



Natural Resources
Canada

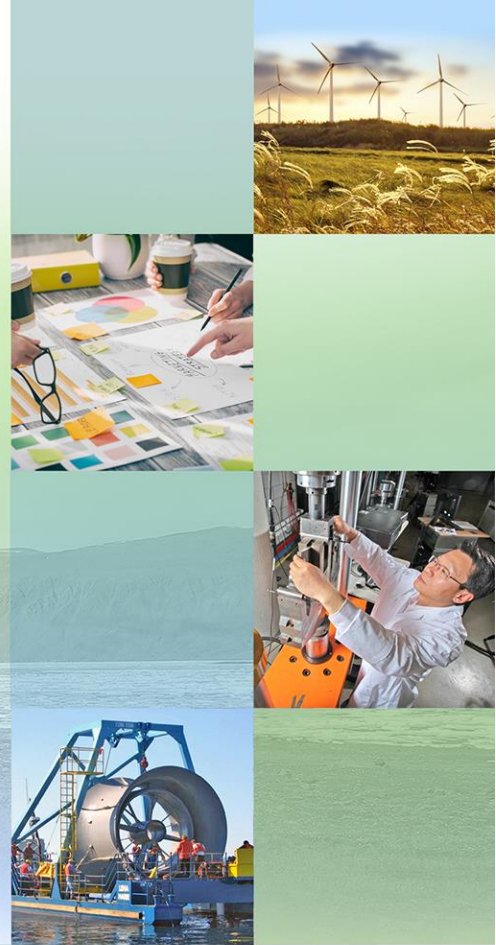
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Clean Growth Program

CanmetENERGY-Devon

Cécile Siewe, PhD, MBA
Director General

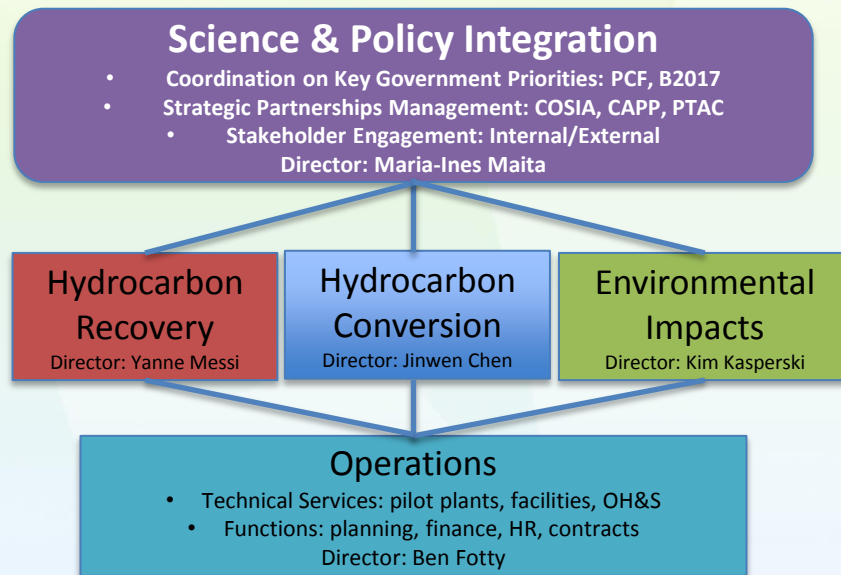
NATURAL RESOURCES CANADA



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CanmetENERGY in Devon

Mandate: Provide national leadership for the **fossil fuel** portfolio to drive sustainable **energy development** and use, and the mitigation of related **environmental impacts** with particular emphasis on unconventional oil and gas. This includes a team of 105 staff spread across the following teams:



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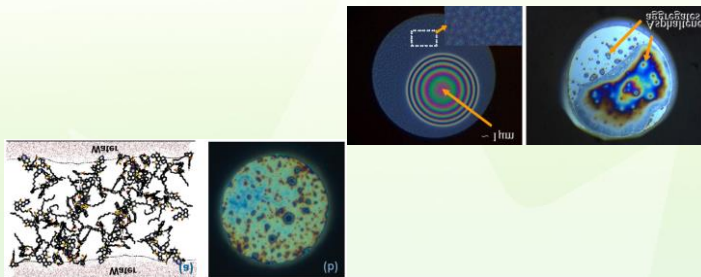
HYDROCARBON CONVERSION RESEARCH



Areas of Focus:

- Partial upgrading
- Upgrading and refining process efficiency
- Future fuels
- Biofuels
- Advanced analytical methods
- Standard analytical methods

HYDROCARBON RECOVERY RESEARCH



Areas of focus:

- Non aqueous & hybrid (water + solvent) extraction from mined oil sands
- Control of multiphase systems
- Bitumen froth treatment – over \$25m in cost recovery in last 10 years
- Advanced modeling and characterization methods
- Carbon Capture, Utilization and Storage

ENVIRONMENTAL IMPACTS RESEARCH



Areas of focus:

