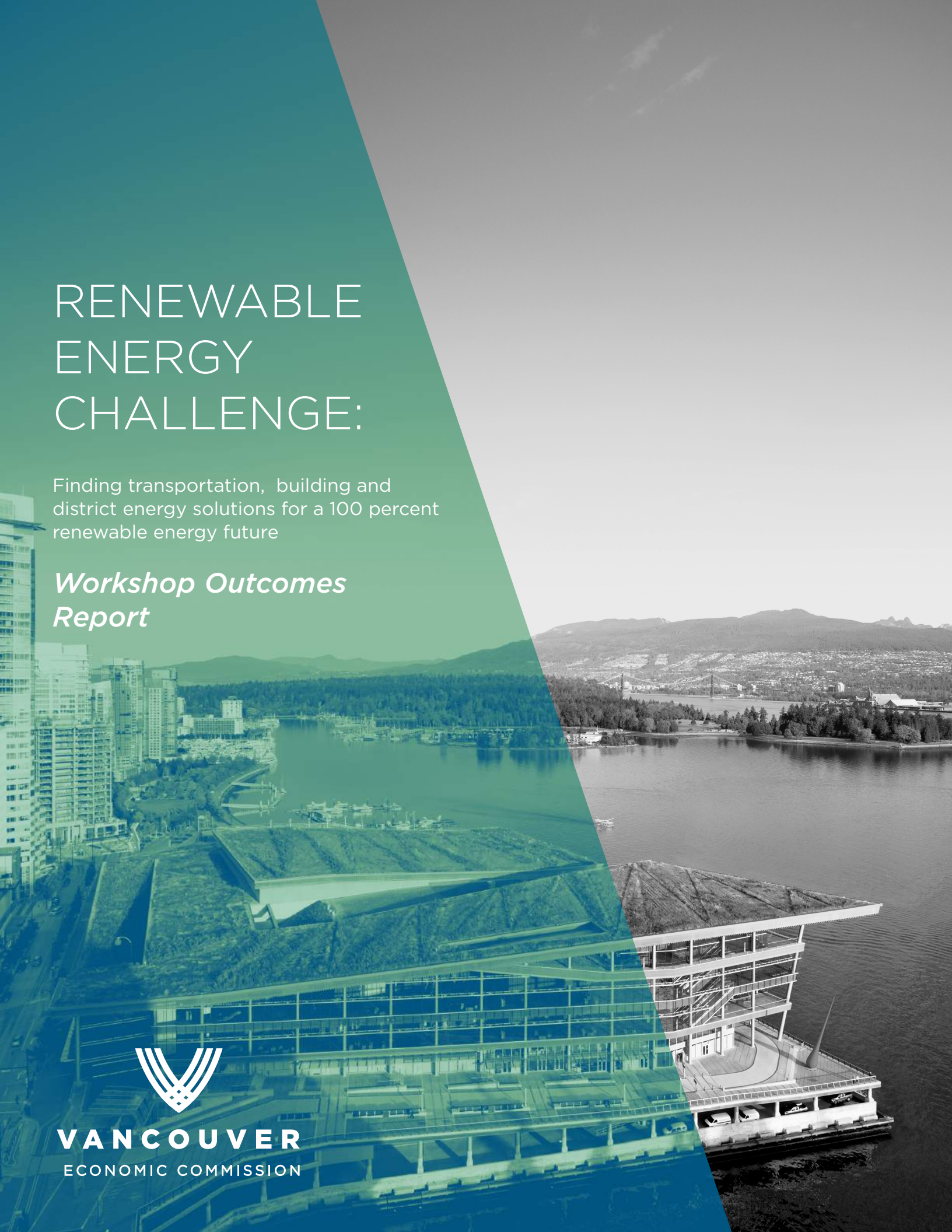
RENEWABLE ENERGY CHALLENGE:

Finding transportation, building and district energy solutions for a 100 percent renewable energy future

Workshop Outcomes Report



VANCOUVER
ECONOMIC COMMISSION

Workshop Outcomes Report

INTRODUCTION

What type of renewable fuel will emerge as the low carbon solution for commercial transportation? How do you make the case for renewable energy in light of inexpensive natural gas? How does a neighborhood business association structure a community solar project?

These were some of the questions being considered by over a hundred experts and leaders at the Renewable Energy Challenge. With over 10,000 investors, buyers, policy makers and leaders from around the world meeting during the GLOBE Conference and Innovation Expo to shape future markets, test policy approaches, strike deals and collaborate, the conference presented a pivotal opportunity for the world to take real, tangible action on climate change following the United Nations Conference on Climate Change.

Much work remains if we are to achieve the goals set out by global leaders at the United Nations Conference on Climate Change in Paris in 2015, better known as COP21. The combined commitments of nearly all the world's countries are not enough to keep a global temperature increase less than 2 degrees. A massive amount of carbon reductions still need to be found if we are to close this gap.

This is where cities and businesses play a critical role. Cities have jurisdiction over more than 75 percent of greenhouse gases, while businesses are critical agents of change, harnessing the opportunities presented by climate action and bringing these opportunities to scale.

EVENT SUMMARY

The Vancouver Economic Commission (VEC), C40, Renewable Cities, CLEAN and the GLOBE Series partnered to deliver the Renewable Energy Challenge, a half-day workshop that took place on Tuesday, March 1st 2016 as a side event to the GLOBE 2016 Conference and Innovation Expo.

Over 100 participants used principles of dialogue and design thinking to solve 9 concrete challenges faced by cities and businesses in their efforts to be 100 percent renewable energy-powered.

The Challenge fostered city-to-city, city-to-business and business-to-business connections to further renewable energy projects.

PROCESS

The workshop used the principles of dialogue and design thinking, with the help of a facilitator and note-taker at each table. Challenge 'champions' presented a real life challenge they face in adopting greater renewable energy within their organization. Participants were encouraged to bring a spirit of curiosity, explore diverse ideas and embrace experimentation in their working groups to create a 3-minute pitch of a solution to the challenge presented

Figure 1: Guiding Principles

Figure 2: Facilitated process

DEFINE: Does your group understand the challenge? What needs to be clarified?

IDEATE: Allow lots of ideas to generate

FOCUS: Use a process to narrow down ideas

PROTOTYPE: The team picks one solutions to build out more fully

PITCH: Develop a 3 minute pitch and a creative way to deliver it

OUTCOMES

The challenge topics and solutions generated are summarized below. The Appendix document contains complete step by step details of the table discussions and other ideas that were considered.

Overall, the room was full of energy during the discussions, with active and lively discussions that resulted in several exciting and meaningful pitches.

The partners plan to build on this experience for similar events in future, and feedback was collected from participants to help improve and fine tune the purpose for future Challenge events.

CONCLUSIONS

The decision to move to 100% Renewable Energy is one not taken lightly by cities or companies and may bring up a number of complicated issues requiring careful and creative policy arrangements, innovative financing and collaboration between a wide variety of stakeholders.

Some key trends that emerged:

- An appropriate price on carbon, as well as policy mechanisms that allow that price to change over time as needed, are critical to moving away from fossil fuels and to make the business case work for sustainable and renewable energy innovation
- There is a real need for pilot and demonstration systems to provide opportunities for cities and companies to try out new and creative ideas
- There is a need for both technical/hard solutions as well as soft/behavioral solution
- Building codes require particular attention in terms of updates and modernization
- Non-traditional approaches are required when thinking of how to increase investments into renewable infrastructure
- A user-centric approach is needed to understand the roll out of charging and fueling infrastructure
- Community and shared economy approaches can offer innovative solutions to improve efficiencies and scale up investments
- There is a real need for short term solutions to bridge the gap to long term transformations

> “”
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> ***Best event at Globe.*** *The act of setting a challenge and creating a space for people to tackle a challenge question together achieve many benefits. Better way to network and get to know people, elicits creative ideas and raises the profile of participating organizations. Encourages collaboration and cooperation.*
>
> ***Participant survey feedback***

Each city or company’s path to 100% renewable energy will be unique, owing to differences in local energy supply, taxation, building codes, degree of investment in public and active transportation systems and land-use planning among others. As displayed in each of the challenges, creativity and the ability to think beyond silos and across disciplines can allow for new and transformative ideas to blossom.

