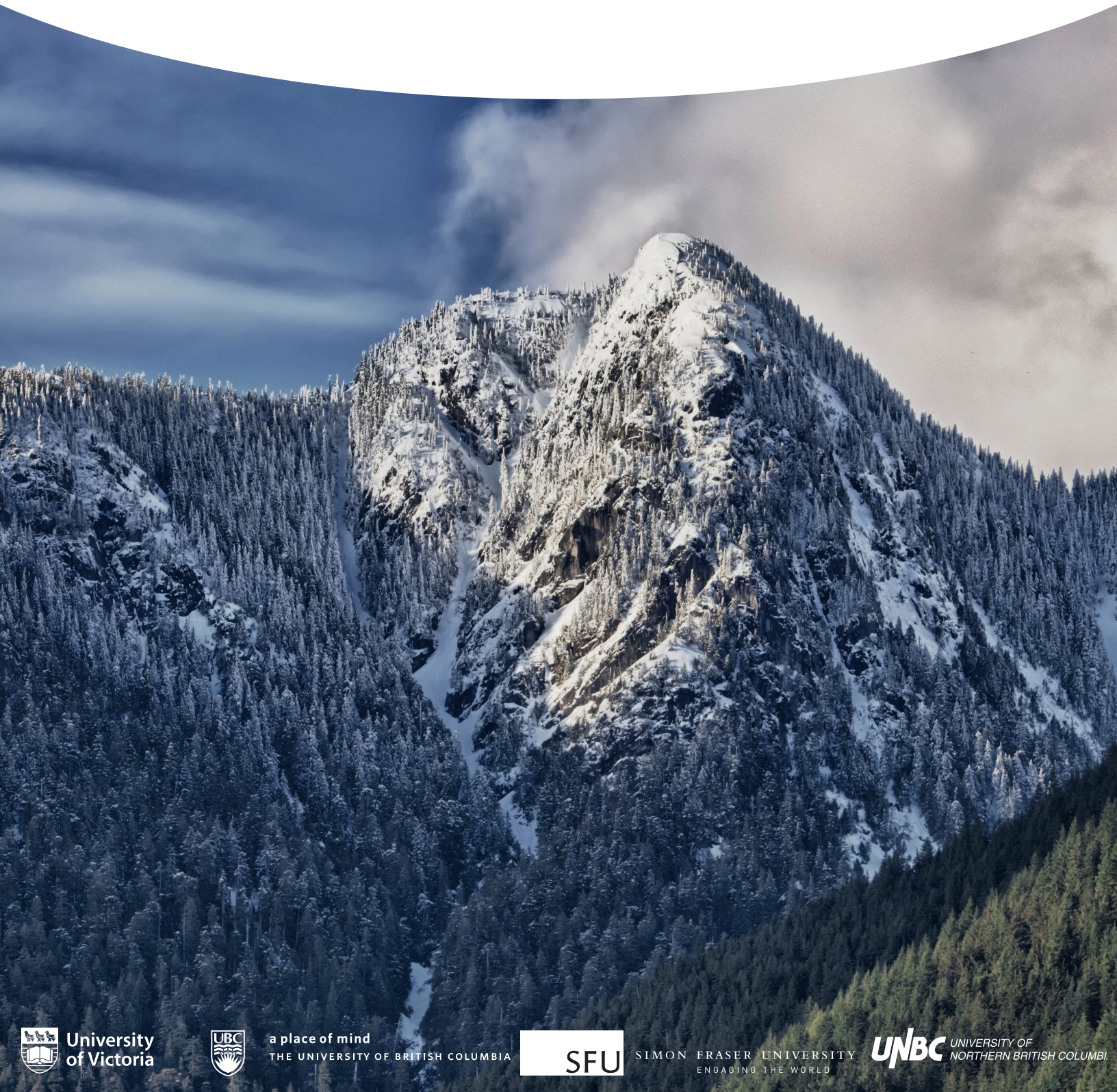
Pacific Institute
for Climate Solutions
Knowledge. Insight. Action.

ANNUAL REPORT 2015



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The Pacific Institute for Climate Solutions gratefully acknowledges the generous endowment provided by the Province of British Columbia through the Ministry of Environment in 2008. This funding is enabling ongoing independent research aimed at developing innovative climate change solutions, opportunities for adaptation, and steps toward achieving a vibrant low carbon economy.

Pacific Institute for Climate Solutions

University of Victoria
PO Box 1700 STN CSC
Victoria, BC V8W 2Y2

Phone: 250-853-3595
Fax: 250-853-3597
E-mail: pics@uvic.ca
Web: pics.uvic.ca

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2015 IN REVIEW

Dr. Sybil Seitzinger PICS executive director (Nov 2015 – present)

As 2015 draws to a close, there is probably no better time in Canadian history to be in the field of climate change solutions, with the country entering a promising new era of climate responsibility and leadership.

The federal election in October ushered in a fresh generation of political leaders led by new Prime Minister Justin Trudeau, who announced that Canada "is back" on the world stage, ready to meet its climate commitments and reduce greenhouse gases. Swiftly to follow was Canada's signing of the Paris Agreement at the UN's climate summit (COP21) in December, and its endorsement of the ambitious target of keeping average global warming below 2 degree Celsius (while striving for 1.5 degrees). Having been involved in both COP21 and COP15 in Copenhagen in 2009, it is heartening to see an emerging global recognition of the urgent need for collective action.

Here in British Columbia, hopes are high for a renewed climate leadership push from the provincial government, with public opinion being sought in the creation of a new Climate Leadership Plan, scheduled for release in Spring 2016. PICS will be doing its part to ensure British Columbians are informed of the options—such as those put forward by Climate Leadership Team—and are engaged in this process. Other provinces such as Alberta and Ontario are also making huge strides towards renewable energy and weaning themselves off a fossil fuel diet.

Decarbonisation and supporting the transition to a prosperous low-carbon society cuts to the heart of what we do at PICS, and it is a privilege to lead the Institute into its next phase of delivering policy-relevant analysis and research for BC and beyond. In these 60 first days as PICS executive director I have met with many of our researchers across our four universities—from engineers to social scientists—as well as our partners within the BC government and industry. It is abundantly clear that my predecessor Dr. Tom Pedersen has done a terrific job in not only laying down a strong foundation for PICS to develop its climate solutions-based research programmes, but also in securing the Institute's reputation as a source of unbiased, scientifically robust and accessible information.

Canada is starting 2016 with a restored reputation and new commitments to support a clean tech future. It will also be developing its first national climate change strategy and introducing a price on carbon. PICS will be supporting that transition to a low-carbon future by working with all levels of government, industry, First Nations and academia, to deliver integrated solutions for society to adapt to the climate changes before us, as well as to mitigate anthropogenic warming.

Sybil Seitzinger

Dr. Tom Pedersen, PICS executive director (2009 – October 2015)

The Pacific Institute for Climate Solutions was established in the spring of 2008 with a compelling mandate: draw on talent pools in British Columbia to provide knowledge, insights, outreach and training to help British Columbians of all stripes to take constructive action in the face of the immense challenge that climate change presents to society. Seven years on, it's fair to ask has PICS succeeded? I had the privilege of directing the Institute for most of those seven years and I think that answer to that question is "yes, but".

The "yes" lies in what the community has achieved. PICS now has a vibrant research program focused on five issues of critical importance to British Columbia, the last of which was funded on May 1, 2015: transportation futures, electrical grid integration, energy efficient buildings, carbon management in our forests, and the social value and implications of natural gas development. All five share a distinguishing characteristic: the research is being conducted by inter-institutional, interdisciplinary teams of outstanding scholars from across the province, charged with exploring options that can contribute directly to policy. That applied approach is relatively rare in academic circles, but is absolutely necessary on a planet that is crying out for solutions.

But solutions remain elusive in a world where political will and social license are sometimes hard to find. In recognizing that, PICS continued to work vigorously in 2015 to liaise with senior members of the provincial government, to provide high-quality lay-language educational products like our free, animated, online and highly popular short-course series, to organize and host hot-button public discussions on issues like fossil-fuel divestment policy, and to offer public lectures by star international scientists like Gavin Schmidt. All of these initiatives have helped to keep in the limelight the opportunity to act on the climate-change challenge.

And now to the "but". It's simple: successes to date aside, we're not there yet. So much remains to be done, an observation that will continue to be true for as far as one can see over the horizon. And in that context, it was a pleasure for me to hand over the reins of the Institute on November 1 to Dr. Sybil Seitzinger, an outstanding scholar with broad international experience. Under her leadership, I know PICS will continue to thrive.

I will sign off for the last time with an acknowledgement. PICS would not have made the progress it has enjoyed without the exceptional contributions of its staff at the head office at UVic and the partner universities. It was an honour for me to be able to work with them. Thank you all. A bientôt

Tom Pedersen

ABOUT PICS

The Pacific Institute for Climate Solutions (PICS) is a dynamic knowledge network that brings together leading researchers from British Columbia (BC) and around the world to study the impacts of climate change and to develop positive approaches to mitigation and adaptation.

Created in 2008 with a major endowment from the BC Ministry of the Environment, PICS is hosted and led by the University of Victoria (UVic) in collaboration with BC's three other research-intensive universities – Simon Fraser University (SFU), the University of British Columbia (UBC) and the University of Northern British Columbia (UNBC).

As such, PICS pulls together the intellectual capital of the province in applying a multidisciplinary approach to climate change research. In partnership with all levels of government, the private and the non-profit sector, we strive to develop innovative climate change solutions that will help lead the way to a vibrant, low-carbon economy.

The Institute's main objectives are:

•understanding the magnitude and patterns of climate change and its impacts;

•evaluating the physical, economic and social implications;

•assessing mitigation and adaptation options and developing policy and business solutions;

•evaluating and strengthening educational and capacity-building strategies to address climate change; and

•communicating climate change issues to government, industry and the general public.