- Air emissions reduction: monitoring, detection, quantification and reduction
- Oil spill science: fate, behavior and response
- Land reclamation
- Water quality
- Tailings management

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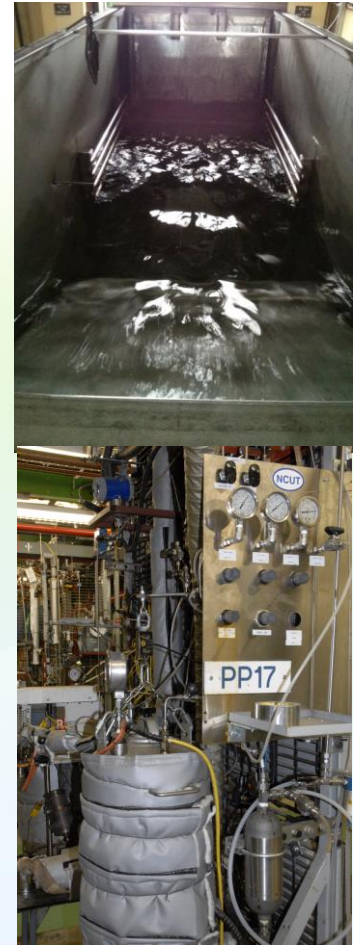
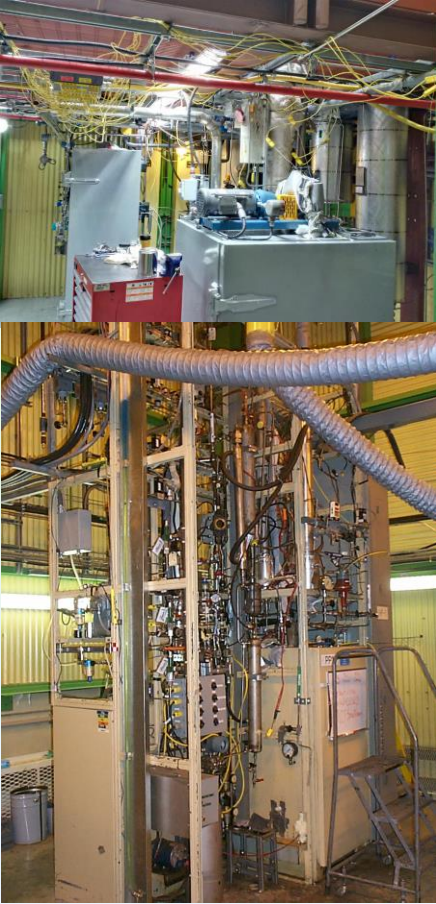
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Pilot Plants

- **Spill Tanks**
- **Paraffinic froth treatment process**
 - Tank infrastructure
 - 2-stage separation with a transparent tailings solvent recovery unit
- **Separation Processes**
 - Continuous Distillation
 - Solvent Deasphalter
- **Primary Upgrading**
 - Delayed Coker
 - Residue Hydrocracker
- **Secondary Upgrading**
 - Hydrotreaters/Hydrocrackers
- **Corrosion Unit**
- **Autoclaves**
- **Currently vacant**
 - Class 1 Zone 2 rated space
 - Electrical and instrumentation infrastructure



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Our Pilot Plant/Bench-Scale Testing Capabilities

- Seven (7) fixed-bed hydroprocessing units
 - Once-through, recycle operation with online distillation
 - Single-reactor, two reactors in series
 - Treat gas: 100% H₂, mixtures of H₂/H₂S/NH₃
- Slurry hydroconversion unit (Canmet process)
 - Slurry phase tubular reactor, continuous stirred tank reactor
- Coking/visbreaking tubular reactor unit
- Solvent deasphalting unit
- FCC pilot plant unit (ACE)
- Continuous atmospheric/vacuum distillation unit
- Four (4) autoclave batch reactors for multiple purposes
- Corrosion unit
- Alcor hot liquid process simulator (HLPS) unit

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Our Standard and Advanced Characterization Capabilities

- Hydrocarbon properties
 - ✓ Density, viscosity ...
- Elemental analysis
 - ✓ C/H/S/N/O, metals (Ni, V, etc.) ...
- Chromatography
 - ✓ SimDis
 - ✓ Refinery gas ...
- Distillation
 - ✓ Atmospheric ASTM D86
 - ✓ Vacuum ASTM D1160
 - ✓ Spinning band ...
- Chromatography
 - ✓ GC-MS, GC-FIMS, HPLC
 - ✓ Sulfur by GC-SCD
 - ✓ Nitrogen by GC-NCD
- Two-D GC (GCxGC)
 - ✓ GCxGC-FID, GCxGC-TOFMS
 - ✓ Sulfur by GCxGC-SCD
 - ✓ Nitrogen by GCxGC-NCD
- Spectroscopy
 - ✓ ^{13}C and ^1H NMR
 - ✓ Raman, Infrared, UV-Vis

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