Feedback Summary Table

WHAT WORKED

- Interesting and engaging format
- Positive and collaborative energy in room
- Good networking event with a diversity of participants
- Collaborative discussions useful to participants
- Discussions have lead to follow up conversations for some challenges
- Interest in bringing more challenges to the table

WHAT COULD BE IMPROVED

- Need for deeper engagement and conversations
    - Narrow the focus of challenge statements
    - Reduce the number of topics covered
    - Provide more data and information prior to the workshop
    - Allow groups more time to work on challenge
- Strategic stakeholder selection
    - Be more selective and strategic
    - Identify most relevant experts and decision makers for the challenge
    - Involve academics in the discussions and other relevant stakeholder groups
- Improve facilitation and modify event format according to the challenge
    - Different challenges may require different formats / facilitation
    - Could break up challenge into small tables focusing on various aspects of the challenge.

Challenge Summary Table

CHALLENGE (AND CHAMPION)	PITCH
The Natural Gas Conundrum (City of Vancouver) A significant (international) barrier to the adoption of renewable energy is cheap natural gas that is easily available through well-developed infrastructure making it difficult to compete using conventional accounting practices. How do we transition the energy system to renewable energy in light of cheap natural gas prices?	Establish a Renewable Energy Infrastructure Investment Fund. This Fund would use appropriate taxation to generate money which would be placed in a Sustainability and Renewable Energy Infrastructure fund. This would incentivize investment into a development project that supports renewable energy and over time, gives better returns to investors. This would also build a real-world model for a business case to promote the shift away from using natural gas as more investors are able to profit from projects funded with this scheme than from natural gas based projects.
Transitioning to a renewable energy grid (Natural Resources Canada) A wide range of changes will be needed in public behaviour, technical know-how, system design and operation to develop and support the knowledge, skills, policy and industry required if we are to transition to a renewable energy grid. How do we develop the knowledge and industry support required?	Education and training that creates in consumers a willingness to pay for the conversion of infrastructure from fossil-fuel based energy to renewable energy, with a very strong narrative aligning renewable energy with improved quality of life.
Community Solar for Industrial Areas (Strathcona Business Improvement Association) Strathcona business district is an inner-city industrial area comprised of light industrial, office, retail and PDR (production, distribution and repair) businesses, the vast majority small businesses. What structure and business model could be used to create a community solar project where opportunities and benefits can be shared among diverse members and local stakeholders?	Four options presented: 1. A brewery demonstration project, in which the community funds solar (both photovoltaic and thermal solar) for use in the brewery. 2. Pilot funded by community in prominent location with results communicated to broader community and city. It was suggested in this plan that the SBIA look into granting programs to cover the costs incurred by the building owner. 3. A program in which city-owned solar panels are placed to provide energy to non-profits housed in SBIA's jurisdiction, and provides job training to low-income workers 4. Solar installations in area parks that provide energy for stakeholders, while educating and raising awareness.

Summary Table (continued)

District Energy System Optimization (University of British Columbia) As owner and operator of a large (200,000 MWh/yr) district energy system and a large portfolio of buildings (1.5M m2), the University of British Columbia is in a unique position to research, develop and even commercialize greenhouse gas reduction mechanisms. How can the University continue to reduce district energy supply and return temperatures in order to improve system efficiency?	If UBC can reduce its return water temperature by 10°C, it would improve the efficiency of the current district energy system and increase the potential for introduction of renewable energy. This requires optimization of the current system, retrofitting campus buildings and educating the university community about occupant behaviour. For fun, the university could create alternative demand in the current system by constructing a Scandinavian spa on campus (using excess heat), contributing financially and to the health and well-being of the university community.
Catalyzing Building Retrofits (New York City) The energy used to heat, cool, and power buildings represents the majority of GHG emissions in many cities. To improve performance would require replacement of old, inefficient systems and upgrades to building envelopes, but undertaking measures of this magnitude is cost-prohibitive. What innovative products, financial services and business or investment models could bring down the cost of deep energy retrofits?	Use multiple approaches including: increasing uptake of district energy; modernizing building codes; using policy prods to incentivize use of specific standards in buildings; an energy benchmarking program; allowing base rent increases in efficient buildings; and incentivizing triple-bottom line accounting, to incorporate the cost of carbon. Also add a local improvement charge to city tax bills to help finance energy efficiency programs.
Commercial Vehicle Options (Mills Office Productivity) Renewable energy vehicle solutions such as hydrogen converted diesel engines and electric powered vehicles offer promising directions for green logistics. But which renewable option will become technologically viable for commercial goods transportation? How will small and medium companies finance conversions? To what extent do solutions need to be combined with installation of fuelling or charging infrastructure?	First, operations need to be made efficient through options such as: route optimization, anti-idling policies, downsizing to a minimum vehicle size, offering night-time delivery and reducing the number of 0-load trips. Only after maximizing efficiency could Mills progressively switch to electric vehicles as the current fleet ages out. To help reduce the price of fleet conversion suggestions included: creation of buyers groups to help drive down costs with volume purchasing; investigating reduced-rate loans for green projects; and the availability of government subsidies.

Summary Table (continued)

Heavy-Duty Refrigerated Vehicle Options (FreshTAP) Currently, there is no one clear renewable solution for heavy-duty commercial vehicles, particularly those that also require refrigeration. How can we scale up renewable alternatives to conventional heavy-duty vehicles and make these financially viable? What interim, technology or process solutions are available, especially for heavy loads that need to be kept refrigerated (e.g. beer and wine)?	The solutions focused on fleet logistics and optimizing goods movement for highest efficiency for local companies (vs. large distributers). Time-shifting could have an impact on fuel as night deliveries would more efficient while smart logistics systems could track orders and deliveries and create incentives for efficiency. A truck-sharing model for local producers was recommended (a truck-Uber), along with a local distribution centre that the city could assist with. Financing of renewable energy vehicles would be made possible by the city issuing a bond that would allow loans to businesses to purchase renewable energy vehicles at a discount cost through a group purchasing scheme.
In Conflict or in Concert: Green Building Policy and District Energy (Reshape Strategies) As cities strive to increase the share of renewables in the energy supply mix for buildings, there are two key areas of focus: Green Building and District Energy (DE). At their best, policies to encourage green buildings work in concert with district energy strategies. However, under some circumstances, conflicts arise. What can we do to ensure green building policy, protocols, and programs work in concert, and not in conflict with district energy strategies to build renewable cities?	Multifaceted approach including: • More transparent incentive programs • Giving monopoly to DE systems and regulating them; enable them to cross public right-of-ways without being treated as a utility • Develop a financing mechanism to enable individual companies and residents to own shares of DE systems (or even community owned) • Refocus building standards on real carbon reduction metric (not energy) • Allow for exceptions within building rating systems (e.g. a point for future DE or off-site energy source?) or building standards (e.g. require buildings to be LEED Gold unless connecting to DE then LEED silver, crediting DE for one level of LEED or have different envelope standards for DE / non-DE) • Introduce mandatory or voluntary benchmarking

Summary Table (continued)

Public Charging and Fueling Infrastructure (City of Vancouver) To transition to a renewable energy transportation system, increased fuel supply and charging and fueling infrastructure are essential. Central industrial areas offer a concentration of businesses with return-to-base vehicle fleets, and could offer an ideal location for shared, centralized charging and fueling infrastructure. To enable individuals to adopt renewably-powered vehicles, public institutions or the private sector could offer fast charging or fueling stations. How can we increase fuel supply and charging or fueling infrastructure? How will infrastructure need to be phased to allow for the current gap in energy storage solutions?	Several recommendations emerged: • Central hubs in industrial areas to offer neighbourhood DC fast charging stations • Repurposing existing gas stations into multi-fuel and charging stations • A smart card system for paying for charging access • Valet Charging service, allowing an EV owner's car to be brought to a charging station while the owners are occupied; or free parking to vehicles while paying for charging • More large and 'big-box' retailers offering charging and fueling in their lots • Apps to make finding available charging infrastructure easier

ABOUT THE PARTNERS

The Vancouver Economic Commission

The Vancouver Economic Commission (VEC) works to position Vancouver as a globally recognised city for innovative, creative and sustainable business. We do this by strengthening our Tech, Digital Entertainment and Green Economy sectors through strategic programmes and initiatives that address each stage of the business growth continuum.

C40 Cities Climate Leadership Group

C40 is a network of 83 of the world's biggest cities working to cut their carbon emissions and become more resilient to the effects of a changing climate. C40 supports cities to collaborate effectively, share knowledge and drive meaningful, measurable & sustainable action on climate change.