Mission Statement

To partner with governments, the private sector, other researchers and civil society, in order to undertake research on, monitor, and assess the potential impacts of climate change and to assess, develop and promote viable mitigation and adaptation options to better inform climate change policies and actions.

Governance

PICS is governed by a Program Committee consisting of researchers from the four partner universities as well as representatives from the provincial Climate Action Secretariat (CAS) and Environment Canada's Canadian Centre for Climate Modelling and Analysis (CCCMA); an Executive Committee appointed by the University of Victoria; and an external Advisory Board comprising representatives from across the public, private and non-profit sector.

More information about the PICS governance structure is included as Appendix 1.

RESEARCH

Collaborative and interdisciplinary research dedicated to meeting the multi-faceted climate-change challenge is at the core of the PICS mandate.

The Institute supports a broad research effort, working directly with between 70 and 100 researchers in any given year. Current initiatives include five major projects of direct relevance to BC's policy environment, 70 graduate and post-doctoral fellowships and 14 annual employment internships. PICS also commissions cutting edge research from academics and experts from within BC and elsewhere.

Research results form the basis for PICS white papers, briefing notes, scholarly journal articles and book chapters, as well as public outreach events, and contributions to outside research initiatives.

Primary users of this work include policy-makers, educators, the research community, media and the interested public. In 2015 PICS invested more than $1.3 million in direct applied research. Project descriptions follow:

The PICS "Big Five"

Five issues of critical importance to British Columbia— transportation, electrical grid integration, energy efficient buildings, forestry, and natural gas development—are the basis for five major research projects all underway since May 1, 2015. The Institute has committed $7.5 million (approximately $1.5 million per project), subject to meeting interim progress targets over five years, with varying start dates in 2014 and 2015.

Project teams are highly collaborative, bringing together experts from a range of disciplines and institutions, including local, provincial and federal governments, academia, industry, and First Nations, as well as graduate students and post-doctoral fellows. Outside support and advice is provided for each team by an advisory panel containing representatives from the PICS executive, the BC government's Climate Action Secretariat (CAS), the business community and academia. The five projects also have meaningful ties to each other, especially following the October 2015 Annual Forum "Pathways to BC's low carbon future: building bridges between the PICS 'Big Five", which has fostered new working relationships.

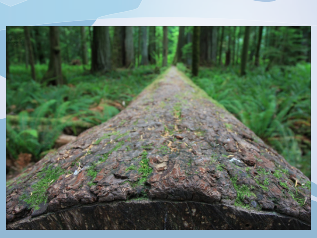
Anticipated outcomes include policy briefs, PICS white papers containing actionable policy/practitioner recommendations, specialist reports, community and industry guides, media releases, conference presentations and Masters and PhD theses. Primary users of this information include policy-makers and planners at the provincial and municipal levels of government, the business community, climate-related researchers, community organisations, the media, researchers, and neighbouring jurisdictions.

The five major projects are summarized as follows:

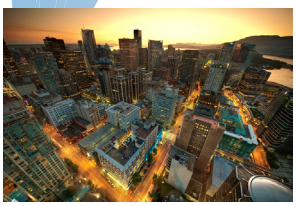
Big Five Research Projects

The 2060 Project: Integrating Canada's electrical grids.

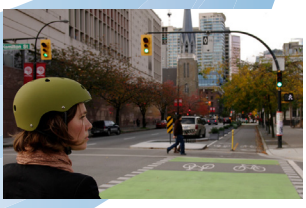
BC Natural Gas Development: A "bridge fuel" to a low carbon future?



Forest Carbon Management: Supporting forest adaptation while maximizing economic value & carbon sequestration.



Energy Efficiency in the Built Environment: Designing, financing & operating buildings for net-positive energy gains.



Transportation futures: Designing low emissions pathways for BC's air, land & marine transport networks.

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The 2060 Project: Integrated Energy System Pathways for BC and Canada

The 2060 Project explores the costs and benefits of electrical grid integration options for Canada, initially between British Columbia and Alberta, and eventually nation-wide and into western North America. Grid integration has been hailed as an effective means to reduce GHG emissions if one region with abundant "clean" renewable electricity supply can displace a heavy emitter (such as coal-fired electricity) in a neighbouring jurisdiction.

The project team includes energy-system engineers and economists, hydrologists, regional climate experts, senior utility planners, electricity system operators, regulators and policy makers. Researchers are examining how the expansion of BC-AB grid interconnections would influence costs, reliability and emissions, taking into account expected changes to hydrology and dam water supplies 50 years from now due to climate change. Further 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. Integration also has the potential to expand consumer access to renewable energy sources such as wind, wave, solar and biomass.

Project lead: Dr. Andrew Rowe, UVic, Associate Professor, Mechanical Engineering

The Forest Carbon Management Project

This project explores how BC's 55 million hectares of forests can best endure under a changing climate, and also help to slow down the rate of global warming by removing heat trapping carbon dioxide from the atmosphere and storing that carbon in living forests or forestry products. The project team will investigate how forest management strategies can be structured and regionally customized to maximize the forestry sector's "carbon sink" and climate change adaptation potential. It will test how various approaches to harvesting, silviculture, site preparation and stand reestablishment activities can alter greenhouse gas (GHG) balances. Researchers will also identify opportunities to substitute timber products for carbon-intensive steel, concrete or plastics products in many sectors, including the building industry.

Project lead: Dr. Werner Kurz, Senior Research Scientist, Natural Resources Canada

Transportation Futures for BC

Transportation is BC's largest aggregate source of GHG emissions. This project tackles that problem by identifying pathways to develop sustainable low-or-zero emission air, land and domestic marine transportation. A key focus is identifying the expansion potential for high-tech renewable energy use and generation within the transport sector, including electric trolleys, fleets, buses, rail, personal electric vehicles, hybrids and bikes and the optimal topologies for recharging and refuelling networks. Other foci, to be explored across multimodal transportation systems, include the potential for increased adoption of hydrogen and associated fuel cell technology and the distribution potential of alternative fuels including compressed (CNG), liquefied (LNG) and renewable (RNG) natural gas. The research team will incorporate land use planning and urban design into the exploration of these modes and their potential deployment. Alongside the modeling and analysis to reduce transport GHG emissions, the team will also assess social readiness and market support for changes to transportation systems.

Project lead: Dr. Walter Mérida, Director, Clean Energy Research Centre, UBC

Energy Efficiency in the Built Environment

This project will develop practical strategies and policy recommendations to increase energy efficiency in BC's built environment, which currently accounts for about 10 percent of provincial GHG emissions. The built environment is a complex intertwined multi-scale system of cities, towns and neighbourhoods whose energy performance is shaped by factors such as building design and the behaviour of its inhabitants, as well by the infrastructure that serves those buildings.

The project team will evaluate many facets for improving building energy performance and, where possible, achieving net-positive energy use. Potential contributions from evolving green building codes, standards, design and new innovations will be explored, alongside alternate energy sources, including bioenergy and district energy systems. Best practices

for increasing building inhabitants' support for, and engagement with, energy efficiency measures will be incorporated. Financing options for energy efficiency retrofits for existing buildings will also be analyzed along with tax and utility-based incentives, following a rigorous review of international best practices.

Project lead: Dr. Ray Cole, Academic Director, UBC Centre for Interactive Research on Sustainability (CIRS)

The Scale of Natural Gas Development & Maximizing Net Social Benefits

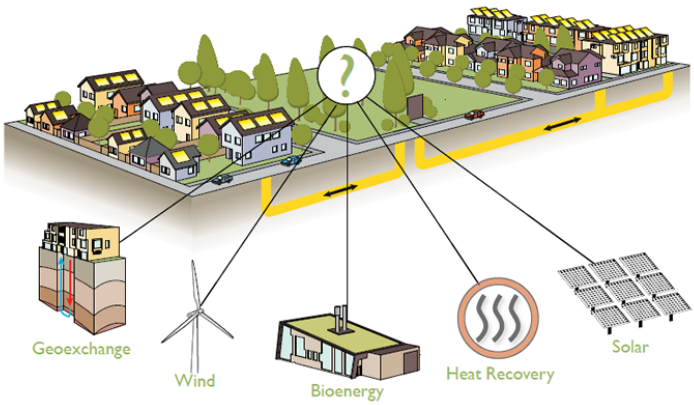
BC has an abundance of shale gas reserves currently earmarked for the development of a new liquefied natural gas (LNG) export market, yet there are many questions about how the scale and nature of development affects resource rents, GHG emissions, water supply and quality, and communities. This project aims to plug that information gap in four targeted areas: a) the economic analysis of markets for natural gas and returns to the province and British Columbians; b) investigating the types of energy sources planned to be exploited during LNG production and the realistic cost implications to industry of using renewable energy sources rather than burning gas (and therefore emitting GHGs); c) studying the cumulative impacts of natural resource development on northern communities; and d) analyzing emerging concerns over hydrological impacts, including the availability of groundwater under a changing climate, and water quality impacts from fracking. Given the potential contribution of LNG exports to the BC economy and also its potential use as a "bridge fuel" to a low carbon future, this project asks a critical question: Can BC's natural gas reserves be developed in a way that maximizes net social benefits to British Columbians while also decreasing net global GHG emissions?

Project lead: Dr. Nancy Olewiler, Director of the School of Public Policy, SFU

Affiliated Projects

PICS supports climate-related research outside the scope of its "Big Five" projects. Current projects include:

- A research team led by Simon Fraser University is working with public health agencies and scientists to identify mechanisms for preventing waterborne diseases arising from extreme precipitation events that affect Metro Vancouver municipal water systems. For example, water system funders could prioritize which watersheds to



Visualizing low carbon neighbourhoods: CALP

focus filtration or other infrastructure in advance of increased stress on the systems.

