

From Vulnerability to Adaptation: BC Hydro's approach to assessing risks from climate change

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Exploring Regional Climate Services:
Meeting Stakeholder Needs for Practical Climate Information
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FOR GENERATIONS

Outline

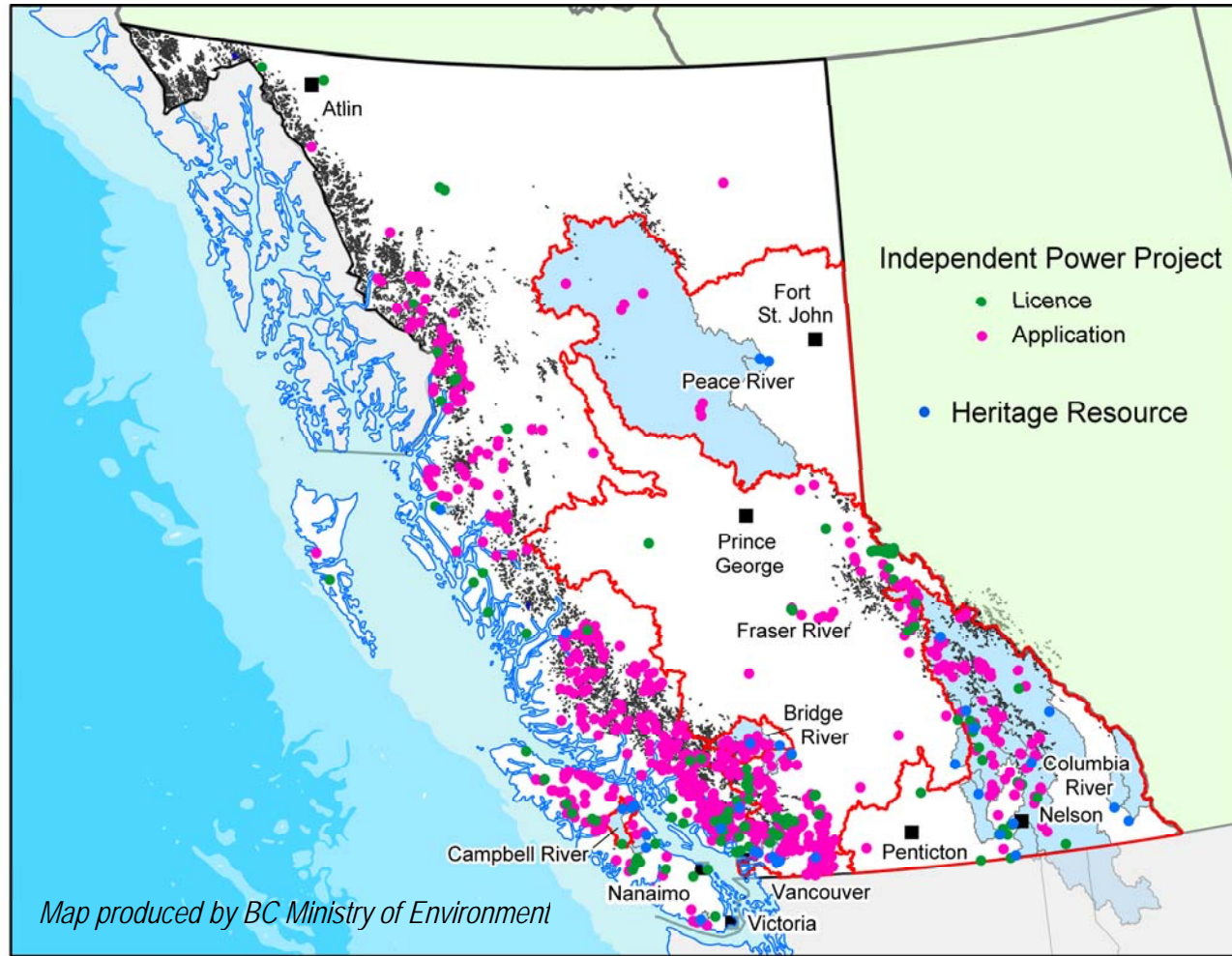
- Overview of BC Hydro
- Approaches to Climate Change studies in the past
- History of impact assessments on water resources
- Adaptation Framework
- Vulnerability assessment
- Risk assessment
- Adaptation examples

