NATURAL RESOURCES CANADA - INVENTIVE BY NATURE

# Meeting Challenges in Heavy Oil Production – R&D for Improved Processing

Heavy Oil Working Group

September 22nd, 2015

Bogotá, Colombia

# Heavy oil has unique challenges…

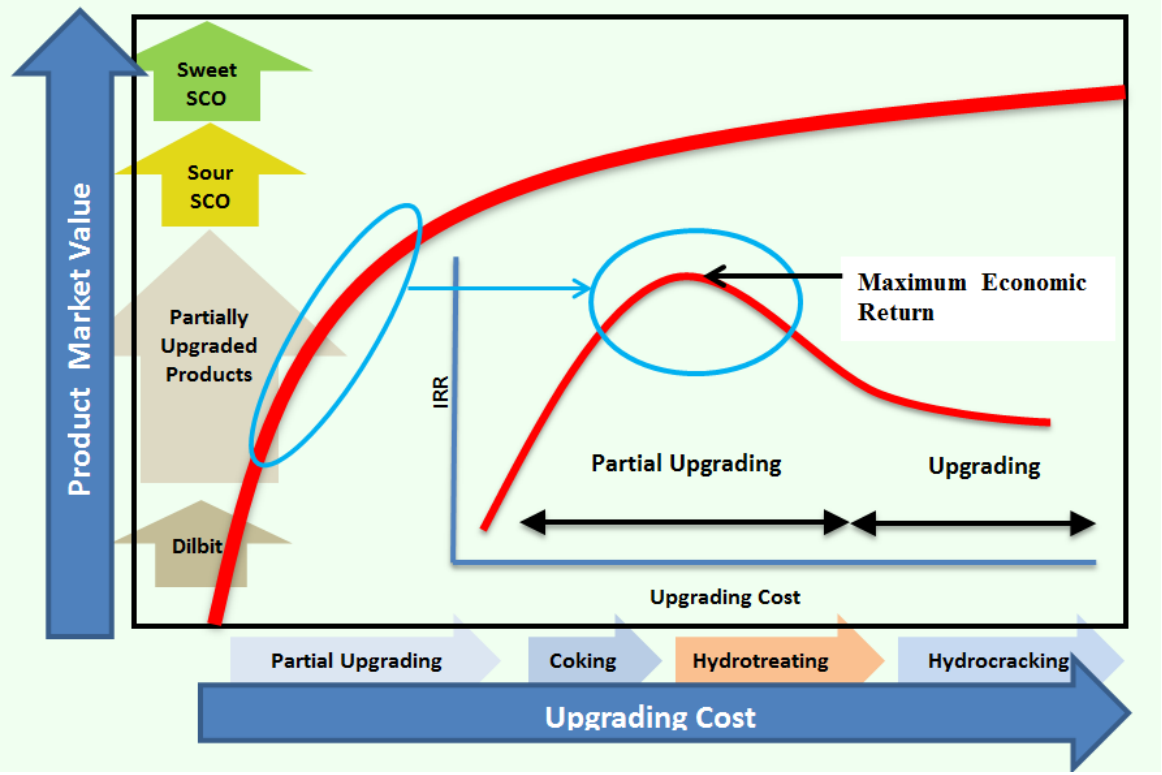
- Heavy oils are viscous and contain metals, sulfur, nitrogen – which results in challenges:
  - Transportation (processing, diluent)
  - Impact on refineries
  - Discounted value
- Canada upgrades less than half of its heavy oil from oil sands and the remainder is diluted with solvent and exported to refineries in other markets
- Use of diluent has risks:
  - Cost and reliability of solvent supply
  - Pipeline capacity – expensive infrastructure; diluent takes a significant portion of that capacity
  - Environmental impacts of diluent production and use (GHGs, spills)

Husky Upgrader, Alberta, Canada

# … and we are looking at partial upgrading to address these risks…

Benefits of partial upgrading:

- Reduce/eliminate solvent use for heavy oil pipeline transportation
- Reduce GHG emissions
- Increase competitiveness and market value



