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Energy sources for a secure (?) and clean (?) energy future

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“To take concrete measures to save energy is not a matter of choice but a matter of survival.”

South Korean Prime Minister Han Seung-soo, 6 July 2008

Energy sources for a secure (?) and clean (?) energy future

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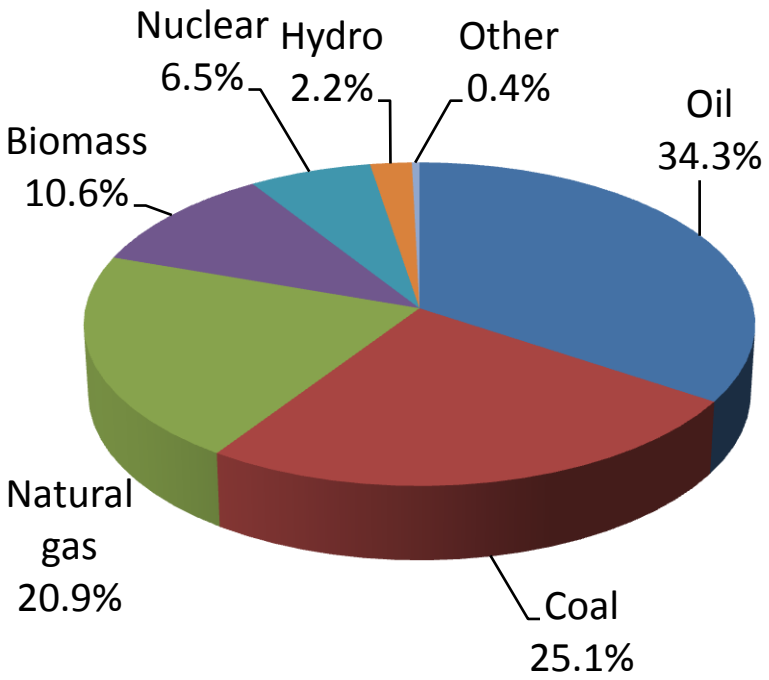
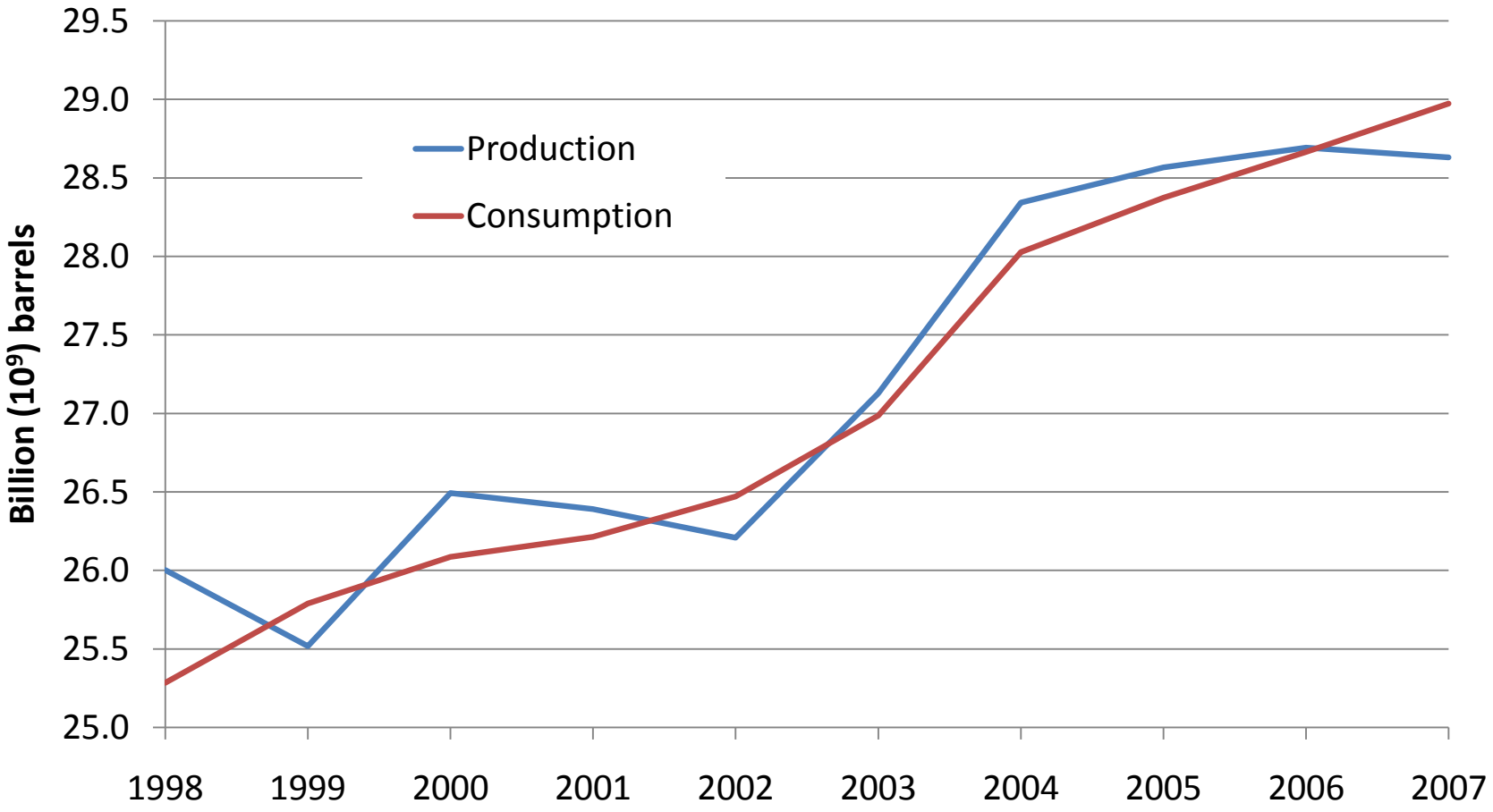
Why all the fuss over oil?