BC Hydro Facts

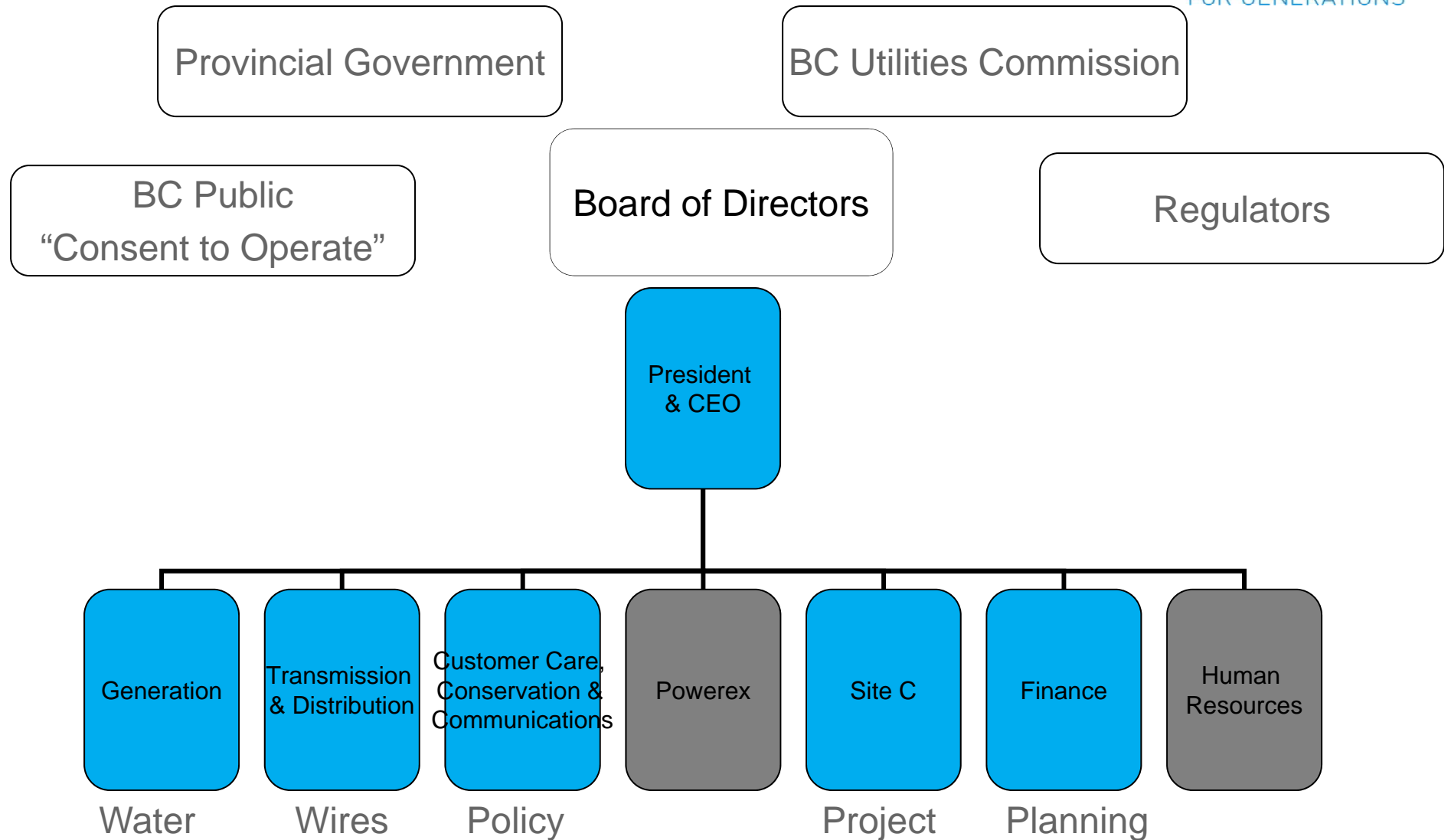
- 3rd largest electric utility in Canada
- Provincial crown corporation
- Serve 94% of population of BC (1.8 million customers)
- 95% hydroelectric and 5% thermal
- 11,300 MW capacity
- 18,500 km of transmission lines
- Energy varies from 43,000 to 54,000 GWh dependant on the weather



