

NRC·CNRC

 NRC.CANADA.CA

Growing Bio-Companies to Scale

Canada's Tools for Success



National Research
Council Canada

Conseil national de
recherches Canada

Canada

Opportunities for Canada

The bioeconomy sector offers great potential for Canada by offering the following:

- Economic growth and new market opportunities
- Reduction of our carbon emissions and footprint
- Technological Innovation
- Positioning Canada as a leader in this space

Medical and health biotech

Industrial biotech

Agricultural biotech

Bio-energy

Environmental biotech

BIOECONOMY

Canadian Bioeconomy Industry Needs

Feedback from Industry indicates that companies need:

- Financial support and investment during the long interval from pilot scale to commercial demonstration to full scale plant operation
- Timely access to experts and equipment for problem solving
- Development of specifications and applications for final products
- Collaborations and partnerships that lead to market access

Federal Government Investments

Because of its potential for growth, Federal Government Investment is significant in the Bioeconomy through

Government Funded programs and initiatives

- Examples: Agricultural Clean Technology Program, Sustainable Development Technology Fund, Impact Canada, Business Development Initiatives for Clean Technology, Clean Growth Program

Government R&D laboratories and programs

- Examples: National Research Council Canada programs, Natural Resources Canada Office of Energy Research and Development

to address the needs of the Canadian Bioeconomy industry

Over 70% of biotech companies access the SR&ED program

About 60% of biotech companies access IRAP

Government of Canada Bioeconomy Ecosystem

Natural Resources Canada

NRCan

- Policies and programs that ensure a sustainable resource advantage
- The Office of Energy Research and Development (OERD) coordinates energy (R&D) activities.

Innovation, Science, & Economic Development

ISED

- Fosters a growing knowledge-based Canadian economy
- Supports the Clean Growth Hub, a portal for Canada's clean technology ecosystem

Sustainable Development Technology Canada

SDTC

- \$1.6B in funds from the Government of Canada since 2001
- Funds the development and demonstration of new sustainable development technologies

National Research Council

NRC

- Canada's research and technology organization
- Supports cleantech R&D across Canada and informs policies and standards for cleantech adoption

Agriculture and Agri-Foods Canada

AAFC

- The Agricultural Clean Technology Program is a three-year investment (2018-2021) supporting clean technology activities across the innovation continuum

Budget 2018

\$1-10 million

\$10 million+

IRAP

Industrial Research
Assistance Program



RDAs

Regional Development
Agencies



SIF

Strategic Innovation
Fund



TCS

Trade Commissioner
Service



National Research Council of Canada

3,950

SCIENTISTS, ENGINEERS,
TECHNICIANS, AND
OTHER SPECIALISTS
including 255 SME industrial
technology advisors

179

BUILDINGS MANAGED
(equivalent to 354 NHL hockey
rinks) in 22 locations

\$1.15B

ANNUAL EXPENDITURE
including an IRAP contribution
budget of \$293.4M for SMEs

The NRC's 3 core roles within the Canadian Science, Technology, and Innovation ecosystem

BUSINESS INNOVATION

- 983 R&D clients*
- \$193M total revenues*

POLICY SOLUTIONS FOR GOVERNMENT

- \$1,145.2M total expenditures* (\$770.7M RCs; \$374.5M IRAP)
- \$389.2M G&C expenditures

ADVANCING KNOWLEDGE

- 1,030 peer reviewed publications**
- 207 patents filed*
- 1,669 active patents*

* 2018-2019 / ** 2018

5 Divisions, 14 Research Centres

DIGITAL TECHNOLOGIES

- Digital Technologies

EMERGING TECHNOLOGIES

- Advanced Electronics and Photonics
- Herzberg Astronomy and Astrophysics
- Metrology
- Nanotechnology
- Security and Disruptive Technologies

ENGINEERING

- Construction
- Energy, Mining and Environment
- Ocean, Coastal and River Engineering

LIFE SCIENCES

- Aquatic and Crop Resource Development
- Human Health Therapeutics
- Medical Devices

TRANSPORTATION AND MANUFACTURING

- Aerospace
- Automotive and Surface Transportation

R&D Labs: 22 Locations Across Canada



Vancouver, BC

- Batteries, fuel cells and industrial tribology



Saskatoon, SK

- Plant biotechnologies and plant-growth facilities



Ottawa, ON

- Aerospace, vaccines, construction, quantum, photonics, machine vision, big data analytics, metrology, materials characterization and testing



Halifax, NS

- Photobioreactors, bioprocessing
- Natural product chemistry, bioactive characterization



Victoria and Penticton, BC

- Optical and radio telescopes
- Adaptive optics



Mississauga, ON (*in progress*)

- Clean energy materials
- Advanced materials for additive digital manufacturing and printed electronics



Saguenay, QC

- Aluminium and multi-materials assembly
- Hybrid manufacturing (extrusions, forgings, castings)



Charlottetown, PE

- Natural product and functional ingredient development



Edmonton, AB

- Nanotechnology, electron microscopy



London, ON

- Additive manufacturing, product development, laser consolidation, micro-machining



Montreal/Boucherville/ Royalmount, QC

- Intelligent machining, robotics
- Medical devices, advanced biologics analytics, biomanufacturing pilot plant



