

THE DIVERSITY OF CANADIAN ENERGY POLICIES: AN ILLUSTRATION OF EMERGING OPPORTUNITIES USING THE NEW MODEL TIMES-CANADA

Energy and Environment (E2G) Team
GERAD Research Center
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1. Project objectives

Research project funded by the NSERC of Canada

- Build a multi-regional energy model for Canada
- Model new technologies and improve data (oil sands, biofuels, LNG, etc.)
- Calibrate the model to the new economic scenarios
- Analyze energy policies (2020) and climate policies (2100) for Canada

Research project funded by the MDEIE of Quebec (link with REACCESS 7th FP-EU)

- Characterize energy supply corridors for the integrated Canadian market
- Model these corridors in TIMES-Canada (focus on Quebec)
- Quebec electric transportation sector development analyses
- Couple the model with the world model TIAM
- Analyze energy security policies (2020) and climate policies (2100) for Quebec and Canada in the international context

2. TIMES-Canada

Regions: 13 provinces and territories

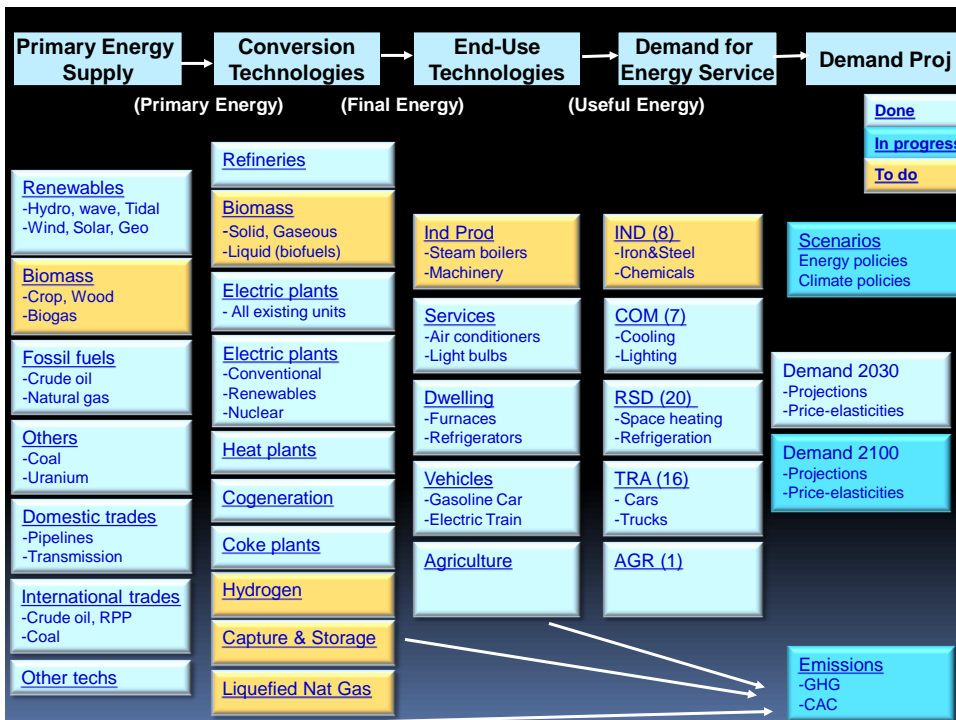


Base year: 2007
 Horizon: 2030 (energy)
 Horizon: 2100 (climate)

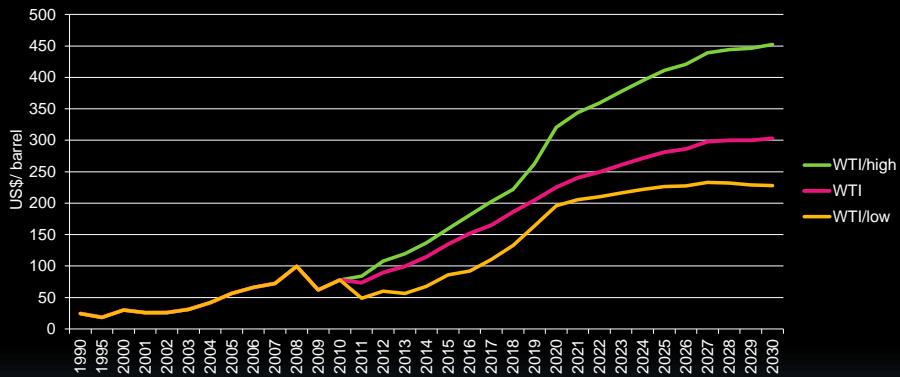
	Start	Mid	End	Length
1	2007	2007	2007	1
2	2008	2008	2009	2
3	2010	2010	2011	2
4	2012	2012	2013	2
5	2014	2015	2017	4
6	2018	2020	2022	5
7	2023	2025	2027	5
8	2028	2030	2032	5