Hydroelectric Power Production in BC



BC Hydro Corporate Structure



Independent approaches to climate change

Generation

Scientific assessment of climate and hydrological change

- Past trends
- Present monitoring and forecasting
- Future projections
- Collaborate with expert groups

Corporate Environment

Environmental Strategic Goal

- Climate Policy
- Focus on GHG reporting and mitigation
- Adaptation Strategy
- Sponsored project looking at Mountain Pine Beetle

Transmission

Research and Development

- Understanding potential impacts to components of transmission system
- Research and development into adaptive technologies and practices
- Discuss at international conferences
- Sponsored research into thematic maps of climate change for icing conditions, wind impacts to transmission lines

Rest of the Organization

No Approach

History of Climate Change Studies

1994 - Mackenzie Basin Impact Study

Using the existing UBC Watershed Model calibration and the GCM climate scenarios available at the time, ran a scenario for Williston Reservoir in the Peace River basin

For a 2xCO² scenario (from 1990 levels, projected to occur ~ 2050), the average annual volume runoff to Williston is projected to increase by 6% over a 1973-1992 baseline. The timing of the runoff is expected to shift towards earlier spring melt, with hotter, drier summers. The average annual temperature was expected to increase by 4 degrees.

1999-2002

Participate in federal and regional climate change workshops and research initiatives (C-CIARN, Canada Country Study)

Key Message: “Projected changes are within the current scale of variability. Trust Us. We know how to handle that.”

The Need for Climate Change Studies



1995 – 2010 Water Use Planning – Consensus-based assessment of BC Hydro's water licenses

- Stakeholders, First Nations, Government agencies participate in wholesale evaluation of BC Hydro's priorities for the management of its water resources
- 5-10 year planning horizon
- Questions start to arise about future impacts of climate change

Key Message: *“The climate won't change much in the next 5-10 years. Perhaps we will look into climate change for the next round of Water Use Plans”*

2003 - Assessing Climate Change Impacts

Questions:

- How have the hydrology and climate of our watersheds changed in the recent past?
- How are the climate and hydrology expected to change in the future?
- What are the vulnerabilities or opportunities for our operations? How have they been impacted by past changes? How could they be impacted in the future?
- What should we be monitoring to help us define and understand the changes?

Process:

- Identify climate change research already underway or completed in our regions (by ourselves and others)
- Identify the gaps in the knowledge, sponsor research to fill in gaps
- Develop communication strategy to disseminate information to decision-makers, BC Hydro staff, stakeholders, public, research community.

Approach

Corporation recognizes need to do further research and get some scenarios to work with and answer questions coming from external stakeholders

- Establish credibility and trust in climate change results
 - Third party, open process
 - Use recognized experts
 - Build capacity in BC to do climate science
 - Build consensus in BC (and BC Hydro) on climate projections
 - other groups investigating impacts in BC use the same science – such as Columbia Basin Trust
- Became partner in building Pacific Climate Impacts Consortium
 - \$800K in grant funding over 2007 – 2010
 - Defined research plan for PCIC to answer specific questions
 - Representation on PCIC Board of Directors and Program Advisory Committee

Hydrologic Impact Studies for BC Hydro

Hydro-climatology Overview Study

- Historic climate trends, preliminary future impacts for BC
 - Completed in 2007 by Pacific Climate Impacts Consortium (PCIC)
- Trend Analysis of historic reservoir inflows by BC Hydro staff in 2010

Regional Climate Modeling and Downscaling

- Downscaling global climate models under different emission scenarios to predict changes in BC regional climate regimes
 - Ouranos consortium in Quebec in partnership with PCIC –complete Fall 2010

Hydrologic Scenarios

- Runoff projections for 2050 for Peace, Columbia and Campbell River
 - PCIC – complete in December 2010