Renewable Cities

Renewable Cities is a global program of Simon Fraser University's Centre for Dialogue in Vancouver, Canada. Our mission is to support cities through the transition to 100% renewable energy and increased energy efficiency. Using research-based dialogue, collaboration and thought leadership we work towards urban energy solutions with cities, government, the private sector, utilities, researchers and civil society.

CLEAN

CLEAN is Denmark's leading green cluster organisation with more than 170 members from the entire cleantech sector. We are a politically and technologically neutral platform where domestic and foreign companies, knowledge institutions and public authorities exchange knowledge and enter into new partnerships.

GLOBE Series

GLOBE 2016 Conference and Innovation Expo is North America's largest and longest-running Conference and Exposition series dedicated to business innovation for the planet. Taking place every two years, GLOBE draws the 'best and brightest' of the international sustainable business community, making it an unsurpassed forum for learning and networking.

> ***Thank you for inviting us to participate, it was very useful and provided a lot of great contacts willing to help with [a community solar] project.***
>
> *Julia Berry, Sustainability Coordinator,*
> *Strathcona Business Improvement Association*

Detailed Outcomes Appendix

CHALLENGE 1:
THE NATURAL GAS CONUNDRUM

CHALLENGE CHAMPION: CITY OF VANCOUVER

THE CHALLENGE!

A significant (international) barrier to the adoption of renewable energy is cheap natural gas that is easily available through well-developed infrastructure making it difficult to compete using conventional accounting practices. Whether the project is a building retrofit or a conversion of an existing district energy system to renewables, it's often very difficult to make the financial case work.

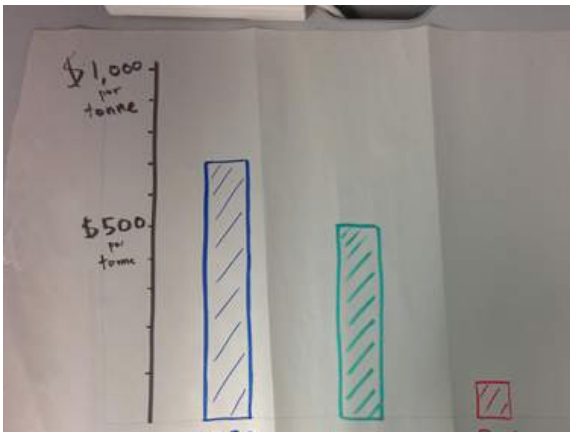
Pricing carbon and removing fossil fuel subsidies are two options that would make renewable energy competitive and financially viable. Both are approaches that would need to be led at the state and sub-national levels. There remains as a need (with few precedents to date) for a more localized, creative solution. Some cities are assessing their regulatory levers and legislative tools to identify the potential for new value systems that monetize the benefits of renewable energy to local development.

Challenge Statement: How do we transition the energy system to renewable energy in light of cheap natural gas prices? What regulatory, incentive, financing or other solutions would catalyze the wide-scale adoption of renewables? How can national and state governments support local governments, who tend to have limited legislative authorities and revenue sources? Can you think beyond pricing carbon and removing fossil fuel subsidies – which are necessary but absent in the short term? Could the private sector and private residents be motivated to move the challenge from a political responsibility to one driven by public desire?

DEFINE!

Participants noted that to address a challenge of this magnitude, the perspectives of city governments, utilities and consumers all require consideration. First and foremost,

Carbon Tax:



participants agreed that the simplest and most elegant way to address the low-cost of natural gas would be to implement an appropriate price on carbon. The Province of British Columbia appointed a team of stakeholders to review and update the carbon tax policy.

The team recommended more aggressive carbon pricing with a yearly increase of $10; however, the Provincial government has not yet accepted these recommendations. Participants debated whether there were any other opportunities to increase the price of carbon and whether that might occur at the federal government level, or need to be addressed at the regional or municipal level.

Participants stated that the City of Vancouver is currently upgrading its green building policy, and has a great deal of control over its building codes, allowing for changes to be implemented without outside approval. This would help to increase the efficiency of new construction. Participants noted that programs and policies to incent energy efficiency retrofits of existing building stock would also be necessary.

Participants quickly began thinking about approaches to this challenge from an infrastructure perspective. One reason why the cost of natural gas to consumers is so low is that the infrastructure needed to transport the gas to consumers is already built, therefore thinking about the infrastructure needs of any alternatives to natural gas would be necessary to developing a viable solution. Participants discussed challenges related to the funding structures and requirements for infrastructure development. One participant noted that comparatively, renewable energy should be cheaper than natural gas, once the infrastructure is established, and that returning those cost-savings to end users might help convince consumers to advocate for a fuel-switch.

A critical question discussed at the table was the source of funds for the initial infrastructure construction and operation. Participants agreed that it would be quite difficult for the government, at any level, to compete with private sector and crown corporation natural gas providers (such as Fortis BC) in delivering infrastructure funding over time.

Participants discussed waste to energy as possibly having a potential role in moving off of natural gas for heating in district energy settings. The City of Vancouver is working with Metro Vancouver to capture heat and energy from its waste facility and there is an active proposal to develop more waste-to-energy facilities in Metro Vancouver. This is not seen as a reasonable alternative to natural gas for district heating, as the amount of waste required would not be sustainable. Participants discussed the differences between the city-owned False Creek Neighborhood Energy Utility, which was built to be able to utilize waste heat

from sewer systems, and some of the older and privately-owned district energy systems in Downtown Vancouver that may not be as flexible in terms of fuel. The Downtown Vancouver systems provide very low cost and efficient heating to 210 large building in the downtown core.

IDEATE!

Participants agreed that solutions developed should address both 1) the funding gap for renewable infrastructure and 2) the carbon price. Cities need to develop innovative ways to generate funding for infrastructure as opposed to asking for money at the provincial and federal level. The participants all agreed that proper application of a carbon tax would be the first and best way to address the relative low cost of natural gas. This proper application would mean that the price of carbon would be set to discourage continued usage of natural gas and incentivize renewable solutions. One wondered if use of property taxes might help create opportunity for investment from third parties by incentivizing investment in alternative energy sources.

Participants observed a need to require trade-offs in new building/project design or retrofits of existing infrastructure to prioritize renewable energy. Participants noted the length of pay-back time for retrofit construction is an important concern here. The use of property taxes was also suggested to help fund more renewable energy infrastructure. For example, an additional property tax line collected for a local improvement. This could be targeted to specific areas, i.e. the downtown core, where buildings are already connected to district energy systems. Funds raised through this tax would go directly to costs related to moving the DE systems to renewable fuels. An example was given of a program in the town of Banff, Alberta, which has a municipal rider on its gas utility billing of a 4% tax whose revenues go directly into an environmental fund for energy efficiency and renewable energy projects. The demographics of Vancouver residents (one generally supportive of environmental policies) may allow for this type of taxation. Participants agreed that it would be critical that funds raised in this kind of taxation scheme are aimed at new sustainability programs and not go into a general revenue fund.

Participants discussed other creative funding options they were familiar with. For example, in the City of Nelson, BC, Nelson Hydro customers have the option to invest in a community solar array system by subscribing to buy a portion of the solar generation. The solar energy that is generated by the garden is credited to the subscriber's electricity bills in proportion to their investment. The principle is to expand the base to more people to stretch costs, allowing for an increase return on investment as cost structure diminishes through community funding.

