

NATURAL RESOURCES CANADA - INVENTIVE BY NATURE

## Canada's Approach to Advancing Carbon Capture and Storage Technologies

7th International CCS Regulatory Network Meeting International Energy Agency, Paris April 22-23, 2015



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#### ...which has led to a specific approach

- Recognizing that CCS has the potential to reduce GHG emissions from the production and use of fossil fuels, while enhancing energy security, and building on our natural advantage and R&D base, Canada's strategy includes:
  - Implementing large-scale demonstration projects to prove the technology while learning-from-doing;
  - Advancing CCS globally by sharing Canadian knowledge and expertise;
  - Improving the CCS business case by reducing technology costs through research and development of 2<sup>nd</sup> and 3<sup>rd</sup> generation technologies; and
  - Promoting innovation in Canada's clean energy technology sector.



## Support by Governments in Canada (since 2008)

- Federal (over \$580M)
  - Budget 2008 \$240M for SaskPower's Boundary Dam CCS project
  - Clean Energy Fund \$150M for 2 large-scale CCS projects in Alberta
  - ecoENERGY Technology Initiative \$112M for CCS initiatives led by industry, universities and federal laboratories
  - ecoENERGY Innovation Initiative \$27M for 2<sup>nd</sup> and 3<sup>rd</sup> generation capture technologies and CO<sub>2</sub> storage
- Provincial (over \$1.2B)
  - Alberta CCS Fund \$1.24B for 2 large-scale CCS projects in Alberta
  - Funding also provided through Alberta's Climate Change and Emissions Management Corporation, Saskatchewan's Go Green Fund, etc.



### ... underpinned by specific policy objectives

- Prove the technology at commercial-scale;
- Provide a stable regulatory framework;
- Improve the CCS business case by advancing 2<sup>nd</sup> and 3<sup>rd</sup> generation technologies that drive down CCS costs;
- Improve public education and engagement;
- Contribute to the international effort to promote the development and deployment of CCS; and
- Profile Canadian expertise and sharing experiences





## As a result, Canada has emerged as a global leader in large-scale demonstration projects...

- With four large-scale projects in operation or under construction
  - Weyburn-Midale Project
    - In operation since 2000
  - SaskPower Boundary Dam
    - Launched on October 2, 2014
  - Quest project
    - Will begin operations in 2015
  - Alberta Carbon Trunk Line
    - Will begin operations in 2017



Federal-Provincial investments in CCS RD&D of over \$1.8 Billion with potentially up to \$4.5 Billion in public-private investment in CCS initiatives



Canada





Government of Saskatchewan



## Our investments are already paying off

World's first commercial coal-fired power plant with CCS now a reality!

Julio Friedmann, Deputy Assistant Secretary, Clean Coal, US Department of Energy: "This project is a culmination of a dream. Projects like this show the world that this is not only a viable technology but a required technology."



Bellona President: "Finally, people cannot say that this is unproven technology. It will be much harder to reach climate targets without CCS."



IEA Executive Director: "Getting Boundary Dam up and running is a great example of how Canada is a leader in CCS... I wish the plant operator every success in showing the world that large-scale capture of CO2 from a power station is indeed not science fiction, but today's reality."







### **Alberta's Quest Project**





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### **The Alberta Carbon Trunk Line**