- Energy:
  - Over 98% of motorized transportation
  - Space and water heating
  - Lighting and cooking
  - Electrical generation
- Non-energy:
  - Pesticides
  - Plastics
  - Cosmetics
  - Asphalt

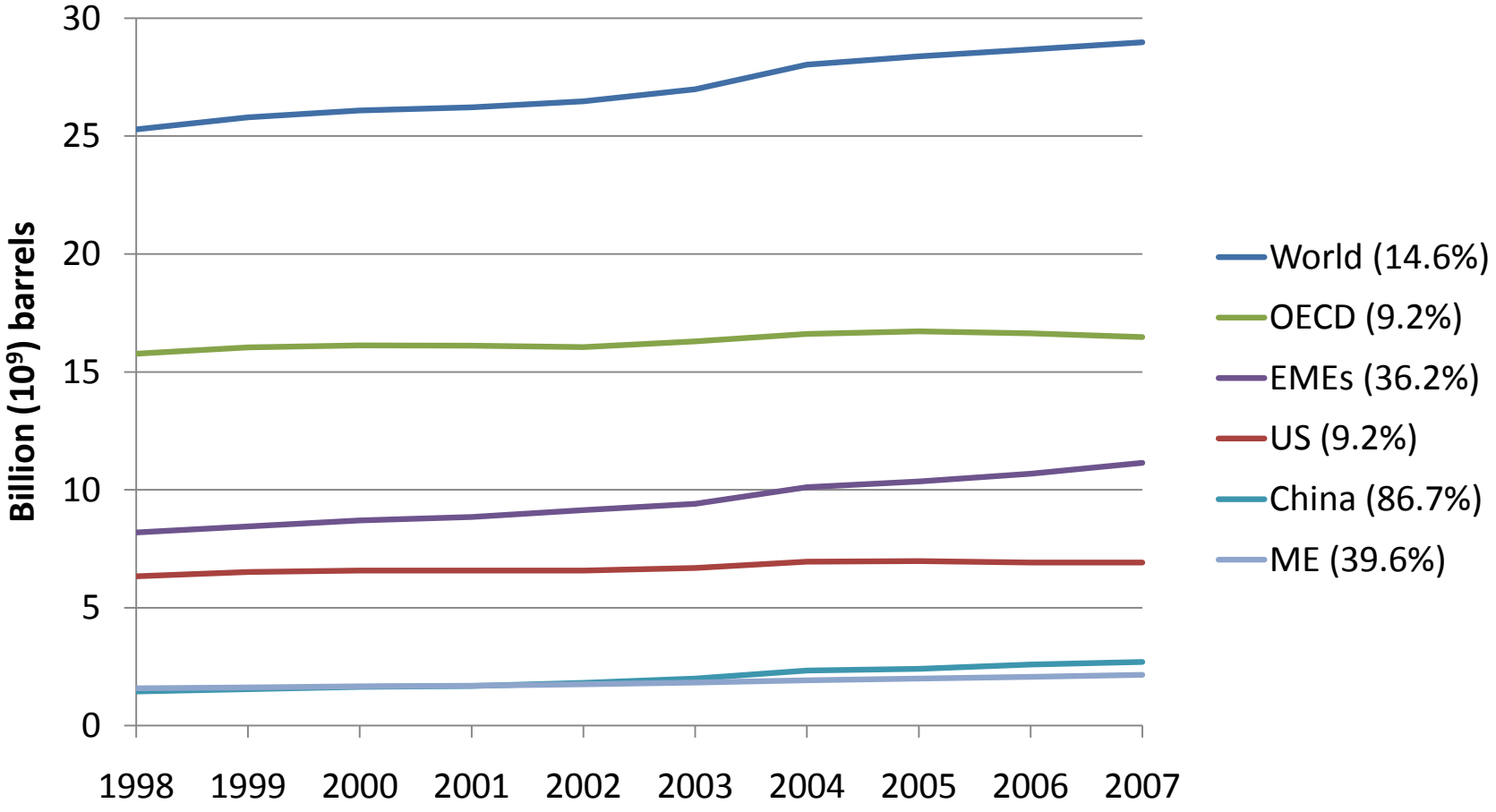
Source: IEA, Key World Energy Statistics, 2006

Oil production vs. consumption



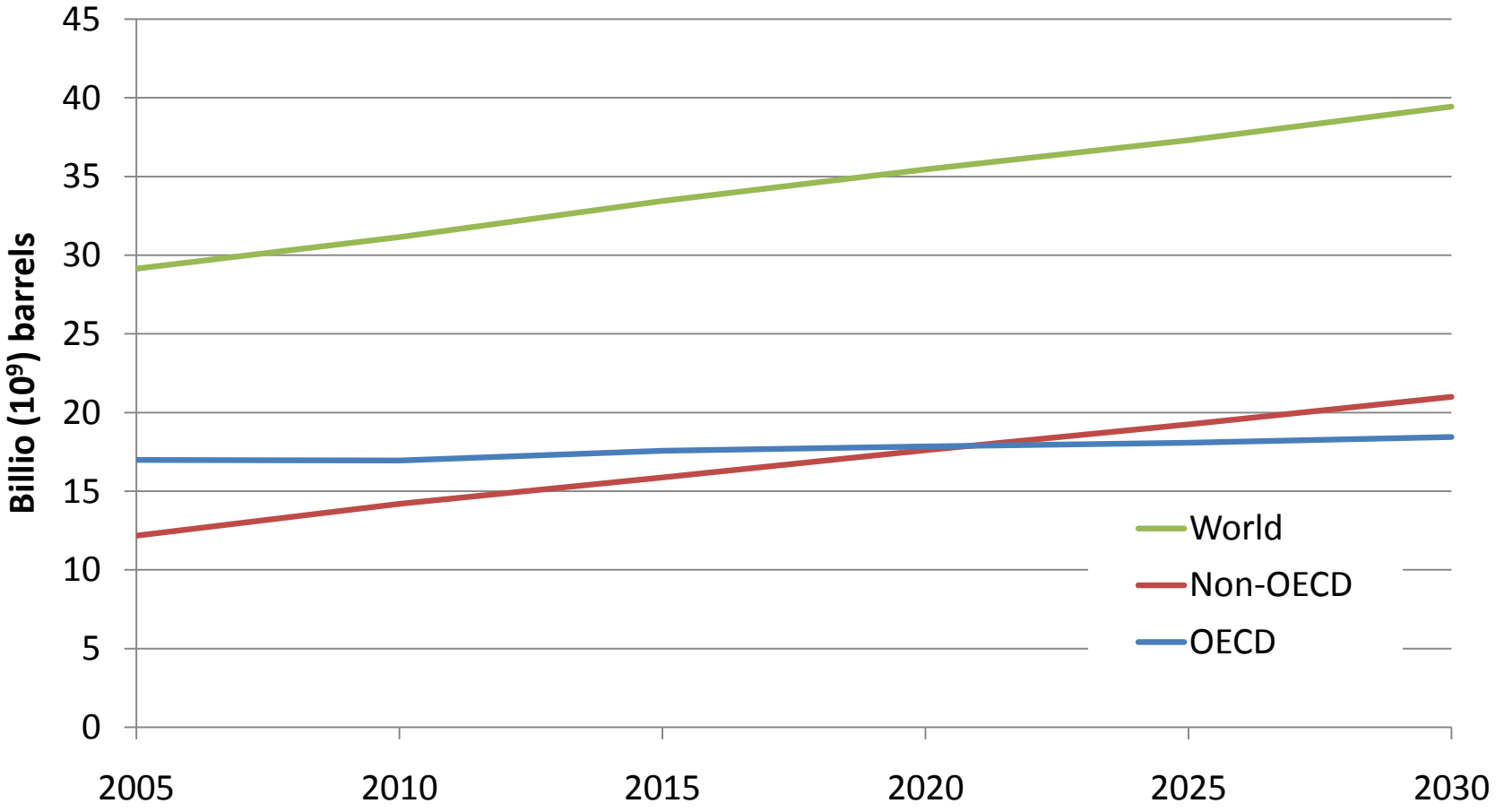
Source: BP Statistical Review of World Energy, 2008

World oil consumption: 1998-2007



Source: BP Statistical Review of World Energy, 2008

World oil consumption: 2005-2030



Source: EIA, International Energy Outlook 2008

Where will the oil come from?

