



**NATURAL RESOURCES CANADA - INVENTIVE BY NATURE**

# Supporting Biofuels Production in Canada

## NRCan Programs and Activities

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# Outline

- Current Status of Biofuels in Canada
- Today's Policy Directions
- International Activities
- IETS-NRCan Programs
- NRCan Biojet Fuel Projects



# Canada's First Generation Biofuels Industry

- Canada's Renewable Fuel Strategy and provincial mandates
- Estimated Production levels
  - Bioethanol: 1.75 BL (2016)
  - Biodiesel: 400ML (2016)
- Real reductions in GHG emissions
- Created a Canadian biofuels industry
- Foundation upon which to build second generation/advanced biofuels/ bioeconomy



# Canada's Next Generation Biofuels Commercial Production

## Enerkem Alberta Biofuels

- 38 million litres per year capacity of liquid methanol and ethanol from municipal solid waste
- Methanol production initiated in late 2015, followed by ethanol in 2017



## Ensyn

- 3 million gallons/year biocrude for heating plant in Renfrew, Ontario - operational
- Cote Nord in Port Cartier, Quebec 10 million gallon/year biocrude production facility - construction initiated



# Policy Directions in Canada

## The Clean Technology Opportunity

- **Canada's vision** for a clean, innovative economy balances both economic growth and environmental protection
- Supporting a clean growth economy will help Canada take advantage of new global opportunities
- Canada can dramatically reduce or eliminate carbon emissions via new clean technology solutions



Prime Minister Justin Trudeau at COP 21



# Pan-Canadian Framework on Clean Growth and Climate Change

- Plan to grow our economy while reducing emissions and building resilience to adapt to a changing climate
- Developed collaboratively by the federal, provincial and territorial governments, and in consultation with Indigenous peoples



# Pan-Canadian Framework on Clean Growth and Climate Change

- Support Canada's commitment to the December 2015 Paris Agreement
  - Agreement to keep the global temperature increase below 2 degrees Celsius
- Aims to reduce emissions in support of Canada's target of a 30 per cent reduction in greenhouse gases from 2005 levels by 2030



# Pillars of the Framework

- Pricing carbon pollution
- Measures to further reduce emissions across the economy
- Measures to adapt to the impacts of climate change and build resilience
- Actions to accelerate innovation, support clean technology, and create jobs





# Proposed Clean Fuel Standard

- Objective - to achieve 30 megatonnes of annual reductions in GHG emissions by 2030
- Implementation 2019



# The government has made ambitious commitments to support clean technology

Early investments in Budget 2016:

- **\$82.5M** for clean energy R&D and technology demonstration
- **\$62.5M** for electrical vehicles and alternative fuel infrastructure
- **\$50M** to develop cleaner oil and gas technologies

Going forward:

- **Over \$1B** over four years to support clean technology, including in natural resources, agriculture and fisheries
- **\$2B** to establish a Low Carbon Economy Fund
- **\$21.9B** investment in green infrastructure

*Clean technologies are key to the Government's approach to promoting sustainable economic growth and will play a critical role in Canada's transformation into a low-carbon economy.*

Budget 2016





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# Working with international partners through Mission Innovation



## Canada's strategic objectives:

1. Double **federal government** investment in clean energy RD&D over five years from \$387M in 2014-15 to \$775M by 2019-20.
2. Encourage **private sector** investment in early-stage clean energy innovation companies in Canada.
3. Increase domestic and international **collaboration** to advance Mission Innovation goals.

## Countries are mobilizing to meet this challenge:

- 23 members, representing over 80% of global public investment in clean energy R&D, currently totaling almost \$15B per year.
- Mission Innovation aims to invest boldly and broadly, including in transformative technologies.
- First Mission Innovation Ministerial was held in San Francisco, May 31-June 2, 2016, alongside the Clean Energy Ministerial.
- Seven Mission Innovation Challenges were launched in November 2016.

Canada is playing an leadership role in the implementation of Mission Innovation, as a member of the Steering Committee, as co-lead of the Joint Research & Capacity Building and Business and Investor Engagement sub-groups and through its participation in the Information Sharing and Communications sub-group.



# Mission Innovation

## Sustainable Biofuels Innovation Challenge

- *Objective:*
  - to develop ways to produce, at scale, widely affordable, advanced biofuels for transportation and industrial applications
- *Opportunity:*
  - to enhance global collaborations that will accelerate performance breakthroughs and cost reductions
- Canada is a co-lead along with Brazil, China and India
- CanmetENERGY-Ottawa is the Canadian lead
- Work plan is currently under development



# Biofuture Platform

## Kickstarting a global, advanced bioeconomy

- Government-led multi-stakeholder platform to promote international coordination on advanced low carbon fuels, biochemicals and biomaterials (bioeconomy).
- Brazil is the interim facilitator
- Canada is one of 20 participating countries
- Canadian lead is the Office of Energy Efficiency
- Creation of the work plan and vision are currently underway