Time slices

- 4 seasons: Spring, Summer, Fall, Winter
- 3 day periods: Day, Night, Peak



3. Oil prices for 3 reference cases, 1990-2030

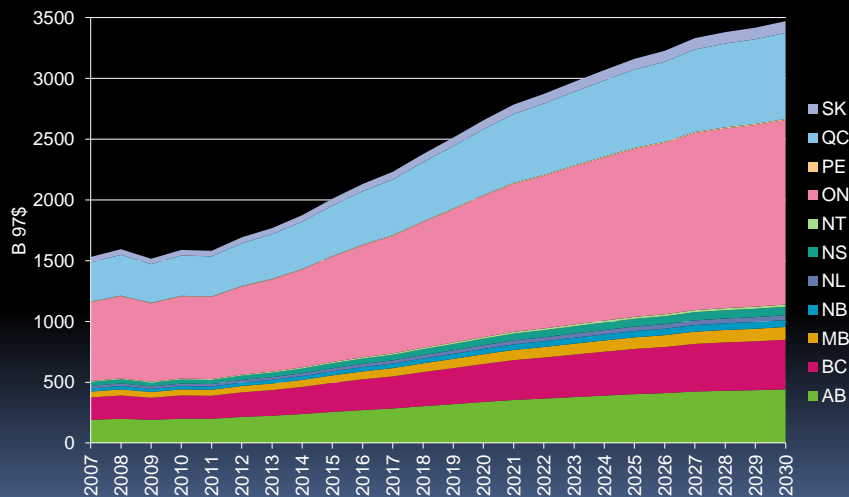


Assumptions for reference case:

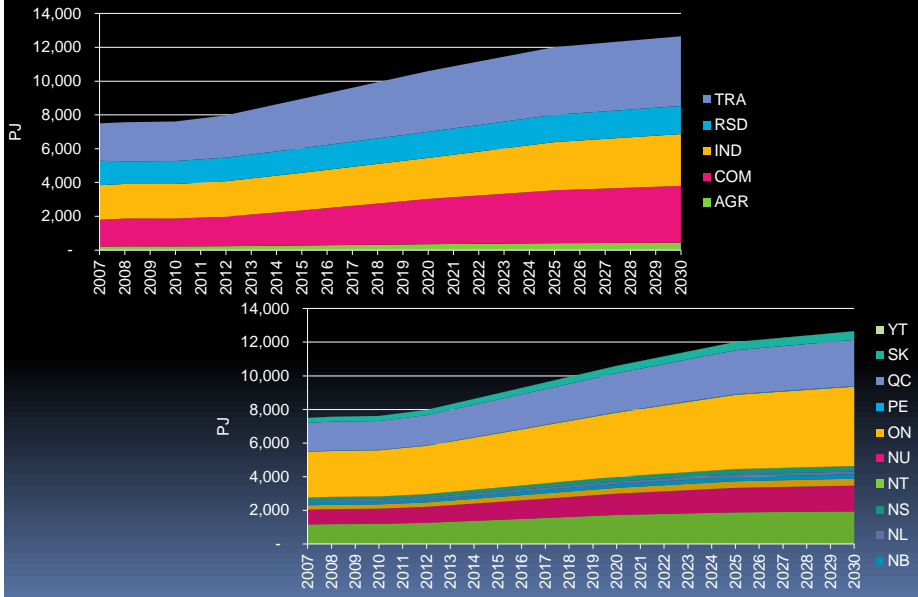
2011 to 2020: Oil prices will follow the BAU scenario, where governments will focus on economic development.

2020 to 2030: high prices will allow the penetration of new energy sources and technologies in a competitive way.