- By 2015 the world will need another four billion barrels/year
- How?
  - Saudi Arabia produces 3.5 billion barrels/year
  - World production is declining at 5.2 percent/year (1.5 billion barrels)
  - Many producing countries in decline (UK, Mexico)
  - Non-conventional fuels (biofuels, tar sands, offshore, deep water) are expensive and cannot make up the shortfall

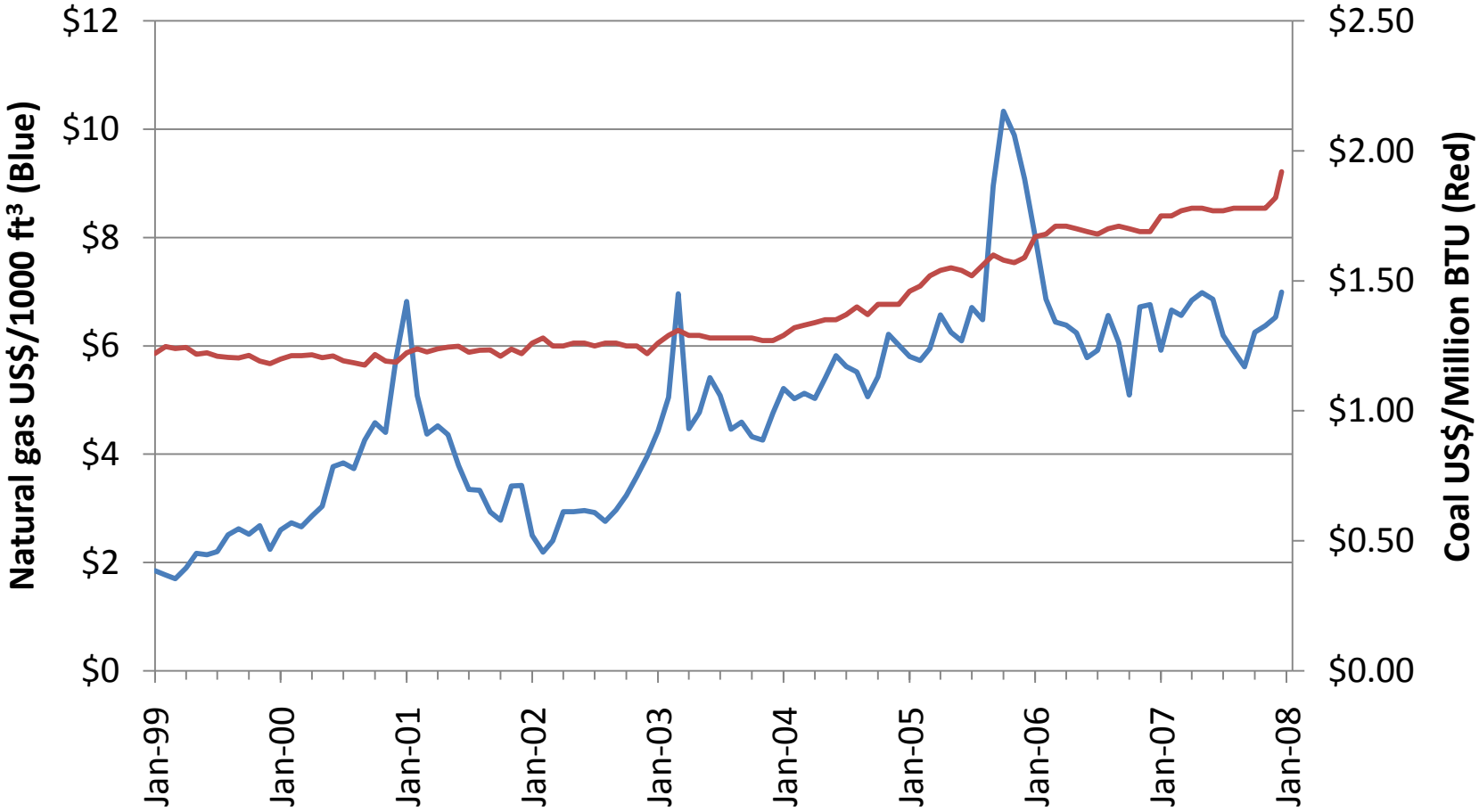
Other issues

- Changes in the oil market:
  - Heavy-sour crude replacing light-sweet crude
  - Exploration and development costs soaring
  - Weakness of US dollar
  - Tensions in Iraq, Iran, Nigeria, Mexico, Venezuela
- Growth in “resource nationalism”:
  - Russia/Gazprom vs. Shell and BP (TNK-BP)
  - Venezuela vs. ExxonMobil, Chevron, Conoco-Philips
- State of reserves are unknown