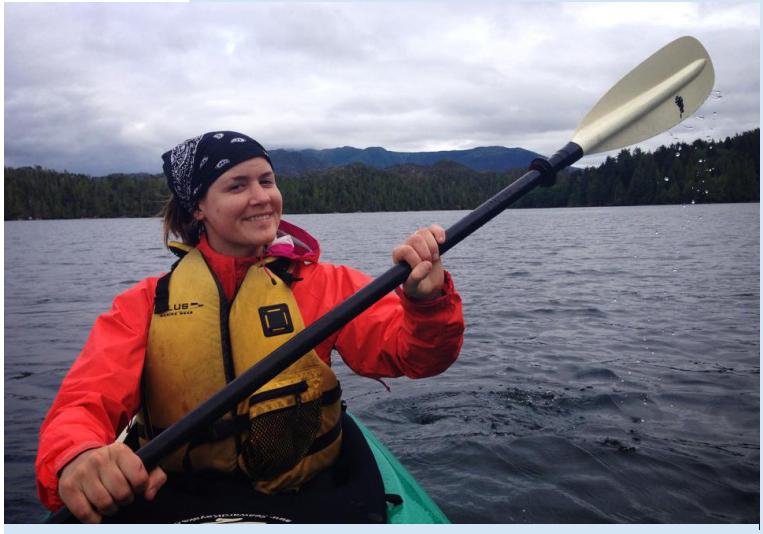
- Phase 2 of the Community Energy Explorer, an online platform to help communities engage with and develop local sustainable energy solutions. Developed by the Collaborative for Advanced Landscape Planning (CALP), this phase will add more interactive components such as energy demand mapping, DYI toolkits for neighbourhood groups to engage with climate change solutions, and social media support, as well as provide case studies of regional renewable energy in action. Longer term, CALP wants to promote the benefits of energy retrofits, using thermal imaging to show heat loss from un-insulated homes.
- The PRISM climate-mapping project by the Pacific Climate Impacts Consortium (PCIC) provides high-resolution temperature and precipitation climatological data ranging in scope from the back yard to the BC province-wide scale. This tells users about the long-term average climate for their region.

Fellowship Program

PICS supported 63 graduate fellowship students and seven post-doctoral fellows from its four consortium universities in 2015. From evaluating the impact of BC's proposed LNG policy to

Community ecologist, **PICS UVic Fellow** and PhD candidate, **Nancy Shackelford**, is tracking ecosystem collapse signals and mechanisms linked to climate change, exploring when a collection of discrete events finally tips over into abrupt changes in the environment. She aims to pinpoint particular mechanisms that may impact which ecosystems are able to absorb or adapt to climate changes such as biodiversity or landscape connectivity. Understanding these mechanisms may help in managing for beneficial traits in vulnerable ecosystems.

Experimenting at scales ranging from mites to whole landscapes on BC's coastline, her research aims to assess whether connectivity between ecosystems can foster resilience. In other words, can we make ecosystems stronger in the face of climate change by recognising the warning signs and knowing when to intervene to prevent major shifts or collapse?



PICS Fellow UVic Nancy Shackelford kayaking during her fieldwork

PICS UNBC Fellow Ben Pelto is part of a research team providing frontline data on the shrinkage and loss of iconic British Columbia glaciers—information that will be used to help develop adaptive management strategies to deal with changes in water availability and timing.

The past year Ben has made four fieldtrips to the Konanee, Conrad, Nordic and Zillmer glaciers that feed the Columbia River Basin. The study seeks to better understand the role that glaciers play in the trans-boundary watershed that is shared between Canada and the United States. Glaciers provide fresh water to the Columbia River during the summer months when winter snowcover has been depleted. Understanding the changes in timing and quantity of glacier runoff in the basin is critical from a water resource management perspective, as well as for downstream ecosystems and species such as salmonids, which depend on cool conditions and plentiful water. The team is using a combination of field-work, remote sensing technology, and computer modeling to quantify past, current and future changes in glacier cover over the next 100 years.

Jordan Brubacher, PICS SFU Fellow

Jordan Brubacher is a **PICS SFU Fellow** researching potential links between climate change, drinking water quality and health in British Columbia, with the aim of increasing the province's adaptive capacity in the face of a warming climate. In spring 2015 Jordan defended his thesis, "Associations between biogeoclimatic zones, aquifer type, agricultural land and five gastrointestinal illnesses in British Columbia from 2000-2013 and potential implications under projected climate change" and graduated from his MSc program in SFU's Faculty of Health Sciences. In his thesis, he found that warmer temperatures were positively associated with three types of bacterial illness, suggesting that further warming may result in an increased burden of these illnesses.

Jordan also has a BSc in Geography and a diploma in the Restoration of Natural Systems from UVic. Outside his academic studies, Jordon volunteered with an NEGO in Nicaragua to help design a community-based watershed restoration plan in a region with vulnerable drinking water supplies and high levels of environmental degradation.

PICS UNBC Fellow Ben Pelto conducting fieldwork to monitor BC glaciers

analyzing the feasibility of turning agricultural waste to energy, the investment in this student-based research is leading BC to the forefront of developing solutions to combat climate change.

PICS fellowships are valued at $18,500 for two years at the Masters level, and $21,000 a year for three years at the PhD level. Since the fellowship program began in 2008, PICS has supported 10 postdoctoral fellows, and 93 graduate fellows at the Masters and PhD levels with a total allocation of $3,000,000.

Within the "Big Five" major research projects PICS currently supports, 30 graduate fellows and 7 postdoctoral fellows. These students are members within a team of researchers and scholars who are from an array of academic disciplines.

For a complete list of 2015 fellowship holders see Appendix 2.

Internship Program

2015 marks the fifth year for the popular PICS internship program, which supports the hiring of students from the four PICS universities to work on a climate solutions related project for four months. Since the program began, PICS has funded 83 internship positions for a total of $850,000.

This year PICS awarded 14 internships valued at $10,000 each to students working in a wide range of disciplines. These ranged from a fenestration-modeling specialist looking at the energy efficiency of windows in Victoria, to a sustainable transportation planner in Kelowna, and carbon management planning for businesses in Prince George. Hiring agencies included the Climate Action Secretariat, the Prince George Chamber of Commerce, the City of Kelowna, Climate Smart Businesses, and the Pembina Institute among others.

For a full list of students and projects supported in 2015 see Appendix 3.

Publications

PICS research generates a growing body of knowledge related to climate change mitigation and adaptation. All publications are solutions focused, and can be used to inform and guide policymakers, educators, the research community, and the interested public.

Maya Guttmann,UBC, was this year's **Blue Carbon Intern** for the Comox Valley Project Watershed Society, which works to protect and restore sensitive local watersheds and habitats. Maya's tasks included assisting with the installation of a silt fence to improve water quality, and monitoring plant survivability at a recently restored saltmarsh site. She participated in eelgrass restoration, helping prepare eelgrass bundles to be planted by scuba divers. Maya also conducted a literature review of how to take marine sediment cores and produced an instructional document on extracting sediment cores, for use by other coastal restoration groups. She had a sediment corer constructed by a local machinist, which was used to process sediment cores on the docks of the Comox Estuary for later analysis.

Ramunas Weirzbicki, PICS UVic intern

Buildings account for more than 10% of BC's greenhouse gas emissions, and windows are often a weak point for heat conservation – but work by **PICS-UVic intern Ramunas Wierzbicki** will help mitigate that problem. Working as a fenestration (window) modelling specialist with the BC Ministry of Energy and Mines, Ramunas investigated the potential of the Component Modeling Approach Software Tool (CMAST), which allows contractors to calculate window energy performance. The analysis revealed that CMAST generated useful reports in a time efficient manner; however its database lacked some features, including certain wood or vinyl window products, which would be useful for glazing contractors.

Information gathered from interviews with the California Energy Commission, the National Fenestration Rating Council, Fenestration BC, and engineers in Canada and in the United States, also shaped his recommendations to government on how to best use CMAST as an inspection tool to increase compliance with energy regulations.

Maya Guttmann, PICS UBC intern, kayaking and preparing sediment cores during her field work in the Comox Estuary

Keeping up with the Johansens: EVs

A PICS report on how to increase uptake of electric vehicles (EVs) gained good traction in the media as well as interest from government agencies investigating clean transport options. The briefing note—"Norway's electric vehicle revolution: Lessons for British Columbia"—looked into how BC could potentially replicate Norway's electric vehicle revolution, and thereby reduce its largest aggregate source of GHG emissions – transportation. The Scandinavian nation has a similar size population, mountainous geography and hydroelectric profile to BC but roughly 30 times the number of electric vehicles (74,000 sold within 6 years)—the highest per capita penetration of EVs in the world.

Former PICS' director Tom Pedersen charging his electric vehicle

So what's the secret? The report explains that while financial incentives such as tax breaks and rebates (as offered in BC's popular Clean Energy Vehicle scheme) are attractive, it was Norway's extra perks such as free parking, free ferries, free toll roads and access to bus lanes that made EV purchases irresistible to new car buyers. Backing this up was a major rollout of re-charging stations across the country, both for driver convenience and peace of mind. The report outlines what Norway got right, how much it cost, and what challenges lie ahead in its EV revolution, plus recommendations for how BC could implement a similar program here.

White Papers

The PICS white paper series consists of independent, peer-reviewed reports authored by leading researchers and policy experts commissioned by the Institute. These reports contain in-depth analysis and recommendations on a range of climate-related topics of key relevance to British Columbia. The following white papers were published in 2015:

- "Cheaper Power Bills, More Jobs, Less CO2: How On-Bill Financing Done Right can be a Quick Win for British Columbia" by Seref Efe, Inam ur Raheem, Tingting Wan and Carter Williamson (UVic)
- "The Path to "Net-Zero Energy" Buildings in BC: The case for action and the role of public policy" by Tom-Pierre Frappé-Sénéclauze and Maximilian Kniewasser (Pembina Institute)
- "Evolution of Energy Efficiency Requirements in the BC Building Code"

Simple loans for energy efficient homes

BC's Climate Leadership Team has picked up on recommendations from a 2015 PICS white paper that promotes on-bill financing as a quick and effective way of retrofitting homes for greater energy efficiency. The paper, "Cheaper Power Bills, More Jobs, Less CO2," was based on research by a team of MA students at UVic's Peter B. Gustavson School of Business.