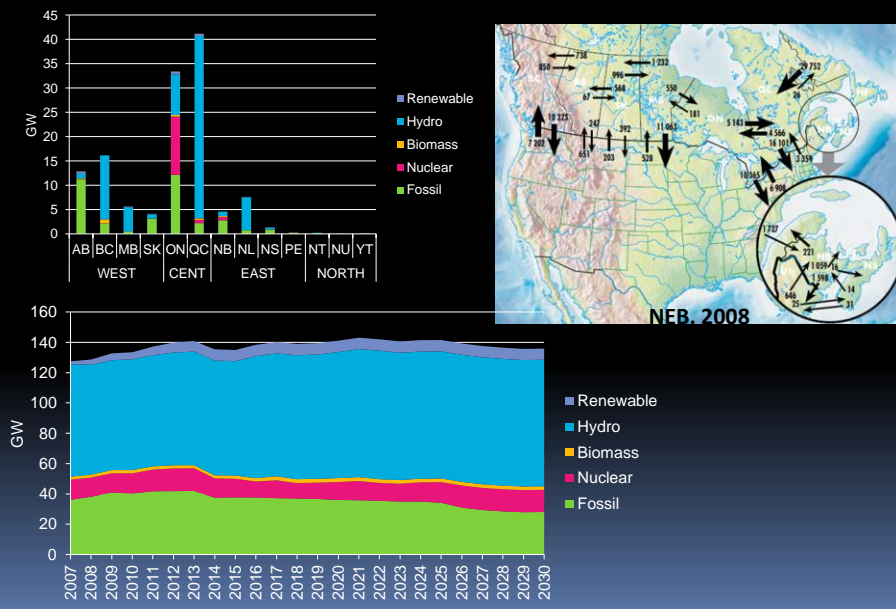
3. GDP growth projections, 2007-2030



3. Final energy consumption, 2007-2030 (PJ)



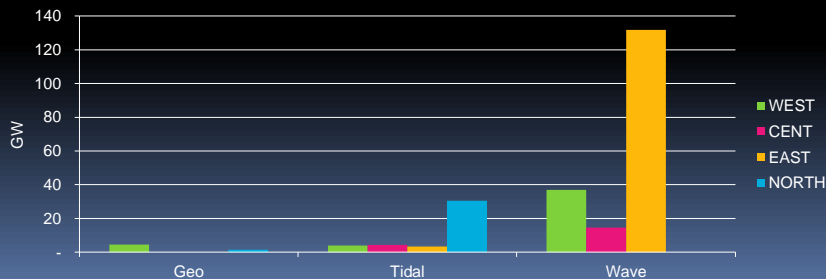
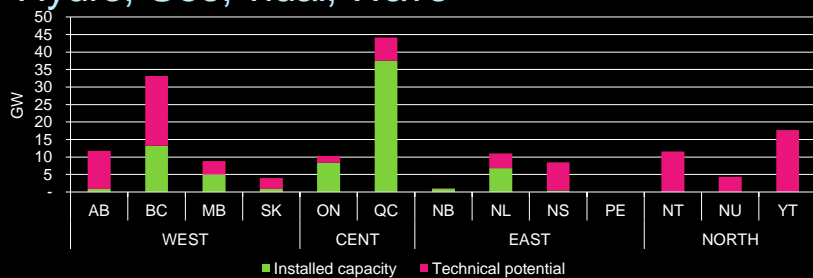
4. Electricity capacity and trade (3500 units)



