Transportation Futures for BC
September 11, 2014
Acknowledgements

Carbon Talks is a partnership with Simon Fraser University’s Centre for Dialogue, and a collaboration with SFU’s Beedie School of Business, the School for Public Policy, and the School for International Studies. Our goal is to advance Canadian global competitiveness by shifting to a low-carbon economy.

Carbon Talks would like to acknowledge the Pacific Institute for Climate Solutions (PICS) for their partnership.

Shauna Sylvester, Executive Director of Carbon Talks and Director of the SFU Centre for Dialogue, designed and facilitated the dialogue, with the assistance of Claire Havens and Keane Gruending (Carbon Talks) and Nastenka Calle Delgado (PICS). Claire Havens and Keane Gruending were the primary rapporteurs, and Nastenka Calle Delgado took additional notes.

Keane Gruending and Claire Havens wrote this dialogue report. It was reviewed and edited by Betsy Agar, and reviewed by Shauna Sylvester, Walter Mérida and Tom Pedersen (PICS), and the dialogue participants. Keane Gruending provided the layout design and formatting. Carl Cantelon, Kristin Johansson, and Tia Alexander (Carbon Talks) provided additional support.

Our thanks goes out to all of the participants who volunteered their time to attend the dialogue and discuss PICS’ role in determining the research needs of low-emissions transportation in BC. The diversity of participant expertise broadened and deepened the discussions surrounding this complex issue. We have endeavoured to accurately capture participant contributions to the dialogue and through the review process.

The views in this publication reflect the ideas generated in the course of the dialogue session. They do not necessarily reflect the views of Carbon Talks staff, funders, collaborators, the SFU Centre for Dialogue, or PICS.

Carbon Talks is part of the Creative Commons. We invite you to use the material in this discussion guide, but please credit Carbon Talks, PICS, and the SFU Centre for Dialogue.

Photo credits: Photos are listed by real name if available, and Flickr username otherwise. All photos are available on a Creative Commons license. Cover: Luton, Ted McGrath, anitakhart, and colink. Remainder of report: Paul Kreuger, Blake Handley, e_walker, Meri Tosh, Andy L, Ted McGrath, Stephen Rees, gillicious, Luke Ma, Windell Oksay, Paul Kreuger, and yokaine. All other photos by Carbon Talks.
DIALOGUE APPROACH

The purpose of this dialogue was to provide the Pacific Institute for Climate Solutions (PICS) with the best insight on transportation emissions, research and research gaps, and innovative projects in BC in order to shape its Transportation Futures for BC research stream.

A variety of participants representing the academic, NGO, government, and private sectors attended the full day dialogue, which was held on September 11, 2014 at the Djavad Mowafaghian World Art Centre at SFU Woodwards. The diversity of participants was designed to reflect the breadth of knowledge on BC’s current transportation picture.

In the interest of having an open and candid discussion, the dialogue was governed by Carbon Talks’ Terms of Engagement (see Appendix A), which includes the Chatham House Rule.

<table>
<thead>
<tr>
<th>Sector</th>
<th># of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic</td>
<td>11</td>
</tr>
<tr>
<td>Local and regional government</td>
<td>7</td>
</tr>
<tr>
<td>Nonprofits</td>
<td>3</td>
</tr>
<tr>
<td>Private sector</td>
<td>6</td>
</tr>
<tr>
<td>Provincial and federal government</td>
<td>3</td>
</tr>
<tr>
<td>Utilities and transportation networks</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>33</td>
</tr>
</tbody>
</table>

The agenda (included in Appendix B) was designed to enable maximum participant engagement and answer the following questions:

- What are the drivers and emerging trends for developing a provincial strategy for low-emissions transportation?
- Where in BC is current work on low-emissions transportation happening?
- What does a provincial low-emissions transportation strategy look like?
- What can PICS do to help develop a strategy?
- What is essential research that fits with PICS’ mandate?

1 - Chatham House Rule: “participants are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed.”
To begin the session, Tom Pedersen, Executive Director, PICS, set the stage with a description of the global climate challenge. In 2013, emissions grew by the largest amount since records have been kept. He linked global greenhouse gas emissions to the local context, “Here in BC you’ll see that 27 million tonnes of greenhouse gas emissions come from our transportation sector—38% of the province’s total emissions.” Pedersen went on to say that the day’s task was to put forward ideas and thoughts to reduce the 27 million tonnes. PICS is now focusing on five interdisciplinary project areas, which either include transportation emissions or have a direct impact on transportation sector emissions. “The electrical grid, shipping of forest products and biomass use, LNG as a transportation fuel, and building design, through land use, are all related to transportation emissions,” Pedersen said.

Pacific Institute for Climate Solutions 5 Project Areas:

- 2060 Project: Exploring integration of the electrical grid in Western Canada
- Maximizing net carbon uptake by BC’s forests
- Natural gas development: Maximizing the value of a relatively new resource
- Energy efficiency in the built environment
- Transportation futures for BC
Walter Mérida, Director, Clean Energy Research Centre, UBC, built on Pedersen’s welcome by saying that transportation is a unique energy service in that it cannot be provided by electricity on its own. “The challenge and opportunities focus on the word ‘clean’,” said Mérida, “It’s not just local, regional needs, it’s also global opportunities.” LNG and transportation have clear linkages in the case of BC, and if the West Coast—BC, Washington, Oregon, and California—unifies as a transportation market, it would be the fifth largest in the world. Mérida outlined that BC is already a leader in fuel cells and LNG fuel switching. He went on to say that much of the work happening in the province is siloed and that the present dialogue would be about understanding how transportation innovation is happening all over BC.

While BC’s transportation sector is the largest generator of GHGs, emissions from other sectors, particularly buildings, are also related to transportation system design, fuels, and technologies.

**FIGURE 1: BC GREENHOUSE GAS EMISSIONS (IN PERCENTAGE, BY SECTOR) - 2010**

- **Industrial & Commercial Transportation** - 23%
- **Oil & Gas** - 19%
- **Other Industry** - 17%
- **Personal Transportation** - 14%
- **Buildings** - 10%
- **Waste** - 7%
- **Net Deforestation** - 5%
- **Agriculture** - 3%
- **Electricity** - 2%
HOPES AND CONCERNS

In the first session, participants were asked to identify their hopes and concerns for the day:

**Hopes**

One member of the group indicated that he hoped that PICS would come up with a balanced agenda, not strictly ecologically focused, but one that encompassed economic and social considerations. Several participants hoped that a better connection between research and policy could be developed and that it would lead to significant policy frameworks that drive operational change at municipalities and businesses. Another participant voiced a hope that the dialogue’s outcomes and PICS’ work would lead to better links with BC businesses and the economy.

**Concerns**

In terms of concerns, one participant worried that efforts might be duplicated, while another indicated that small communities could be left behind. Hype around a particular policy or technology was a concern to one participant as he worried that the province could fall into a trap where a transportation idea doesn’t lead anywhere or that it could be left behind in five years’ time. One participant was concerned about the need to engage many levels of government and different types of stakeholders and gain access to a more dispersed network of decision-makers. Finally, another person was concerned that the session might not lead to practical outputs.
The purpose of this exercise was to determine the drivers for developing a provincial strategy for low-emissions transportation and identify the emerging trends that could impact the strategy. Participants were grouped into tables that each covered one of five dimensions—social, environmental, economic, political, and cultural—and were asked to indicate drivers and trends within that context. See Appendix C for a full review of the output from this exercise.

**Economic**

For the economic group, drivers included: taxes, domestic and international trade, household transportation spending, energy imports and exports, and the link between climate change and health. Trends included investing in systems with no perceived public gain, labour and economic competition, the impacts of an aging population, personal mobility, social change and faster increases in carbon pricing. Development in “resilient infrastructure to cope with climate change” was identified as both a driver and a trend.

**Social**

The group looking at the drivers and trends for the social dimensions of transportation identified the “cool factor” of EVs, Fraser Valley air quality impacts on health, striking a quality of life balance between being mobile and the benefits of nature, transit as a place for social interactions, increasing “cyber commuting,” growing interest in the sharing economy, and affordability. The trends identified follow similar themes: owning a car and a large house is less popular among youth, and people are recognizing the potential savings that accrue from not buying a personal vehicle.
**Environmental**

The group working on environmental aspects of low emissions transportation identified the following drivers: demand for transportation services from outside of the region, the impact of regulations outside of BC and their implications on local technology, regional and provincial air emissions targets, land pressures within the Lower Mainland, the willingness of people to make long term investments, and Canada’s reputation as an environmental laggard. Trends included emissions standards, the Pacific Coast Action Plan, linking of greenhouse gas emissions standards into funding for transportation projects, and lifecycle analysis of technology and equipment. The environmental group identified three items that are both drivers and trends: BC reacts to trends set outside the region, environmental transportation investments are risky, and there are tradeoffs between truck and rail transportation.