Under OBF programs, energy utilities provide loans to customers to pay for improvements such as insulation, solar hot water, heat pumps and draft-proofing. Loan payments are simply added to utility bills. The decreased energy demand (as a result of the retrofit) lowers energy costs so that there's little-to-no net change in utility bills until the loan is paid off. Such scheme have been trialled in BC before and failed – but this report identifies missing key elements that have made OBF a huge success elsewhere. The climate leadership team's Recommendations Report released by the BC government in November 2015 cites OBF as a program to encourage retrofits and improve energy efficiency in existing building stock.

Carter Williams and Tingtin Wan, part of the team behind PICS' On-Bill Financing white paper

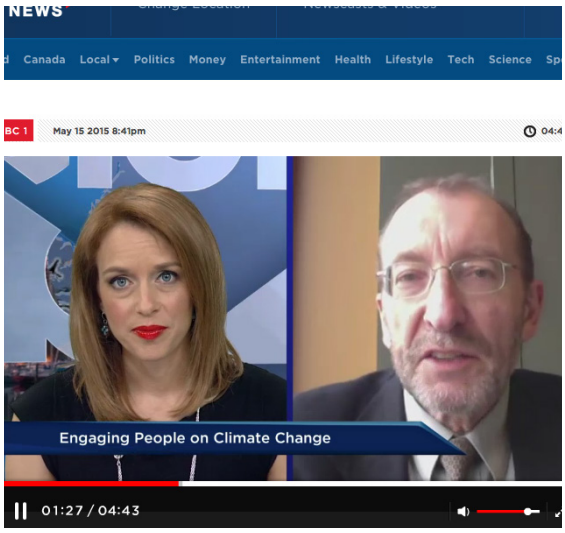
Achieving "net zero" energy buildings

PICS teamed up with the Pembina Institute in 2015 to release two white papers aimed at ramping up energy efficiency in BC's new and existing building stock. Along with its Pacific Coast Collaborative partners—the states of California, Oregon and Washington—BC has committed to "lead the way to 'net-zero' buildings"—meaning ultra-efficient buildings that produce at least as much energy as they consume, but has yet to define a plan to get there.

The "Evolution of Energy Efficiency Requirements in the BC Building Code" recaps the role and history of building regulations in accelerating energy efficiency. And "The Path to 'Net-Zero Energy' Buildings in BC" report describes the environmental and economic case for ultra energy efficient buildings, reviews some of the targets adopted in leading jurisdictions, and then articulates ten key policies to get there. With building floor space expected to double globally by 2050, it is essential that the energy intensity of buildings falls rapidly. The Pembina papers follow May's release of another PICS white paper, "Accelerating Energy Efficiency in BC's Built Environment – Lessons from Massachusetts and California".

by Tom-Pierre Frappé-Sénéclauze and Josha MacNab (Pembina Institute).

- "Accelerating Energy Efficiency in BC's Built Environment: Lessons from Massachusetts and California" by Tom Berkhout (UBC)
- "Fossil Fuel Divestment: Reviewing Arguments, Implications & Policy Opportunities" by Justin Ritchie and Hadi Dowlatabadi (UBC)



CALP director and social mobilization report co-author Stephen Sheppard interviewed on Global News

Other PICS publications

PICS research forms the basis of journal articles, book chapters, briefing notes, conference proceedings and theses produced by the Institute's fellowship holders, as well as special reports commissioned, or produced by PICS. Below is a sample selection of specialist reports published during 2015.

- "Norway's electric vehicle revolution: Lessons for British Columbia" – this specialist report examines the policies behind Norway's EV uptake success, and offers recommendations for how BC could achieve the same results.
- The question of what works – and what doesn't – for motivating people to take action on climate change is tackled in this report produced by UBC's Collaborative for Advanced Landscape Planning (CALP). "The Special Report: A Synthesis of PICS-Funded Social Mobilization Research" summarizes key findings from seven PICS social mobilization research projects conducted in BC between 2010 and 2014. The report provides a range of recommendations—and pitfalls to avoid—for those wanting to mobilize communities effectively on climate change. The research attracted solid media attention including Global TV BC news, and the Globe and Mail.

- "Robust response to hydro-climatic change in electricity generation planning" by Parkinson, S. C., and Djilali, N. (2060 Project). Climatic Change journal.
- "Combining wave energy with wind and solar: Short-term forecasting" by Reikard, G., Robertson, B., and Bidlot, J. R. (2060 Project). Renewable Energy journal.
- "Enhancing water security in a rapidly developing shale gas region" by Shannon Holding, Diana Allen, Chelsea Notte and Nancy Olewiler. Journal of Hydrology.

OUTREACH & EDUCATION

Raising public awareness and understanding of climate change is an essential foundation for effective action on global warming. PICS outreach efforts include hosting public events, briefings and expert lectures, and creating a range of free educational online products and publications. PICS also regularly co-hosts free public events with its sister organization, the Pacific Climate Impacts Consortium (PCIC), resulting in a greater sharing of expertise across a wider range of disciplines. The vast majority of public lectures and panel events are live webcast and archived on the PICS website.

Lectures & Seminars

PICS Public Lectures

Staff at the four PICS universities regularly host free public seminars featuring climate change experts across a broad spectrum of topics, ranging from adaptation and community health impacts, through to technology innovations for a carbon free future. Since September 2013, the Institute has also held lectures that showcase the results from PICS funded projects and Fellows' research. These presentations will be predominantly be held where the principal investigator is based – Vancouver, Victoria or Prince George. Full details on the UBC-SFU Public Lecture Series, and the UVic-hosted Pacific Climate Seminar Series are available in the Campus Updates section of this annual report.

PICS guest speaker Gavin Schmidt, NASA GISS Director

Invited Speakers

In addition to its regular seminar and lecture series, PICS periodically hosts special public event with key climate change authorities from around the world. Invited speakers and topics during 2015 have included:

- **Gavin Schmidt**, director of the National Aeronautics and Space Administration (NASA) Goddard Institute for Space Studies (GISS), on how climate models work and what they can tell us about future climates. Lectures in Victoria and Vancouver, April 8 & 9.
- **Katherine Hayhoe**, atmospheric scientist, author and climate change evangelist, on why achievable actions that people can relate to—rather than scientific facts—will inspire people to accept global warming and adopt climate-friendly behaviour. Two Vancouver lectures, May 7 & 8.
- Public panel discussion on "What Needs to be Done for a Successful Climate Conference in Paris 2015" featuring **Mary Polak**, BC Minister of Environment, **Nicolas Chapuis**, French Ambassador to Canada, and **Gregor Robertson**, Mayor of Vancouver. Vancouver, May 26.

- **Stephan Lewandowsky**, cognitive psychologist, author, and University of Bristol Chair on Cognitive Psychology, on the human mind and what it will take to motivate people to take action against anthropogenic climate change. Victoria, June 25.
- **Catherine Potvin**, professor and Canada Research Chair in Climate Change Mitigation and Tropical Forests at McGill University, and leader of the Sustainable Canada Dialogues. Her lecture on acting on climate change after Paris COP21 emphasised the importance of adaptation, and how mitigation alone was not enough. Victoria, December 1.

Catherine Potvin at her UVic lecture

Fellowship Symposium

The PICS annual fellowship symposium is an opportunity for fellows to present their interim research results and learn about the work being undertaken by others working in the field of climate change solutions. This exchange of information always sparks lively discussion and fosters collaboration among the broad range of disciplines supported through this program.

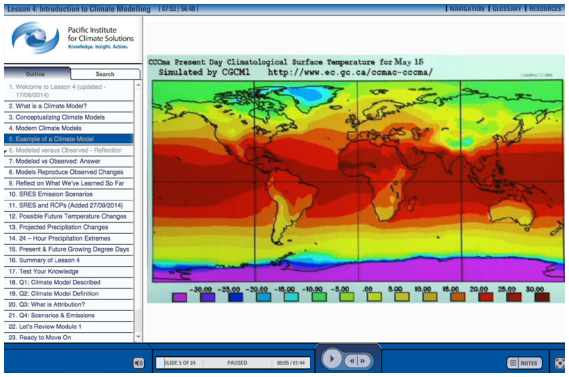
This year's fellows (which include engineers, social scientists, legal scholars, biologists, atmospheric chemists, epidemiologists and computer scientists), met in Vancouver in April 2015. Among the presentations was research into the effects of climate change on gastrointestinal illness, how to deliver greater carbon efficiencies in urban planning, developing new materials for more sustainable cooling systems and detailed mapping of the potential for wind power off BC's coast. Transforming from a fossil fuel based economy to one based on renewable energy will require a collective effort across society, hence the importance of interdisciplinary approaches.

Climate News Scan

PICS' flagship current affairs product, the Climate News Scan, wrapped up another successful year in analyzing global climate issues for Canadians, with plans to transform and further expand the publication's reach in 2016. Since its launch in 2009, the weekly News Scan has taken topical climate and energy issues in the press and scientific journals—from carbon capture and storage to ocean acidification to the controversy around the 'Hiatus'—and interpreted them for both policy makers and the informed lay public. 2015 saw the arrival of Leigh Phillips, an experienced science journalist whose work has appeared in such publications as the New Scientist, Nature, and the Guardian, to bring a fresh voice to the News Scan, with ongoing

contributions from UBC's Clean Capital team of writers.

Work is underway to develop the News Scan as a 'microsite' within the wider PICS website, with an up-to-date new look and improved usability. Stories will be more shareable, offer additional search functionality, be more responsive to those viewing it on their mobile or tablet, and the site will offer a platform for commentary from climate and energy policy thought-leaders both from within the PICS family and further afield. Watch online in early 2016 for the launch of the microsite.



PICS Climate Insghts 101 lesson on climate modelling

The PICS Newsletter

The newsletter is a quarterly publication featuring the latest PICS research results, announcements and events, both past and upcoming. It is widely distributed electronically and (as required) as hard copy.