International Energy Agency's Medium Term Oil Report

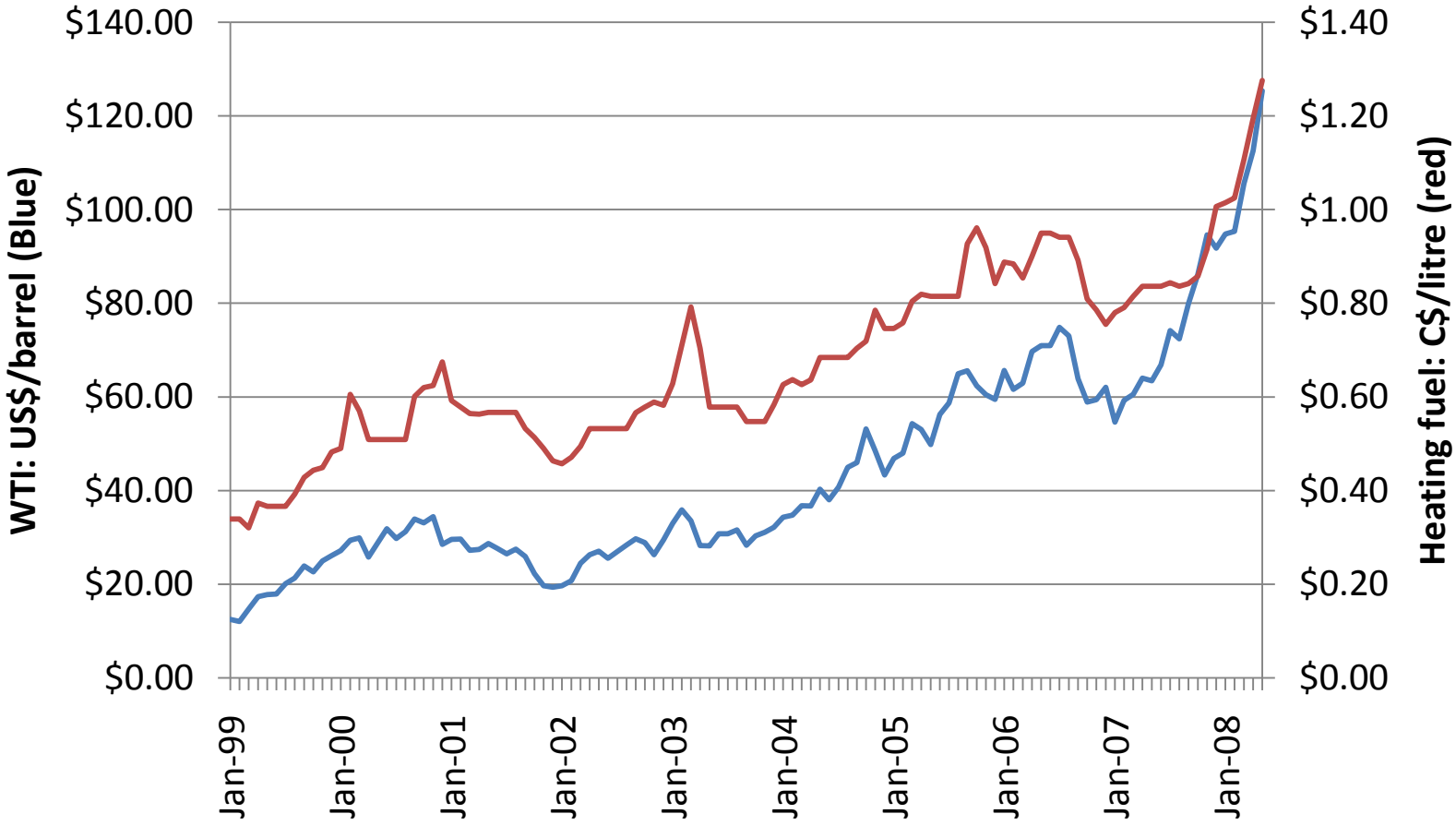
- July 2007:
  - "Supply crunch" starting in 2009:
    - OECD production begins to tighten and fall
    - OPEC spare capacity shortfall
  - OPEC and Russia expected to pick up the slack
- July 2008:
  - OPEC spare capacity will drop to negligible levels over the next five years
  - Non-OPEC supply growth will peak
  - World economic downturn will soften blow until 2011