**Political**

From a political perspective, the drivers for low-emissions transportation include air quality, commitment from leadership, the economic costs of inaction, lack of autonomy for local governments to plan transportation services, the need to integrate transit with economic benefits, and the need to communicate climate impacts through the effects on people’s lives. The group identified the following political trends that impact a low-emissions transportation future: political schizophrenia (referendums for transit, but not for bridges), municipal and regional approaches are gaining momentum, and the influx of climate migrants.

**Cultural**

The cultural drivers identified consist of an unwillingness among the public to be taxed, cultural heterogeneity, and an openness to sharing. The trends include: an increasing awareness and interest in health, the environment, and technology, an acceptance of low-carbon technologies like transit, fewer young people driving, and public approval needed for transit investment (the referendum).
CURRENT RESEARCH UNDERWAY

Participants were asked to map out research that has been done, or is currently underway, on low-emissions transportation in BC. The results were categorized into the following areas: active, transit, motor vehicles, goods movement, air, marine, rail, and land use. For the results of this research mapping, please see Appendix D.

**Active Transportation**

A number of jurisdictions and regions, including the City of Vancouver, Central Okanagan, and Metro Vancouver as well as UBC and the Fraser Basin Council have completed studies and surveys on pedestrian safety, safe urban cycling, trip habits and planning, transportation demand management, and the link between transportation infrastructure and health. The City of Vancouver is also collecting data on the effect of bike lanes on various modes of transportation and on businesses. The City of Kelowna and District of West Kelowna are also in the process of drafting updated Pedestrian and Bike Master Plans.

**Land Use**

Land use has an outsized influence on transport related emissions and research on this topic is integral to understanding and developing low-emissions transportation policies and technologies in BC. TransLink has studied the impact of the built environment on the transportation system, focusing on factors that impact auto ownership rates, vehicle kilometres travelled, sustainable mode share, and GHG emissions. The Regional District of Central Okanagan 2014 Clean Air Strategy also considers land use implications for transportation.
Fuel and Energy Efficiency

Academics at SFU have researched public acceptance and media coverage of alternative fuels as well as the design for the low-carbon fuel standard for BC. In addition, the Community Energy Association and QUEST have created a community energy planning implementation guide. Washington State has conducted research and disseminates knowledge on biofuels through BioEnergy Washington. At UBC, there is research underway on local natural gas storage and distribution, hydrogen fuel cells, and biomass. There is also research being conducted at SFU that examines fuel cell manufacturing and durability.

Air Transportation

There have been a number of air transportation research projects outside of BC that influence emissions in the province: The Transportation Research Board’s Airports Council Research Panel on Environment, FAA’s work on aircraft emissions dispersion, and Airbus’ composite materials aircraft design. In Canada, Transport Canada has led the Action Plan for Aviation Emissions and there is ongoing research at YVR airport that looks into the feasibility of hydrogen fueling.

Marine Transportation

Similar to air transportation, research outside of Canada has implications for low-emissions shipping in BC. For example, the Royal Institution of Naval Architects has researched fuel efficient ships. There are a number of private companies that are currently researching hybrid ferries as well as the marinisation of shore based technologies, such as waste disposal. In terms of current research, SFU has work underway on fleet LCA and on the adoption of environmental technologies for the port industry. UBC and the Department of Fisheries and Oceans is currently studying the impact of transportation on marine ecosystems.
In terms of shipping, research has been completed on the electrification of port service vehicles, container ship-shore power feasibility, and the movement of goods to ports by Metro Vancouver. SFU and the City of Surrey have researched the impact of implementing CNG into refuse collection vehicles. Research on goods movement underway includes: case studies on the adoption of trucking efficiency technologies (E3 Fleet), adaptive traffic signals (City of Surrey), and fleet LCA modules for CNG/LNG applications for freight applications.

**Transit**

There are a number of completed research and pilot programs for alternative fuels, including: hydrogen buses in Whistler, hybrid buses at the City of Edmonton, and new technologies for batteries and hydrogen fuel cells. Regional bodies, including the Metro Vancouver Mayors’ Council and Regional District of Central Okanagan as well as the Cities of Calgary, Ottawa, and Surrey have completed transportation visions or plans, which include research on transit-oriented community development. Research has been conducted by Hitachi Data on transit and the role of big data, and the University of California in Berkeley has studied and continues to study car sharing systems. BC Transit is participating in the creation of the Canadian Urban Transit Research & Innovations Consortium, which aims to establish Canada as a global leader in transit innovation. The City of Calgary is applying to pilot E-bus projects and both BC transit and TransLink are in the process of introducing CNG buses into their fleets. In terms of smaller communities, the Transportation Association of Canada, of which the Central Okanagan is a co-lead and sponsor, is developing a transit implementation guide for smaller communities.

**Goods Movement**

In terms of shipping, research has been completed on the electrification of port service vehicles, container ship-shore power feasibility, and the movement of goods to ports by Metro Vancouver. SFU and the City of Surrey have researched the impact of implementing CNG into refuse collection vehicles. Research on goods movement underway includes: case studies on the adoption of trucking efficiency technologies (E3 Fleet), adaptive traffic signals (City of Surrey), and fleet LCA modules for CNG/LNG applications for freight applications.
Current motor vehicle research completed includes life cycle analysis (LCA) for fleets (E3 Fleet and SimaPro) as well the development of a fleet LCA tool by SFU and the City of Surrey. Research has also been conducted on affordable low-emissions vehicles (Go Ultra Low), lightweight automotive materials (UBC), EV uptake and infrastructure in Canada (Clean Energy Canada), and reducing GHG emissions from urban travel (Transportation Association of Canada).

The EV sector is well represented in research and pilot projects that are currently underway. The Fraser Basin Council is studying the business case for EV adoption into fleets while the Columbia Basin Trust is undertaking research on building retrofits and electric vehicles. Scholars at SFU are currently researching strategies for deployment of EV charging infrastructure, the design of a zero-emissions vehicle policy for BC, consumer demand for passenger EVs, and the GHG impacts of passenger EVs. Powertech Labs is studying the impact of smart charging infrastructure on EV adoption and the BC Government and Natural Resources Canada is deploying 30 DC fast chargers across BC.

Metro Vancouver is conducting research on apartment parking as well as completing a study on car sharing in the region. There is also research both completed and underway on distance-based insurance.
DEscribing a sustainable provincial strategy for transportation

For this component of the dialogue, participants were divided into five multidisciplinary groups and asked to envision a low-emissions transportation future for the province of BC. Specifically, the activity included the following instructions,

“The year is 2025, and you are writing a promotional brochure that describes BC’s commitment to low-emissions future and the policies and projects that reflect that. You are responsible for writing the transportation section. What does it say?”

**Group 1:**

With its ongoing commitment to using the best available technology on our path to zero emissions, BC is proud of the growth of renewable electricity generation, of the sharp shift to electric vehicles, of its growing multi-modal transit network, and clear declines in consumption of fossil fuels. We remain a North American leader. Super Natural BC—it’s real.

**Group 2:**

Collaboration between industry, government, non-profits, and academia has enabled the BC transportation sector to reduce its related GHG emissions by 50% over 2007 levels, while enabling the movement of an additional one million people and 100 million tonnes of cargo; creating 100,000 jobs in fuel efficiency and alternative energy, and the energy conservation culture. We now have a $10 billion clean transport sector, 100 million tonnes more cargo; we’ve met our GHG reduction targets and we are a world leader in efficiency and clean transport, exported globally. Also, 50% of our fuel supply is locally sourced.
**Group 3:**

We have put resources into our transportation system—electrification, rail, public transit, alternative fuels, and intelligent land use policies. Freedom to move: half of all trips are by foot, bike, and transit. Carbon taxes and increased levees on fuel, parking, and auto licensing have financed the alternative transit that is available to you. It’s not just less expensive, but better. You can work, communicate with colleagues, and read and write while on transit.

**Group 4:**

The clean and green economy is thriving: Local businesses are part of the green solution. Through public transit you can see your carbon tax dollars at work. 50 by 50: 50% zero emission mode share by 2050 and 75% of public transit is zero emission by 2050. A healthy built environment and positive choices in transportation reinforce health, social, and environmental benefits in our communities.

**Group 5:**

Ability to move, freedom to breathe: Spawning sustainable transportation for global benefit. We are a world leader in clean transportation. Healthy air, active people, and livable cities.

Build independence, save energy, cut emissions, drive economic development, improve health, and create livable communities in the Best Place on Earth.
The Key to a Sustainable Provincial Strategy

Following the presentation of visions for a low-emissions transportation future, participants were asked to identify the key elements of a sustainable provincial strategy. What would it look like and what would it take?