Climate Insights 101

Designed to bridge the gap between scientists and general society, Climate Insights 101 is a series of free, online animated interactive courses that provide an in-depth understanding of the science behind climate change and where the solutions lie in terms of mitigation and adaptation.

The three courses available on the Education section of the PICS website are Climate Science Basics, BC Climate Impacts & Adaptation, and Mitigation Needs & Action. Each course contains test-your-knowledge quizzes and typically takes two hours to complete, although users can jump directly to individual topics within the lessons.

With online users in more than 170 countries, the audience for Climate Insights 101 includes educators, policymakers, industry, NGOs, and members of the public wanting to gain a comprehensive understanding of climate change. The series has been developed and peer reviewed by leading climate scientists and experts from British Columbia.

PICS has developed complementary products to the Climate Insights 101 courses that make climate change education accessible via shorter animated videos, available on YouTube and the PICS website. What's on offer:

- **Climate Insights: mini lessons**

These fun and engaging mini-lesson videos explain the basics of climate science and expose common climate myths. Most are under 10 minutes in duration.

- **Clear the Air**

These animated short videos refute common global-warming denier myths in under two minutes.

PICS regularly showcases the suite of Climate Insights 101 products in BC schools, public libraries, and university education expos, as well as to community groups and NGOs. The series' global audience continues to grow, with 10 of the YouTube videos translated into Finnish by the Finnish Meteorological Institute.

Media Coverage

2015 was another busy year for PICS in the media, with widespread coverage of the Institute's new research announcements and events by print, radio and television networks within British Columbia and beyond. In addition, PICS received regular requests from media for expert commentary on climate issues, particularly in the lead-up to United Nation's major climate summit (COP21) in Paris during November/December.

Former PICS executive director Tom Pedersen interviewed by CBC television

Issues that attracted the most media attention for PICS during 2015 include the debate over divestment from fossil fuels, COP21, and its new research on energy efficient buildings and increasing uptake of electric vehicles.

PICS people, events or guests featured in the following print, online and broadcast media in 2015:

Print & Agency: Vancouver Sun, Globe and Mail, Hill Times, Toronto Star, Business in Vancouver, Times Colonist, Calgary Herald, The Georgia Strait, The Squamish Chief, The Tyee, The Star, Yahoo News Canada, Sunday Edition, Power and Politics, The Martlet, The Ring, Metro News Vancouver, The Indo-Canadian Voice, Clean Technica, Northeast News, Prince George Citizen, Comox Valley Record, Vancouver Observer, My Prince George Now, Phys.org, Douglas Magazine, BC Business, Better Farming, The Nelson Daily, Huffington Post,

Radio: CBC Early Edition, CBC On the Island, CBC All Points West, CFAX 1070, BC Almanac, CBC Quirk and Quarks, News 1130, Radio NL Kamloops, Radio Canada, The EcoCentric" on CJLY in Nelson BC.

Television: CBC The National, CKPG TV, CBC News, Global TV News,

Online blogosphere: IAsk.ca, Ecolog,

Website and Social Media

The PICS website houses information on the Institute's research activities and outcomes, news, events, publications, free education tools, funding programs, and other climate related resources. PICS social media communication has continued to grow over the past year via its Facebook and Twitter channels and through its Climate Insights 101 online products.

CAMPUS UPDATES

University of Victoria

As the host institution, UVic houses the central PICS office staff, including the executive director, administrators, and communications/ outreach staff. PICS at UVic is responsible for directing the Institute's overall programming and outreach activities. This includes administering the PICS research, fellowship and internship programs; producing the weekly Climate News Scan and white paper series; organizing PICS annual forums, lectures and other events; creating the Climate Insights 101 short courses; and managing the Institute's promotional activities and media relations, as detailed earlier in this report.

Robbert Gifford at his UVic lecture

Pacific Climate Seminar Series

The Pacific Climate Seminar Series is a joint PICS-PCIC initiative of UVic-based public talks by local and visiting lead researchers. The series runs from September to April, with a talk typically held on the third Wednesday of each month from 3:30pm- 4:30pm. With a focus on climate science, regional impacts and potential solutions, seminar topics over the past year include:

- **John Fyfe,** senior research scientist with the Canadian Centre for Climate Modelling and Analysis (a UVic-based Environment Canada laboratory), on the latest research findings over the recent slowdown or "hiatus" in global surface temperature since the turn of this century, and why we should not be surprised to see hiatuses in the future.
- **Robert Gifford**, professor of psychology at UVic, on the psychological barriers to climate change action. In his September 16 lecture on "The Dragons of Inaction: Why Good Intentions Often Do Not Lead to Action-and Seven Ways to Fix This", Dr. Gifford identified over 30 'dragons of inaction', which restrict how much climate positive action people take. He also offered a variety of solutions to counter apathy and fear, including the need to communicate that climate change is happening here and now, rather than in the distant future. He also advocated creating infrastructure to make the climate positive actions the easiest choice; e.g. building cycling paths, electric vehicle charging stations or widely distributing recycling bins.
- **Brian Starzomski**, associate professor in Environmental Studies at UVic, gave a talk in February on a new method for analyzing and predicting climate change impacts on the Canadian Rocky Mountains, using computer-based analysis of historical photographs. To overcome the lack of colour, his team

are using a computer visualization techniques grounded in texture analysis and machine learning, whereby a baseline algorithm serves as a reference for change detection algorithms. Next steps include combining the results of these analyses with biodiversity data collected in the field to provide predictive models of changed species assemblages and carbon sequestration.

Outreach

Divestment – bridging the divide

PICS raised public awareness and fostered discussion on the hot-button issue of divestment from fossil fuel stocks through the release of new research and by co-hosting a public panel discussion with the University of Victoria. Institutions, including the four PICS universities, are being urged to drop their endowment holdings in oil, gas and coal companies for ethical, environmental and economic reasons by home-grown campaigns on their campuses. Investors around the globe managing more than $50 billion (US) of combined assets have already committed to divest, raising a timely question of how to most effectively use that money.

The white paper "Fossil Fuel Divestment: Reviewing Arguments, Implications & Policy Opportunities", released on January 29, examined the potential impacts of divesting on: (a) keeping fossil fuels in the ground, (b) protecting investors from exposure to unburnable carbon and (c) reducing greenhouse gas (GHG) emissions. The report and its policy recommendations attracted equal parts support and criticism, in a debate that spans the moral aspect of divestment through to its real economic implications.

Likewise the January 26 public panel discussion held at UVic highlighted the polarization of views on divestment, despite the panel's common goal of reducing global GHG emissions. The panellists represented key interests within the divestment debate – **Steve Douglas**, vice president of investor relations at Suncor Energy; Divest UVic represented by student **Malkolm Boothroyd**; **Cary Krosinsky**, co-founder of the Carbon Tracker Initiative; **Crystal Lameman** from the Beaver Lake Cree Nation; and columnist **Stephen Hume,** from the Vancouver Sun. A video of the event and the white paper are available on the PICS website.

Panelists Malkolm Boothroyd and Steve Douglas at the PICS-UVic forum on divestment.
Photo by Hugo Wong

COP21

Raising public awareness about the urgent need for climate action was a priority for PICS ahead of the UN climate summit in Paris (COP21) held 30 November – 11

December, 2105. Activities included hosting a free public panel discussion in Vancouver (see OUTREACH section), and co-hosting two COP21 themed talks in Vancouver: "Climate change, the resource economy and the road to Paris" by internationally acclaimed scientist and author Tim Flannery, and lectures by leading Australian economist and leading public servant, Martin Parkinson, and Catherine Potvin, who leads the Sustainable Canada Dialogues.

Sybil Seitzinger talking about COP21 on CBC's Quirks & Quarks

PICS two executive directors during 2015, Tom Pedersen and Sybil Seitzinger, also gave numerous broadcast and print media interviews in the lead up to, during and after COP21.

University of British Columbia

Climate change and public health, community energy planning, social mobilization and communication continued as key themes for PICS UBC's activities over the past year, with a wide range of events being supported and co-hosted with other climate-change specialists and other groups both on and off campus. PICS UBC program manager Sara Muir-Owen co-hosted public talks and webinars, attended a number of regional conferences, gave presentations at elementary schools, and fostered partnerships on many initiatives at UBC and beyond. A few of this year's highlights include:

The Sacred Headwaters talk by Wade Davis

PICS UBC partnered with UBC Reads Sustainability, the Liu Institute for Global Issues and the Irving K. Barber Learning Centre to host Professor Wade Davis, Canadian author, anthropologist and former Explorer-in-Residence at the National Geographic Society for a talk about his latest book, The Sacred Headwaters, at UBC on February 12, 2015. Wade makes the case that pristine salmon-bearing rivers such as the Stikine, Skeena and Nass remain "sacred headwaters for all Canadians, and indeed, of all peoples of the world," and as such, should be spared from industrial development. More than 500 people attended the talk, and another 620 viewers watched the live webstream.

This Changes BC: Conversations on Climate Justice

From February through March 2015, thirty-six people from all walks of life across Metro Vancouver shared their ideas and concerns about how climate change will impact their lives and province in a series of four PICS-supported winter/spring workshops, organized by the Canadian Centre of Policy Alternatives (CCPA) as part of the ongoing UBC Climate Justice Project. This Changes BC: Conversations on Climate Justice, an outreach and engagement initiative, enabled the

Natalie Alteen, PICS UBC intern, worked with the Prince George Chamber of Commerce on a Carbon Footprint project aimed at reducing the environmental impact of local businesses. Following completion of carbon audits by the project team, Natalie met with each company to develop an energy conservation and reduction strategy. Applicable energy incentives through FortisBC and BC Hydro were identified, along with the payback calculations for efficiency upgrades and investments (e.g. low flow faucet aerators, lighting upgrades, and programmable thermostats). Natalie's work gave businesses the tools they needed to lower their energy bills, as well as become green leaders. She also completed a carbon footprint analysis for the Chamber itself.