Natural gas and coal prices are rising too…

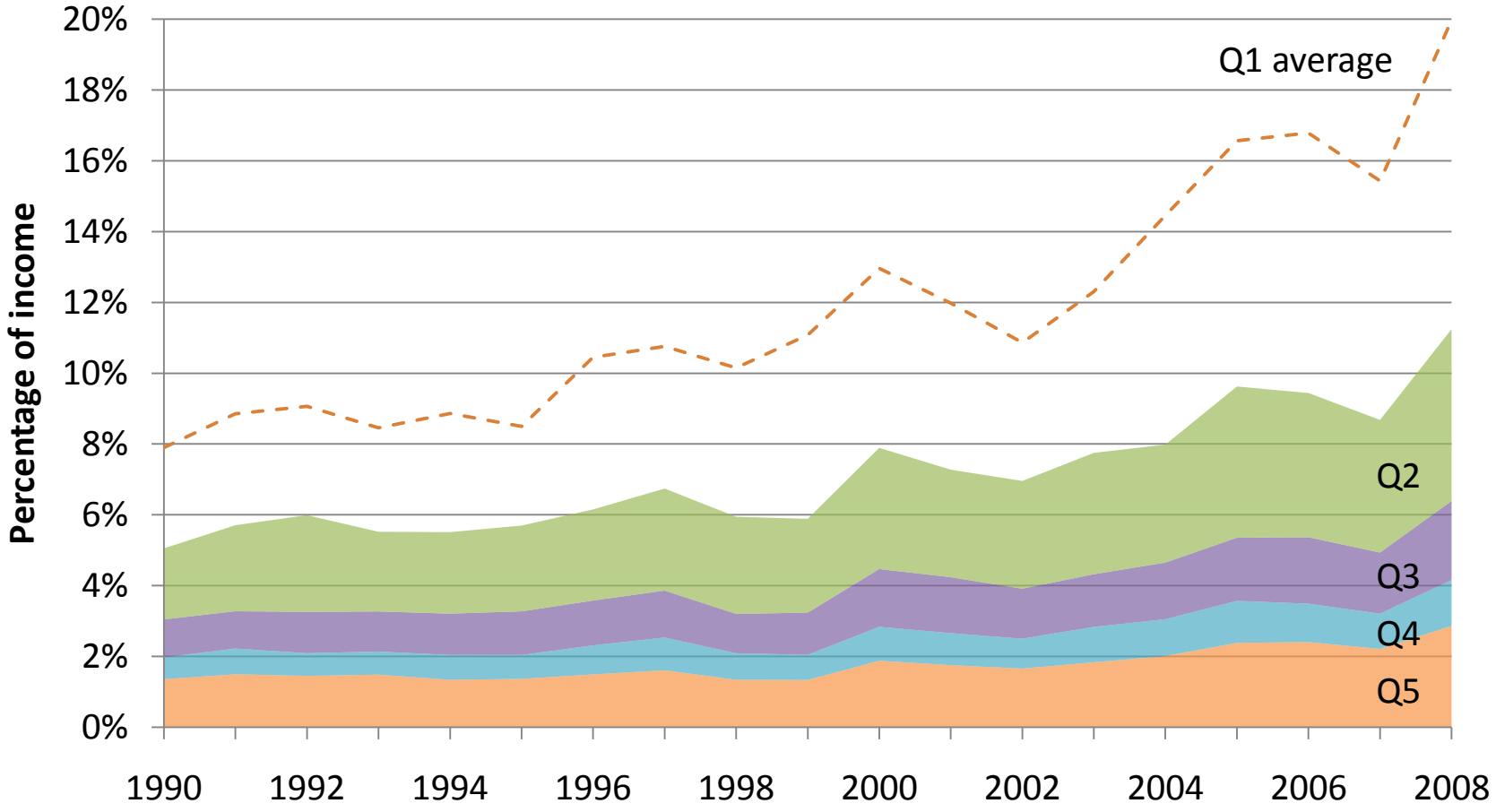


Source: EIA

The rising cost of home heating fuel



Impact of rising home heating fuel costs



Sources: CANSIM Upper Income Limits, V25731965; www.fuelfocus.nrcan.gc.ca

Energy security

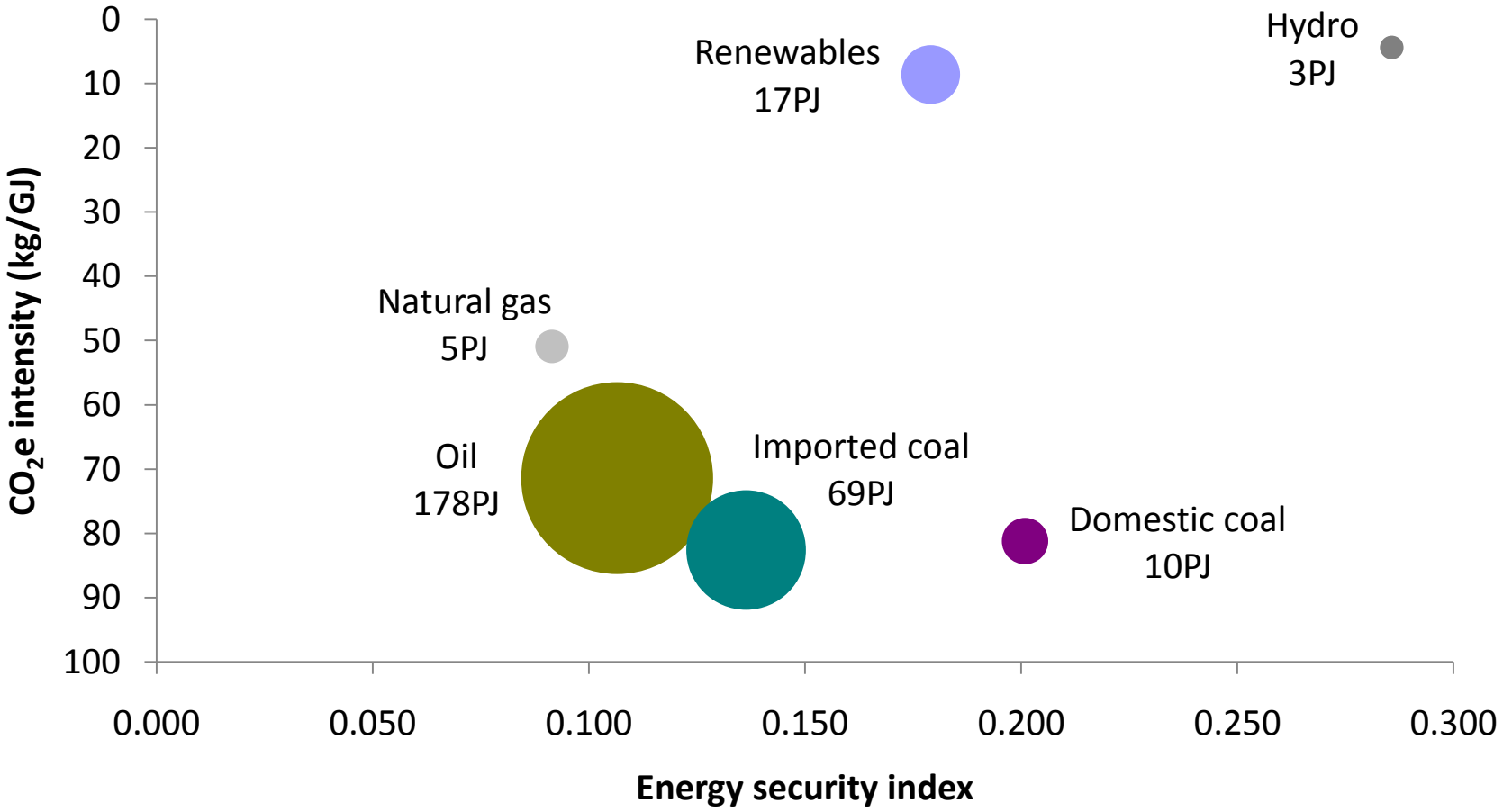
- What:
  - The availability of a regular (i.e., uninterrupted) supply of energy at an affordable price.
- Why:
  - Economic growth
  - Poverty reduction
  - Political stability
- Requires:
  - Supply
  - Infrastructure