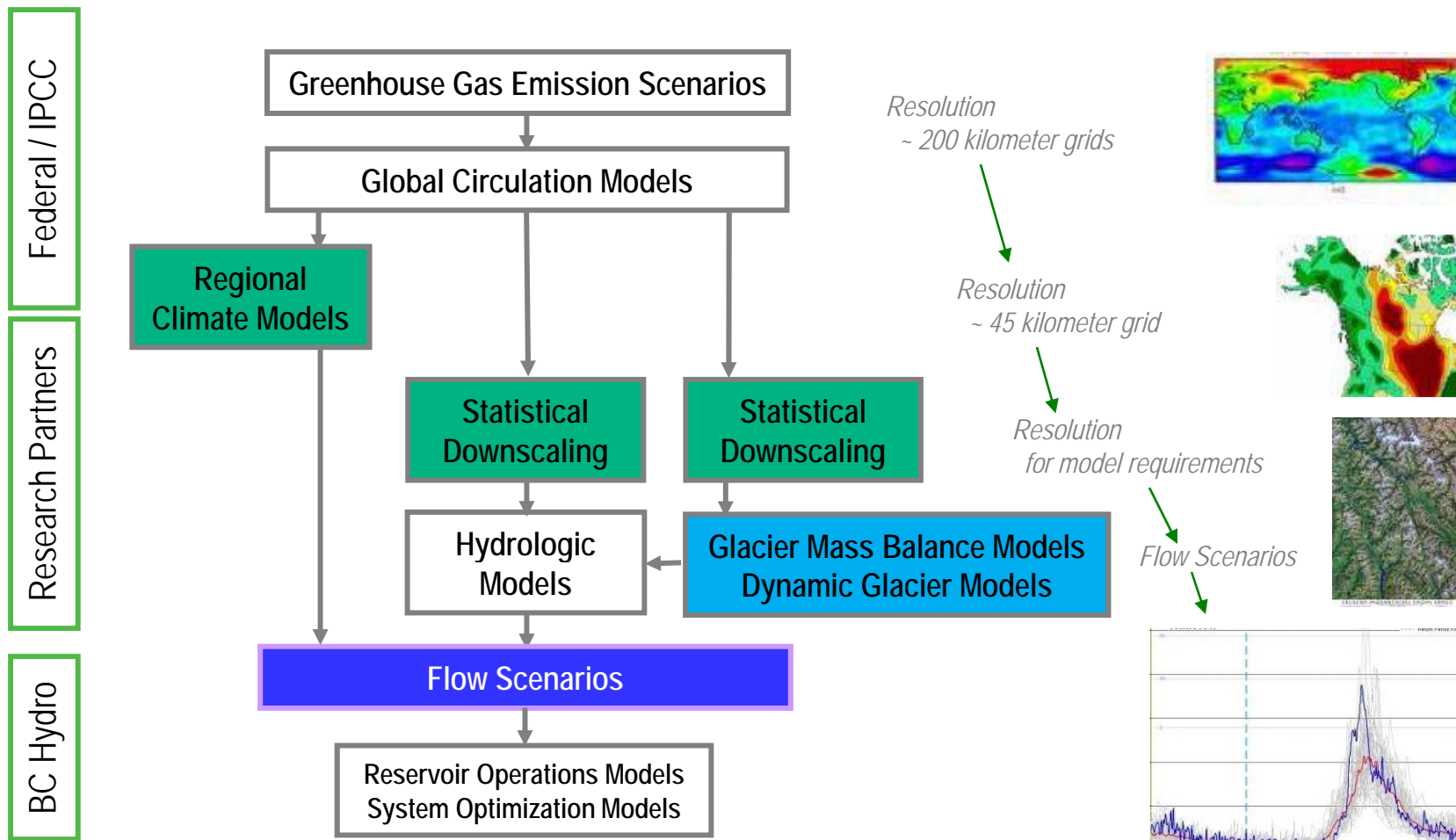
Mica Glacier Impacts Study

- In-depth study focusing on impacts to glaciers and hydrology in Upper Columbia
 - Western Canadian Cryospheric Network –complete in December 2010