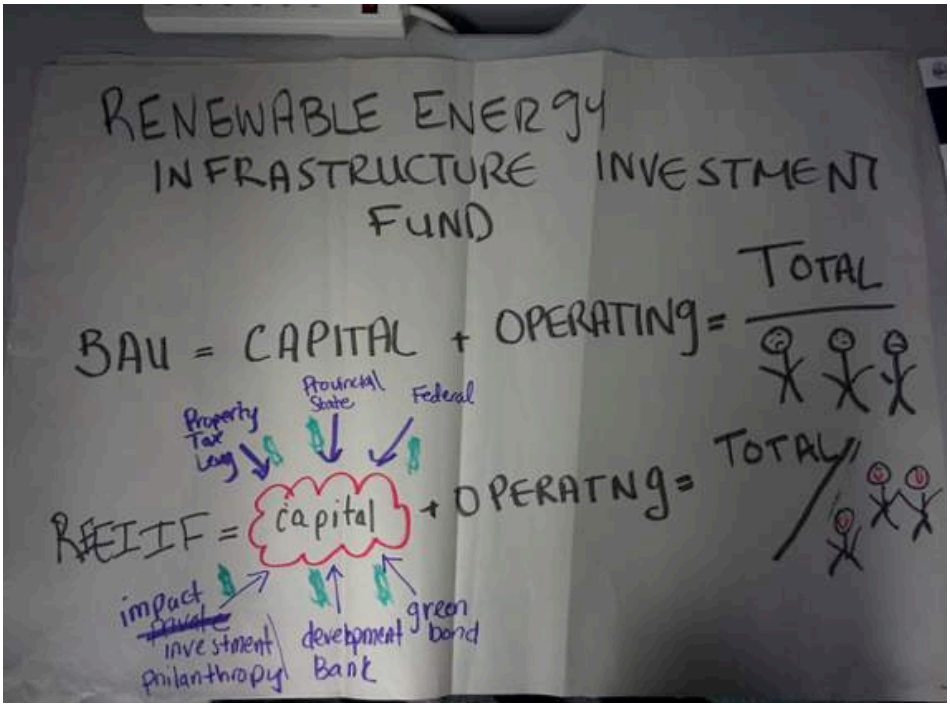
Participants discussed the need for building a 'De-gassing Vancouver' toolbox of policies that would help the city incent renewable energy use over use of natural gas. The first and most important piece in this toolbox would be to place an aggressive price on carbon, with appropriate policy mechanisms to ensure the price is maintained at the correct level over time. Participants also suggested re-writing the Vancouver Charter to allow for municipal taxation to generate a 'green fund'. Increasing city control over its property tax levy,

time of sale mandates and riders on natural gas bills could also generate funding for new renewable energy implementation. The group suggested that the city research how they might attract international investment into this kind of fund, whether through bond issue or another instrument.

Participants agreed that comparatively, once installed, renewable energy systems should be cost competitive with fossil fuel energy systems, they simply lack the decades of infrastructure funding that supports, for instance, natural gas use in the City. Participants explored a Thermal Infrastructure Plan, which considered alternative infrastructure to the well-developed infrastructure that has been in place and funded for natural gas. An investment plan to reduce the capital outlay required to build renewable infrastructure such that it might compete with natural gas on an operational cost basis was considered. This led to a further discussion of the need to make a solid business case for shifting from business as usual to a carbon-constrained economy. Participants noted that a price for carbon would be essential to building this case.

PITCH!

Participants pitched a combination of these ideas, and called for a Renewable Energy Infrastructure Investment Fund. This Fund would use appropriate taxation to generate money which would be placed in a Sustainability and Renewable Energy Infrastructure fund. This would incentivize investment into a development project that supports renewable energy and over time, gives better returns to investors. This would also build a real-work model for a business case to promote the shift away from using natural gas as more investors are able to profit from projects funded with this scheme than from natural gas based projects.



CHALLENGE 2:
TRANSITIONING TO A RENEWABLE ENERGY GRID

CHALLENGE CHAMPION: NATURAL RESOURCES CANADA

THE CHALLENGE!

COP21 showcased renewable energy as a critical component of a low-carbon future, but decisions made today regarding a city's infrastructure will determine its ability to pursue a path towards low carbon development in the future. Many cities must invest in major infrastructure renewal over the next 35 years. A wide range of changes will be needed in public behaviour, technical know-how, system design and operation to develop and support the knowledge, skills, policy and industry required for a transition to a renewable energy grid.

Challenge statement: How do we develop the knowledge and industry support for the transition to a renewable energy grid? What training programs would be required? What cultural education and social infrastructure could promote this future lifestyle? What industry sectors would need to be promoted?

DEFINE!

Participants noted that much of the conversation around the transition to renewable energy is primarily driven by governments, often municipal governments, at a perceived risk of having the same people charged with both creating climate policy and regulations that will oversee the renewable energy industry. This is quite different than for other industries, where consumer demands have dictated the evolution of the industry (an example discussed was the telecommunications industry shift to smaller, customizable personal phones driven by public demand).

How do we move the responsibility and demand for low-carbon energy from municipal governments into the citizens' hands? Participants noted that when it comes to energy purchases, consumers are less loyal to a particular energy source than the accessibility and affordability of that energy source. As an illustration of this point, a participant noted that consumers aren't interested in buying a gallon of gasoline as an end in itself, rather they are interested in easily and affordably purchasing what that gallon of gasoline represents: use of a personal car, getting around the city easily. Participants noted that sometimes clean energy is not as accessible and affordable, which indicates a potential disconnect in the sales strategy for clean and renewable energy. This might also indicate a lack of understanding between government policy makers and what citizen/consumers actually want or prioritize. Participants wondered if perhaps there could be improvements to arguments for implementing renewable energy if this disconnection were better understood.

Participants agreed that this disconnect is both a financial issue and a cultural issue, noting that what might be successful in generating consumer/citizen action in one part of the world might not work elsewhere, and that success in pushing for renewable energy implementation might need to be culturally specific.

Participants wondered whether customers are aware of the source of the electrons they pay for when paying monthly electrical utility bills. There was general agreement that there is a fundamental problem with asking people to pay more to 'do the right thing', but participants noted that there are cases where public opinion shifted, and renewable energy became normative, although they questioned whether this could be accomplished without government incentives. Participants discussed 'contagious' ideas, and how aspects like emotional triggers, social currency and the stories people tell about different technologies can impact public perception of those technologies. Fundamentally, participants agreed that the easiest way to affect major change is cost, and without incentives to change, change is unlikely to occur.

IDEATE!

Participants asked the following questions in their ideation process: are we selling the wrong "product" to make the transition toward renewable energy? What are the benefits that the public wants? Is there a disconnect between the public and the government/policy makers? How do we address this? Participants generated the following ideas:

1. Energy marketplace needs to recognize the true cost of carbon- based electricity: participants saw this as being part of an international carbon market, when carbon is globally traded, emissions can be priced appropriately.

2. A value-based argument: Participants proposed making the argument that renewable energy has impacts beyond just energy production, including environmental concerns, air quality, job creation, energy security.

3. Public exposure to technology and innovation: Until consumers have all the information they need to make a decision, they won't be able to invest in a solution. Smart meters, energy source disclosures, better energy literacy are all important.

4. Encourage social competition: People who live in Vancouver have a high willingness to pay. There is a strong quality of life (including bike paths, natural resources, parks etc.) – there is a tangible element to what they're paying to live in Vancouver. Participants agreed that making renewable energy a part of that quality-of-life argument might be useful in Vancouver's cultural context.

PITCH!

Participants agreed that solutions brought forward by the group should create in consumers a willingness to pay for the conversion of infrastructure from fossil-fuel based energy to renewable energy, and that this was primarily a branding and/or communications problem. The participants saw a need to sell solutions with a very strong narrative aligning renewable energy with improved quality of life.

Participants agreed that this campaign should start with cities that have an interest in sustainability (for instance, C40 cities) because they've already self-identified as a sustainable geography. Different roles were foreseen for different sectors: the private sector would be responsible for developing innovative technologies, the public sector would be responsible for making the case for transition to citizens, and academics were charged with helping both sectors in studying policy and technological innovation. Participants saw these roles as leading to greater levels of interaction between all three sectors.

Participants decided to present an implementation plan for cities to push implementation of renewable energy:

1. Establish the baseline – identify issues of importance to the local context.
2. Assess the practices that are key to the City's sustainability strategy. Different cities have different portfolios of sustainability initiatives
3. Based on available options, work with the cities to implement renewable energy grid in conjunction with their different sustainability initiatives.
4. Provide value proposition to residents by combining the use of renewable energy with arguments related to issues with local resonance.
5. Build political capital and consultation with leadership to validate intention to continue conversion into renewable energy grid.

CHALLENGE 3:
COMMUNITY SOLAR FOR INDUSTRIAL AREAS

CHALLENGE CHAMPION: STRATHCONA BUSINESS IMPROVEMENT ASSOCIATION (SBIA)

THE CHALLENGE!

Strathcona business district is an inner-city industrial area comprised of light industrial, office, retail and PDR (production, distribution and repair) businesses, the vast majority small businesses. The Business Improvement Association has for many years developed innovative programs to help business members transition to the low carbon economy and they have identified local renewable energy generation as an attractive choice for local businesses.

There are many challenges for widespread adoption, such as a long ROI for solar projects and a diversity of members that would receive varying benefits (some are property owners, some are businesses that own their property, and some businesses rent their facility). Between 2012 and 2015 alone, aggregate commercial property values have increased 35% and more and more large developers and investors have secured property. Buildings vary in age, but many are in the 30 to 70 year old range.

