Low Carbon Scenarios for Canada

Presentation slides for:

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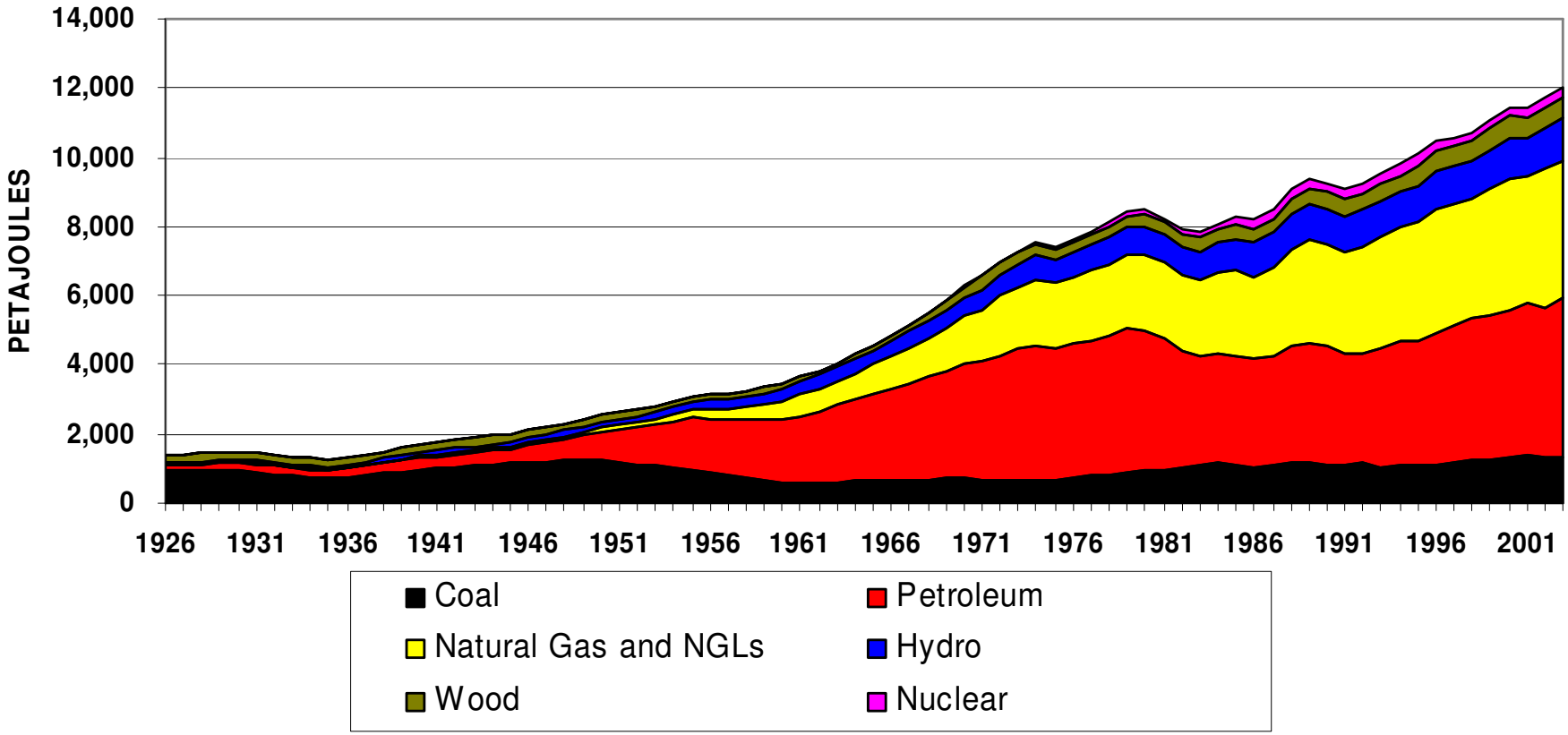
Japan-UK Joint Research Project Expert Workshop