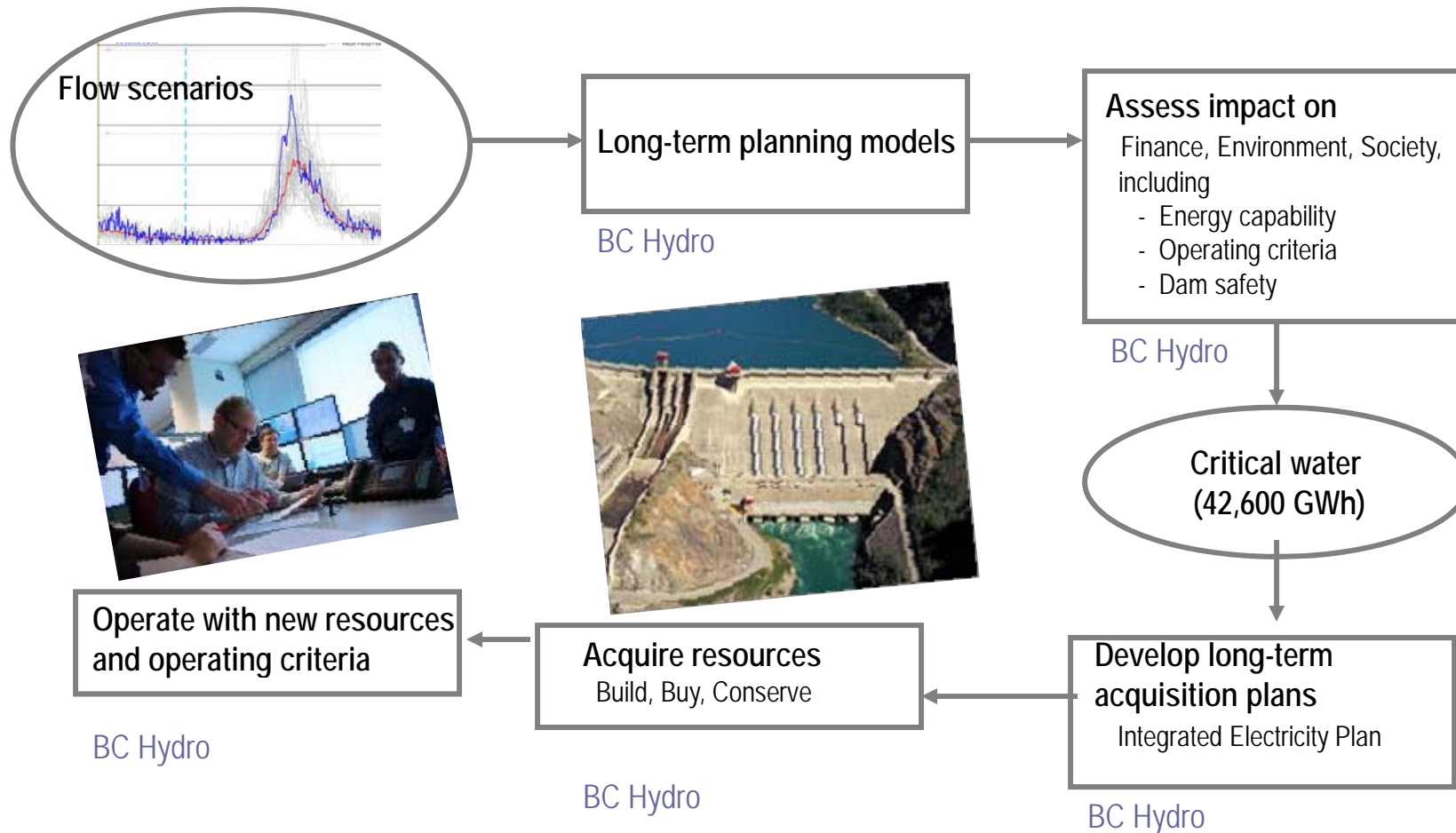
Photos from Moore et al., Hydrological Processes

BC Hydro Generation Impact Assessment



Adaptation (e.g., Reservoir Operations)