Technology and Infrastructure

- Clean/green fuel
- Technology
- Multi-modal
- E-mobility: advanced telecommunications, point of sales systems, and apps that direct you to where bike and car sharing systems are
- Identifying waste and reduce it first
- Direction on renewables: incentives for adoption of clean energy
- Fewer trips and higher volume
- Mutually reinforcing land use strategies
- Integrating green infrastructure and recreation: green buildings can accommodate this

Economy

- Economic sustainability: next generation transit systems need to pay for themselves
- Emphasis on economic development: demonstrating that the connection and implementation of a sustainable transportation system, both rural and urban, is wealth creating
- Builds economic development: the green economy. The province should look at its indigenous strengths for export (green transportation)
- Pricing strategy for outcomes: carbon pricing or based on insurance. Some kind of mobility pricing that is attached to goods movement and transit

Policy

- Strong climate policies (alternative fuels, efficiency, vehicles–systemic approach)
- Collaboration between all levels of government
- A regional governance mechanism, like an airshed authority, with a mandate for Lower Mainland transportation
- Requirement to fully evaluate transportation projects with all externalities
- Lifecycle assessment of low emission vehicles

Building Citizen Will

- Value proposition: social, environmental, and capital
- It isn’t a sacrifice, it’s better choices: not rationing, rational
- Emphasis on better quality of life: attracting immigrants with a cleaner environment
- Regional dialogues and processes
- Link to regional: across Pacific Northwest
- Strategies to increase the adoption of new technology and the infrastructure to spur it on (EV charging for example).
- Plans, policy, and infrastructure all need better supporting programs: education, behaviour change, etc.
- Visible, sustained leadership
- A literate constituency: they need to understand this and embrace it
DEVELOPING RESEARCH TOPICS FOR PICS

The facilitator asked the participants to divide themselves into small groups, self-sorted by the following streams: Policy and Legislation, Research, Technology and Infrastructure, Training and Education, and Building Citizen Will. The participants were then asked to address the following questions and fill out a template provided (see Appendix E):

What can PICS effectively do to develop a provincial strategy that addresses air, marine, surface and personal transportation?

What are some specific projects PICS can take on?

After discussions at their tables, participants were invited to report what they had discussed. Each group provided the best project ideas they had developed to the whole group. A complete list of project ideas can be found in Appendix F.

While the participants broke for lunch, the facilitator summarized the top research ideas in each stream on a whiteboard. After lunch, she reviewed the research areas with the group, and ensured that they had been accurately captured.

Tom Pedersen explained that the prioritized ideas would be written up in a report and presented to the PICS Program Committee. From there, PICS would determine whether the research areas warranted post-doctoral fellows, internships, graduate students, and/or convening and event funding. An up to five-year research plan would be developed, and funds allocated accordingly. He emphasized that this workshop was an opportunity to elicit diverse project ideas, and that the results will guide PICS but are non-binding.

Each participant was given five dot stickers which they used to “vote” for the areas of focus they deemed most important. The research areas with the most votes were highlighted and the participants sorted them by theme.
The process converged on the following set of research priorities:

**Develop a policy research program**

Participants who put forth this idea encouraged PICS to develop a policy research plan that is intermodal, and includes cost-benefit analyses of different projects. The project would also involve a research gap analysis to find global applications that could apply to BC (e.g., mobility pricing). It would address how to translate research into policy, and focus on mobility and transportation services generally, not on individual transportation modes. The policy research plan would include considering the potential to minimize movement through innovations and strategies that encourage less mobility such as tele-commuting, mixed use development, etc. The development of a policy framework to advance low-emissions transportation choices would need to be robust, and insulated from electoral cycles (e.g. LEED standards). This plan would be informed by global research, and include a review of the advantages and disadvantages of being an early adopter, where we need to “fast forward” as a province, and where it is acceptable to be a “laggard”.

**Research into marketing approaches & developing a broader vision of lifestyle and health benefits**

This proposed project focuses on the health and lifestyle benefits of low-emissions transportation and includes four different components. They are:

1. Conduct specific market research on the transportation issue to understand citizen priorities, trade-off decisions, and values.

2. Conduct marketing research to better understand the access points to effect behavioural change, including communications channels and demographic differences. The marketing research should then be summarized to inform policy decisions.

3. Develop resources that are relevant, condensed and useable for decision-makers who are time constrained (briefing/information notes).

4. Convene strategic partnerships to build in the notion of lifestyle change, and the healthy built environment between agencies and organizations. These sessions could highlight the co-benefits of cooperation between health, climate advocacy, and research communities.

“This is a “burning issue”, and we need to know what people are thinking.”
Convene an institutional collaboration to develop curriculum on sustainable transportation

A third research idea included developing a collaborative model or working group of government, industry, non-profit, academia, and civil society players to work on three educational initiatives and to catalyze them. The three initiatives could:

1. Develop broad support through engaging children and families to create a culture of transportation knowledge; develop future scenarios for transportation infrastructure, and encourage primary and secondary students to understand “where they want to go together” and the role of transportation in quality of life. Outreach and curriculum development should be thought of generally and include Teacher’s Associations, school boards, airport/port tours, goods movement stakeholders, transit operators and others.

2. Create a leadership program: an ongoing program that engages and creates change agents for sustainable transportation infrastructure through certificates or annual events. This, like other professional communities of practice, will result in the formation of a common language and shared resources.

3. Capacity building: use the collaborative group as a platform to figure out what the capacity gaps and constraints are. Through partnerships, engage the transportation community to identify where further training and education is needed.

“The how: start with the multi-disciplinary group, work together on a piece, and then communicate it to the public and government in an accessible way.”
Quantify the economic potential

The fourth research idea, which evolved from the concept of developing a collaborative multi-sectoral partnership model, would involve quantifying the economic and social opportunities to support the clean tech industry as they relate to transportation. To affect change at the policy level, decision makers need data and an understanding of the impacts. How do we build a modeling system to define the benefits of different policy implementations? Participants suggested the foci be on the following:

1. Develop highly quantified economic (widely defined to include health benefits, lifestyle benefits, etc.) information to bolster sustainable transportation, and account for GHGs. The outcome would be a report on the net benefits.

2. Define the economic benefits from each (lower emissions) transportation sector.

3. Using the collaborative working group to communicate the benefits to stakeholders and the government.

After allowing the small groups to refine the research focus areas, the facilitator asked the larger group what might be missing from the discussion. One participant noted that there was very little talk of “direct action opportunities”, that is, ensuring that PICS includes in their mandate the ability to support growth in low-carbon transportation technologies through purchasing or other means. Another said, “Canadians usually do the right thing when other people are watching” and suggested this work should be globally connected, and bring in international participants for a conference to encourage “global eyes on us.” Yet another participant decried the absence of federal and provincial government participation, “so much depends on senior government leadership, we need engagement and outreach of those levels.” Another participant pointed out that the group should be considering the impact on mobility through trends such as telecommuting or the autonomous car. Lastly, a participant encouraged PICS to pay attention to failures, and be open to research on why something doesn’t work.
### FINAL ROUND

Participants were asked to offer one piece of advice to PICS as they develop a five-year research agenda on low-emissions transportation.

| **Organization and Outcomes** | • Three years from now, what is the one practical, tangible outcome of this dialogue, what is the policy or technology change?  
• Report back on the quick starts: things that can happen immediately  
• Apply the square/multi-disciplinary model to ensure that academics are solving the right problems |
| **Resources** | • Don’t miss out on using our natural resources and beautiful environment to our advantage  
• Come up with a reinvention of fire  
• Remember that transportation that uses energy is a means to an end, it’s not the end |
| **Partnerships and Engagement** | • PICS should identify a small number of key partners—who aren’t in this room—to help out with this work: the industry associations, NGOs, groups we haven’t thought of  
• Strategically leveraging the right partners for system wide change, and other entities across Canada working in that space, part of that is the collaborative and convening function  
• Create a stakeholder feedback loop for PICS  
• Broad, visible engagement to discuss our various transportation futures at all levels (senior levels of government as well as communities)  
• Solutions: apply tangible and quick solutions. Get it out on the ground. We’re not paying attention to some really great stakeholders out there—accountants, bricklayers, how do we engage them?  
• Build ongoing strategic partnerships. Create a balance between the big picture pieces with the specifics (mode specific technologies and research)  
• Engagement of the existing and current decision makers—you need to talk to them and consider the electoral cycle |
| Research | • Identify the opportunities, quantify the benefits, communicate clearly  
|          | • Quantification and solutions—specifically emissions reductions. Underpin linkages across all the areas of policy interests—social/environmental  
|          | • Conduct research that quantifies the benefits, particularly health, which is a big budget item. Identify and quantify the synergies between policy/health/transportation/climate  
|          | • Transportation should be a sexy and appealing topic, connect it to the research objectives and policy needs  
|          | • The future of transportation should be seen as an integrated mobility and land use issue. Better data leads to better models |
| Communications | • Find an artist: you need someone who can transcend political/government/industry and find a connection that is much broader: This is how the railway was developed in Canada, an image and a narrative  
|          | • Reduce our reliance on burning fossil fuels—communicate that we’re not changing lifestyles, but making life better |
| Policy | • Focus on real policy choices that stakeholders are facing that have high and broad impact  
|        | • More informed provincial/federal/city leadership to act with more wisdom on transportation  
|        | • We know what we need to do, we’ve known it for decades. There needs to be pragmatic, coordinated implementation plans. It’s not “what do we need to do,” it’s “how do we do it?”  
|        | • Strong, effective climate policy |
SUMMARY OF PRIORITIES, NEXT STEPS, AND CLOSING

Walter Mérida said that the day’s session made loud and clear to him the need for communication, “Linking our narrative and aligning with health.” He also cited that a multidisciplinary model could help guide the work. Mérida observed:

“If we cannot solve the problems in our own backyard, then it’s very difficult for us to show the world that we are leaders in anything.”