http://www.enhanceenergy.com/actl





Alberta

# Canada is also home to world-class private sector expertise toward a lower-cost generation of CCS

Company	Technology	Piloting Activities include
Saskatchewan-based HTC CO2 Systems Corp.	The HTC LCDesign™ advanced post combustion amine CO2 capture technology	<ul> <li>Facility construction began at Husky Energy's Pikes Peak</li> <li>South (Saskatchewan) heavy oil project in 2014</li> </ul>
Quebec-based CO2 Solutions Inc. (\$4.7M from NRCan's ecoEll Program)	Enzyme-enabled CO2 capture technology	<ul> <li>Technology was pilot tested at the University of North Dakota's Energy &amp; Environment Research Center (EERC) with partial funding from U.S. DOE (January 2015)</li> <li>The technology will be demonstrated at larger scale at Husky Energy's Pikes Peak South (Saskatchewan) heavy oil project (May – Oct. 2015) with partial funding from NRCan</li> </ul>
BC-based Inventys Thermal Technologies Inc.	Patented VeloxoTherm post- combustion CO2 capture technology	<ul> <li>Husky plans to pilot the technology at its Pikes Peak South heavy oil project (~2016)</li> <li>Funding from the UK Energy Technologies Institute to demonstrate advanced capture technology in gas-fired power (~2015/2016)</li> </ul>
Nova Scotia-based CarbonCure Technologies	Develops and licenses technology that sequesters CO2 in concrete during its manufacturing resulting in improved material and environmental performance	<ul> <li>The company is on track to license its technology to 30 manufacturing facilities in North America and enter emerging markets, driven by market demand for green building products, benefits for economics, and CO2 reduction potential</li> </ul>
SaskPower Carbon Capture Test Facility (CCTF - \$1.3M from NRCan's ecoETI Program)	Facility is designed to provide evaluation of amine post- combustion technologies	<ul> <li>CCTF anticipated to launch in summer 2015</li> <li>After initial demonstration by Hitachi, the CCTF will provide a unique platform to evaluate further technologies</li> <li>Member of the International Test Center Network</li> </ul>





# Canada also continues to advance CCS through regulatory development and public engagement

- Federal regulations for coal-fired power generation
  - Published in 2012, with specific provisions for the adoption of CCS
- Provincial regulations advancing Alberta at the forefront globally
- Public information and education efforts
  - In addition to federally funded work such as Pembina's recent study on successful public engagement practices, Canadian project proponents, such as Shell, have been recognized as world-leading in this area





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## ...as well as through ongoing international engagement

- Canada-UK Joint Statement on CCS
  - Includes cooperation in research and innovation, knowledge sharing, and international engagement
- Canada-US (Clean Energy Dialogue / Energy Cooperation MoU)
  - Includes joint Canada-U.S. CCS work in collaborative R&D, knowledge sharing, and public engagement
- Multilateral Engagement
  - Canada participates in a number of CCS-related international fora such as the IEA, the CSLF, the CEM, etc.
    - In 2015, CSLF meeting in Regina June 15-19; CSLF Ministerial in Saudi Arabia Nov. 1-5.
  - SaskPower also participates in the International CCS Test Centre Network
- Other Bilateral engagements
  - Canada also maintains bilateral CCS-related agreements with government entities in Norway, Japan, China, South Korea, and Mexico





### In Summary:

- Canada has parlayed its natural CCS advantage and strong R&D foundation into a position of global leadership;
- Canada is proving CCS at scale while learning-from-doing;
- Canada is contributing to the global effort to advance CCS; and
- Going forward, focus is on strengthening the CCS business case through continued R&D of 2nd and 3rd generation technologies, with active international collaboration.







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## **The Province of Alberta**



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## Alberta's CCS Development Program

- Impetus: Alberta's 2008 Climate Change Strategy (currently under review)
- CCS Funding Program
  - Objective: facilitate development of commercial-scale CCS
  - Quest and Alberta Carbon Trunk Line
    - \$1.24B over 15 years, 2.76 Mt CO<sub>2</sub>/year
  - Reduce oil sands emissions
- CCS Policy and Regulatory Development
  - Reduce regulatory barriers facing CCS
  - Continue to build a comprehensive and transparent regulatory framework





## **CCS Regulatory Developments**

#### **CCS Statutes Amendment** Act, 2010

- Pore space ownership
- Tenure agreements
- Long-term liability
- Post Closure Stewardship Fund

Province of Alberta	
MINES AND MINERALS ACT	
Revised Statutes of Alberta 2000 Chapter M-17	
Current as of December 2, 2010	
Office Consolidation	
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### **Post-Closure Stewardship Fund**

- Established in the Mines and Minerals Act
- Allowable uses of the PCSF:
  - Monitoring of injected CO<sub>2</sub>
  - Fulfilling obligations assumed when closure certificate issued
  - Suspension, abandonment, remediation and reclamation of orphaned facilities (not capture or pipelines)





### **Knowledge Sharing Requirements**

- Knowledge sharing is a requirement of the Alberta **CCS Funding Program**
- Knowledge sharing reports focus on:
  - Capture, transport and storage
  - Regulatory Approvals
  - Costs and Revenues
- Knowledge sharing reports are publically available at:

http://www.energy.alberta.ca/Initiatives/1438.asp