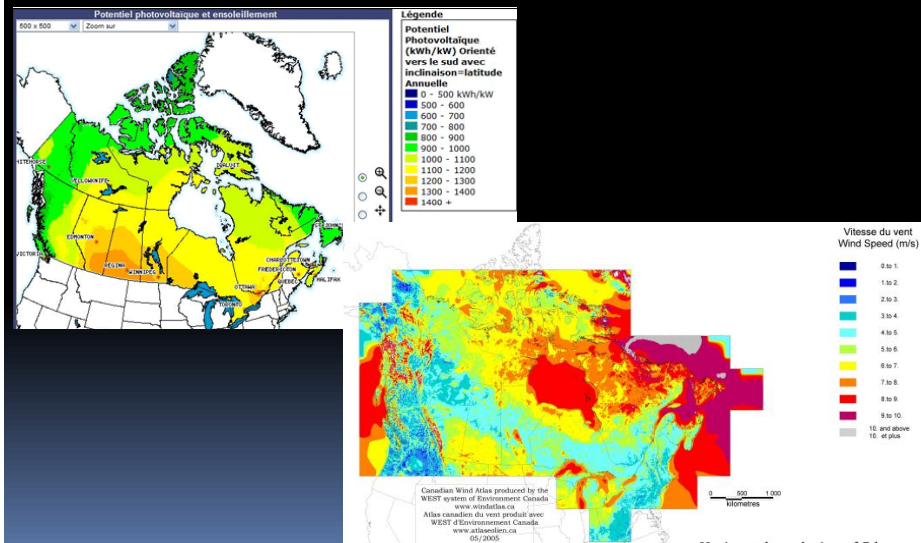
5. Diversity of regional energy systems

- Canada is an important player on the world scene
 - The largest supplier of natural uranium (1/3 of the global demand) (SK)
 - An important coal heritage (BC, AB, SK, Atlantic)
 - A leader in hydroelectricity production and important exporters (BC, QC)
 - An important producer of oil and gas (AB, MB, Atlantic)
- New opportunities for producing provinces to generate additional revenues from exports (fossil fuels or renewable electricity)
- Energy security issues for non-producing provinces that depends on crude oil imports (for transportation)
- Interests to develop renewable energy sources in all provinces
- Take into account GHG emission reduction issues
- Lack of a national energy strategy to optimize the management of energy systems and the conception of climate policies.

5. Renewable potential – Cumulative (GW) Hydro, Geo, Tidal, Wave

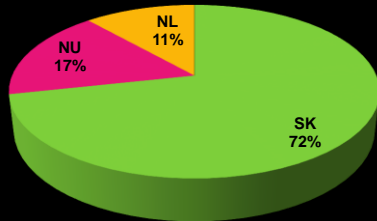


5. Renewable potential – Annual (kWh) Photovoltaic and Wind

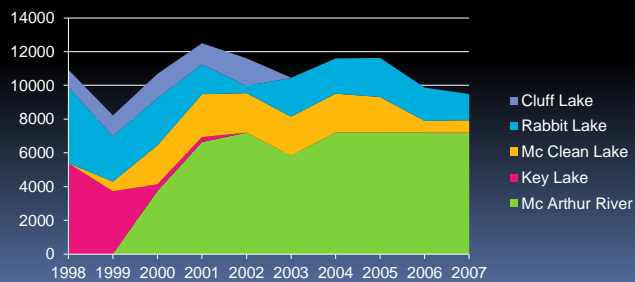


5. Uranium reserves and production, 1998-2007

Total reserves: 544 kt (365 EJ)

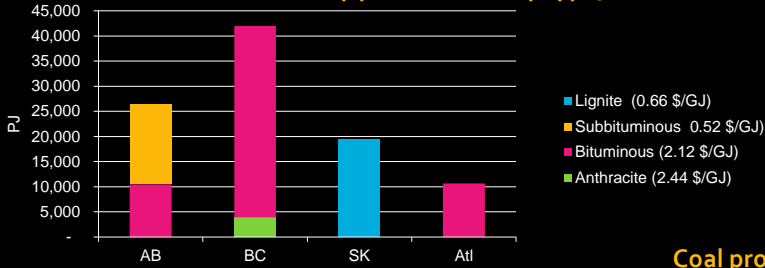


Uranium production in Saskatchewan (t)