Sources: IEA, 2001; "Energy Security Issues", World Bank, 2005

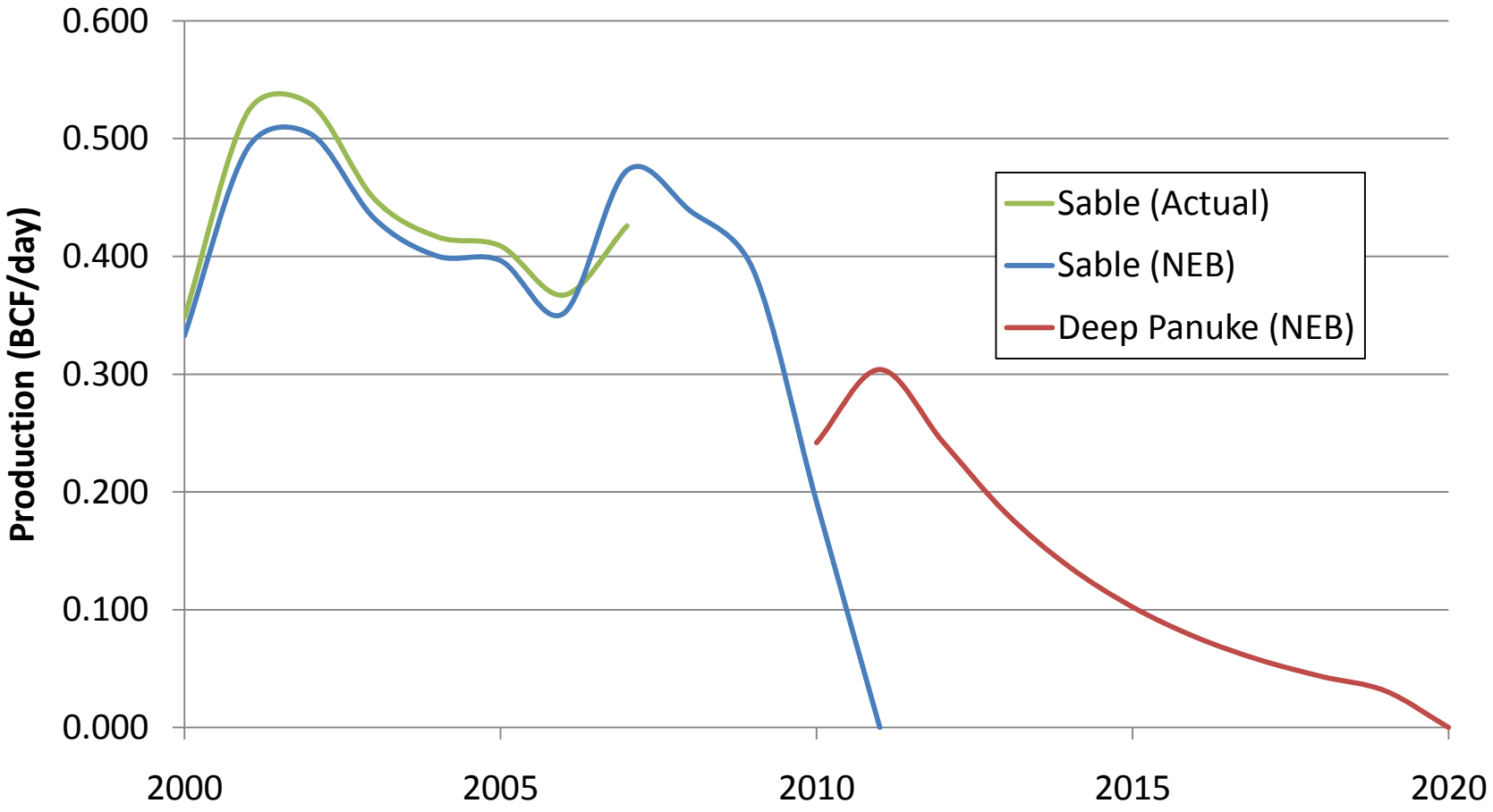
Approaches to energy security

- USA:
  - Military, trade, national production, biofuels
- Europe:
  - Russia, nuclear, biofuels
- China:
  - Long-term trade deals, takeovers
- Canada:
  - Not to worry, “bastion of energy security”

Nova Scotia: Energy security and emissions



Offshore Nova Scotia



Can Nova Scotia rely on Canada?

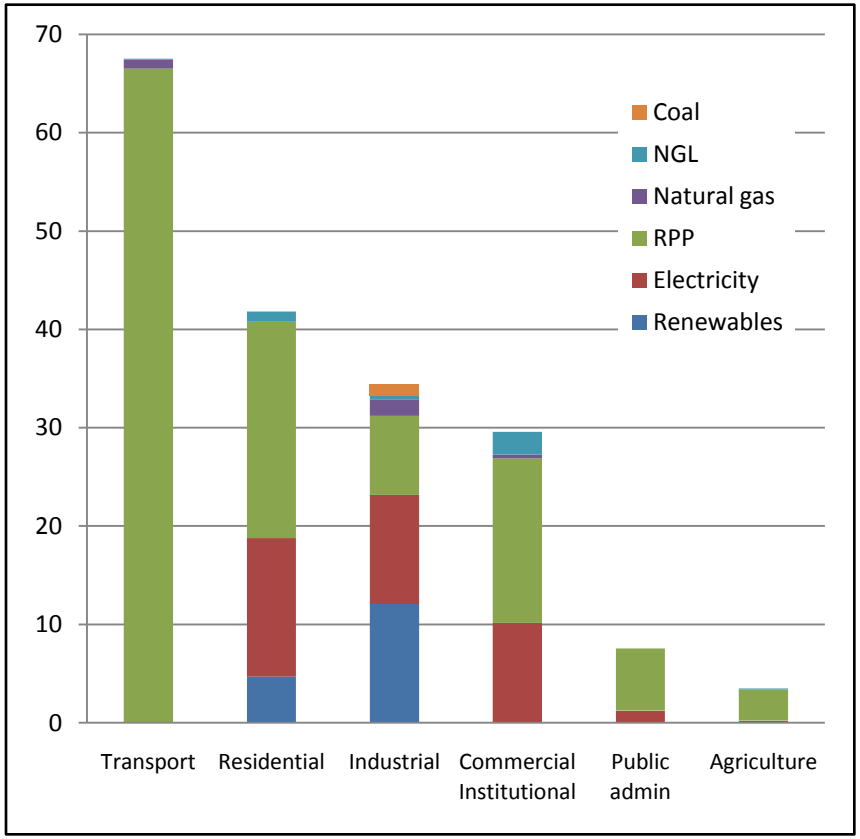
- No significant energy corridors:
  - 300 MW_{el} connection to New Brunswick
  - Natural gas pipeline to New England
- NAFTA proportionality clause (Chapters 6 and 21) restrict reduction of energy exports
- Lower Churchill (2,300 MW):
  - Earliest completion date: 2015
  - Competition for energy from other jurisdictions

The four ‘R’s of energy security

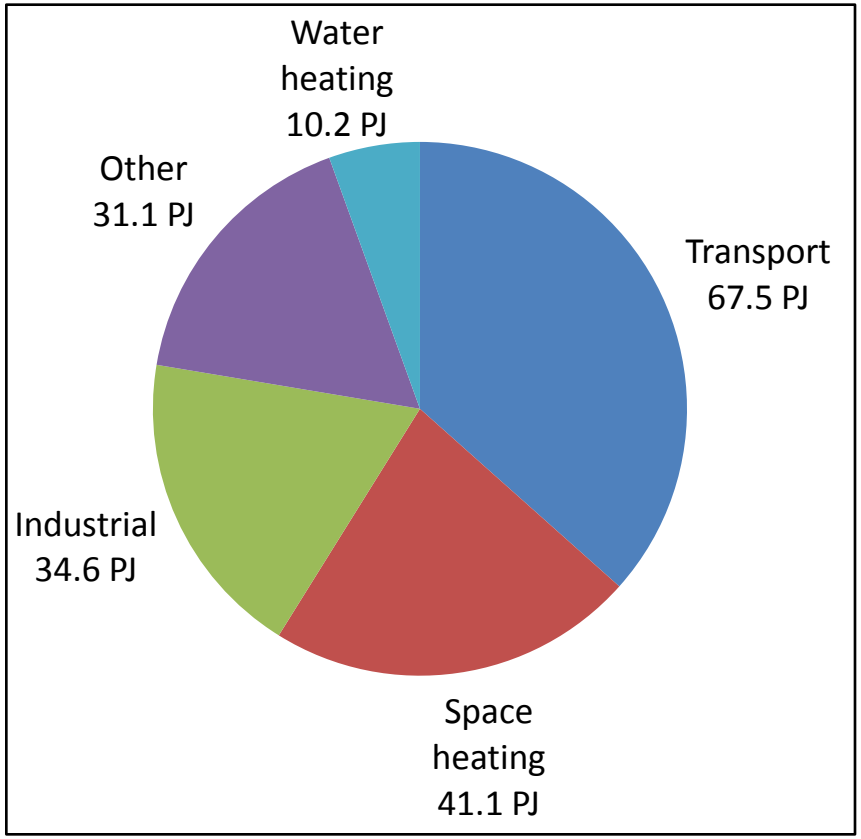
- Review:
  - Energy existing supplies and infrastructure
  - End-use energy requirements
- Reduce:
  - Reduce demand
  - Conservation and efficiency measures
- Replace:
  - Replace insecure energy sources with secure ones:
    - Diversify suppliers
    - Alternative energy sources
- Restrict:
  - New demand should be met from secure sources

Review: It's the end-use, stupid!