Impact Assessment Process - Generation



Adaptation Strategy Workshops

April 2010 – Joint PCIC – BC Hydro Public Workshop

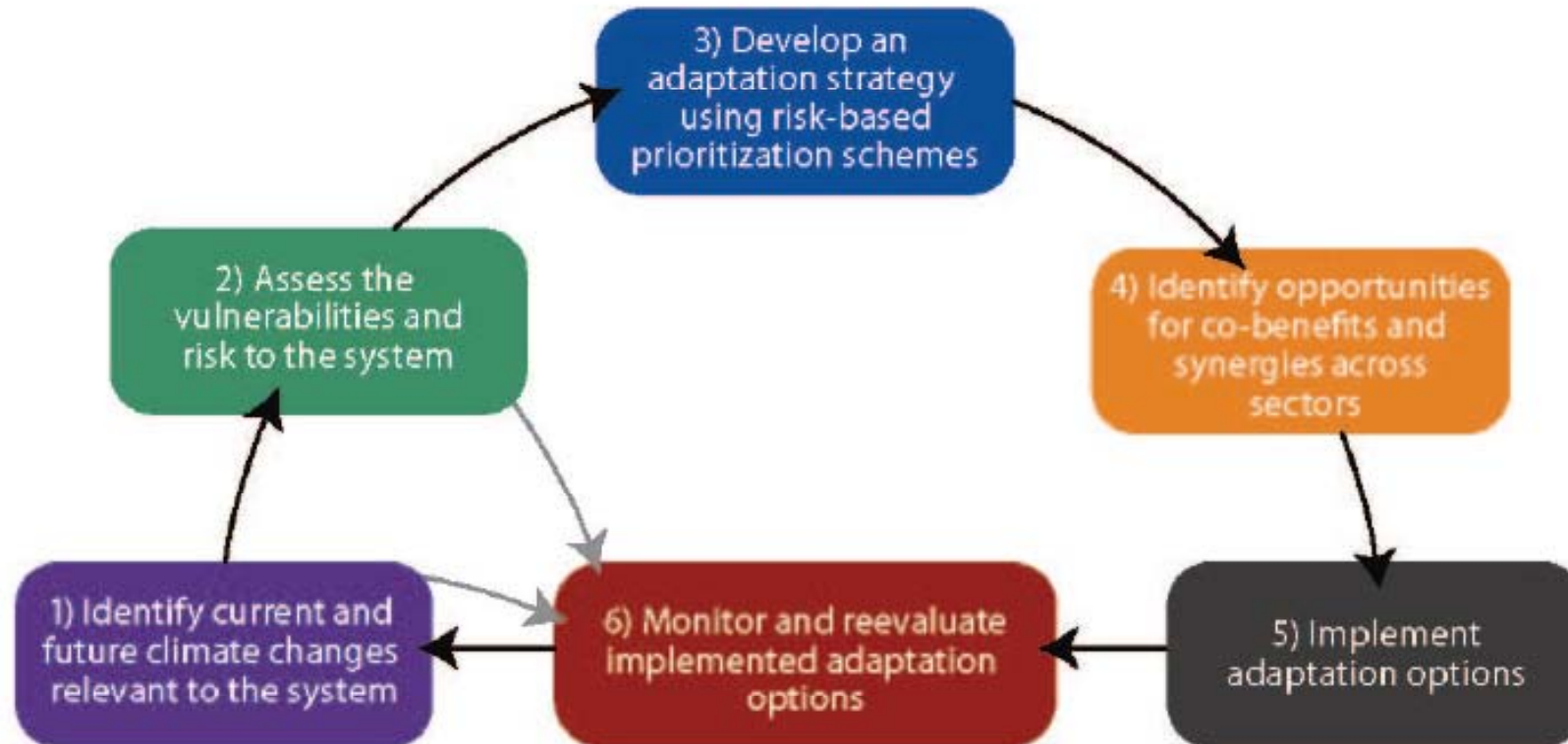
- *Assessing Hydrologic Impacts on Water Resources in BC*

Key Objectives

- Present PCIC accomplishments from three years of collaboration
- Engage and attract potential new consortium members
- Explore the implications of PCIC's hydrologic impacts research for BC Hydro's future adaptation and resource planning activities
- Ask stakeholders what they think the adaptation issues are for BC Hydro
- Inform and engage a spectrum of BC Hydro employees in the climate change work done to date

Key Message: "Here's what we have learned about climate change. Tell us what concerns you about our future."