Using UBC as an example, which hit its Kyoto targets and will eliminate 100% of its greenhouse gas emissions by 2050, Mérida described the challenge as a tremendous opportunity to create solutions.

Pedersen summarized PICS’ goals and the challenges of reducing greenhouse gas emissions. He admitted that he thought that technology would be the predominant topic of discussion at the dialogue, and didn’t anticipate the primary focus on policy:

“We’re at a different point in our society where we aren’t grappling with technological solutions. They already exist. We need now to find and encourage political will to put them into practice.”

Pedersen described his engagement with the public on climate change issues. He noted that the 8% of the population that is represented at PICS’ events and read the newsletters, understands the issue and supports the solutions. But the question remains: How do we reach and engage the remaining 92% of the population given that the political domain responds to public pressure? Without political support for low-emissions transportation policy, the targets will not be reached. Pedersen stated that it’s everyone’s responsibility to reach out to the 92% and that we need to take the 27 million tonnes of annual transportation related GHGs and “ratchet them down.”

“I would like to be able to come here in three years and say it’s now 22 million tonnes,” he said, “I don’t know if that’s achievable, but that’s what I’d like to see.”

Once the final report is complete, the PICS team will consider how to best integrate participant suggestions into its research agenda. The research program should be finalized by the end of November, 2014.
APPENDIX – CARBON TALKS’ TERMS OF ENGAGEMENT

1. Chatham House Rule: “participants are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed.”

2. The focus is on dialogue not debate.

3. Hats off: Each participant is here as an individual and is not speaking on behalf of their business or organization.

4. Step up or step back.

5. Cell phones off (or muted).

6. Open Source: The information will be recorded and presented in a report that participants will review. Following the review the report will be available publicly and registered under the Creative Commons.
APPENDIX B – AGENDA

Transportation Futures for BC
Djavad Mowafaghian World Art Centre
SFU Woodwards, 149 West Hastings, Vancouver, BC
September 11, 2014

8:45am  Welcome and Context-setting (Walter Mérida and Tom Pedersen)
8:50am  Agenda Overview, Carbon Talks Terms of Engagement (Shauna Sylvester)
8:55am  Roundtable: Hopes and concerns
9:15am  Session #1: Impetus for a provincial strategy for low-emissions transportation
9:45am  Session #2: Mapping of current work on low-emissions transportation in BC
10:15am Refreshment Break
10:35am Session #3: Elements of a sustainable provincial strategy for transportation
11:05am Session #4: Small Groups – PICS’ role in developing a strategy
12:15pm Lunch
1:00pm  Session #5: Presentation of the ideas matrix (Shauna)
1:15pm  Session #6: Small groups – Identifying top 5 ideas
2:00pm  Session #7: Priority Setting – Dotmocracy
2:45pm  Summary of Priorities and Next Steps (Walter Mérida)
3:00pm  Final Round
3:20pm  Closing (Tom Pedersen)
3:30pm  Adjourn
## APPENDIX C – DRIVERS AND TRENDS

<table>
<thead>
<tr>
<th>Driver</th>
<th>Trend</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Economic</strong></td>
<td>- Carbon tax: political will in BC</td>
<td>- Resilient infrastructure to cope with climate change</td>
</tr>
<tr>
<td></td>
<td>- Combining health and climate change: rising health care costs as a driver</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Long term versus short term investment in a carbon free future</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Demand for trade, which depends on transportation (domestic and international)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Domestic vs. national energy imports/exports</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 20% of household income in BC spent on transportation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Investing in invisible systems with no perceived public gain</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Economic competition (globally, talent and business retention)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- The impact of an aging population on mobility</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Linking health, aging population, social change to transportation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Faster increases in carbon pricing</td>
<td></td>
</tr>
<tr>
<td><strong>Social</strong></td>
<td>- Making “green” cool: hybrids and EVs are a desirable product</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Health concerns around poor air quality in the Fraser Valley</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Balance between need for mobility and economic development (investment in major infrastructure and quality of life/environment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Transit is a great social mixer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Cyber commuting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Car sharing and the sharing economy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Population growth</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Affordability and equity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Youth are trending away from driving and car ownership</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Youth are trending away from larger, expensive housing (impact on land use planning)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Thinking about average household savings from reduced car use</td>
<td></td>
</tr>
<tr>
<td>Environmental</td>
<td>Driver</td>
<td>Trend</td>
</tr>
<tr>
<td>---------------</td>
<td>--------</td>
<td>-------</td>
</tr>
</tbody>
</table>
| - Demand for port transportation services (beyond the region)  
- Regulations set elsewhere affect technology options here: emissions and supply chain standards  
- Regional and provincial air emissions targets  
- Land pressures within Lower Mainland and movement within the region  
- Willingness of people to make long term investments  
- Canada’s reputation: we are an environmental/climate laggard | - Emissions standards  
- Pacific Coast Action Plan  
- Air quality: demand outside of the region for clean technology (for example, air quality decisions in China are driving local investment/innovation)  
- California and Texas linking environmental rankings and requirements for federal funding for transportation projects (no longer GHG requirements in Canada for federal funding)  
- In Europe there is lifecycle analysis of technology and equipment: BC Transit is not required to do this when purchasing—need more regulatory guidance to leverage funding on the supply side | - We are often following trends elsewhere (reactive and not proactive)  
- Difficulty making risky investments in environmental transportation options  
- Rail versus truck transport issues and how they are regulated |
<table>
<thead>
<tr>
<th>Political</th>
<th>Driver</th>
<th>Trend</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Air quality</td>
<td>- Political schizophrenia in terms of making transportation investment decisions (referendum for transit, but not for bridges)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Leadership commitment</td>
<td>- Bottom up (sub-national) approaches are gaining momentum: local and municipal governments are inspiring provinces to think about national energy strategy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Economic costs of inaction</td>
<td>- Climate migrant influx</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Local governments lack autonomy to plan and deliver transportation services</td>
<td>- Discussion on climate action moving beyond partisan politics in the province</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Political realities require more emphasis on jobs/economic side of benefits of transportation</td>
<td>- Bundling economic, social, and environmental benefits when communicating transportation investment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>investment: Linking transit to jobs and the economy</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Need to communicate climate impacts through effects on people’s lives</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cultural</td>
<td>- Unwillingness to be taxed affects policy and investment</td>
<td>- Increased awareness and interest in health, environment, and technology</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Cultural heterogeneity impacts transportation</td>
<td>- Healthy lifestyles are becoming more popular</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Openness to sharing (space/financial)</td>
<td>- Acceptance of public transit and other low-carbon practices</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Lower number of young people driving</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Public approval needed for transit investment (referendum)</td>
<td></td>
</tr>
</tbody>
</table>
## APPENDIX D – MAP OF COMPLETED AND CURRENT RESEARCH

