

PICS Strategic Research Plan 2014-2018

Phase Two: Focusing on Solutions February, 2014 (Updated November, 2014)

Prologue

In the spring of 2009, the PICS Program Committee established an initial (Phase 1) structure for a formal Research Program based on four themes: Sustainable Communities, Social Mobilization, Low Carbon-Emissions Economy, and Resilient Ecosystems. A fifth theme, Carbon Management in BC Forests, was added later that year. A series of expert workshops was held in 2009-2010, one for each theme, and that process yielded sets of key questions designed to guide the overall PICS research effort. The initial PICS Strategic Research Plan (SRP), released in November 2010 and updated in 2011, offered a full description of the rationale for each theme and listed the questions that arose from the expert workshops.

Calls for proposals—one for each theme—were issued in 2010 and 2011, with a request that submissions address the priorities discussed in the workshops (and subsequently listed in the SRP). Some 160 proposals were received and nearly forty funded for a success rate of about 25%.

While the five-themed approach and structure had clear merit, it was never intended to be permanent. In June 2012, the PICS Annual Forum, entitled “The Road Ahead”, presented an opportunity to reflect on success to that point and ask how we might structure PICS programming in a “Phase 2”. That reflection was in part based on a perception that PICS could have more impact in the scholarly and policy domains if it focused more on a limited set of issues of key importance to British Columbia. The research-program structure would thus evolve from a *five-theme* to a *multiple-question* form, with each question to be tackled by a multidisciplinary team of investigators who would bring different perspectives to bear on the issue at hand. That approach was supported by the External Review Panel that delivered its assessment of the Institute in April, 2013. The tighter focus concept was also endorsed at a joint retreat of the PICS Program Committee and the External Advisory Board in early 2013. That group recognized that the new structure would mark a significant evolutionary step for PICS, encouraging stronger interdisciplinary interaction while allowing the Institute to concentrate more directly on mitigation and adaptation-oriented concerns. Moreover, there was an anticipation that the new approach would allow research insights on solutions to be fed more directly into the policy domain than was possible in Phase 1. The Phase 1 Research Plan was retired on March 31, 2014. Research support under Phase 2 formally began on January 1, 2014.

The Phase 2 program is based on the following principles:

1. The number of major questions or issues to be supported will be kept to single digits. Issues must be pressing and solutions-oriented and are developed through consultation with

members (institutional and individual) of the PICS community, including the Climate Action Secretariat.

2. To avoid stasis, new questions will be incorporated from time to time; others will be retired. Five issues form the current structure of the program, as described below.
3. Projects will be supported for up to 5 years, where such duration can be justified.
4. Building capacity through the education and training of highly qualified persons will be encouraged in all projects. In addition to graduate students, inclusion of Post-docs and Research Associates will be particularly encouraged.
5. An interdisciplinary approach will be a foundational element for each project. Teams of scholars will be drawn from primarily from the four consortium universities, but may include others from government, business/industry, and NGOs. “Interdisciplinarity” is defined as embracing multiple research dimensions that will typically include economics, technical/technological considerations, and social and environmental analyses.
6. Team selection will allow flexibility and be both top-down (soliciting participation from known teams or individuals) and bottom-up (in response to calls for proposals or via receiving unsolicited proposals that address, perhaps in unforeseen ways, the key issues).
7. Support will be sufficient to ensure that project team members can interact frequently via, for example, face-to-face workshops.
8. Obtaining matching funds from external agencies, while welcome, will not be a criterion for support.
9. Every project will need to have a communications and outreach plan in place by the end of the first year of support. Where appropriate, an extension plan will be established.
10. Research projects will be assessed on a regular basis. Site visits and progress reports, organized by PICS Central, will be components of the assessments. Continuance of funding will be subject to demonstration of progress.
11. When and where appropriate, solicited syntheses that draw from the supported projects will be a component of the new structure. These will present tenable recommendations for consideration by the public, the provincial and municipal policy sectors and the business community.
12. A small, interdisciplinary ‘Advisory Panel’ will be appointed for each project to provide advice on project objectives and implications for policy development. Each panel will comprise either the Director or Associate Director of PICS (who will serve as Chair), a member of the Climate Action Secretariat, and a small number of external experts.

The Phase Two Strategic Research Priorities

Descriptions follow of the five key projects that comprise the initial structure of the Phase Two research program. The reported greenhouse gas emissions profile for BC along with community consultations helped to set these priorities. The emissions profile comprises four major “sectors”, each of which represents a major piece of the solutions challenge: transportation --roughly one-third; fossil-fuel production—one-quarter; emissions from buildings —one-fifth; and net deforestation— one-tenth.

- 1. Conduct a full-picture social, economic and environmental analysis of fossil-fuel consumption, production, use, and export, in BC, the target being development of a defined pathway to an 80% reduction in emissions levels compared to 2007, by 2050.**

Recognizing that social, environmental and economic issues are integral to fossil-fuel development, this analysis is to include variously:

- full emissions profiles of particular fuel sources;
- impacts of full-spectrum carbon pricing at various levels on business sectors, individuals and urban and rural families;
- assignment of value to environmental parameters, including biodiversity, provision of clean water and air, eco-tourism, health, and costs (social, economic and environmental) associated with impacts on such parameters;
- impacts of changes to royalties on extracted hydrocarbons and coal;
- assessment of cumulative and community impacts of resource exploitation in BC's north
- assessment of issues associated with groundwater and surface flows as well as aquifer integrity.

This project will require extensive modeling and scenario analysis, with input from, amongst others, energy economists, specialists in rural and urban sociology, taxation, finance, commodity markets and international trade, biodiversity and the environmental sciences, including hydrology.