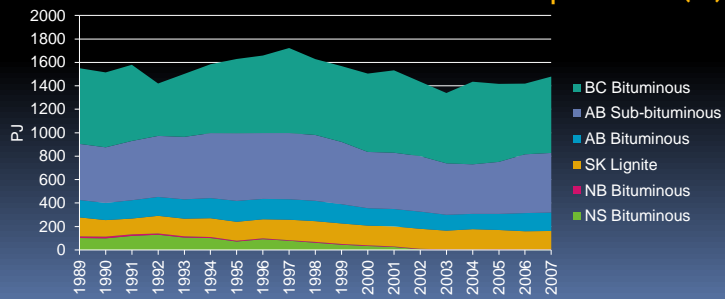


5. Coal reserves and production, 1989-2007

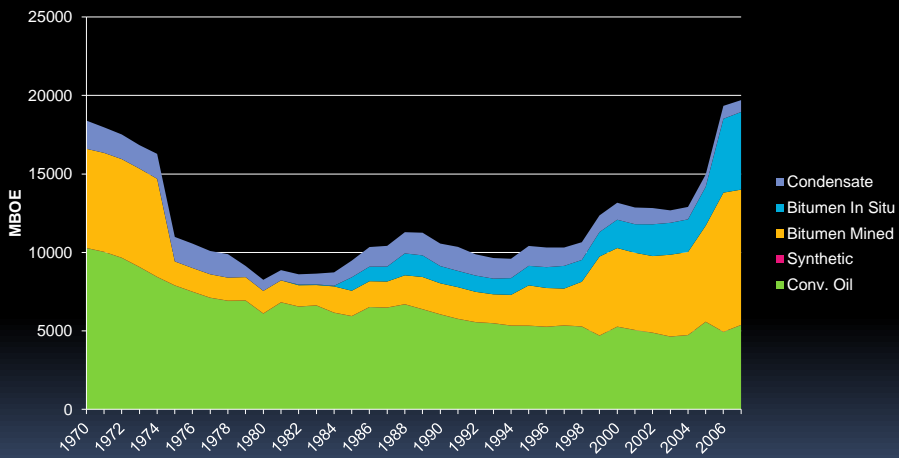
Coal recoverable reserves by province and by type, 2007 (PJ)



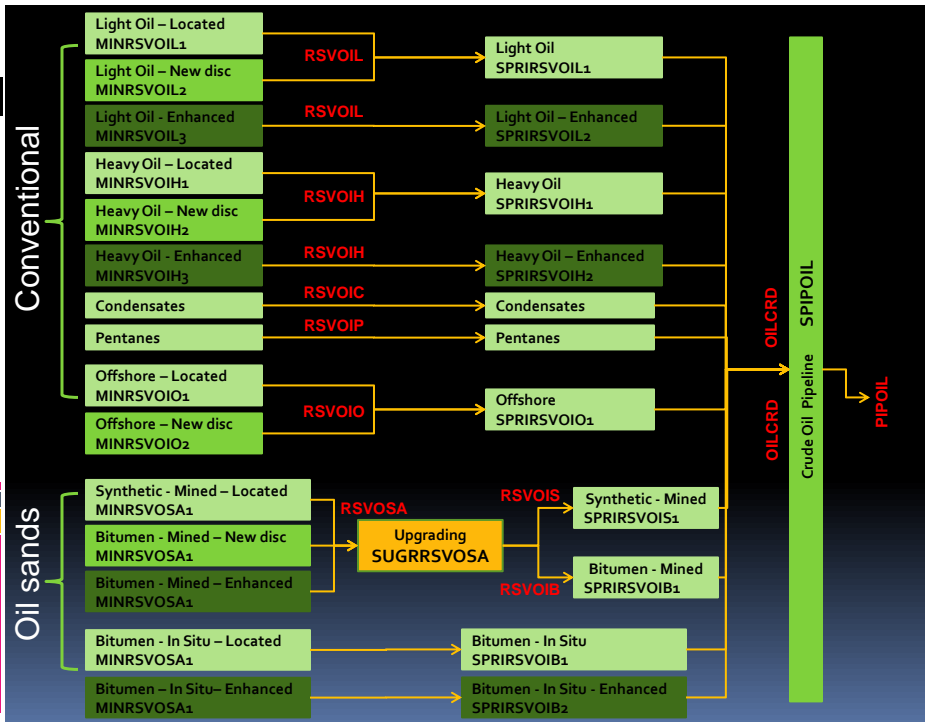
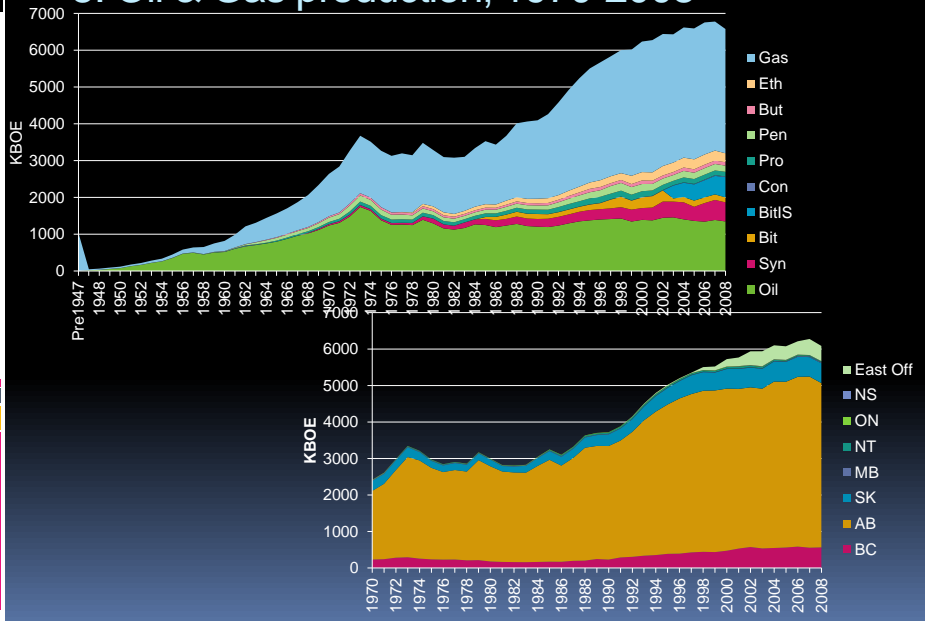
Coal production (PJ)