By final demand (PJ)

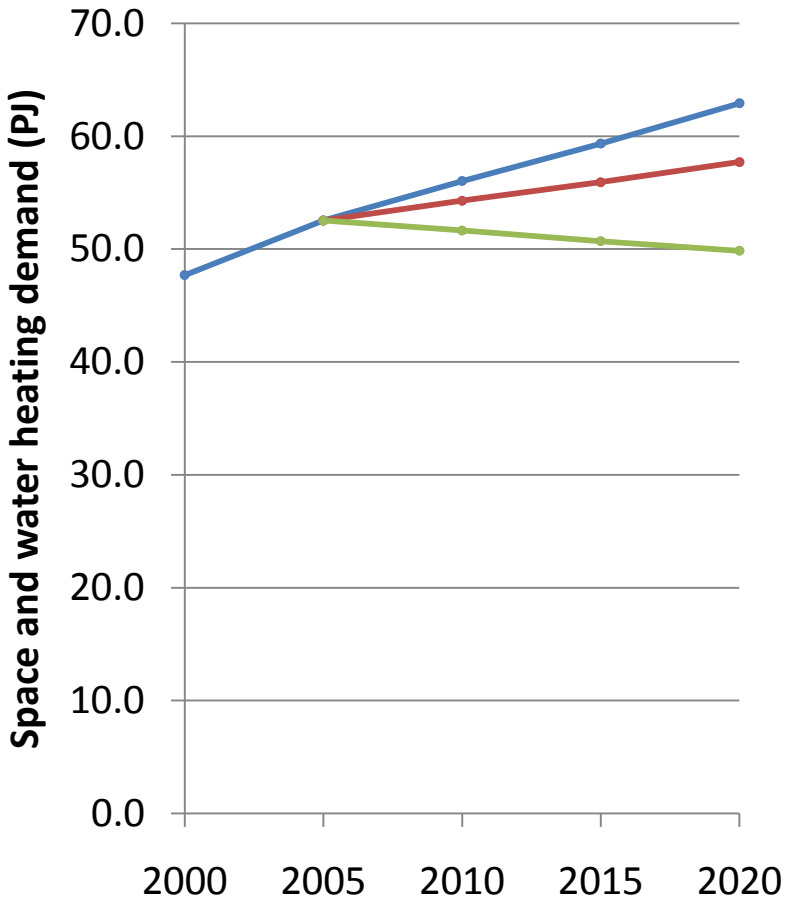


By end-use



Source: CANSIM, Table 128-0009

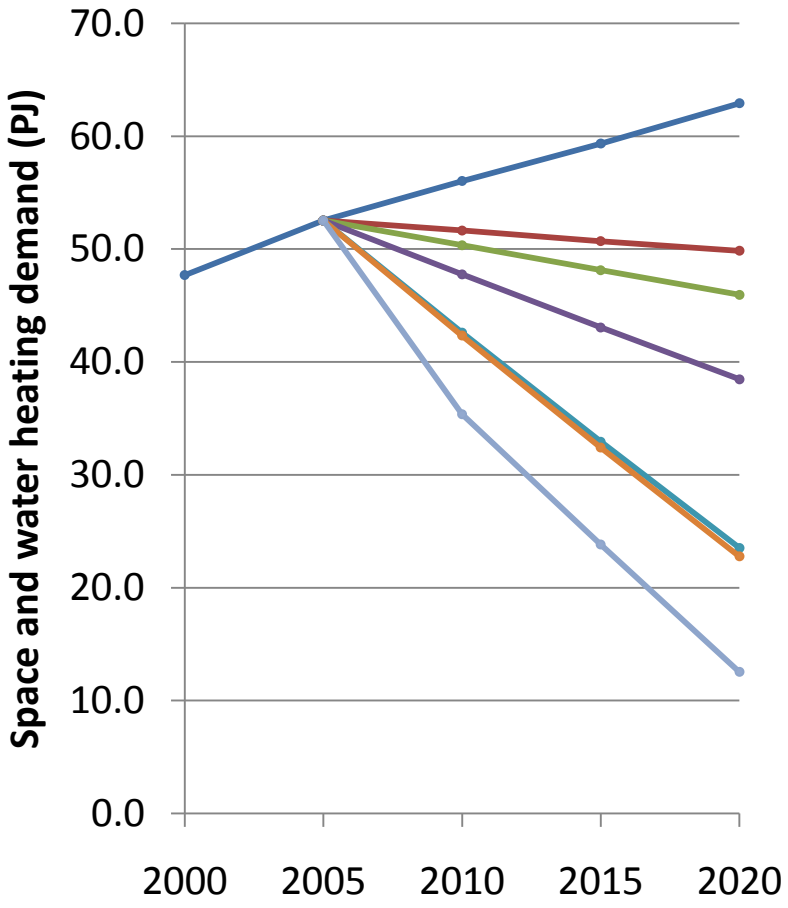
Reduction: Heating



- New buildings:
  - 50 percent reduction vs. existing buildings
  - Building techniques and materials
  - 5.2 PJ reduction
- Existing buildings:
  - One percent reduction per year
  - Conservation and retrofits
  - 7.9 PJ reduction
- Ideally: 13 PJ reduction