Natalie Alteen, PICS UBC intern, with the info plaque created during her internship

In recognition of supporters of the project and the businesses that became carbon neutral as a result, in September a commemorative tree and educational plaque were installed in the city's Duchess Park. The plaque contains information on the carbon cycle, why fossil fuels are associated with carbon emissions, and how trees sequester carbon.

Climate Justice research network to develop a deeper understanding of public perceptions, values and attitudes related to social justice issues and climate policy. Education resources are planned as a spin-off from the project, with the broader goal of developing a useful engagement model on climate change adaptation and mitigation that could be scaled-up to other parts of BC and Canada.

2015 UN International Year of Soils

PICS UBC was a co-sponsor of the UBC Botanical Garden workshop series in spring, which celebrated the 2015 UN International Year of Soils: Sustainability, Climate Change and Society. The event brought about 80 UBC and community members together to learn about soils in the city, soil management and food security in BC, and how soils are sequestering carbon and mitigating climate change. The range of speakers included PICS-UBC program manager Sara Muir-Owen, who outlined the climate change research, fellowship and internship programmes that PICS currently supports.

Summer Camps, LEx Kits, and Teachers' Workshops

PICS has introduced new interactive activities on climate change and energy generation to the "Phenomenal Physics" summer camps for kids in grades 2 to 10

that are run each summer by UBC Physics & Astronomy Outreach program. About 30 young campers learned how to create "greenhouse gas effect" models by developing tiny, controlled "atmospheres" and how to measure temperature effects from changing surface colour and environment type. They also discussed energy demand and explored renewable energy generation through assembly and exploration of small wind turbines alongside hand-cranked, circuit generators.

Students and teachers benefitted from PICS investment in UBC's physics and astronomy program with new climate content for summer camps and science teaching kits.

PICS support also enabled the outreach program to create a series of in-depth articles about the science of climate change. This new content links to the PICS online education products, including Climate Insights 101 and the Mini Lessons. And the fall of 2015, the physics and astronomy team prepared "Lend an Experiment" (LEx) boxes for around 20 high school teachers. The LEx kits contain instructions and equipment for conducting experiments on energy consumption, climate change and sustainability as part of the science curriculum. All kit recipients had attended an earlier teaching training workshop hosted by the program.

Community Energy Explorer and other CALP Collaborations

Sara Muir-Owen continued to support climate action at the community level throughout 2015 by working with UBC's Collaborative for Advanced Landscape Planning (CALP) on the Community Energy Explorer (an online tool) and the District of West Vancouver Community Energy and Emissions Plan. She also assisted with outreach and workshops on "what works, and what doesn't" for motivating people to take action on climate change as summarized in a PICS Special Report prepared by CALP (see Other Publications section). To learn more about CALP's community energy literacy and mapping tool, visit the CEE at http://energyexplorer.ca.

PICS SFU UBC Public Lectures

Since 2010, PICS UBC and SFU have co-hosted a free public lecture series where professors from both universities engage with the public

PICS UBC Fellow Stefan Pauer is investigating why most governments shy away from carbon tariffs, despite calls for their implementation from many environmentalists and academics. Carbon tariffs levy a charge on goods crossing a border. The tariff rate is determined by the amount of greenhouse gases emitted during production - the bigger the carbon footprint, the higher the charge.

Stefan Pauer, PICS UBC Fellow

Proponents of carbon tariffs favour them for several reasons: Firstly, tariffs strengthen domestic carbon pricing by ensuring that industries are not at a competitive disadvantage to those operating in a jurisdiction without a price on carbon, creating an equalizing effect. And secondly, they counter the problem of "leakage" where businesses transfer production to a jurisdiction with fewer constraints on emissions. Also, carbon tariffs may motivate other countries to cut emissions, and bring more co-ordination to the largely fragmented global response to climate action. Critics of tariffs however claim they are trade sanctions and protectionist.

While in Brussels, Stefan interviewed politicians, senior government officials and policy experts within business, industry and the environmental community, with the aim of identifying the actual barriers that keep practitioners from adopting carbon tariffs, and also to assess tariffs' viability as a climate solution. In Canada where trade is equivalent to more than 60 percent of the annual GDP, carbon tariffs could be a solution to alleviate concerns over competitiveness while helping meet emissions reductions targets. Stefan is a PhD candidate in law at UBC, and previously was a policy officer at the European Commission.

on diverse climate change topics. Two events were held in 2015.

- **Sarah Henderson** (UBC) and **Anders Knudby** (SFU) gave a January 22 talk on mapping extreme heat events and associated risks on human health. Dr. Henderson has been involved in the development of a new local Heat Health Warning System to assist health agencies in better preparing for hot weather. Dr. Knudby provided insights into Greater Vancouver's urban heat "archipelago," and demonstrated how local authorities can identify, measure and map health-risk hot spots throughout the region. Together, their research offers insight into effective warning systems that can assist our cities' most vulnerable prepare for and adapt to the extreme heat events under a changing climate.
- The second lecture (in November) again featured **Dr. Sarah Henderson**, alongside **Dr. Meg Krawchuk** from the Geography Department at SFU, discussing the risks and benefits of forest fires in the context of climate change, human health and ecological

systems. Meg Krawchuk explained how wildfires play a key role in the maintaining forest biodiversity. Dr. Henderson shared information on the BC Asthma Monitoring System (BCAMS), which was used by the BC Centre for Disease Control to track smoke exposure and its impacts through the forest fire summer season of 2015.

Simon Fraser University

Motivating climate action through education and outreach, and supporting climate solutions research continued to be a central priority of PICS SFU in 2015. Highlights include: the successful Energy & Climate educational outreach program led by PICS SFU Program Manager Nastenka Calle; the hosting of the first SFU Climate & Energy Research Day, and PICS SFU involvement in two major events, Renewable Cities and the 2015 Canadian Water Summit.

SFU Climate Energy Research Day

PICS SFU and the SFU VP-Research co-hosted the first ever Climate and Energy Research Day at Simon Fraser University on April 14, bringing together faculty members from the three SFU campuses to share their latest research on diverse climate and energy topics. The day was moderated by **Drs. Tim Takaro** and **Kirsten Zickfeld**, members of the PICS Program Committee. The event brought together over 120 participants, including faculty, students, community partners and the general public.

As part of the day, 29 graduate students from different disciplines shared their research via a climate change poster competition. Some of the topics covered included: risk and resilience in the shale gas context, citizen acceptance of new fossil fuel infrastructure, applying 3D visualizations to climate and energy challenges, ocean acidification in Canadian coastal communities, sustainable energy systems, and fuel cell research. For the complete list of presentations please check the abstract book and video recordings available at www.sfu.ca/climatechange/pics-sfu/initiative.html

Renewable Cities

PICS was a major sponsor and partner of the highly successful Global Learning Forum held in Vancouver in mid-May, which saw the launch of a new five year program called Renewable Cities, a new initiative of the SFU Centre for Dialogue. The three-day forum brought together city staff, elected officials, businesses, NGOs, and researchers from around the world to participate in a solution-focused dialogue on implementing renewable energy and energy efficiency in cities. The forum comprised of plenaries, knowledge mobilization, peer-to-peer learning, networking, and intent to action sessions where participants learnt about the global trends that are impacting renewable energy adoption.

Carbon Talks public dialogues

PICS SFU has been a co-sponsor with SFU Carbon Talks of the Public Carbon Talk Dialogues since September 2011. These dialogues provide a platform to discuss emerging topics on climate change. Leading

up to COP 21, many of the dialogues that took place in 2015 were about raising awareness on the urgent need for climate action by governments, businesses, communities and the public in general. This year's series also addressed the controversial topic on the BC transportation referendum and how to best reconcile increasing renewable energy supply while reducing energy use and ensuring resiliency. Topics and speakers during 2015 include:

- The Economics and Politics of Carbon Pricing in Australia, with **Dr. Martin Parkinson,** Secretary of the Department of Prime Minister and Cabinet (former Secretary to the Treasury and Department of Climate Change, Government of Australia)
- Apres Paris: A COP21 Debrief, with **Merran Smith**, Executive Director, Clean Energy Canada; **Bryan Buggey,** Director, City of Vancouver's Economic Commission; and **Jennifer Allan,** (IISD)

Martin Parkinson, Secretary of the Department of Prime Minister and Cabinet, Government of Australia

The Canadian Water Summit and Blue SFU

PICS lent its support in 2015 to two events dedicated to safeguarding the health of Canada's watersheds – the BLUE SFU Water Research Day on June 24, followed by the 6th Annual Canadian Water Summit. SFU's research day enabled academics to share their latest findings in the areas of ecological conservation; protecting watersheds and salmon biodiversity; climate change adaptation and water governance; urban sustainability; and water, sewage and storm water issues. Water-related research at other leading universities was also highlighted such as UVic's POLIS research project, and the PICS water-energy nexus research being undertaken as part of its natural gas project. The creation of the Pacific Water Research Centre at SFU was also announced at the event. PICS SFU provided seed funding to the Centre for the purpose of allocating small research grants to support projects related to water and climate issues.

Green Tech Exchange Forums

Since 2012 PICS SFU has been a partner and supporter of the Greentech Exchange (GTEX) Forum, a monthly networking event—created by the SFU Innovation Office—for accelerating clean technology innovation and deploying clean energy solutions in a regional cleantech cluster. Highlights from the 15 events hosted in 2015 include:

- "Clean, Green and Sustainable: Making Waves in the Marine and Shipping Industry",
- "Getting More with Less from the Grid: Innovations in Energy Demand Management"
- "The Renewable Revolution: Cultivating Green Technology for Developing Nations"

The Climate Nexus

In December SFU's Adaptation Climate Change Team—ACT—launched a new book called "The Climate Nexus: Water, Food, Energy and Biodiversity in a changing world" by Jon O'Riordan & Robert William Sandford. PICS Fellow Sukhraj Sihota, from SFU's School of Public Policy, contributed significantly to this work. The book explains how understanding the interconnection between the nexus elements—water, food, energy and biodiversity—is of crucial importance in better managing and protecting these vital resources.