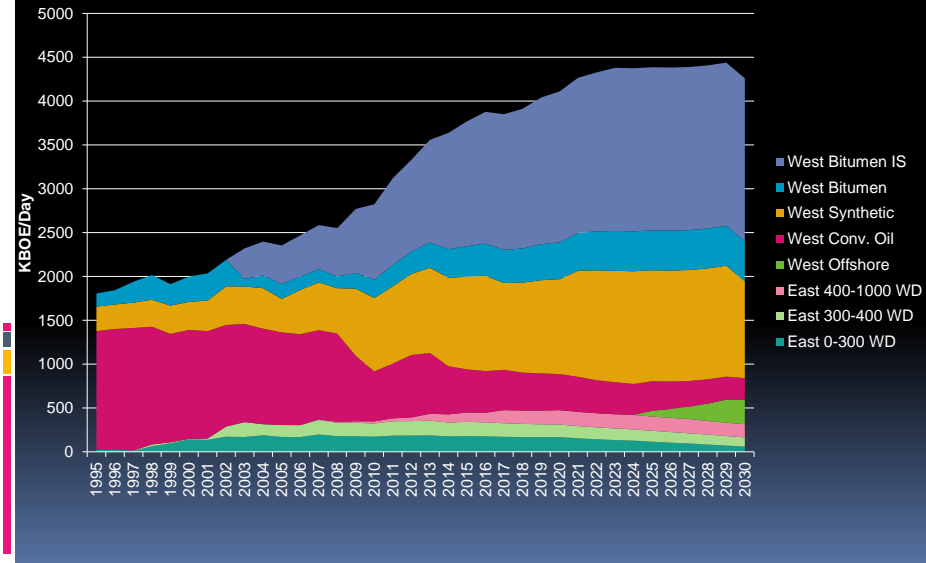
5. Oil reserves, 1970-2007



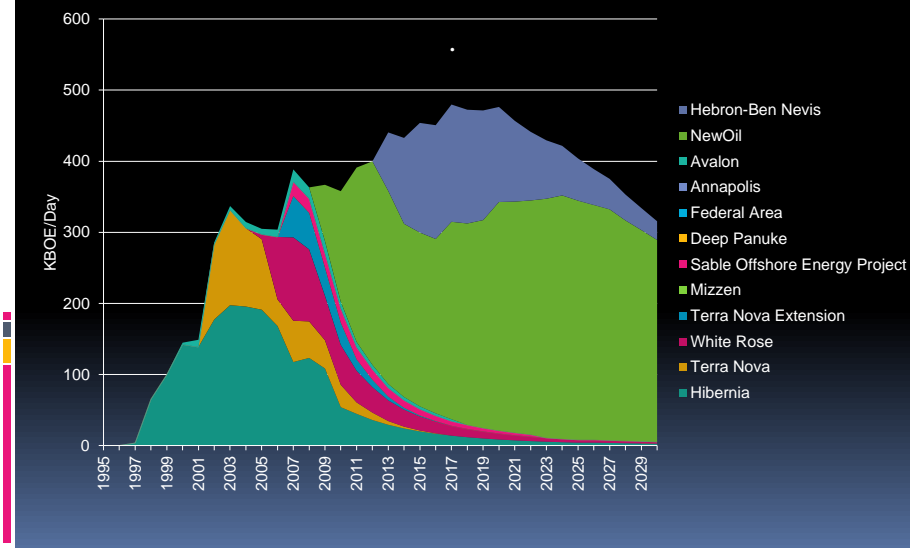
5. Oil & Gas production, 1970-2008