<table>
<thead>
<tr>
<th>Completed</th>
<th>Current</th>
<th>Needed*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Active</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• What route types motivate cycling? Evidence about route preferences &amp; safety – Kay Teschke</td>
<td>• Counter data: Bikes, vehicles (comparisons before and after bike lanes) – City of Vancouver</td>
<td>• What are all of the pathways by which transportation/mobility impact health?</td>
</tr>
<tr>
<td>• Cycling in Cities Bike Safety Study – University of British Columbia</td>
<td>• Vancouver Separated Bike Lane Business Impact Study – Stantec Consulting Ltd.</td>
<td></td>
</tr>
<tr>
<td>• Cycling infrastructure, bike share, lanes – several Simon Fraser University, Masters of Urban Studies students</td>
<td>• Bicycle counter program-data collection devices along strategic corridors in the downtown area to monitor pedestrian and cyclist use coming into and leaving the downtown core – City of Kelowna</td>
<td></td>
</tr>
<tr>
<td>• Zero Emission Fuel Cell Scooter – Intelligent Energy</td>
<td>• Pedestrian and Bike Master Plan (should be completed in 2015) – City of Kelowna</td>
<td></td>
</tr>
<tr>
<td>• Transportation 2040 Pedestrian Safety Study – City of Vancouver</td>
<td>• Pedestrian and Bike Master Plan (2014 final draft pending approval) – District of West Kelowna</td>
<td></td>
</tr>
<tr>
<td>• Transportation demand management strategies for small/medium communities – Fraser Basin Council</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Larry Frank: link between infrastructure and travel choice, health and social connectedness – Comox Greenway</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 2011 Trip diary survey for Metro Vancouver – TransLink</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• SmartTRIPS neighborhood trip planning pilot program (2012/13) – Central Okanagan</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: needed research focus areas were addressed throughout the day, this is not comprehensive.*
<table>
<thead>
<tr>
<th>Completed</th>
<th>Current</th>
<th>Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transit</td>
<td>• Role of big data in transit usership – Information Technology and Innovation Foundation (Robert David Atkinson); Hitachi Data Systems (Umeshwar Dayal); RideScout (Joseph Kopser) • Transit-land use patterns – several Simon Fraser University, Masters of Urban Studies students • Transit-oriented community planning – City of Calgary; East Clayton Transit Oriented Area Plan – City of Surrey; Ottawa’s Light Rail Transit (LRT) – City of Ottawa • Future planning process for local government and communities – BC Transit: <a href="http://www.bctransit.com/transitfuture/default.cfm">http://www.bctransit.com/transitfuture/default.cfm</a> • Transportation Sustainability Research Center (Carsharing.org/research) – Dr. Susan Shaheen, University of California Berkeley • STPCO Regional Strategic Transportation Plan (Phase 1) 2014 – Central Okanagan • Outcomes analysis (including VKT and sustainable mode share) for Mayors’ Council 10-year regional transportation vision for Metro Vancouver – Translink</td>
<td>• High capacity bus (80” e-bus) • E-bus projects – applications – City of Calgary • Fleet LCA modules for transit buses – Simon Fraser University • Introduction of its first CNG bus fleets: Nanaimo Transit in March 2014, Kamloops scheduled for 2015 – BC Transit: <a href="http://www.bctransit.com/transitfuture/cng_latestupdates.cfm">http://www.bctransit.com/transitfuture/cng_latestupdates.cfm</a> • STPCO Regional Strategic Transportation Plan (Phase 2) – pending funding – Central Okanagan • Transit Vision 2040 with many templates developed or in the development stage – Canadian Urban Transit: <a href="http://www.cutaactu.ca/en/public-transit/publicationsandresearch/vision_2040.asp">http://www.cutaactu.ca/en/public-transit/publicationsandresearch/vision_2040.asp</a> • Design and Implementation of Transit Services: Guidelines for Smaller Communities by the Transportation Association of Canada – Central Okanagan (sponsor and co-lead)</td>
</tr>
<tr>
<td>Completed</td>
<td>Current</td>
<td>Needed</td>
</tr>
<tr>
<td>-----------</td>
<td>---------</td>
<td>--------</td>
</tr>
</tbody>
</table>
| Transit  | • Operation of 20 hydrogen fuel cell buses in Whistler along with hydrogen fueling infrastructure 2010-2014  
• Low and no emission vehicle technologies: Go Ultra Low, hybrid electric and fuel electric transit – City of Edmonton  
• New battery technology for EVs (V2G for interconnection between transportation sector and residential)  
• Hydrogen fuel cell vehicles – sustainable H₂ production in BC & Canada, thermochemical H₂, NG H₂ production, electrolysis H₂  
• Next generation low-cost, durable fuel cells for transit buses – Simon Fraser University, University of Victoria, Ballard Power Systems  
• Whistler Transit, operation of 20 hydrogen fuel cell buses in Resort Municipality of Whistler along with hydrogen fueling infrastructure 2012-2014 – BC Transit  
• Third party analysis of BC Transit fuel cell bus operations undertaken – US DoE National Renewable Energy Laboratory:  
• Fraser Basin Council / FleetCarma / BC Transit non-revenue vehicle fleet EV suitability assessment | • BC Transit participation in efforts to create the Canadian Urban Transit Research & Innovations Consortium (CUTRIC). CUTRIC has been established as a not-for-profit Research Centre for the Canadian Transit industry. The vision behind CUTRIC came from Canadian Urban Transit Association (CUTA) members, to make Canada the global leader in innovative, cutting-edge manufacturing and innovation in integrated mobility - from vehicles to communications systems to software - and to achieve this by promoting greater partnerships between industry, academia and policy |
## Motor vehicles

- Existing electric vehicle policy in Canada – Clean Energy Canada
- Affordable low emission vehicles – Go Ultra Low
- Lightweight materials for automotive – UBC Material Labs
- EV uptake rates in Canada and globally over the last 5 years – Clean Energy Canada
- 500+ level 2 charging stations across BC – BC Government and Natural Resources Canada
- LCA of different vehicles – E3 Fleet
- In-house LCA fleet – SimaPro LCA software
- Fleet LCA tool (assesses integration of emerging, low-emission vehicles into fleets) – Simon Fraser University, City of Surrey
- Fleet LCA case study on CNG powered pickup trucks – Simon Fraser University, City of Surrey
- CNG and LNG on and off engine technologies for passenger vehicles, buses, trucks, marine & rail

## Current

- Apartment parking study, 2012 – Metro Vancouver
- Transportation map of the month (driver’s license rates in Metro Van., truck traffic, RGS designations & GM infrastructure) – Metro Vancouver
- Distance-based vehicle insurance – Victoria Transportation Policy Institute
- The Metro Vancouver Car Share Study – Metro Vancouver
- Design of a zero-emissions vehicle policy for BC (copying California) – Simon Fraser University, Jonn Axsen
- Municipal fleet benchmark report – E3 fleet program (e3fleet.com)
- Vehicle origin-destination survey deploying cellular data capture – City of Surrey
- Energy System impacts of vehicle technology and fuel choices
- Energy in the Columbia Basin: building retrofits and electrification of vehicles – Columbia Basin Trust
- Strategies for effective deployment of electric vehicle charging infrastructure – Simon Fraser University, Jonn Axsen