Nastenka Calle, PICS SFU Program Manager at Science Rendezvous

Sukhraj Sihota's research focuses on climate change and the energy-water-biodiversity nexus in the Columbia River Basin - her thesis is "Swimming Against the Current: Valuation of White Sturgeon in Renewal of the Columbia River Treaty "

Outreach

2015 chalked up another successful year for the Exploring Energy Outreach Program run by PICS SFU Program Manager Nastenka Calle, in collaboration with SFU Science in Action. The program offers a workshop designed for Grade 4-8 students that teaches energy conversion, consumption and conservation, and how it relates to climate change. The workshop, through 6 interactive stations, educates students on topics related to renewable and non-renewable energy, the greenhouse effect and its impacts; and on how to reduce energy use and their own carbon footprints.

Since its launch in June 2011, the program has reached over 52,000 people via workshops, family science events and special presentations. Schools participants in 2015 were: Vancouver Christian School, Khalsa School, SD43 Gifted Program, Sperling Elementary, Pacific Academy, Chaffey-Burke Elementary, and Westridge Elementary. In addition, the program was also part of major science & community events including: Science Rendezvous on May 9 – the largest science festival in Canada with 7,000 people attending; and Around the Dome Science Festival in Science World on September 26-27, with 14,000 visitors on that weekend. The success of this program is also due to SFU student volunteers who share

their time and knowledge with the younger generation.

Another useful feature of the workshops is that they allow SFU researchers to test how effective their new climate-related innovations are at engaging the public. The "energy conservation game", an interactive visualization tool designed by researchers from the SFU - School of Interactive Art and Technology (SIAT) and tested in the workshops, is now one of the biggest successes of the program.

The Climate Insights Bite size video - CO2 and the Green House Effect - part of the PICS Climate Insights 101 online courses and mini-lessons, are also used to help explain the GHG effect – at one of the workshop's stations. Nastenka Calle, was also a guest lecturer for a REM graduate class at SFU with the topic "Climate Change in BC: Science, Mitigation and Adaptation" on March 31, and hosted a booth in the Catalysts 2015 conference on October 23 – organized by the BC Science Teacher Association - where teachers showed real interest in the PICS Climate Insights 101 educational program.

For details of the SFU-UBC co-hosted public lecture series see above in UBC section.

Michelle Connelley, PICS' new UNBC program coordinator on CKPG News

University of Northern British Columbia

PICS welcomed a new UNBC Program Co-ordinator and research manager, Michelle Connelly in fall 2015, following the departure of one of the Institute's original staffers, Kyle Aben. The David Suzuki Foundation in Vancouver was fortunate to gain Kyle when he joined its climate action team this summer. Michelle has quickly established herself within the climate community in the far north, having joined local groups such as the Green University Planning Committee and the Natural Resources & Environmental Studies Institute, and by appearing regularly in the local media on climate issues.

PICS UNBC has had high profile in the wider Prince George region this year, on campus, within the local business community and even among the sporting elite, having ensured that the 2015 Canada Winter Games were carbon neutral.

Michelle Connelly, PICS UNBC

Prior to joining PICS, Michelle Connelly has worked as a coordinator, a biologist, a technical writer, a researcher and a field technician for federal, provincial and local governments, academia and non-

PICS UNBC intern Adam Seip worked this summer as a Climatology Research Assistant for the BC Ministry of Forests, Lands, and Natural Resource Operations in Prince George. His fieldwork consisted of collecting data from, and doing maintenance on, 25 weather stations and hundreds of weather data loggers all over northern BC. The data are being used to monitor climate change trends in the region, particularly in the areas of forest health and permafrost loss. One location with a more specialized purpose is a carbon flux site that collects data in a mountain pine beetle-killed tree stand. This site monitors net carbon emitted from the stand along with the change in rain and snow depths due to a loss in canopy cover. Adam also rappelled to reach temperature probes in the cliff side at Mt. Gunnel, which is experiencing increased avalanches due to permafrost melting.

Adam Seip, PICS UNBC intern in a helicopter, on the way to check weather stations south of Tumbler Ridge in the Peace River Valley

governmental organizations. She has a BSc in forestry from UBC and an MSc in forest ecology from UNBC. Michelle first became concerned about the impacts of climate change after learning about declines in yellow-cedar because of warming winters. She is supportive of conserving natural landscapes as a way of avoiding emissions. Michelle loves the wild landscapes of northern BC and is proud to be representing UNBC with PICS.

Northern businesses reduce carbon footprints

The Prince George Chamber of Commerce teamed up with the University of Northern British Columbia and PICS UNBC to help local businesses reduce their carbon footprints in 2015. Students from the course, "Carbon Management: The intersection of Business and Environmentalism" worked with 10 local businesses to measure their corporate carbon footprints and investigate recommendations for carbon reductions and energy savings.

The service was free and offered students the opportunity to solve real-world business problems, while businesses saved money and reduced their emissions. Businesses involved included farms, restaurants, piano tuners, and even a tattoo shop. Additional assistance was also provided through sponsorship of student interns to help the local businesses implement some of the recommendations provided.

Canada Winter Games achieves carbon neutrality

The 2015 Canada Winter Games that ran from February 13—March 1 will leave a legacy of sustainability as well as national sporting

excellence, thanks the efforts of PICS UNBC, the University of Northern British Columbia and games organizers in securing carbon neutrality status for the event.

The Charles Jago Northern Sports Centre, host to the carbon-neutral 2015 Canada Winter Games

PICS UNBC program coordinator and certified greenhouse gas inventory quantifier, Kyle Aben, worked pro bono with the Games Sustainability Manager, Emily Harrison, to calculate the games' carbon footprint. They then worked with the UNBC Student Sustainability Committee to identify carbon credit companies to approach to offset the approximately 583 CO_2 tonnes of carbon emissions created by the games.

Former PICS UNBC Program Co-ordinator Kyle Aben in an electric Might-E Truck

In early March it was announced that Tolko Industries made carbon neutrality a reality by donating the required carbon credits from its gasification project that turns wood waste into renewable syngas.

The impact of northern resource development

2015 saw the launch of a new community-based group that will research the cumulative impacts of resource development across Northern British Columbia and give a voice to communities being affected by these changes. PICS UNBC is one of a number of supporters of the "Cumulative and Community Impacts Research Consortium (CCIRC)" which will provide a platform for research and dialogue on recent and proposed increases for resource development across the region. Recent years have seen a tremendous increase in resource development including oil and gas pipeline proposals, more hydraulic fracturing exploration for natural gas, a growing liquefied natural gas industry, the Site C hydroelectric project proposal, new transmission lines, mountain pine-beetle recovery, and new mines. Activities of the CCIRC include supporting community workshops and discussions, and creating an online information hub of academic, traditional and experiential knowledge on cumulative impacts.

Working with the BC Government

PICS continues to build and maintain strong relationships with the BC government, primarily through the Climate Action Secretariat (CAS). The PICS Executive Committee includes a representative from CAS, and the PICS Executive Director communicates regularly with the Head of CAS to keep the province up to date regarding ongoing PICS activities, as well as to ensure that PICS-supported research is addressing provincial government information needs in a timely manner. CAS and other government representatives frequently attend PICS lectures and meet with invited speakers to discuss a wide range of relevant topics.

FINANCIAL REPORT

The PICS endowment income fund performed well throughout 2013 resulting in a spend rate of 4.5% for the fiscal year 2014-2015, a budget of $3.4 million. The majority of PICS annual budget, 46%, was spent in support for our graduate fellows and major research initiatives. Communications and outreach spending declined this year due to completion of the PICS Climate Insights 101 short course series.

Budget categories include:

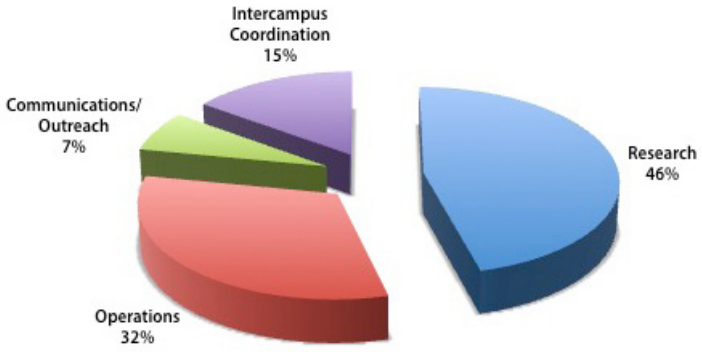
Funded Research supports: The five major research projects, fellowship students, intern student funding, and unsolicited proposals and white papers.

Operations supports: UVic overhead, salaries and administrative costs.

Outreach and communications supports: PICS lecture series and hosted events, the weekly news scan, short courses, sponsorships and the PICS annual forum.

Intercampus Coordination supports: funding for the PICS Campus support at the

University of British Columbia, Simon Fraser University and the University of Northern British Columbia.



Breakdown of total PICS budget expenditures 2014-2015.

APPENDIX 1: GOVERNANCE

Board and Committee Memebership: January 1, 2015 to December 31, 2015

Advisory Board

Michael Miller, Associate Vice-President Research, UVic (Chair)

Lori Ackerman, Mayor, Fort St. John

Karen Dodds, Assistant Deputy Minister, Environment Canada

Mark Edwards, Director, Environment, Teck Cominco Ltd.