Challenge Statement: What structure and business model could offset the initial investment cost and/or improve the ROI for business participating in a community solar project? Are there alternative revenue sources available to businesses, such as renting out their roof for the community solar project and/or allowing for public investment in the community solar project? How can the opportunities to invest in, and the benefits received from a community wide renewable energy project, be shared among diverse members and local stakeholders? What are the regulatory and infrastructure barriers that need to be considered?

DEFINE!

In order to further define the challenge, the table participants first discussed the background to the project, including why the SBIA was interested in adding solar to their energy mix, what the end use for this energy was going to be and the payback times the SBIA might be able to expect with difference technologies. Next, participants discussed the buildings in the neighborhood that were being considered for this project. Currently, flat roofs of non-residential buildings are under consideration for inclusion in this solar project, including 2 current and 2 planned breweries. The buildings range from 30-70 years old, and participants felt they would need more information about the specific buildings. Participants wondered if a current grid analysis for the neighborhood had been conducted by BC Hydro.

IDEATE!

The first model for a community solar project that the table discussed involved one in which the City owns the solar panels, while the building owner receives a credit from the city for usage. The Building owner would then pay a decreasing rate for the power produced, until the payback is reached. Interested community members are invited to invest and receive dividends. Participants wondered whether there was a minimum size for this kind of project, and landed at range of about 20-30 kWh, although some participants wondered if it was risky to set these kinds of limits in advance of a project. Participants mentioned the possibility of incorporating an energy storage component to the project, with pricing based on time of day to offset peak consumption, although this would have to be investigated with BC Hydro. Participants also suggested that the business association invest in energy efficiency projects, for instance, upgrading to more efficient boilers with condensers.

Participants suggested that this could be a great community-funded pilot program that might provide lessons for others parts of the city. They advised the business association not to let the scope of the project get too big, but instead, get the details right. Participants also suggested that this project could be a way to build community engagement with and awareness of energy choices, and their impacts.

The table group narrowed down their ideas to 4 pitches:

1. A brewery demonstration project, in which the community funds solar (both photovoltaic and thermal solar) for use in the brewery.
2. Pilot funded by community in prominent location with results communicated to broader community and city. It was suggested in this plan that the SBIA look into granting programs to cover the costs incurred by the building owner.
3. A program in which city-owned solar panels are placed to provide energy to non-profits housed in SBIA's jurisdiction, and provides job training to low-income workers.
4. Solar installations in area parks that provide energy for stakeholders, while educating and raising awareness.

Participants suggested that if the SBIA consider the several important criteria in their decision-making around a community solar project: that they pursue a model that can be scaled-up or –down as requirements change, that the roofs used for the project are in sufficient condition and size to bear the weight associated with the project. They recommend that solar installation be carried out in a high profile and community accessible location, and that the community be able to visit both the physical panels and the performance results from the project. It was also suggested that SBIA consider the building's energy load and the optimal return-on-investment for the project. Several financial models were discussed for funding the pilot project, including a community investment model, a cooperative model and a straight investment project, in which investment is sourced outside of the community.

PITCH!

Table participants pitched the pilot project "Sunshine Strathcona" with the goal to create reasonable energy generation through solar panels on roofs of businesses throughout the area, and provide savings to community members that invest in the project. The Sunshine Strathcona project would require a thorough assessment and inventory of buildings for solar feasibility as well as a large community engagement project, to invite financial and other forms of participation from the broader community. Participants suggested some incentives to help pay for the pilot program, including that building owners will pay lower than BC Hydro's rate after the first year. It was also agreed that community investors should receive dividends from the project.

CHALLENGE 4:
DISTRICT ENERGY SYSTEM OPTIMIZATION

CHALLENGE CHAMPION: UNIVERSITY OF BRITISH COLUMBIA

THE CHALLENGE!

As owner and operator of a large (200,000 MWh/yr) district energy system and a large portfolio of buildings (1.5M m2), the University of British Columbia is in a unique position to research, develop and even commercialize greenhouse gas reduction mechanisms. The University has a reduction target of 67% by 2020 target and 100% by 2050.

Challenge Statement: How can the University continue to reduce district energy supply and return temperatures in order to improve system efficiency and improve options for recovery of low-grade waste heat sources (e.g., maximize flue gas heat recovery)? How can the University continue to transition buildings from natural gas to connect to the district energy system?

DEFINE!

In order to further define the challenge, the table participants discussed the following specifications of the UBC district heating system. It is a medium-temperature system, with a supply temperature around 85°C and returning it at 65°C. In the UBC system, hot water is provided by co-generation, and is supplied at 90°C. The system's load is approximately 37MW and involves 11 km of piping, connecting 80% of the buildings on campus.

Participants discussed how UBC can get the buildings that are currently using natural gas onto the system when the cost could be up to $200k/building. Participants agreed that since this is tied to the plant replacement cycle, it makes best sense to do when the plant is in need of replacement but not necessarily at other times.

UBC can't see the possibility of getting down to a 'Danish Style' low temperature system because of specific requirements of the system such as domestic hot water. The challenge is more about lowering the return temperature without simply dumping heat. It's about the temperature of the buildings. The goal isn't to try to get buildings to use less energy, but to use a lower grade of energy.

IDEATE!

The table generated the following ideas in the categories of hard and soft solutions:

Hard	Soft
Improve performance	Occupants working towards energy conservation
More even heat distribution – heat exchanger design	Revisit how university views the services it provides
Control every terminal unit	Staff engagement of energy conservation
Heat demand	Heat owner's competition between buildings
Valve optimisation	Making results public
Fully utilizing exhaust gas using heat exchangers	Charge users on a low delta T
Small geothermal to stabilise	Rebates for energy savings
	Sell heat to the surrounding neighbourhood

The 'hard solutions' identified by the group involve system optimization, by looking at the design and control of the district energy system. The 'soft solutions' involve education, engagement of the university community, as well as possibly finding more and/or alternate uses for the heat provided by the university system. Participants noted that as the university achieves its 100% renewable energy goal, investment return expectations will have to change.

PITCH!

If UBC can reduce its return water temperature by 10°C, it would improve the efficiency of the current district energy system and also increase the potential for introduction of renewable energy technologies in the future. To reach this goal, the table proposed a solution that combines two options. The first option was described by the group as "practical and nerdy", and would involve optimization of the current system, retrofitting campus buildings connected to the district energy system and educating the university community about UBC's district energy system and how building occupant behaviours impact the efficiency of the system. The second option presented by the group was to create alternative demand in the current district energy system by constructing a Scandinavian spa on campus. This would use excess heat in the system and contribute both financially and to the health and well-being of the university community.

CHALLENGE 5:
CATALYZING BUILDING RETROFITS

CHALLENGE CHAMPION: NEW YORK CITY

THE CHALLENGE!

The energy used to heat, cool, and power buildings represents the majority of GHG emissions in both Vancouver and NYC. These loads are dominated by heating, which is primarily fueled by inexpensive fossil fuels. Reaching a 100 percent renewable future or an 80 percent reduction in GHG emissions by 2050 will require significantly decreasing emissions from existing buildings through replacement of old, inefficient systems and upgrades to building envelope performance.

Undertaking measures of this magnitude is often considered cost-prohibitive—particularly given today's prices for natural gas, fuel oil, and electricity—time and labor intensive, and potentially disruptive for tenants. The market for deep energy retrofits is fragmented and the demand for available products and services is low. For those that do want to pursue deep energy retrofit measures, efforts can be limited by the misalignment of terms and conditions of financing, particularly given the loan duration required for the type of necessary upgrades. Efforts to electrify building heating systems could have significant impacts on the grid, straining transmission capacity and renewable resources. Finding the solutions to these challenges is essential for achieving Vancouver and NYC's respective goals.

Challenge statement: In light of these barriers and opportunities, what innovative products, financial services and business or investment models are available, or must be developed, to bring down the cost of deep energy retrofits and catalyze their implementation in the private market? What role can the city play in bringing down the costs of the necessary products and services and in increasing both the trusted supply of and demand for them? How can cities and businesses develop customer friendly models for deep retrofits, and assist building owners in prioritizing these measures? What are the right financial mechanisms to use to achieve these goals and what is the right return on investment timeframe that should be considered when making investments of this nature? How can these investments be aligned with the natural cycle of work that occurs in buildings and properly built into capital plans?