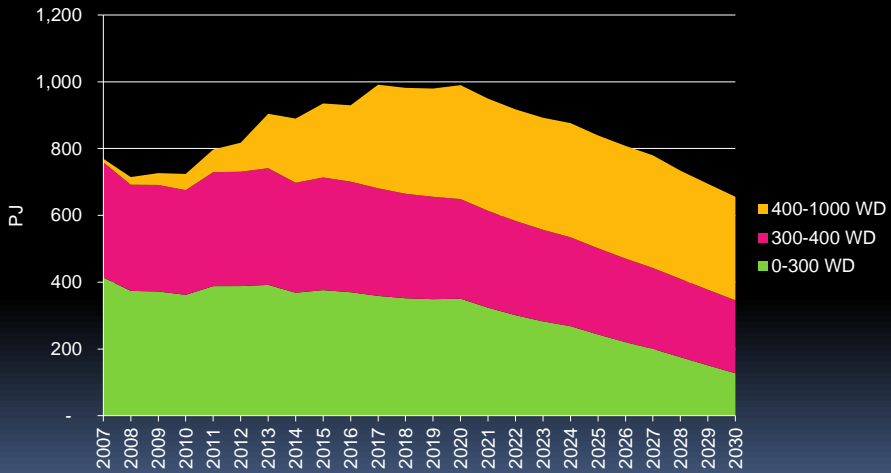
6. New oil production in Canada, 1995-2030



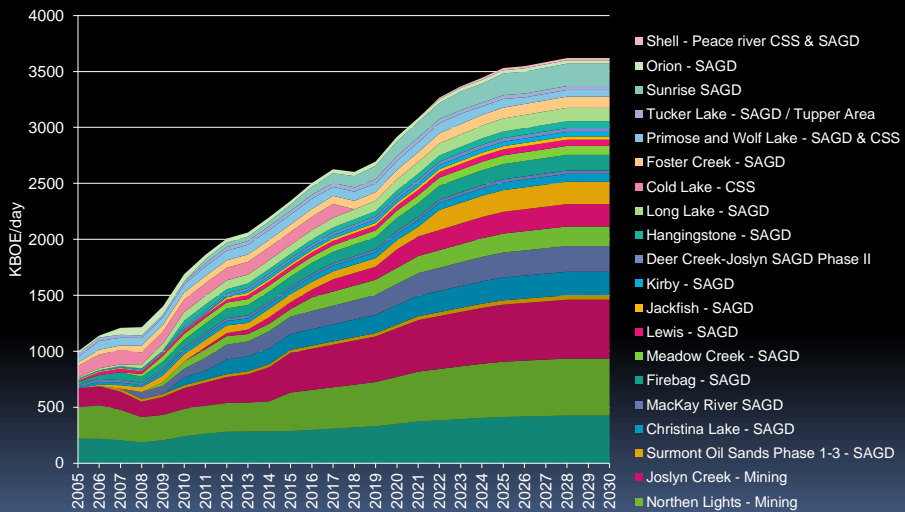
6. New oil from East, 1995-2030 - By project



