Artificial Intelligence at Natural Resources Canada

Cécile Siewe, Director General, CanmetENERGY-Devon
PTAC Oil and Gas in the Digital Era Forum

September 27, 2018
Context: The Digital Transformation

AI has the potential to impact all aspects of environment, society, and the economy.

AI is “the next factor of productivity” with potential to:

• double annual economic growth rates by 2035
• boost labour productivity by up to 40% globally\(^1\)
• add $7.54B to Canada’s GDP and create 170,000 jobs by 2025\(^2\)

“AI policy will become the single most important area of government policy.”

– Ian Hogarth, AI expert, blogger and thought leader

\(^1\) Accenture's "AI is the Future of Growth"
\(^2\) The Digital Finance Institute’s “Towards Inclusive AI Artificial Intelligence & Machine Learning Report for Canada”
Pan-Canadian Artificial Intelligence Strategy

Budget 2017 invested $125m toward making Canada one of the core intellectual centers of AI research in the world.

• This investment funds three Centres of Excellence in AI research:
  ▪ Alberta Machine Intelligence Institute (Amii, Edmonton)
  ▪ Vector Institute (Toronto)
  ▪ Montréal Institute for Learning Algorithms (Mila).

• The program is lead by the Canadian Institute for Advanced Research (CIFAR)
  ▪ CIFAR has been advancing AI since 1982
Innovation Superclusters Initiative

Budget 2017 also allocated up to $950m in matching funds to develop industry superclusters in five key innovation areas, three of which relate to AI / ML:

- **Lead by CIFAR.**
- Quebec-based program in AI-driven supply chain optimization.
- Over 110 participants, expected to generate $16.5B in GDP and 16000 jobs over 10 years.

- **BC-based program applies data analytics, machine learning and quantum computing to natural resources, health and manufacturing sectors.**
- Over 270 participants, expected to generate $5B in GDP and 13500 jobs over 10 years.

- **Ontario-based program focusing on machine learning, Internet of Things and cyber-security in manufacturing.**
- Over 130 participants, expected to generate $13.5B in GDP and 13500 jobs over 10 years.
Mission Innovation

Through its participation in Mission Innovation, the Government of Canada aims to:

- Double federal investment in clean energy R&D from $387m to $775m
- Encourage private sector investment in early-stage clean tech companies
- Increase domestic and international collaboration
Mission Innovation Challenges: AI Plays a Part
NRCan’s Innovation & Energy Technology, and Lands and Minerals sectors hosted a roundtable session in Toronto on advancing AI in Canada’s natural resources industries.

Key messages / themes:
- Accessing and ensuring quality data
- De-risking the development and use of AI
- Enhanced collaboration
- Sectoral roadmaps
- Attracting and developing talent
Natural Resource Sector Opportunities for AI

AI can drive clean, sustainable growth for natural resource sector competitiveness in:

**Forestry**
- Resource management
- Industrial processes
- Forest fire mitigation

**Mining, Oil and Gas**
- Resource exploration
- Productivity
- Process automation

**Energy**
- Smart grid and storage
- Cleaner fossil fuels use
- Building and home efficiency
Expertise: National labs such as CanmetENERGY-Devon (CE-D) are developing AI tools to optimize and automate energy use and process control for buildings, industry, and electricity systems; as well for accelerating material science RD&D.

Data: NRCan is a producer of high-value data sets, e.g. through the Canada Centre for Mapping and Earth Observation and from our research and testing.

Programs: NRCan’s Innovation and Clean Growth programming supports the development of next generation technologies that target natural resource sector needs, including AI-based solutions.
AI at NRCan Today

4 Pillars:

- **500+** AI related S&T publications in past 10 yrs*
- **600+** world class data sets: geospatial, energy, invasive species, material properties, etc.
- **Active use of AI** across sectors
- **Action Plan** under development

* Based on SCOPUS search criteria for both general and specific terms related to artificial intelligence

**PARTNERS**

- **OGDs**: Establish best practices and governance, and coordinating programs
- **INSTITUTES & ACADEMIA**: Partner in cutting-edge research
- **PROVINCES & TERRITORIES**: Whole of government approach
- **INDUSTRY**: Empowering companies to improve competitiveness and outcomes for Canadians
AI Research at NRCan

- Self-regulation of buildings, renewable energy sources and storage, and local grids to minimize energy use [CE-O].
- Automation and optimization of HR, real property, and infrastructure needs [CE-V].

- Predictive algorithms for rapid acceleration of material science research and discovery [CMAT].
- Vehicles (cars, drones, mining vehicles etc.) communicating together, with surrounding infrastructure, and optimized for efficiency [CE-O].

- 3D sub-surface geological modelling using machine learning algorithms to predict richness of deposits [GSC].
- Geospatial data for significant improvements to public safety in emergencies such as flooding and forest fires [CFS].
- Full value chain analysis and optimization, for example regional forest bioeconomies [CFS].
RETScreen: Clean Energy Management Software

- Developed and managed at CanmetENERGY – Varennes in partnership with NASA, World Bank and other international & domestic organizations.
- Machine-learning based optimization software for clean energy project planning & management.
  - Over 500 000 individual users worldwide, including 1100 universities.
  - Recommended in the United Nations Framework Convention on Climate Change (UNFCCC).
  - Estimated $8B in user cost savings, with 20MT/yr GHG reductions and 24GW of installed renewables capacity, including:
    - Energy efficiency retrofits at the Empire State Building
    - Analysis of solar air heating in US Air Force installations
    - Screening applications to Manitoba’s Combined Heat and Power (bioenergy) Program
    - Project analysis in Ireland’s wind power industry
  - RETScreen training workshops have been conducted in Chile, Saudi Arabia and over 15 countries in West and Central Africa.
Collaboration: Essential to Success

- AI is ultimately a data-driven technology. NRCan hosts a wealth of data on Canada’s natural resources, as a result of its fundamental and applied research and development work.

- CE-D will be hosting an AI Symposium on October 30th to identify current opportunities for collaboration between government, industry and academia.

For more information:
Dr. Cécile Siewe
Director General
CanmetENERGY-Devon
Cecile.Siewe@Canada.ca