## Needed

- Driverless cars
- New powertrains
- Zero emissions
- Impact of EVs into the grid
- CO2 benefits of EVs in BC
- Renewables integration & EVs (wind in BC, solar)
<table>
<thead>
<tr>
<th>Completed</th>
<th>Current</th>
<th>Needed</th>
</tr>
</thead>
</table>
| Motor vehicles | • Deployment of 30 DC fast chargers across BC – BC Hydro (funded by BC Government and Natural Resources Canada)  
• GHG impacts of passenger EVs in BC (connecting to renewable electricity) – Simon Fraser University, Jonn Axsen  
• EV charging in stratas – CMOA – pluginbc.ca  
• EV primer: EV charging best practices – community energy.bc.ca  
• Business case for EV adoption in fleets in BC – Fraser Basin Council – plugin.bc.ca  
• Consumer demand for passenger electric vehicles (PHEVs/EVs) in BC – Simon Fraser University, Axsen  
• Smart charging infrastructure on impact of EV adoption – Mark Dubois, Director of Smart Utility Services at Powertech Labs Inc.  
• EV – Renewables integration into BC grid with consumer models around vehicle purchase and charging  
• Advanced options for Fleet LCA tool for integration of low-emission vehicles into fleet operations – Simon Fraser University, City of Surrey  
• Moving Smarter Project on leading practices for reducing GHG emissions from urban travel in Canada – Transportation Association of Canada |
<table>
<thead>
<tr>
<th>Completed</th>
<th>Current</th>
<th>Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goods movement</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Cargo handling equipment; rubber tire gantry crane, hybrid battery &amp; electrification study (feasibility)</td>
<td>• Rubber tire gantry crane natural gas feasibility study</td>
<td>• Business case study for electrification of all goods movement</td>
</tr>
<tr>
<td>• Container vessel share power feasibility study and terminal shore power feasibility study – Sandia National Laboratories, Joe Pratt</td>
<td>• Case studies on adoption of trucking efficiency technologies – E3fleet.com</td>
<td></td>
</tr>
<tr>
<td>• Moving goods through marine ports in Metro Vancouver – 2013, Metro Vancouver</td>
<td>• Adaptive traffic signal application on arterials corridor to improve coordination, operation and minimize delay – City of Surrey</td>
<td></td>
</tr>
<tr>
<td>• Fleet LCA case study on CNG powered refuse collection vehicles – Simon Fraser University, City of Surrey</td>
<td>• Plug-in hybrid drivetrain optimization and control</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Fleet LCA modules for CNG and LNG use in freight applications – Simon Fraser University</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Aurora Testbed (wireless technologies for freight security and efficiency) – University of British Columbia</td>
<td></td>
</tr>
<tr>
<td>Completed</td>
<td>Current</td>
<td>Needed</td>
</tr>
<tr>
<td>-----------</td>
<td>---------</td>
<td>--------</td>
</tr>
</tbody>
</table>
| **Fuel and Energy** | • Social/cultural/political acceptance of unconventional fossil fuels (e.g., oil sands, shale gas) – Simon Fraser University, Jonn Axsen  
• “Hype” and alternative fuels – comparing media coverage of biofuels/BUs/FCUs – Simon Fraser University, Jonn Axsen  
• Design of the low-carbon fuel standard for BC – Simon Fraser University, Jonn Axsen  
• Biofuels – research from VOLPE, Washington State  
• “Community Energy Planning – Getting to Implementation in Canada” – CEA & QUEST  
• Community Energy and Emission Planning Research Summary 2013 | • Market analysis of district energy viability in city centre development – City of Surrey  
• Local natural gas storage and distribution – University of British Columbia, Mechanical Engineering  
• Carbon sequestration – thermochemical, materials/geochemistry  
• Fuel cells and hydrogen research – Clean energy research center – UBC  
• Fuel from biomass – University of British Columbia, Chemical and Biological Engineering  
• Fuel cell manufacturing and durability – Simon Fraser University, Fuel Cell Research Lab | • Energy storage  
• Rural BC – what does the low-carbon transportation transition look like for these communities?  
• Economic benefits and jobs associated with transportation in BC – transition to low-carbon > export opportunity, competitiveness assessment, industry growth  
• Policy to meet Pacific Coast Action Plan > economic and social analysis |
<table>
<thead>
<tr>
<th>Completed</th>
<th>Current</th>
<th>Needed</th>
</tr>
</thead>
</table>
| **Air**   | • 2014 Clean Air Strategy (pending approval) – Central Okanagan  
• Many research projects completed through the Transportation Research Board’s Airports Council Research Panel on environment (mostly US-funded)  
• Transport Canada led Action Plan for Aviation Emissions – current research across different sectors – academic, government, industry related to aircraft use, biofuels, etc.  
• Composite materials airplane design – Airbus  
• Emissions inventory refinement & ties to noise impact of aircraft – FAA’s AEDT development (aircraft emissions dispersion tool) | • Ongoing: efficiency improvements to aircraft design & procedures for operation  
• H2 refueling at YVR  
• MIT’s Partnership for Air Transportation Noise and Emissions Reduction: http://partner.mit.edu/projects | • Spatiotemporal Variation of PM2.5 in the Central Okanagan Region: Implications to Continuous Monitoring Planning and Analysis—may be possible by 2015 |
| **Marine** | • Fuel efficient ships – Royal Institution of Naval Architects - Influence of Energy Efficient Design Index on Ship Design | • Hybrid ferries – Caledonian Maritime Assets Lt. (CMAL); MV Hyak Hybrid Project, Washington; MV Hallaig Hybrid Ferry, Scotland  
• Ongoing: Marinisation of existing shore-based technologies (reliquefaction, waste disposal)  
• Impacts on marine ecosystems – DFO, University of British Columbia  
• Adoption of environmental technologies and innovations in the port industry – Simon Fraser University  
• Fleet LCA modules for ships – Simon Fraser University |
<table>
<thead>
<tr>
<th>Completed</th>
<th>Current</th>
<th>Needed</th>
</tr>
</thead>
</table>
| Land Use                                                                  | • Impact of built environment on VKT, auto ownership, GHGs at neighbourhood level in Metro Vancouver – Translink  
• Impact of built environment characteristics on sustainable mode share around rapid transit stations and corridors in Metro Vancouver (Arup report)  
• TransLink Transit-Oriented Communities Design Guidelines  
• 2014 Clean Air Strategy (pending approval) - Central Okanagan | • Conflicts between municipalities/communities and port-logistics industry – Simon Fraser University  
• Port governance and decision-making – Simon Fraser University  
• Perceptions and use of waterfront land and its role in the economy – Simon Fraser University  
• South of Fraser market analysis of land value capture: pros and cons (in context to impacts on rapid transit corridor development rate) – City of Surrey  
• Housing/transportation cost burden – Metro Vancouver  
• Regional green infrastructure network – Metro Vancouver, Diamond Head Consulting ltd  
• Integration of GHG emissions and health impacts from the urban form  
• Economic/societal sustainability impacts – Sauder/ISIS  
• Land use planning: Best practices in adaptation – Metro Vancouver  
• Regional land use implications of port and logistics development – Simon Fraser University | • Impacts of building technology on GHG emissions and energy  
• Application of evidence on urban form to GHG emissions throughout scenario planning tools  
• Effect of land use & transport investments on per capita GHG emissions |
# APPENDIX E – TRANSPORTATION FUTURES IDEAS MATRIX

<table>
<thead>
<tr>
<th>Transportation Future Ideas Matrix</th>
<th>Technology &amp; Infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active transportation</td>
<td></td>
</tr>
<tr>
<td>Transit</td>
<td>• Higher density vehicles- double decker buses</td>
</tr>
<tr>
<td>Motor vehicles</td>
<td>• Quantify barriers/opportunities for hybrid hydrogen-electric vehicles</td>
</tr>
<tr>
<td>Goods movement</td>
<td></td>
</tr>
<tr>
<td>Personal</td>
<td>• Electrifying the fleet quantity size of the opportunity</td>
</tr>
<tr>
<td>Air</td>
<td>• Ways to reduce numbers of trips</td>
</tr>
<tr>
<td>Marine</td>
<td>• Port electrification - 50%</td>
</tr>
<tr>
<td>Rail</td>
<td>• Hybrid systems</td>
</tr>
<tr>
<td>Land use</td>
<td></td>
</tr>
<tr>
<td>Specific project ideas for PICS</td>
<td>• Use what we have better- under-utilized infrastructure</td>
</tr>
<tr>
<td></td>
<td>• Update ‘2005 study’ and ‘BC Clean Energy Action Plan’</td>
</tr>
<tr>
<td></td>
<td>• Education</td>
</tr>
<tr>
<td></td>
<td>o Survey best practices &amp; promote constituencies:</td>
</tr>
<tr>
<td></td>
<td>- Build a business case that will engage</td>
</tr>
<tr>
<td></td>
<td>- Research needs to include practitioners directly (practitioners will take results back into their communities)</td>
</tr>
<tr>
<td></td>
<td>• Use pilot programs</td>
</tr>
<tr>
<td></td>
<td>o Explore what marketing approaches work with citizenry</td>
</tr>
<tr>
<td></td>
<td>- Identify successes</td>
</tr>
<tr>
<td></td>
<td>- Can green pride be tapped?</td>
</tr>
<tr>
<td></td>
<td>o Focus on the younger generation</td>
</tr>
<tr>
<td></td>
<td>o Conduct research on affordability of electric vehicles (comparative with other jurisdictions)</td>
</tr>
<tr>
<td></td>
<td>o PICS needs to be an honest broker</td>
</tr>
<tr>
<td></td>
<td>o Health is a key word</td>
</tr>
<tr>
<td></td>
<td>- Use this with its budgetary implications for BC as a linking concept</td>
</tr>
<tr>
<td></td>
<td>o Research at a deeper level on economic implications</td>
</tr>
<tr>
<td></td>
<td>- Health</td>
</tr>
<tr>
<td></td>
<td>- Energy costs</td>
</tr>
<tr>
<td></td>
<td>- Employment creation</td>
</tr>
<tr>
<td></td>
<td>- Return on investment – quantitative</td>
</tr>
<tr>
<td></td>
<td>- Opportunities to help constituents reduce their transportation/mobility costs</td>
</tr>
<tr>
<td></td>
<td>• Communication/outreach-</td>
</tr>
<tr>
<td></td>
<td>o PICS should/could meet with... e.g. B.C Trucking Association</td>
</tr>
<tr>
<td></td>
<td>o Make it personal- stories work</td>
</tr>
<tr>
<td>Transportation Future Ideas Matrix</td>
<td>Policy &amp; Legislation</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>----------------------</td>
</tr>
</tbody>
</table>
| **Active transportation**         | • Cost benefit- walking and cycling.  
• Reason to invest- social and environment (communicate with politicians).  
• Biking- criteria as mode of transportation  
  o Not just recreate suburban governance  
  o Audience- goals and targets  
• Bang for buck analysis- where to spend first dollar?  
• Clean air- safe routes to get to school program  
  o Walking & biking  