DEFINE!

Participants confirmed that buildings are the largest drivers of emissions in NYC, (73%), dominated by heating and driven by inexpensive fossil fuels. By comparison, 56% of the City of Vancouver's emissions come from buildings. Since energy efficiency in buildings is critical for meeting a city's renewable energy goals, participants talked about ways to make this a priority for home and building owners. Participants discussed how the city can help spur an increased demand for building retrofits by making them as easy and customer-friendly as possible, including incentives and other policies.

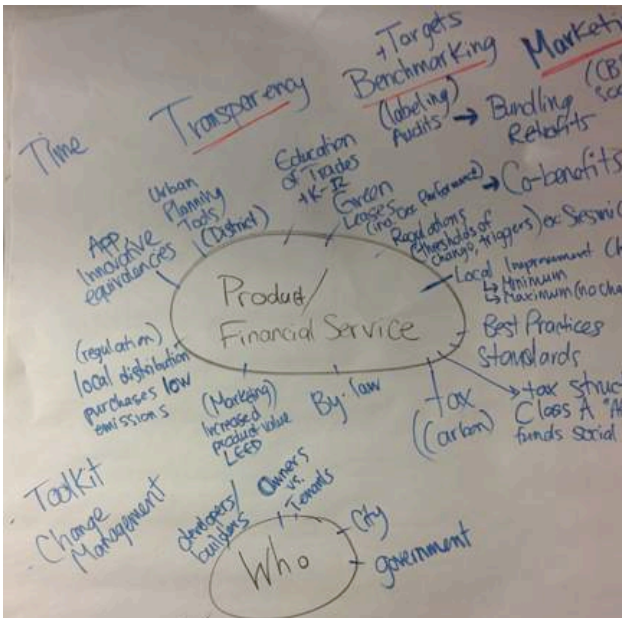
As discussed by the group, the main barriers to catalyzing building retrofits include a lack of incentives for developers, the very low cost of fossil fuels and electricity (in the Vancouver case, if not the NYC case).

IDEATE!

Participants discussed a number of solutions that might be helpful in catalyzing building retrofits, including increasing uptake of district energy; modernizing building codes; using policy prods to incentivize use of specific standards in buildings; energy benchmarking programs; allowing base rent increases in efficient buildings; and incentivizing triple-bottom line accounting, incorporating the cost of carbon. Participants also suggested adding a local improvement charge to city tax bills to help finance energy efficiency programs.

PITCH!

Participants suggested a 3-pronged program to incent increased investment into energy efficiency. The first part of the solution that participants generated was to mandate collection of building energy usage, with the understanding that collecting the data on how a building uses energy will allow for data-driven comparisons of building energy performance. Second, participants called for the collected data to feed into a building energy benchmarking program. Participants noted that building energy benchmarks can act as a trigger, leading to contractor certification programs (contractors that build better quality buildings are recognized), which allow for clearer regulation of building codes and for governments, the private sector and utilities to offer performance incentives. The final piece of the solution generated by participants was a building-labelling program, which acts as a marketing scheme for high-performing buildings and an honour for building-owners that develop them.



CHALLENGE 6:
IN CONFLICT OR IN CONCERT: GREEN BUILDING POLICY AND DISTRICT ENERGY

CHALLENGE CHAMPION: RESHAPE STRATEGIES

THE CHALLENGE!

As cities strive to increase the share of renewables in the energy supply mix for buildings, there are two key areas of focus: Green Building and District Energy (DE). At their best, policies to encourage green buildings can work in concert with district energy strategies to accelerate the adoption of renewables in the building sector. However, under some circumstances with existing green building protocols and programs, conflicts arise that actually hinder the shift to renewables, for example 'demand reduction at all cost' ideology; timing issues; boundary issues; and metric issues.

Challenge Statement: What approaches are working best when it comes to green building policies that promote adoption of renewables? What programs need refinement? What can we do to ensure green building policy, protocols, and programs work in concert, and not in conflict with district energy strategies to build renewable cities?

DEFINE!

The transition to renewables is complicated by the existence of multiple parties with different interests, preferences, priorities, and timing. Competing policies and frameworks and goals can complicate the issues. Participants agreed that change requires collective action and they felt it important to demonstrate the value of harmonizing district energy, renewable energy, and energy efficiency policies for key decision makers so they understand and support the initiatives, and can help generate public support.

Participants proposed working on a solution that addressed the 4 distinct issues in the proposed challenge: timing of changes needed, the metrics and standards used to rate buildings, the boundaries of the problem (i.e. that existing policies and -codes apply to individual buildings rather than groups or districts of buildings) and market issues (supply and demand for change).

Participants discussed issues of timing, such as the misalignment in timeframes between policies, and when considering development of new buildings or retrofits of existing buildings. Participants stressed the need for rapid deployment strategies to achieve rapid change in the building industry. Participants noted a perceived lack of options for building owners and developers, making an apparent conflict between building 'green' or connecting to a DE system. Green Building standards (such as LEED) incent making decisions that are inconsistent with DE systems (i.e. points accruing to certain kinds of boilers, but not

recognizing the efficiency of connecting to DE). At the same time, there is a lack of incentives available for using non-DE energy systems, such as geothermal energy
There are also a number of different existing green building standards such as LEED, Passive Haus, ASHRAE and others. But participants question whether any one of them are most appropriate to either moving to 100% renewable energy or include a building's connection to district energy. Hence each building standard has tradeoffs and requires different metrics of a developer, and these can be confusing to navigate, particularly for planning for now and into the future. Participants wondered if there might be a way to ensure better harmonized policies, or changes to these existing systems.

Participants also recognized a boundary issue; namely that building codes and standards apply only at an individual building level, and cannot account for efficiencies at a district level. For example, a building may in fact be more energy efficient if it connects to a DE system, but green building labeling systems only rate a building on its own, and may downgrade a building connected to DE. Participants noted that in the transition to 100% renewable energy, there is a need for 'systems thinking' and, in this case, 'building systems thinking' rather than individual building thinking.

Finally, participants noted that there are market considerations to address in creating a solution to this challenge. Harmonizing district energy policies with energy efficiency and renewable energy implementation policies cannot all be pushed by the government, nor can they all be pulled from the developers. Instead, city governments, those who design and maintain green building standards and developers must all work together to examine the

IDEATE!

Table participants brainstormed the following ideas to address the 4 main issues identified above.

Timing	Metrics
• Move towards transparent incentive programs (e.g., PowerSmart). Move away from complex and elusive incentive programs (e.g., Pacific Carbon Trust, now the Climate Action Secretariat – very difficult to go after carbon credits). Having these incentives facilitates and expedites transitions • Give a monopoly to district energy and regulate them. Use DE franchise to bridge 'Timing Issue'. (ex., Latvia) • Mark the district energy area. In order to invest into renewables, municipalities should know the future consumption investment per MW/h at a large scale. Saved MW/h = Produced MW/h	• Building standards need to be refocused on real GHG reduction • Establish common carbon metric to measure carbon and not energy • Engage in comprehensive data collection efforts to establish a database to benchmark different building standards. • Mandatory Benchmarking: in New York, landlords are required to file this with the city through energy audits. This has had the benefit of creating a dialogue between energy auditors and building owners on increasing efficiency in buildings. • Voluntary benchmarking: In Richmond, large companies were invited to report on GHG reduction as part of a building energy challenge • Allow for exceptions within LEED. Perhaps crediting LEED point for future district energy. • E.g. require all buildings to be LEED Gold unless they are connecting to DE then they only have to be LEED silver, essentially crediting one level of LEED. • Buy carbon offsets as a stop-gap measure to get to LEED Gold before building is powered by DE.

Boundary	Demand and Supply
• Consider a larger boundary to analyze the problem. A large system with lots of inputs and outputs. • Imagine building a new city from the ground up. How would we go about this? • Enable privately-owned district energy systems to cross public right-of-ways without being treated as a full-fledged utility (e.g., New York Policy change that recognizes the distinction between DE and utilities) • Develop a financing mechanism to enable individual companies and residents to own shares of district energy systems (as with virtual metering for community shared solar systems) • Ensure that all stakeholders are at the table and involved in the decision-making from the beginning. It is important to understand who the stakeholders are and what specific roles they play. • Add an additional level (similar to LEED) or other mechanism to recognize off-site energy sources	• Establish shared community owned DE systems that people can buy into • Use different envelope standards for DE and non-DE areas • Demand reduction + renewables + accommodation of district systems (e.g., EnWave) • Establish a guide to evaluate demand/supply • Saved MW/h = Produced MW/h. Under the franchise model, buy spare heat from landlords and put it back in the system. • Incentivize landlords and developers to meet these buildings or certification standards. May need to get the Federal or Provincial government to offer some incentives (e.g., incentive program in Brussels)

PITCH!