Adaptation Strategy Framework



Taken from: National Academy of Sciences, 2010. “Adapting to the Impacts of Climate Change” National Academies Press, Washington, D.C.

Step 1 & 2

October 2010 – Adaptation Workshop 1

- Identify current and future climate changes relevant to the BC Hydro system
- Assess the vulnerabilities and risk to the system

Table One: Impacts of Climate Change on BC Hydro

Primary	Secondary	Tertiary
Precipitation Temperature Wind Direction and Speed Glaciers Cloud Cover Lightening Permafrost disappearance Air temperature and discharge	Reservoir Inflow Timing Ice Jam Flooding Water Supply Wet vs. Dry Snow Hydrologic drought and minimum flows Impacts on Load Frequency and magnitude of extreme and severe events (ice storms, wind storms, floods, and critical water level) Distribution and abundance of species	Fish and Fish Habitat Relationship to other resource management issues Increased risk of forest fire Mountain Pine Beetle Infestation Impact of IPP/small rivers Impacts on Infrastructure Impacts on System reliability

Step 3: Develop an adaptation strategy using risk-based prioritization schemes



December 2010 – Adaptation Workshop 2

Develop an adaptation strategy using risk-based prioritization schemes

- Identify adaptation options
- Use BC Hydro’s risk-based approach to prioritize

Vulnerability →	VULNERABILITY*	BC Hydro Corporate Risk Matrix							
		LOW	LOW	MED	MED	MED	HIGH	HIGH	
	HIGH	3	4	5	6	6	6	6	
	HIGH	3	3	4	5	6	6	6	
	HIGH	2	3	3	4	5	6	6	
	MED	2	2	3	4	5	6	6	
	MED	1	1	2	3	4	5	5	
	MED	1	1	1	3	4	5	5	
	MED	1	1	1	2	3	4	4	
	LOW	1	1	1	2	3	4	4	
	LOW	1	1	1	2	3	3	3	
	LOW	1	1	1	1	1	2	2	
	CONSEQUENCE TYPE**	CONSEQUENCE SEVERITY							

* Depending on issue, could be vulnerability, frequency or likelihood

** Considers consequences related to worker and public safety, environment, financial, reputational and reliability (supply and customer).

Consequence Severity →

Step 4: Identify opportunities for co-benefits and synergies across Lines of Business

2011

- BC Hydro review and synthesis of all hydrologic impact studies
- Work with internal customers of climate change scenarios to implement projections into existing planning models, identify further gaps in knowledge
- Build Communications Strategy and training to enable regional community relations staff to be able to discuss BC Hydro climate adaptation plans with public and stakeholders
- Building relationships with other utilities on Adaptation strategy
- Collaboration of Adaptation Strategy team on preparation of a case study for NRTEE report
- Coordination on attendance to key climate change conferences

Step 5: Implement adaptation options

Transmission Adaptation Examples

- Develop specialized weather prediction services (UBC, U of A)
- Identify tree failure risks as a function of storm severity (UBC)
- Modify current maintenance and design standards for lines
- Research and demonstrate dynamic thermal ratings for lines and equipment
- Researching and applying high performance corrosion resistant materials for transmission hardware and structures



Crossarm made of advanced high performance composite material (developed with BC Hydro R&D)

Transmission Innovations Inc

Step 6: Monitor and re-evaluate

Ongoing and Future Work

- Completing synthesis of climate change impact studies
- Building Communications strategy
- BC Hydro continues to partner with PCIC to further the research into impacts of climate change in BC – Committed \$1.3M in support over next 4 years
 - Expand geographic regions, examine other parameters
- BC Hydro part of consortium supporting Joint UVic – UQAM NSERC Collaborative Research and Development grant “Dynamical Downscaling of Western and Eastern Canada Hydroclimate” led by Andrew Weaver

Key Message: *“We are working on understanding and addressing the risks of climate change to BC Hydro infrastructure and operations”*

THANKS!

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