government intervention
Experience the Future of Sustainable Construction with a Tour of DIRTt’s Green Learning Center

Ms Lisa MacIntosh⁴, Ms Stacy Bozyk²

DIRTT, Vancouver, Canada, Innovior Construction, Vancouver, Canada

Construction uses more raw materials than any other industry and fills a quarter of all landfills. DIRTt is fixing that!

DIRTT is a building process powered by technology. We’re changing the face of construction with industry-leading software and advanced manufacturing. Complete interior spaces are built faster, cleaner and more sustainably. Long term, a DIRTt interior is ready to respond to whatever the future brings.

Why divert waste when you can eliminate it? Building your space with DIRTt means virtually no on-site material waste. All DIRTt components can be disassembled and repurposed for a long life cycle. At our production facilities, we source materials, energy, finishes and materials to match our sustainability goals. From recycled denim, to zero volatile organic compound (VOC) finishes, to sustainably-forested wood. We’re a bit on the obsessive side in our drive to reduce our footprint. Need proof? DIRTt is the only interior construction provider with a Life Cycle Assessment and Environmental Product Declarations.

Join us for a tour of DIRTt’s Vancouver Green Learning Center. Learn how digital construction is transforming the way we build – for the better.
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