The solution developed by the table is to create a transparent framework for developers with a clear financial benefit. The framework will be implemented by the local municipal government and should include incentivizes that address the issues mentioned above. For example, a building code that allows more floors to be built for meeting LEED platinum and accessing DE in the future, allowing for carbon offsets to be purchased up until the point that they switch to DE.

CHALLENGE 7:
COMMERCIAL VEHICLE OPTIONS

CHALLENGE CHAMPION: MILLS OFFICE PRODUCTIVITY

THE CHALLENGE!

The physical network of vehicles connecting people to markets will be transformed by the pursuit of low carbon transportation, and success is dependent on the viability of new technologies. Small and medium sized businesses are key players yet face unique barriers in this transition.

Renewable energy solutions such as hydrogen converted diesel engines and electric powered vehicles offer promising directions for green logistics. Yet questions remain surrounding how green technologies will be adapted to fit the needs of commercial operators as well as what financial strategies are available to fund capital intensive fleet upgrades or conversions.

Challenge Statement: Which renewable energy powered commercial vehicles will become technologically viable for commercial goods transportation? How will small and medium companies finance conversions? To what extent do solutions need to be combined with installation of fuelling or charging infrastructure?

DEFINE!

Mills currently measures their GHG emissions through the ClimateSmart program, and are aware that the largest source of emissions is from transportation (~70%). One of the biggest challenges they face is the company's aging fleet with vehicles from 2006 to 2012, including 4 diesel-burning vehicles. In 2011, the company purchased an electric vehicle, which required an investment of approximately $200,000 (Canadian dollars). They've also done a test conversion with one vehicle being retrofitted to propane. The rest of the fleet is about 18 small to medium sized vehicles, all of which Mills owns. Mills Office Productivity operates within BC with main routes travelling from the interior and in and around Vancouver. They've set themselves a 10 year timeline to achieve 'ambitious' vehicle emissions-reductions.

IDEATE!

Participants first discussed how the company might be able to make their operations more efficient. Options considered included route optimization, anti-idling policies, downsizing to a minimum vehicle size, offering night-time delivery and reducing the number of 0-load trips. Participants suggested that pursuing partnerships with other businesses might help, especially with reducing 0-load trips and optimizing routes. Participants also suggested that the company consider partnering with the City of Vancouver in developing better alternative fueling infrastructure. Finally, participants discussed fuel types and vehicle conversion

options that the company might consider exploring, including dual fuel, renewable natural gas engines and electric vehicles.
Participants decided that the technology best-suited for achieving the company's "ambitious" target is switching the existing fleet to electric vehicles. They noted that this would need to be combined with optimization strategies to maximize efficiency. Participants recommended a progressive switch to electric vehicles as the current fleet ages out of usefulness, while starting to optimize efficiency immediately.

Participants recognized that cost is a prohibitive factor in this solution, so they considered a number of options that might help reduce the price of fleet conversion. These included the creation of buyers groups to help drive down the price of electric vehicles with volume purchasing, investigate the possibility of reduced-rate loans available for green projects and the availability of government subsidies. Participants also suggested that Mills establish the return on investment of the electric vehicle already in operation in the company's fleet.

PITCH!

The solution generated by the table called for Mills to establish a full costing as well as the return on investment of the electric vehicle already in operation in the company's fleet. Participants envisioned that the company should convert all fleet vehicles to EVs as the current fleet ages out of use. They proposed that the fuel switch should be combined with route optimization and other steps to achieve maximum emissions-reductions. Next, the group suggested investigating all subsidies, tax credits and incentives that the company might qualify for when switching its fleet to EV. Finally, participants proposed that Mills enter into business partnerships both to maximize route efficiencies, but also to investigate the possibility of entering into an EV buying group to decrease the cost.

CHALLENGE 8:
HEAVY-DUTY REFRIGERATED VEHICLE OPTIONS

CHALLENGE CHAMPION: FRESHTAP

THE CHALLENGE!

In many cities, wholesale and logistics businesses with 'return to base' fleets are the single largest source of emissions from industrial activities. These businesses and others with large distribution functions have the potential to become powerful centres for smart logistics, greening the supply chain of entire industry clusters and promoting the clean distribution of goods and services.

Currently, electric powered vehicles offer few solutions for heavy-duty commercial vehicles, particularly those that also require refrigeration. Hydrogen requires investment in relatively expensive refuelling infrastructure, and renewable natural gas is not yet available in large enough volumes. Financing for fleet conversions is often out of reach for small and medium sized enterprises.

Challenge Statement: How can we innovate heavy-duty vehicle fleets at scale, particularly those that require refrigeration? How can we scale up alternatives to conventional heavy-duty vehicles and make these financially viable? What interim, technology or process solutions are available, especially for heavy loads that need to be kept refrigerated (e.g. beer and wine)?

DEFINE!

In order to limit emissions per kilometers travelled in a five-year time frame, participants suggested a need to both assess the vehicle and fuel options and improve efficiency in fleet logistics. Currently, the consumer demand for buying local has led to an unsustainable system of delivering those locally made goods. As an example, if 50% of a restaurant's products come from different local producers with different ordering and fulfillment methods, this means a lot more delivery vehicles on the roads. At the same time, there is a reduced dependence on major distributors, which are often more efficient. Again, this means more vehicles making more deliveries and less efficiency overall.

IDEATE!

The table conversation first considered the different vehicle types and fuel options that might help reduce emissions. Participants suggested using carbon pricing to incent the use of low-carbon fuels and setting stricter performance standards for fuel efficiency. The use of natural gas as a fuel was discussed, as was the possibility of making use of waste heat

from the fleet's engines. Refrigerated trucks present another complication, and participants suggested using solar panels on the trucks to provide the electricity for refrigeration.
Next, participants considered fleet logistics and optimizing goods movement for highest efficiency. It was noted that large distributers are able to capture efficiencies with multi-chain operations, where they can drop goods from various producers at once. Participants wondered if local companies could use the same approach. Next, time-shifting of deliveries was discussed, and it was noted that time-shifting might have an impact on vehicle fuels as night deliveries would be more popular if residents and others were not disturbed by vehicle noise. Participants suggested using smart logistics systems to track orders and deliveries and creating incentives for increasing efficiency. Again, participants noted that an appropriate price on carbon, including on carbon-based fuels would change the incentives for fleet operators and would likely lead to a major reduction of diesel-fuelled trucks. Participants developed the idea of developing a truck-sharing model for local producers.

Next, participants discussed financing options for reducing vehicle fleet emissions. One option raised was for the city to issue a bond that would provide loans to fleet operators to electrify their fleets, ultimately leading to the businesses being given the option to pay-back the loan over longer time-scales than commercial lending. It was suggested that local entities such as Translink and the Port of Metro Vancouver might be interested in funding such a program because it would greatly reduce the need for more roads to be built if there was enough uptake, as vehicles would be removed from the road. Participants suggested that aggregation might be a key to incent smaller companies to participate in a buying scheme, as buyers could group around the trucks, aggregating demand around a technology, and go to market together to reduce costs. Finally, distance-based business licensing was suggested as a way of incentivizing fleet operators to keep their fleet base in a central location for their deliveries.

PITCH!

Participants presented a pitch for a truck-sharing model - an Uber for trucks, or Tuber. The pitch incorporated load shifting, shifting deliveries from day to night, and developing a long-term goods delivery optimization software platform. It was suggested that an NGO lead a pilot project for truck sharing among similar businesses (i.e. Restaurants, or bars). Local governments would contribute by assisting the group in establishing a local distribution center centrally located to the receivers and would issue the bond that would allow loans to businesses to purchase an efficient truck. The suppliers and receivers would share the costs of any increase in service charges, as well as the costs of developing the software necessary to create optimized delivery routes.

CHALLENGE 9A:
PUBLIC CHARGING AND FUELLING INFRASTRUCTURE

CHALLENGE CHAMPION: CITY OF VANCOUVER

THE CHALLENGE!