# IEA Bioenergy Technology Collaboration Programme

- International collaborative agreement established in 1978 by the International Energy Agency
- Aims to improve cooperation and information exchange in bioenergy research, development and deployment
- 22 member countries and European Commission
- Participation is coordinated through the Office of Energy Research and Development (NRCan)



# IEA Bioenergy TCP

## Canadian Participation

- **Task 32** Biomass Combustion and Co-firing
- **Task 34** Direct Thermochemical Liquefaction
- **Task 39** Commercializing Conventional and Advanced Biofuels from Biomass
- **Task 42** Biorefining in a future BioEconomy
- **Task 43** Biomass Feedstocks for Energy Markets



# Innovation and Energy Technology Sector (IETS)

- IETS supports energy innovation through its responsibility to:
  - Fund energy RD&D in Canada (incl. private sector, academia, and government) via a suite of programs (OERD).
  - Manage Canada's national energy laboratories (CanmetENERGY) and energy RD&D experts.
  - Work with key stakeholders to strengthen Canada's energy innovation system.
  - House the Clean Innovation Task Team responsible for delivering a government-wide Clean Innovation Strategy.

**Vision:** Position Canada for leadership in a sustainable, low-carbon economy by promoting clean technology and innovation to capture clean jobs, market opportunities and strengthen our competitiveness.



# IETS is Canada's leading funding organization for clean energy RD&D

- ***Office of Energy Research and Development (OERD)***
  - The Government of Canada's co-ordinator of energy research and development (R&D) activities under IETS/NRCan.
- ***Program of Energy R&D*** (\$38M in FY 2015-16) – **ongoing**
  - Long-term federal interdepartmental program on basic and applied research & pre-demo pilot projects
  - Conducted by federal laboratories with a focus on fossil fuels, electricity, and end-use
- ***Clean Energy Fund*** (\$315M over 7 years) – **sunsetting**  
**October 2016**
  - Support development of new technologies to reduce GHGs and other air emissions
  - External large-scale carbon capture and sequestration demos; external small-scale pre-commercial demos in clean energy and renewables, federal clean energy R&D



# IETS is Canada's leading funding organization for clean energy RD&D

- ***ecoENERGY Innovation Initiative*** (\$271M over 5 years) – sunsets March 2017
  - RD&D projects are ongoing but there are no further calls for proposals
  - Support energy technology innovation to produce and use energy more cleanly and efficiently
- ***Energy Innovation Program*** (\$82.5M/2 years)
  - supports innovation in the clean energy sector by providing funding for research, development (R&D) and demonstration (collectively, RD&D) projects
  - supporting the Government of Canada's commitment to reduce gas (GHG) emissions, and contribute to Canadian prosperity and competitiveness by advancing clean energy RD&D



# Funding, Grants and Incentives

## *NRCan Website*

- News calls for funding
- Current funding programs
- Provincial grants and financial incentives
- Other federal funding sources
- <http://www.nrcan.gc.ca/energy/funding/4943>



# OERD RD&D Funding Areas Relevant to Biojet Fuel

- Optimizing the feedstock supply chain with a focus on sustainability
- Advancing biomass preprocessing technologies
- Developing advanced liquid biofuels
- Integration of bioenergy and bioproduct processes into biorefineries



# Examples of NRCan funded Biojet Fuel Projects

- Enhancing the biomass inventory mapping and analysis tool- BIMAT (AAFC, CFS/CWFC and NRC; Lee and Sidders)
- Sustainable corn stover harvesting practices for cellulosic biofuel production (AAFC; Drury)
- Upgrading biomass-derived intermediates to advanced liquid biofuels (CE-O; Monnier)
- Production Of Biojet Fuels From Woody Biomass-Derived Bio-Oils (CE-O, Monnier) funding from CFS' Forest Innovation Program
- Advanced fast pyrolysis processes (CE-O; Gupta and Preto)





# Examples of NRCan funded Biojet Fuel Projects

- Multi-stream pyrolysis of low quality biomass feedstocks (CE-O, NRC, CE-D; Bronson)
- Optimized pretreatment of lignocellulosic biomass for optimized sugar platform (CE-V; Benali)
- Development of Innovative materials for the construction of advanced biorefineries (CMAT; Zeng)
- Lignin to drop-in biojet fuels and chemicals (CRB Innovations Inc.)
- Biomass-rich waste conversion into drop-in Fuels (Enerkem)



# Federal Ad Hoc BioJet working group

## NRCan participation

- Innovation and Energy Technology Sector (IETS)
- Canadian Forest Sector (CFS)
- Office of Energy Efficiency (OEE)
- Energy Sector (ES)



# Q&A

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# Proposed Clean Fuel Standard

- Winter 2017 - Consultations on the framework and technical aspects of the regulations with multi-stakeholder consultative and technical working groups
- Further public engagement to be organized as required (e.g., webinars)
- Late-2018 - Publication of proposed regulations in Canada Gazette, Part I
- Mid-2019 - Publication of final regulations in the Canada Gazette, Part II