**Cross-cutting**  
• Carbon tax- price increases/ revenue neutral? |
| **Transit**                        | • Costs of not investing in transit  
• Comparison to real life equivalency  
• Investigate different models for BC Transit- institutional  

**Cross-cutting**  
• Communications- make issues real  
• How to communicate carbon  
• Messaging resonates on clean transport |
| **Motor vehicles**                 | • Car share relationship- between transit + car share  
• Distance based funding  
• Tipping points-  
  o Electric vehicles  
  o How much government funding- to the tipping point  
  o Other technologies  
• Automated vehicles + impacts  
• Policies that support economic development in transportation  
• New mobility services > equity  

**Cross-cutting**  
• PCC- policies- what are the policy options to meet the commitments  
• Other jurisdictions- speakers  
• Policy scan annually- source on potential impacts |
| **Goods movement**                 | • Automation in goods movement  
• Change- policy work, labour  
• Impact for global carbon pricing on exports  
  o Coal, oil, natural gas  
• Investment policy  
• Re-investment |
<table>
<thead>
<tr>
<th>Transportation Future Ideas Matrix</th>
<th>Policy &amp; Legislation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal</td>
<td>• See Motor Vehicles</td>
</tr>
<tr>
<td>Air</td>
<td>• Update ‘Airshade’ plans through the province to support local programs</td>
</tr>
</tbody>
</table>

*Cross-cutting*

• Analysis policy incentives to meet Metro Vancouver growth strategies – what are the price signals and role for policy?

| Marine                           | • On-shore- hook-ups? |
|                                  | • How to address concerns? |

*Cross-cutting*

• Neighborhood- PM data - Central Okanagan

| Rail                             | • Cost/ Benefit-  
|                                  | o Electrification of rail  
|                                  | o High-speed rail corridor – Portland/ Vancouver/ Seattle  
|                                  | o Truck to rail cost- benefit + policy role  

*Cross-cutting*

• Policy to support clean transport in economic sector

| Land use                         | • Integration land-use transportation- what if we don’t invest in policy to support? |

| Specific project ideas for PICS  | 1. Cost/ benefit for investing in walking + cycling with briefing for politicians |
|                                  | 2. Cost no-investing in transit with communications for public  
|                                  | a. High turn-around  
|                                  | 3. Policies + economic analysis for Pacific Coast Climate Action Plan  
|                                  | 4. Relationship between transit + car share? - cost/benefit  
|                                  | 5. Policies to support clean transport economic sector  
|                                  | 6. Cost/benefit electrification rail + high speed connection  
|                                  | 7. Cost of not doing  
|                                  | a. Transit  
|                                  | b. Low-carbon transportation  
|                                  | c. Infrastructure  
|                                  | 8. Annual globe policy scan- briefing for government/speakers  
<p>|                                  | 9. Tipping point to support market |</p>
<table>
<thead>
<tr>
<th>Transportation Future Ideas Matrix</th>
<th>Training &amp; Education I</th>
</tr>
</thead>
</table>
| **Active transportation**         | • Mobility training, not driver training  
|                                   | • Different topics for different ages  
|                                   | o Elementary = safe schools- walk/bike/carpool  
|                                   | • Develop union interests in new technologies (cross-sector)  
|                                   | • Create structure  
|                                   | o Awareness for employers as a group  
|                                   | o Building learning in organization – support through culture  
|                                   | o Culture of learning through business sector- not academia  
|                                   | o Exploration & evaluation of program effectiveness  
|                                   | o Supported by planning, awareness, infrastructure  
|                                   | • Under invest in BC  
|                                   | o People with training will come to us  
|                                   | o Little incentive to keep best people  
|                                   | o Assess value of exporting knowledge |
| **Transit**                       | • See Active Transportation |
| **Motor vehicles**                | • See Active Transportation |
| **Goods movement**                |                         |
| **Personal**                      |                         |
| **Air**                           |                         |
| **Marine**                        |                         |
| **Rail**                          |                         |
| **Land use**                      | • Need sidewalks- sidewalks get you to schools |
| **Specific project ideas for PICS** | • Certification/ qualifications of professionals, example: health professionals, LEED  
|                                   | • Change area/ target resources at high school age  
|                                   | • Go beyond driver education to mobility education  
|                                   | • Research on strategies  
|                                   | • Integrate programs  
|                                   | • Leadership model for ESL in B.C- how can this work for climate/transport (common language[curriculum])  
|                                   | • Build B.C expertise + market as a hot bed for research- Education <-> Industry  
|                                   | • Become leader in partnership development  
|                                   | o Inter-disciplinary/ inter-sector  
|                                   | • PICS could fund leadership, inter-sector/disciplinary barriers  
|                                   | o Examples: City of Vancouver- greenest city action plan, scholars, Washington state biofuel |
| **Notes**                         | 1. Different audiences- general public, specialists/professionals, politicians/decision makers, legislators (grouped by audience, not by sectors)  
|                                   | 2. Transportation ties to economic engine  
|                                   | 3. Professional development is silo’d  
<p>|                                   | 4. Transportation has health impact |</p>
<table>
<thead>
<tr>
<th>Transportation Future Ideas Matrix</th>
<th>Training &amp; Education II</th>
</tr>
</thead>
<tbody>
<tr>
<td>General ideas for all areas of Transportation</td>
<td>• Means to achieve a communication strategy + policies on low-emission transport</td>
</tr>
<tr>
<td></td>
<td>• Political will, capacity, and progress for sustainable transport sector</td>
</tr>
<tr>
<td></td>
<td>o Collaboration between academic institution, industry, and government institutions</td>
</tr>
<tr>
<td></td>
<td>o Interdisciplinary and inter-sectorial culture of learning</td>
</tr>
<tr>
<td></td>
<td>o Importance of leadership and compelling vision</td>
</tr>
<tr>
<td></td>
<td>o Demonstration by actions</td>
</tr>
<tr>
<td></td>
<td>- Wisdom, judgment, knowledge, understanding, awareness</td>
</tr>
<tr>
<td></td>
<td>• Training and education:</td>
</tr>
<tr>
<td></td>
<td>A. General public- K-10++, ESL</td>
</tr>
<tr>
<td></td>
<td>B. Professionals and practitioners- trades+ labour, envision ISI++, LNG</td>
</tr>
<tr>
<td></td>
<td>C. Policy makers and politicians- policy tool kits, prof dw</td>
</tr>
<tr>
<td></td>
<td>Examples:</td>
</tr>
<tr>
<td></td>
<td>o LEED</td>
</tr>
<tr>
<td></td>
<td>o Recognition of expertise on low emission transport</td>
</tr>
<tr>
<td></td>
<td>o Take a leave from waste reduction campaign + programs</td>
</tr>
<tr>
<td></td>
<td>• Policies need to applied across the fullest spectrum of transport</td>
</tr>
<tr>
<td></td>
<td>• Influence labour/unions to effect change</td>
</tr>
<tr>
<td></td>
<td>• Identify the ‘groups’ that will have influence on changes across all modes</td>
</tr>
<tr>
<td></td>
<td>o Target training + educational programming to achieve a desired end</td>
</tr>
<tr>
<td></td>
<td>o Better awareness + buy-in to a low-emission future</td>
</tr>
<tr>
<td></td>
<td>• Reductionism?</td>
</tr>
<tr>
<td></td>
<td>o Sector Council: labour/industry/education</td>
</tr>
<tr>
<td></td>
<td>o Industry clusters: cooperation</td>
</tr>
<tr>
<td></td>
<td>• The need to cross-train across modes/sectors</td>
</tr>
<tr>
<td>Specific project ideas for PICS</td>
<td>• Inter-disciplinary/ inter-sector- need to overcome barriers</td>
</tr>
<tr>
<td></td>
<td>• Training for leadership</td>
</tr>
<tr>
<td></td>
<td>• Targeting newcomers- visitors to this region</td>
</tr>
<tr>
<td></td>
<td>o So they become sensitized on sustainable transportation + best practices</td>
</tr>
</tbody>
</table>

**Note:** the Building Political Will group did not submit a paper template
APPENDIX F – PRELIMINARY RESEARCH
PROJECT IDEAS

Tech and Infrastructure

- Research whether the transport sector could be supported by hydro. What could the current grid support from an electrification of various modes of transport?
- Develop a vision document that quantifies the economic opportunity to support the clean tech industry in BC. This document could help develop the political impetus and show how we can leverage the sector. The Energy Plan and Climate Action Strategy could serve as guides. There is currently little support for startups—how do we create an enabling environment for cleantech? We need research devoted to quantifying that opportunity and acknowledging what we already have.
- Conduct a study to quantify the transportation infrastructure we may be under-utilizing and investigate how to use it better.
- Consider the development of industry clusters – transportation could benefit from a more cohesive industry cluster.
- Use Plug In BC (a multi-sector forum that met regularly to talk about what projects made sense, and sought funding for electric vehicles) as a model to help guide some of the low-emissions transportation efforts. Create steering committees or working groups to help guide the direction the projects take.
- Review standards—a multi-sectoral working group could become an advocate for work on standardization.