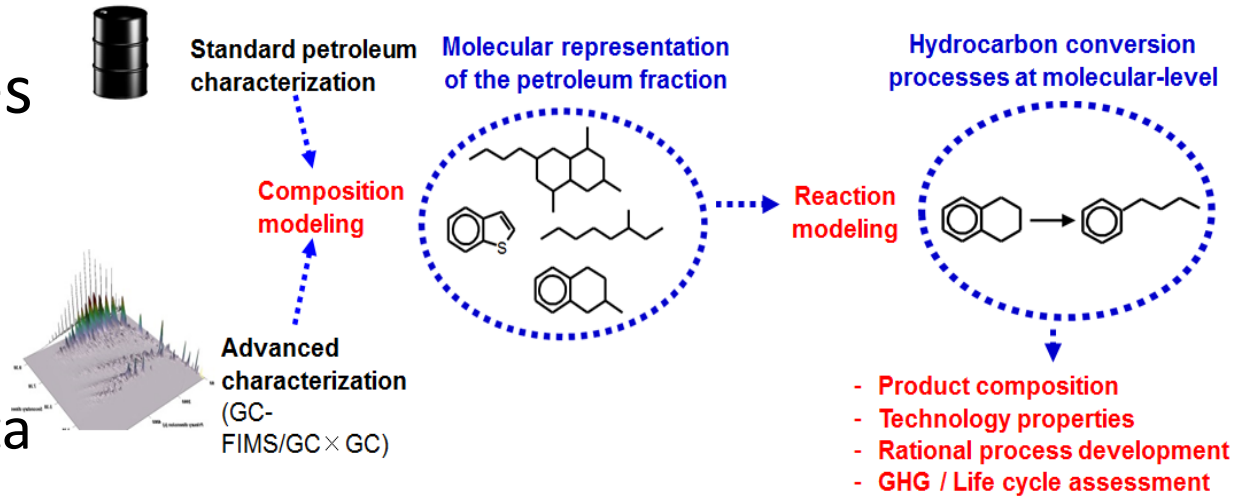
# …with a comprehensive R&D program that includes several activities…

- Develop and demonstrate partial upgrading technologies in our pilot plants
- Modelling and analysis to understand and predict technology outcomes
- Evaluate whether partially upgraded products are compatible with other feedstocks to, and configurations of, refineries

# … and has a strong research direction…

Strong modeling capacity helps to evaluate technologies prior to (expensive) piloting. Using:

- analytical expertise
- pilot and industry data on upgrading processes
- thermodynamic and kinetic models



# …including exploring key technologies…

- MEG HI-Q®
  - recover diluent from field-transported heavy oil; mild thermal cracking; recycle solvent
  - next step, solvent deasphalting
  - just past research stage

From: www.megenergy.com

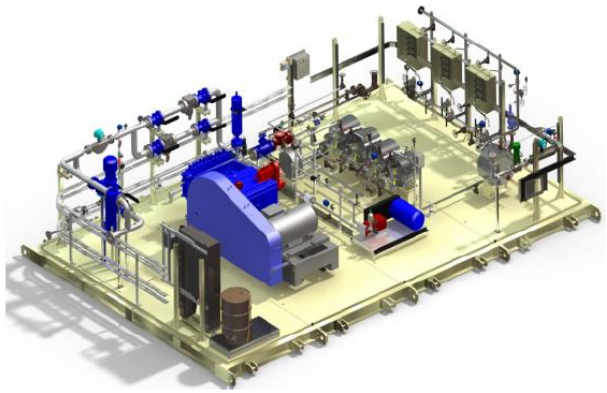
- Solvent de-asphalting
  - small-scale pilot under construction at federal research centre
  - other collaborations between federal research centre and industry under discussion
  - at small-pilot stage


Deasphalting pilot under construction

# …with industry partners and experts.

- Super-critical water cracking (JGC Corporation of Japan)
  - no $H_2$ or catalysts needed; lower energy per barrel
  - suitable for remote sites
  - 5 bpd pilot plant at NRCan research centre
- Sonic cavitation (Jetshear™ – Fractal Systems)
  - reduce diluent required to meet pipeline's viscosity spec for Canadian bitumen (~10° API), by up to 50%
  - focused on "lighter" heavy oils (~13° API), reduce diluent by ~35% (based on lab testing)
  - 1000 bpd pilot scale tests


From: www.jgc.com



From: www.fractalsys.com

# Opportunities for Collaboration

- Technology development
  - proof of concept
  - pilot-scale trials
- Modelling to evaluate technologies
- Life-cycle assessment (GHGs)
- Advanced analytical methods for characterizing hydrocarbons
- Sharing expertise and samples

# Thank You!

**For further information please contact:**

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