St. John's, NL

- Ocean engineering
- Ice and vessel management



R&D Lab Activity in the Bioeconomy

BIO-
MANUFACTURING
(HHT)

BIOMATERIALS
AND SUSTAINABLE
MANUFACTURING
(AMP/AST)

BIO-ENERGY
(EME)

BIO-BASED
SPECIALTY
CHEMICALS
(ACRD)

Example: Agricultural Biotechnologies at ACRD

STRENGTHS



Agricultural Biotechnologies



Genomics & Microbial Profiling



Natural Products & Ingredients



Algal & Marine Biotechnologies



Bioprocessing & Bioproduction



Biomass Characterization

APPLICATIONS

Aquatic and Natural Products

Algae

- Algae carbon conversion
- Wastewater remediation
- Seaweeds for ecosystem services
- Genomics and GLP cultivation
- Algae as nutrition

Ingredients and active components

- Food ingredient development
- Medical cannabinoids
- In-vitro modelling
- Zebrafish models
- Higher animal models

Natural product development

- Chemical authentication
- Extraction and formulation technologies

Bio-based Products and Technologies

Microbial Fermentation

- Strain development
- Process development and optimization
- Separation and purification
- Solid state fermentation
- Process scale up and production

Biocatalysis and Bioprocessing

- Enzyme assisted processing
- Biotransformation and characterization
- Biocatalysis and conversion
- Biopolymer synthesis
- Natural fibers

Nanomaterials

- Nanopolysaccharides
- Nanomaterial characterization and synthesis
- Applications R&D

Genomics and Plant Biotechnology

Genomics and Bioinformatics

- Sequencing and bioinformatics
- Genotyping and marker development
- Environmental, human health and agriculture metagenomics

Plant productivity, pathology and protection

- Abiotic and biotic stress
- Seed biology
- Photosynthesis

Plant Metabolism

- Systems biology
- Lipids, carbohydrates and protein
- Plant metabolic engineering

Plant Platform Technologies

- Cell-based technologies
- Double haploidy
- Plant hormone profiling
- Controlled plant growth environments



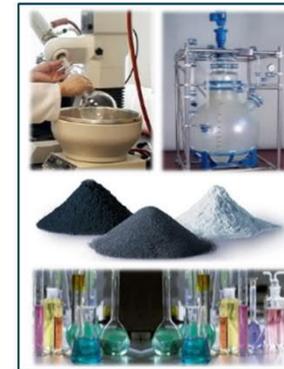
Example: Industrial Biotechnologies at ACRD & EME



**Microbial
Production
and
Biosynthesis**



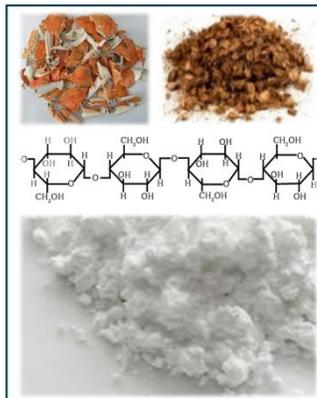
**Bioprocessing
and Extraction
Technologies**



**Chemical
Synthesis and
Conversion**



**Lipid
Biotechnologies**



**Polysaccharide
Nanotechnologies**



**Lignocellulosic
Technologies**

Industrial Research Assistance Program • NRC IRAP

\$293M

ANNUAL CONTRIBUTION
FUNDING TO SMEs

8,159

FIRMS RECEIVING
ADVISORY SERVICES OR
FUNDING

15,662

JOBS SUPPORTED
IN SMEs



Industrial Research Assistance Program • NRC IRAP



Provide advice, connections, and funding to help Canadian small and medium-sized businesses increase their innovation capacity and take ideas to market



Serve over 8,000 clients annually (advisory services + funding) across all industry sectors and fund over 3,000 clients



Link innovative Canadian SMEs to global value chains and support their growth by providing access to current technology and business market intelligence on priority industry sectors



Support youth with employment programs

IRAP's 9 Streams

Core IRAP –
Contributions
to Firms

EUREKA,
Eurostars

International
Initiatives

Large-Value
Contributions

Canadian
International
Innovation
Program

White Label –
Other Govt
Departments

Youth
Employment
Program

Third-Party
SME Services

CANExport –
Global Affairs
Canada

Some NRC IRAP Biotechnology Clients



Develops and implements processes for making cellulosic biofuels.



A bio-refining technology company that refines various feedstocks with a pilot-scale bio-refinery (i.e. forestry and agricultural waste, sewer sludge).



A sustainable company leading the way in low carbon solutions for the biofuel industry with Carinata, a non-food crop that can be grown anywhere.



Develops and sells sustainable ingredients for lubricants, cosmetics, etc. that outperform and are more cost-effective than their petroleum-based counterparts.

Summing Up

- **IRAP** can provide advice and funding to support your research and technology project.
- **NRC labs** can conduct collaborative research with you and provide access to facilities. Examples:
 - ACRD – agricultural biotechnologies
 - EME – industrial biotechnologies
 - AST – composite materials, bio-polymers, bio-plastics

NRC-CNRC

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THANK YOU

Iain Stewart
President, National Research Council of Canada



National Research
Council Canada

Conseil national de
recherches Canada

Canada 