To transition to a renewable energy transportation system, increased fuel supply and charging and fuelling infrastructure is essential. Businesses cite lack of charging or fuelling infrastructure as a barrier to adoption of renewable fuel fleets, and the issue of home charging must be addressed in cities where residents do not have access to residential charging or in some cases, even private garages for overnight charging or fuelling.

Central industrial areas offer a concentration of businesses with return-to-base vehicle fleets, and could offer an ideal location for shared, centralized charging and fuelling infrastructure. One strategy to enable individuals to adopt renewably-powered vehicles, public institutions or the private sector could offer fast charging or fuelling stations. In British Columbia, BC Hydro alone is authorized to generate and sell electricity, but has a limited mandate to develop charging infrastructure.

For heavier duty vehicles where electrification is not an option, renewable natural gas is available where there is waste stream separation allowing for organics-to-energy conversion, yielding high quality methane. In such cases volumes would still serve only a fraction of the market. Renewably sourced hydrogen is not yet widely available, and energy storage needs to be addressed.

Challenge Statement: How can we increase fuel supply and charging or fuelling infrastructure for commercial fleets? What options are on the horizon for energy storage, and how will infrastructure need to be phased to allow for the current gap in energy storage solutions?

DEFINE!

Participants determined that a large part of this challenge is getting more charging stations into existing multi-unit residential buildings. The participants raised two major questions: who pays for these charging stations, and who should be responsible for their maintenance? Participants pointed out, however, that fast home charging (i.e. above level 1 trickle charging for overnight use) might not be necessary. This is especially the case when other options include charging at work and other locations. Participants suggested that charging infrastructure at different locations should match the behavior of users at the location. For example, people who drive to work typically park for 8 hours, while that's not the case for other vehicle trips. Participants proposed the following:

Define user needs → Define duty cycles → Develop solutions

IDEATE!

Participants suggested that fast-charging stations need not be in MURBs, and they could then support both commercial and residential uses. Participants suggested thinking about a within-neighbourhood distribution of charging stations located in mixed-use locations. This would suggest the need for inter-urban charging stations that could provide electric fast-charging stations as well as liquid fuel stations such as renewable natural gas, hydrogen fuels and others as they approach commercial viability. Participants suggested that the type of infrastructure should depend on the location and surrounding resources, so as not to introduce heavy infrastructure in residential neighborhoods.

PITCH!

Participants suggested creating a central hub, for example, in False Creek Flats, that offers both warehouse and goods distribution facilities and a neighborhood DC fast charging stations. These kinds of hubs could be calibrated to land use and density, and could be created on existing gas station property incorporating renewably supplied fuels. In more industrial areas, participants suggested that zoning should require EV/rapid charge stations, and commercial areas should include requirements for EV/rapid charging stations for delivery trucks.

CHALLENGE 9B:
PUBLIC CHARGING AND FUELLING INFRASTRUCTURE

CHALLENGE CHAMPION: CITY OF VANCOUVER

DEFINE!

The City of Vancouver's Renewable City Strategy (2015) sets a goal of having 40% of all vehicles plug-in hybrids and an additional 25% fully electric, with the remaining vehicles being conventional hybrids powered by sustainable biofuels. One major challenge to meeting this goal is the difficulty of integrating charging infrastructure into condominium parking lots, further complicated by the fact that, charging resources are shared among residents. Although the investment in EV charging infrastructure pays for itself over a relatively short period (currently ~ 5 years), charging stations require high installation costs. The lack of installed charging infrastructure in Multi-Unit Residential Buildings presents a barrier to EV purchase for residents living in MURBs.

IDEATE!

Participants developed many ideas to address the need for public charging and fuelling infrastructure in the city of Vancouver. The first idea was to repurpose existing gas stations into multi-fuel and charging stations. These would offer multiple charging units as well as biofuels and natural gas. Participants suggested integrating complementary businesses into these charging stations, as they observed that gas stations likely make as much or more money on selling snacks and drinks, and other supplies, as they do on actual fuel, and this could improve the business case for such a station.

Participants also discussed how to making public charging stations more accessible and useful. One suggestion was to use large wire charging, essentially using longer than standard wires in for charging stations in order to allow more vehicles to be reached by the charging wires, increasing a charging stations' accessibility. Participants also discussed using a smart card system similar to a transit pass card such as a Compass Card or Metrocard for paying for charging access. This kind of smart card system would allow for centralized access to charging data, as well as the ability to determine customers' charging patterns. This kind of data collection would allow for changes to pricing structure or placement of additional charging stations in high-use areas.

Participants noted that the City of Vancouver has a high level of control on building codes, so the City would be able to implement new building codes to facilitate the construction of new charging infrastructure. Participants suggested requiring more charging stations essentially allows building owners, developers and lessees to subsidize the costs of charging stations for EV users (i.e. everyone pays a bit, therefore the costs don't fall only on EV early adopters). Participants also discussed the need to add charging stations in existing

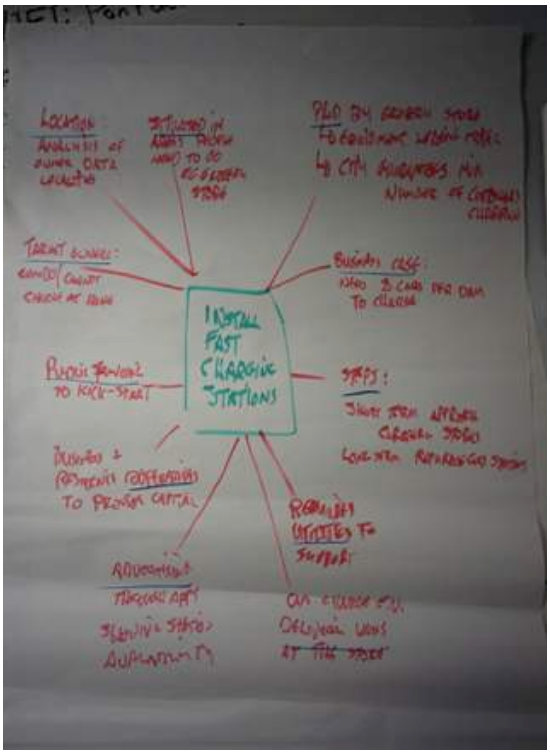
buildings and parking lots, as well as the need to install more than one kind of charging station, to respond to changes in technology.

One idea proposed by participants was a Valet Charging service, allowing an EV owner's car to be taken away by the service provider and brought to a charging station while the owners are occupied. This might be a popular service anywhere that valet parking is currently used, and might also be expanded to places where people might expect to stay for a few hours, like at movie theatres, festivals, and shopping malls. Participants also suggested that one incentive City or lot owners might provide would be to offer free parking to vehicles paying for charging.

Participants discussed the possibilities if more large and 'big-box' retailers offered charging services in their lots. This would induce the volume of EV traffic coming to the store, potentially increasing revenue, and would provide EV owners an incentive to shop at a particular retailer over another. Larger parking lots, like those associated with big-box retailers would also allow for multiple charging stations. Participants also suggested that EV customers might be able to enjoy a discount for spending on charging while at the retailer.

Similar to this, participants explored ideas for increasing charging infrastructure in other high-frequency locations such as grocery stores and gyms/fitness clubs. Participants suggested that these businesses might be able to involve solar leasing for panels that would deliver the electricity for these charging stations. These kinds of locations were determined to be ideal targets for increased charging stations because they are locations that customers frequent regularly and often for an hour at a time.

Finally, participants also discussed some technological approaches to these issues, including the need for apps to be developed that would make finding available charging infrastructure easy. The feasibility of EVs having replaceable batteries was also discussed. This would likely be complicated logistically, but might remove the necessity of cable charging. Instead, batteries could be switched out easily and either brought into an EV owner's residence or to a centralized location for charging.



PITCH!

Participants presented an idea in which existing grocery stores and big box retailers became the hosts of charging infrastructure within their parking lots. These would provide highly visible charging stations in locations where many people drive (even if they might commute to work by other methods of transportation). While the stores are closed, the retailers' delivery fleets could use charging stations. Participants reasoned that people have busy lives and often visit grocery stores multiple times per week – why not offer them the convenience to charge their cars while shopping? By doing so, grocery stores will also serve as community leaders getting the message out to the public that EVs make sense to use. Grocery stores will also attract more environmentally conscious shoppers and generate PR benefits. The investment will allow for grocery stores to charge their own delivery vehicles, enabling a faster electrification of their own fleet.