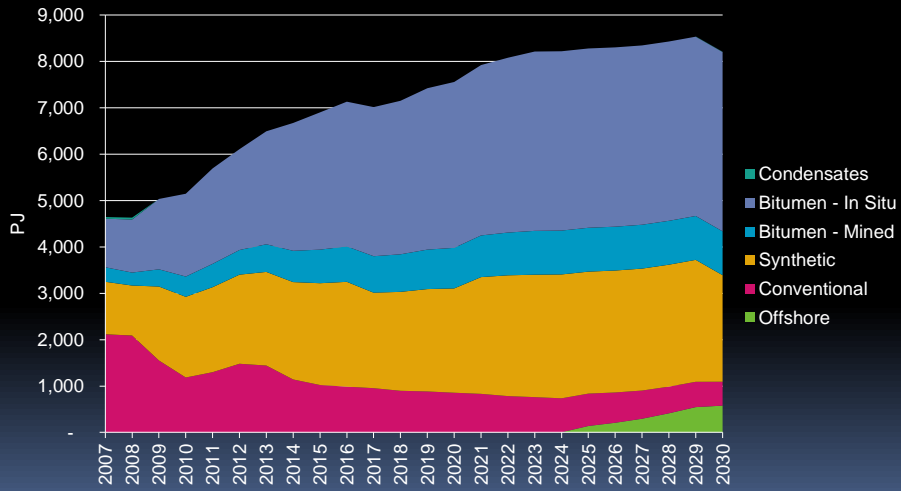
6. New oil from East, 2007-2030



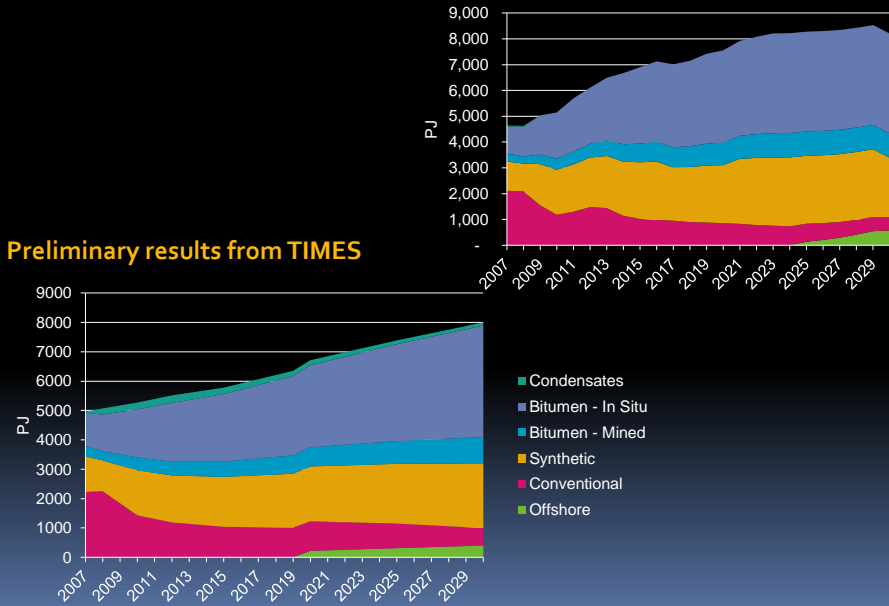
6. New oil from West, 2005-2030 - By project



6. New oil from West, 2007-2030



6. New oil from West, 2007-2030



7. Future works: Model developments

- Projection of the demand up to the 2030 horizon using the new Canadian Energy Outlook (CEO) to be published soon
- Building of three reference cases, illustrating low, moderate and high Canadian socio-economic growths
- Calculation of GHG from processes and CAC emissions
- Modeling of emerging technologies
 - Next generation biofuels
 - Liquefied natural gas (LNG)
 - Hydrogen economy
 - Carbon capture and sequestration (CCS)
 - Electrification of transportation
- Implementation of the energy corridors
- Coupling of the model with the TIAM world model
- Energy and climate policies analysis

7. Future works: Oil sector analysis

- From the three reference scenarios (2007-2030), compare costs and GHG emissions of conventional and unconventional oil production
- Perform sensitivity analysis on:
 - Short term evolution of crude oil prices.
 - Type of energy used for reserves extraction and transformation (natural gas, nuclear, etc.).
 - Domestic and international trade movements.
 - Offshore reserves and potential developments.
 - Provincial energy strategies (renewable targets).
 - Canadian climate policies.
 - Exogenous social and political constraints to illustrate the economic impacts of different choices on controversial issues (e.g. moratorium on nuclear, shale gas, etc.).

Thank you from the team

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