Research

Rather than specific project ideas, the group focused on research had a few key suggestions about the directions PICS should take. They advised beginning with policy design, rather than specific transportation nodes. Policy objectives such as reducing total journeys, increasing the uptake of alternative fuels, and efficiency gains, should be integrated. How are these indicators measured and tracked over time? Technology development should be holistic and policy should be the driver of technology research.

Policy

- Develop cost-benefit analyses for low-carbon transportation modes such as high speed rail connections, walking/cycling. Ensure that the information is available for government, and an accessible format (briefing notes, etc.). Partner with groups that can help deliver the findings.
- Develop the policies needed to achieve the commitments laid out in the Pacific Coast Action Plan on Climate and Energy.
- Conduct a global scan of clean transportation policies, target it to BC and what leaders in BC need to know about what’s happening in the rest of the world.
- Research the phenomena of tipping points. What is the role of government policy in supporting clean transportation technology and in kicking off new tech such as EVs? When should government support an industry, when should it call it quits, and what is the right level of support?
Building Citizen Will

- Conduct the economic analysis–PICS as an honest broker.
- Research best practices in marketing approaches for low-emissions transportation uptake around the world. Understanding the constituencies and what people want. Understanding the drivers and what could make a change. Make it personal–how this is going to affect you as an individual? “Engage. Experiment. Fail Forward.”
- Develop a broader vision of the lifestyle and health benefits. Communicate how transportation enables something bigger, better and more important to people. Focus on younger generations who are riper for change.
- Create pilot programs–drill down in detail with some case examples.

Training and Education

- Develop strategies that are aimed at generating political will. Integrate education about transportation choices into primary and secondary curriculum so students have an understanding at an early age as to how transportation affects their quality of life.
- Design training for decision-making policymakers and executives to create an appreciation for, awareness of, and desire for sustainable transportation and infrastructure.
- Develop the capacity of the sustainable transportation sector through partnerships with professional associations, trade and labour, etc. For example, there are specific rating systems for sustainable infrastructure on the East Coast–why aren’t we pioneering this? We should consider professional accreditation in sustainable infrastructure as well. There is a need to build capacity among industry professionals, which will in turn develop political will.
- Create models for multiple stakeholders to work together on sustainable transportation, moving it forward. For example, leadership training that focuses on advancing projects and learning by doing. For example, a pilot–convene a collaborative working group on curriculum development and training.
- Investigate what the value added to economy as exporter of knowledge on sustainable transportation is currently, and could be with specific investments.
A Workshop on Transportation Futures for British Columbia
Vancouver September 11, 2014.
OVERVIEW

Transportation has always played a central role in British Columbia. In 1871, the province agreed to join Canada in exchange for a rail link to the rest of the Confederation. The annual global trade in the province is approximately $75 billion in goods, with $32 billion corresponding to exports. Consequently, 34% of the provincial gross domestic product depends on freight.

Port Metro Vancouver is one of the best natural deep-water harbours in the world with the shortest distance to Asia from any major North American city. It is located in a time zone compatible with three hubs for electronic global trade (London, New York, and Hong Kong) in a single working day. In 2013, the port handled more than 135 million tonnes of cargo, with increasing trends already reported at the end of June 2014. Cruise ship calls indicate an upward trend, and BC may return to 2002 levels, with more than one million passengers visiting Vancouver alone. Other ports in the province (Victoria, Nanaimo, Alberni, McNeil, Rupert, Stewaqrt and Kitimat) are reporting similar trends.

The Vancouver International Airport (YVR) is Canada’s second busiest airport. It reported almost 18 million travellers in 2013, facilitated more than 300,000 aircraft take-offs and landings and handled over 228,000 tonnes of cargo. Fifty-three airlines serve the YVR, enabling more than 109 non-stop destinations worldwide.

In 2013, there were 3,380,245 registered vehicles in BC. Of these, 9,817 were buses with a significant portion running on diesel. Urban passenger transportation is complemented by electric trolley buses, light-rail transit, a fully automated rapid transit line (the Canada Line), and diesel seabuses moving passengers across the Burrard inlet. The West Coast Express links downtown Vancouver to Port Moody, Pitt Meadows, Maple Ridge, and Mission.

CHALLENGES

The economic, environmental and geopolitical impacts of air and surface transportation are significant. In British Columbia, the sector is the single largest source of greenhouse gas (GHG) emissions, accounting for 38% of the total in 2012.

---

Clean Energy Research Centre (CERC) 2360 East Mall, Vancouver, BC Canada V6T 1Z3
Tel: 604.827.4342, Fax: 604.822.6003 www.cerc.ubc.ca info@cerc.ubc.ca
Cars and trucks are the dominant sources. Hence, alternative fuels and electrical energy on board are part of a revolution aimed at making transportation sustainable. The relevant technologies are applicable to marine, rail, and air transportation, but the current emphasis is on automotive technology. Hybrid Electric Vehicles (HEVs), Plug-in Hybrid Electric Vehicles (PHEVs) and Fuel Cell Vehicles (FCVs) represent the state-of-the-art in low- or zero-emission automotive design.

For air and surface shipping, the challenges include new standards for aviation and marine fuels (e.g., maximum sulphur content within Environmental Control Areas), ballast water and control of aquatic invasive species, marine mammal avoidance, hull bio-fouling, improved propulsion technologies, and sub-optimal waste-heat recovery. Port electrification may impose limits on engine use while at port (on January 1, 2014, California became the first jurisdiction to require shore power use while at berth.) Beyond these concerns, the sector’s current reliance on global positioning systems (GPS) makes it vulnerable to compromised navigation capabilities due to natural (solar flares) or other causes (human error, intentional satellite jamming, etc.) Other factors include: the Panama Canal expansion, recent interest on a second interoceanic canal in Central America, and the potential sovereignty issues surrounding the Northwest Passage.

**OPPORTUNITIES**

The provincial and federal governments, the Vancouver Fraser Port Authority, Vancouver’s international airport, the regional transit authority, the three Class 1 inter-continental railways that serve the port, and other stakeholders have an opportunity to transform British Columbia into a global leader in sustainable transportation.

Locally, Vancouver’s 265 km of bicycle networks, car-share programs, and the targets in the Greenest City 2020 Plan, can become templates for leadership in urban planning, improved quality of life, and citizen engagement. The initiatives on natural gas may provide an opportunity for more significant penetration of this low-carbon fuel into the transportation sector (currently dominated by gasoline, diesel, Jet-A and marine fuels.) BC already hosts global leaders in the development of natural gas engines, and hydrogen fuel cells. The significant efforts on truck and passenger vehicles can be expanded into rail, marine, and ultra heavy duty sectors.

Regionally, the Continental West Coast (British Columbia, Washington State, Oregon State, and California) represents the world’s fifth largest economy, and a significant market (53 million people and US $2.8 trillion GDP.) The Pacific Climate Energy Partnership and the Mexican energy reforms may expand this market further. Globally, improved logistics are required to optimise trucking routes, highway and rail infrastructures. Overall, BC strategy can be aligned with international trade activity and the Trans Pacific Partnership (as reported in “Canada’s Global Markets Action Plan,” December 2013.)

The workshop on September 11 aims to develop a new research initiative focused on “Transportation Futures for BC.” We hope that your expertise can help PICS in developing a new multidisciplinary research program, and we thank you for your willingness to participate.

Sincerely,

Dr. Tom Pedersen     Dr. Walter Mérida,

Contacts:
Dr. Walter Mérida, Director
Clean Energy Research Centre, UBC
director@cerc.ubc.ca

Dr. Thomas F. Pedersen
Executive Director, Pacific Institute for Climate Solutions
picsdir@uvic.ca

Pacific Institute for Climate Solutions PO Box 1700 STN CSC Victoria, BC V8W 2Y2 Canada
Tel: 250-853-3595 Fax: 250-853-3597 http://pics.uvic.ca pics@uvic.ca
APPENDIX H – EVALUATION

At the end of the dialogue, participants were asked to complete an individual evaluation. The results of that evaluation are shown in the graph below; all answers are rated on a scale of 1 to 7.

- The phone calls and emails during recruitment and after agreeing to participate gave helpful information.
- The registration process was efficient and friendly.
- The dialogue handbook provided for the discussions was clear and contained, relevant and useful information.
- The facilitator provided clear explanations, guidance and support throughout the day.
- The meals and refreshments were satisfactory.
- There was adequate opportunity for me to learn and to participate in group discussions.
- Overall, the dialogue was worthwhile to me.
- Based on this experience, I am more likely to become involved with similar consultations.