Richard Flury, former Chief Executive, Oil, Gas and Renewables, BP plc (retired)

Graham Kissack, External Consultant, Sustainability, Catalyst Paper Corporation

Gordon Lambert, former Vice-President, Sustainable Development, Suncor Energy (retired)

Doug Little, Vice President, Powerex Corporation

Jonathan Rhone, President and Chief Executive Officer, Axine Water Technologies

Peter Robinson, Chief Executive Officer, The David Suzuki Foundation

Mossadiq Umedaly, Cleantech Entrepreneur and Business Executive

Executive Committee

David Castle, Vice-President Research, UVic (Chair)

Ranjana Bird, Vice-President Research, UNBC, to September 2015

Geoff Payne, Acting Vice-President Research, UNBC, from September 2015

Ken Denman, Chief Scientist, Victoria Experimental Network Under the Sea (VENUS), UVic

Joy Johnson, Vice President Research SFU

Catherine Krull, Dean of Social Sciences, UVic from from September 2014

Susanna Laaksonen-Craig, Head, Climate Action Secretariat, BC Ministry of Environment

Michael Miller, Associate Vice-President Research, UVic

Tom Pedersen, Executive Director, PICS, to October 2015

Sybil Seitzinger, Executive Director, PICS, from November 2015

Brent Sauder, Director Strategic Initiatives, Office of the Vice President Research and International, UBC to May 2015

John Hepburn, Vice-President Research and International UBC, from June 2015

Program Committee

Tom Pedersen, Chair - Executive Director, PICS to October 2015

Sybil Seitzinger, Chair - Executive Director, PICS from November 2015

Stephanie Bertels, Assistant Professor, Technology, Operations Management/Innovation & Entrepreneurship, SFU

Art Fredeen, Professor, Ecosystem Science and Management, UNBC, to May 2015

Brian Menounous, Professor, Canada Research Chair in Glacial Change, UNBC, from September 2015

John Fyfe, Research Scientist, Canadian Centre for Climate Modelling and Analysis, Environment Canada, to June 2015

Greg Flato, Research Scientist, Canadian Centre for Climate Modelling and Analysis, Environment Canada, from September 2015

Robert Gifford, Professor, Department of Psychology, UVic

Zoe Meletis, Assistant Professor, Geography, UNBC

Walter Merida, Associate Professor, Department of Mechanical Engineering, UBC

Stephen Sheppard, Professor, Faculty of Applied Sciences, School of Architecture & Landscape Architecture; Forest Resources Management, Faculty of Forestry UBC

Curran Crawford, Professor, Department of Mechanical Engineering, UVic

Tim Takaro, Associate Professor, Faculty of Health Sciences, SFU, to September 2015

Kirsten Zickfeld, Associate Professor, Department of Geography, SFU, from October 2015

Thomas White, Manager, Science and Adaptation, CAS, British Columbia Ministry of Environment

APPENDIX 2: PICS FELLOWSHIP HOLDERS

Graduate Fellowships 2015

Simon Fraser University

Mehdi Aminipouri, PhD Candidate,Geography: *Modifying the urban surface energy balance in British Columbia's urban neighborhoods: how effective is urban greening and reflective roofs in keeping neighborhoods cool and people safe during an extreme heat event?*

Kaitlin Boyd, Master's Candidate, Resource & Environmental Managemen: *The social cost of carbon and Canadian climate policy.*

Jordan Brubacher, Master's Candidate, Health Sciences: *Can boil water advisories in BC be linked to extreme weather events that may increase with climate change?*

Evan Damkjar, Master's Candidate, Public Policy: *Multiple Attribute Social Benefit-Cost Analysis of Under-utilized Renewable Energy Resources in BC*.

Khorshid Fayazmanesh, PhD Candidate, Mechatronic Systems: *Development of advanced composite materials for adsorption cooling systems.*

Mikela Hein, Master's Candidate, Resource and Environmental Management*: Harmonization Strategies for British Columbia's Climate Policies.*

Derrick Ho, PhD Candidate, Geography: *Mapping and managing heat-related vulnerability and mortality in British Columbia: A case study in the GVRD.*

Alex Jiang Jun, PhD Candidate, Chemical and Biological engineering: *Coupled removal of caron dioxide and water treatment for BC relevant industries.*

Sukhraj Sahota, Master's Candidate, School of Public Policy*, Climate Change and the Energy-Water Nexus: Implications and Obligations for the Columbia River Treaty.*

Barbara Wilson, Master's Candidate, Education: *Education/Mobilizing communities for Action in a World of Changing Climate: Initiating action on Haida Gwaii.*

University of British Columbia

Tugce Conger, PhD Candidate Institute for Resources, Environment and Sustainability: *Green Infrastructure For Coastal Resilience to Storm Flooding and Sea Level Rise in the Salish Sea*.

Saad Dara, PhD Candidate, Chemical and Biological engineering: *Coupled removal of carbon dioxide and water treatment for BC relevant industries*.

Thor Jensen, PhD Candidate Institute for Resources, Environment and Sustainability: *Development models for community scale heating utilities*.

Cher King-Scobie, PhD Candidate, School of community and regional planning, *Post-disaster land use changes as a climate adaptation strategy*.

Stefan Pauer, PhD Candidate, Law, *Border Tax Adjustments in Support of Domestic Climate Policies: Explaining the Gap Between Theory and Practice*.

Robert Tsin, Master's Candidate, Population and Bublic Health: *Surface Temperature Heat Mapping in the Lower Mainland*.

Hongli Wang, PhD Candidate, Chemical and Biological Engineering, Environmental, economical and policy analyses of an integrated agricultural wastes-to energy E*con-Industrial system for GHG emissions reduction and air quality improvement in British Columbia*

University of Northern British Columbia

Talaat Bakri, PhD Candidate, Natural Resources and Environmental Studies, *Assessing offshore wind power production in British Columbia*.

Geoff de Ruiter, PhD Candidate, Environmental science/engineering: *Comparing industrial biochar applications: Optimizing revenue versus CO_2-equivalent emissions reductions or carbon sequestration*.

Ben Pelto, PhD Candidate, Geography: *Planning for climate-induced changes to the Columbia Basin's Freshwater Resources*.

M. Alexander Schare, PhD Candidate, International Studies: *A Comparative Study of the Carbon Footprint of Interurban Passenger Transportation in British Columbia, and Measures to Mitigate It*.

University of Victoria

Jeff English, PhD Candidate, Mechanical Engineering: *GHG mitigation through coordinated management of large hydro reservoirs in adjacent jurisdictions.*

Italo Franchini, MAS Candidate, Mechanical Engineering: *Prospects for optimal tidal energy integration in BC.*

Meysam Karimi, PhD Candidate, Mechanical Engineering: *Development of Floating Offshore Wind Turbine Platforms for BC.*

Karine Lacroix, Master's Candidate, Psychology*: Choices and climate change: The differential importance of social and psychological barriers for climate-positive behaviours across seven segments of the Britith Columbia population.*

Benjamin Lyseng, PhD Candidate, Mechanical Engineering: *Methane at the gate: the role of natural gas in future energy systems.*

Saeed Rahman, PhD Candidate, Business, *Securing energy and water sustainably: Managing critical inputs for an expanding mining industry in BC.*

Lajevardi Seyedmotjaba, PhD Candidate, Mechanical Engineering : *BC LNG Policy: A net CO benefit?*

Nancy Shackelford, PhD Candidate, Environmental Studies: *Ecosystem resilience and changing climate: detecting catastrophic change before it happens.*

Markus Sommerfield, PhD Candidate, Mechanical Engineering, *Airborne Wind Energy Systems.*

Cedar Welsh, PhD Candidate, Geography: *Past trends and future change in the hydrologic regime of the upper Stikine River basin in northern British Columbia, Canada.*

Charlotte Whitney, PhD Candidate, Environmental Studies*, The future of vulnerable marine species in a changing climate: conservation opportunities through marine protected area design.*

APPENDIX 3: STUDENT INTERNSHIPS 2015

Adaptation to Climate Change Team - Simon Fraser University

Chris Seo, UBC, International Economics

BC Ministry of Energy and Mines

Ramunas M Wierzbicki, UVic, Computer Engineering

BC Ministry of Environment, Climate Action Secretariat

Zoe Yunker, UVic, Sociology

BC Ministry of Environment, Climate Action Secretariat

Anika Bell, UVic, Engineering

BC Ministry of Forests Lands and NRO, Competitiveness and Innovation Division

Brad Van Dyck, UVic, Public Administration

BC Ministry of Forests, Lands, and Natural Resource Operations

Adam Seip, UNBC, Environmental Engineering

Capital Regional District - Integrated Water Services - Watershed Protection Div

Maryanna Kennedy, UVic, Geography & Computer science

City of Campbell River

Cassandra Smith, SFU, Geography

City of Kelowna/Sustainable Transportation Partnership of the Central Okanagan

Cameron Taylor-Noonan UBC, Planning

Climate Smart Businesses Inc

Taspia Raka UBC , Applied Sciences

Comox Valley Project Watershed Society

Maya Guttman, UBC, Environmental Sciences

Pembina Institute

Bassam Javed UBC Clean Energy Engineering

Prince George Chamber of Commerce

Natalie Alteen, UBC, Environmental Engineering

APPENDIX 4: PICS STAFF

Dr. Sybil Seitzinger, Executive Director from November 2015

Dr. Tom Pedersen, Executive Director to October 2015

Megan Jameson, Administrative Officer

Robyn Meyer, Sr. Communications Officer

Nancy Chan, Executive Assistant

Stephanie Inman, Communication Assistant and Event Coordinator

Leigh Philips, Science Writer

Michelle Connolly, Program Coordinator - University of Northern British Columbia from September 2015

Kyle Aben, Program Coordinator-University of Northern British Columbia to June 2015

Nastenka Calle, Program Coordinator-Simon Fraser University

Sara Muir-Owen, Program Manager-University of British Columbia

Annual report production and layout: Robyn Meyer and Stephanie Inman

Pacific Institute for Climate Solutions

Knowledge. Insight. Action.

University of Victoria
PO Box 1700 STN CSC
Victoria, BC V8W 2Y2

Phone 250-853-3595
Fax 250-853-3597
E-mail pics@uvic.ca
Web pics.uvic.ca

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PICS is hosted and led by the University of Victoria in collaboration with the University of British Columbia, Simon Fraser University and the University of Northern British Columbia.