Specific questions to guide the project include:

- a) what is the likely future of liquefied natural gas (LNG) production and coal mining in BC, given full-picture/cost accounting and considering various international market, C-tax, emissions limits, environmental and royalty scenarios?
- b) what are the cumulative impacts of the NG and coal industries (along with other industries including forestry and mining) on water quality and abundance, as well as biodiversity, ecosystem integrity and resilience, and what are associated socio-economic values and impacts?
- c) where and how can the value chain of BC's fossil fuel sector be maximized, while reducing emissions?

2. Design an optimum structure for electricity and space heating provision and distribution in British Columbia and Alberta to the year 2060 to increase the penetration of renewables while reducing aggregate CO₂ emissions from an integrated two-province system.

This project will see application of an integrated approach where multiple energy sources, technologies, and energy carriers are available to meet demands for electricity, transportation, and space heating, all set against a backdrop of demand growth, anticipated demand-side management, technology costs and innovation, transmission costs and innovation (including introduction of smart grids), and district energy networks. Consideration of a changing climate that will influence building heating and cooling needs as well as availability of water for generation of hydropower will be included. Bilateral implications (in particular, the Columbia River Treaty) will be built in. This project recognizes that BC is not an island unto itself, and its renewables resources could be used creatively to reduce western Canadian electricity-sector emissions and improve community energy security, given a radical shift in generation mode and transmission capacity in the coming

decades. A primary objective of the project is to make the case quantitatively for such a radical shift.

Like #1 above, this project will require extensive modeling, with input from, amongst others, systems engineers, economists, specialists in energy markets trading, hydrologists, regional climate modelers, sociologists, and specialists in social acceptance, Canadian constitutional law, and interprovincial relations and politics.

Specific questions to guide the project include:

- How will variations in the geographic and temporal availability of water impact electrical generation over time?
- What will be the effects of regional climate change scenarios (projected by models) on heating and cooling demands in the building sector?
- How will demand-management policies and smart-grids change energy supply and cost?
- Can BC's Hydro resources provide backup for Alberta wind to a significant degree, assuming interprovincial cooperation and appropriate transmission capacity? If so, at what cost and with what potential economic penalties (compensatable?) for BC? What policy changes would be needed to accomplish greater integration of the electricity flows between and among provinces?
- What would be the impact of carbon emissions taxes on an integrated interprovincial electricity supply system?
- What would be the role of locally produced energy and district energy in reducing need for/dependency on long distance transmission? What barriers in generation and policy need to be overcome to increase local provision of energy?
- How can we best accommodate climate-change related vulnerabilities for future long distance energy transmission?

While the first two years of this project will focus on the costs and benefits of strengthening electrical grid integration between BC and Alberta, future work will investigate the impact of large-scale energy systems across Canada under various carbon policies and global growth scenarios, as well as greater integration into the Western Interconnect.

3. Design a low-emissions transportation policy for British Columbia that considers all modes of transport and that is fully integrated with community-scale planning.

More than a third of greenhouse (GHG) gas emissions in BC come from the transport sector, where we have great scope for electrification of vehicles and rapid transit infrastructure; considerable scope for fuel-switching to cleaner alternatives like natural gas, biofuels and hydrogen in the trucking, rail and ferry industries; and immense scope for redesigning urban environments in ways that support lower-emissions lifestyles.

Toward those ends, the project will explore:

- Policy and planning dimensions (physical, economic, social, business-related) of densification when developing or redeveloping in urban or suburban settings;
- issues directly associated with integration of *electric* rapid transit infrastructure (subway, light rail, trolley, battery-electric transit buses): costs, including carbon tax impacts,

infrastructural needs, electrical grid implications, and assignment of values to co-benefits such as improved air quality and human health;

- how best to incent fuel-switching from diesel to natural gas and other energy alternatives including hydrogen in the trucking industry, in rail locomotives and in the BC Ferries fleet;
- prospects, costs and impacts of electrifying rail transport.

This project will require input from the planners, transportation and systems engineers, economists, health experts, and specialists in regional and municipal politics and transportation policy.

4. Explore how BC can routinely design, build and retrofit residential and commercial buildings that exceed international benchmarks for energy efficiency.

What are the barriers—economic, political, social, physical—to reaching such a lofty goal? What building-automation control-systems technology development and occupant behavioural research needs to be carried out? What changes need to be made to provincial, regional, and municipal planning regulations and building codes to make high energy efficiency and low/zero-carbon emissions a normal requirement rather than a special-case requirement? If incentives are required, what would (should?) be their optimum design?

5. Optimizing our forest stewardship, forest carbon management, and carbon-accounting procedures in the face of a changing climate.

Primary research priorities will include:

- improving understanding of how climatic shifts are already changing BC forests, and projecting future changes in order to adjust adaptation and mitigation approaches across the province's highly variable geographic and climatic landscape. A key consideration must be determining how best to maximize the value of our forests sustainably across the full economic-social-environmental spectrum, in recognition of the importance of the forest resource to BC communities;
- establishing specific silvicultural approaches for the pine-bark-beetle affected stands in BC's interior that consider, for example, appropriate replanting strategies;
- development of quantitative carbon and carbon-offsets accounting methods for the forest sector;
- exploring the potential of biomass as an energy source (along with its environmental and social concerns and assessment of net greenhouse gas impacts on the atmosphere) for example for district heating use, given the multiplicity of different forest and community environments in the province;

This will require intensive input from forest economists and ecologists, silvicultural experts, bioenergy engineers, rural/municipal planners, social scientists, and regional climate modelers. This project will build on extensive work done to date by government scientists (BC and federal) and the academic sector. Added value will accrue through integration of future-forest scenario planning with social, economic, and environmental benefits/impacts analysis.