Source: Canada's Energy Outlook 2006-2020, NRCan

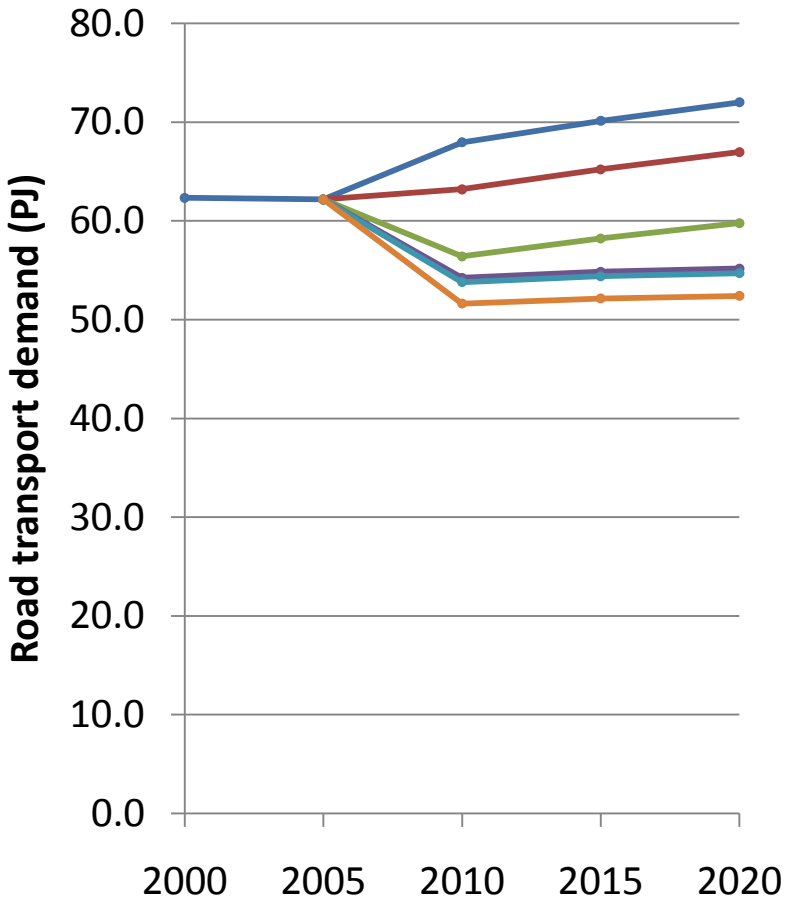
Replacement: Heating



- Reduction (13 PJ)
- Solar (new buildings):
  - 75% demand from solar
  - 3.9 PJ
- Solar (existing buildings):
  - 15% demand from solar
  - 7.5 PJ
- Wind heating:
  - 30% demand from wind
  - 15 PJ (1,900 turbines)
- District heating:
  - 1.5% demand from district heating
  - 0.7 PJ
- Biomass:
  - 20% from biomass
  - 10.2 PJ (700,000 tonnes)
- 12.5 PJ shortfall

Source: Canada's Energy Outlook 2006-2020, NRCan

Reduction: Transportation



- 90km/h limit:
  - 7% demand reduction
  - 5 PJ
- Tune-up:
  - 10% demand reduction
  - 7.2 PJ
- Fuel economy
  - 0.5% reduction per year
  - 4.6 PJ
- 1% modal shift:
  - 0.5 PJ
- 5% modal shift:
  - 2.3 PJ
- 52 PJ shortfall

Source: Canada's Energy Outlook 2006-2020, NRCan

Replacement: Transportation

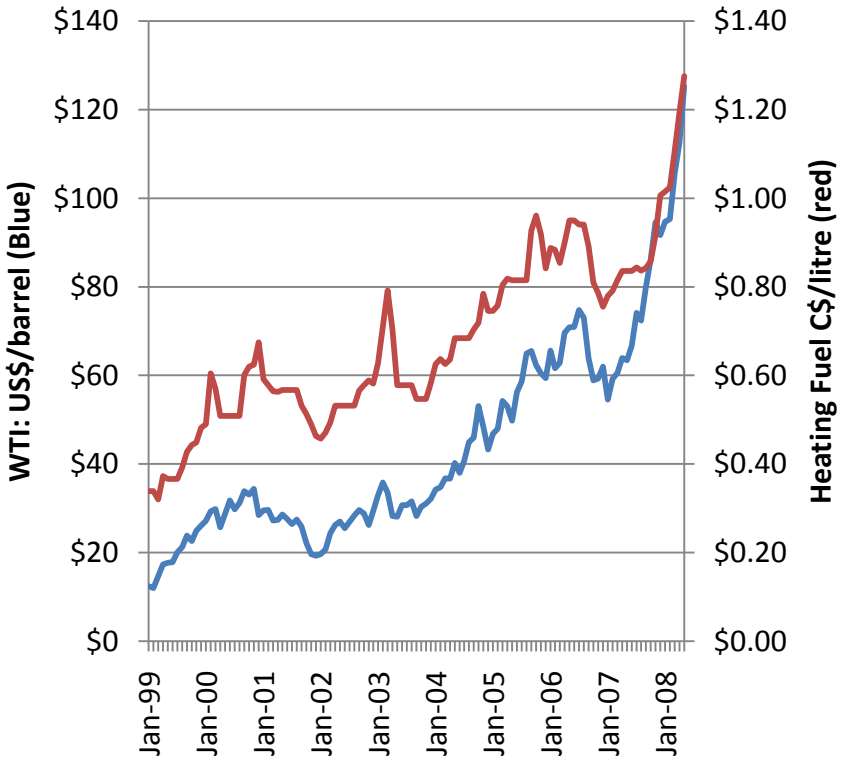
- Nova Scotia's road transport demand: 1.228 billion litres of gasoline

Fuel source	Yield	Requirements	Comments
E5 (5% ethanol) Corn: 400 litres/t	5t/ha	42,900 ha	10.5% Nova Scotia's farmland
	10t/ha	21,467 ha	5.3% Nova Scotia's farmland
E85 (85% ethanol)	5t/ha	729,930 ha	179% Nova Scotia's farmland
	10t/ha	365,965 ha	89% Nova Scotia's farmland
Coal-to-liquids (Fischer-Tropsch)	500 litres/t	2.5 Mt coal/yr	5.5 Mt coal/yr (2.5 Mt transport + 3 Mt electricity) or 40 years supply
Forest biomass (Fischer-Tropsch)	210 litres/t	5.8Mt biomass	145% of Nova Scotia's forest yield (about 4 Mt/yr)

Source: Energy Security and Nova Scotia, CCPA, Hughes

Short-term issues will dictate policies

Energy costs are rising…



What can be done…

- Lower building temperatures?
- Switch to:
  - Natural gas?
  - Biomass?
  - Electricity?
- Subsidies?
- Requisition fuel?
- Rationing?
- Heat shelters?

Nova Scotia's dilemma

- Supply:
  - Overwhelming reliance on imported energy
  - Ill-prepared for rising energy costs
  - Limited domestic energy supplies
- Infrastructure:
  - Rising costs will limit actions
  - Other jurisdictions are facing similar problems
- Short-term issues will dominate:
  - Food and fuel costs will hurt many Nova Scotians
  - Energy security will trump emissions reduction
  - A cold and hungry voter is an unhappy voter

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