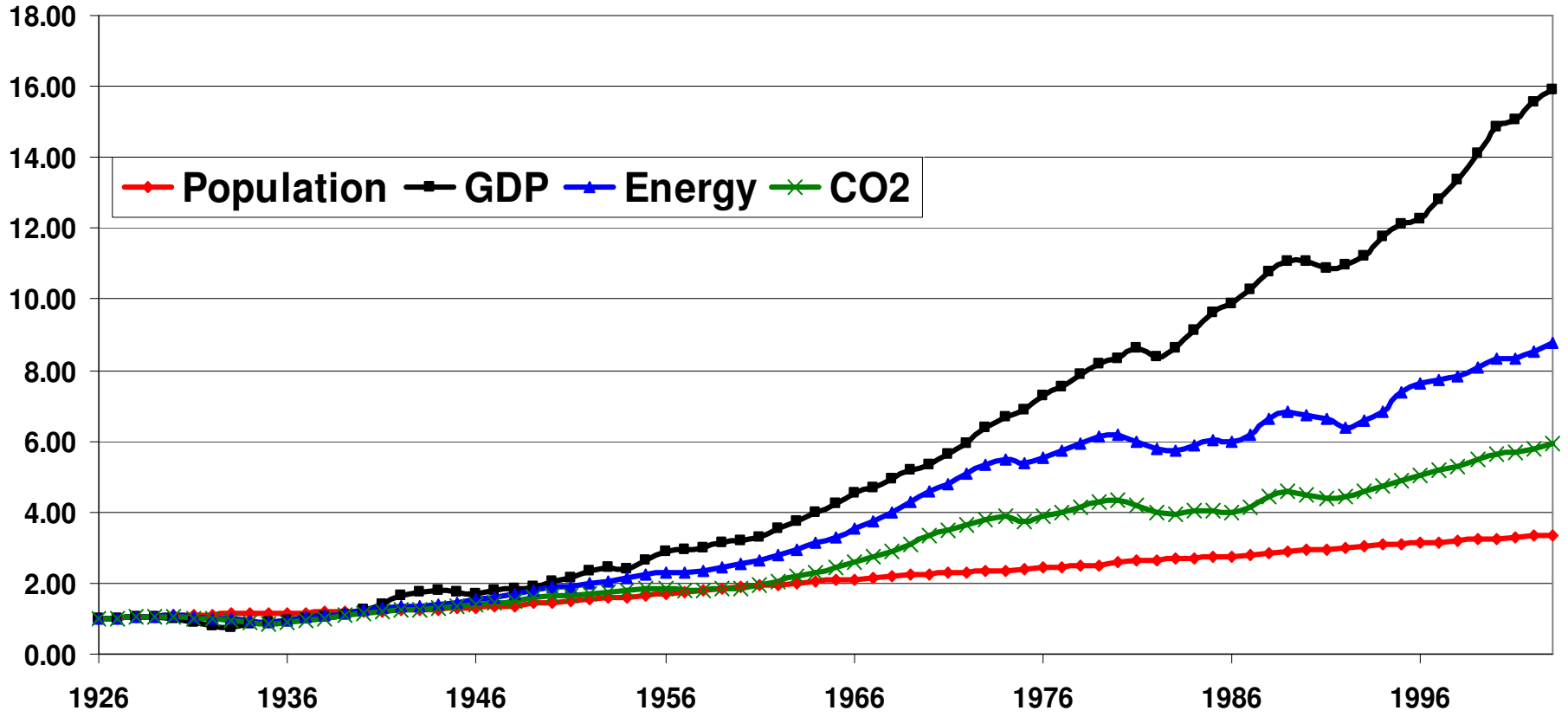
"Developing Visions for a Low-Carbon Society through Sustainable Development", Tokyo, June 2006

- Canadian Context
- Research Method
- Low Carbon Scenario for Canada
- Key Conclusions
- Observations and Research Issues

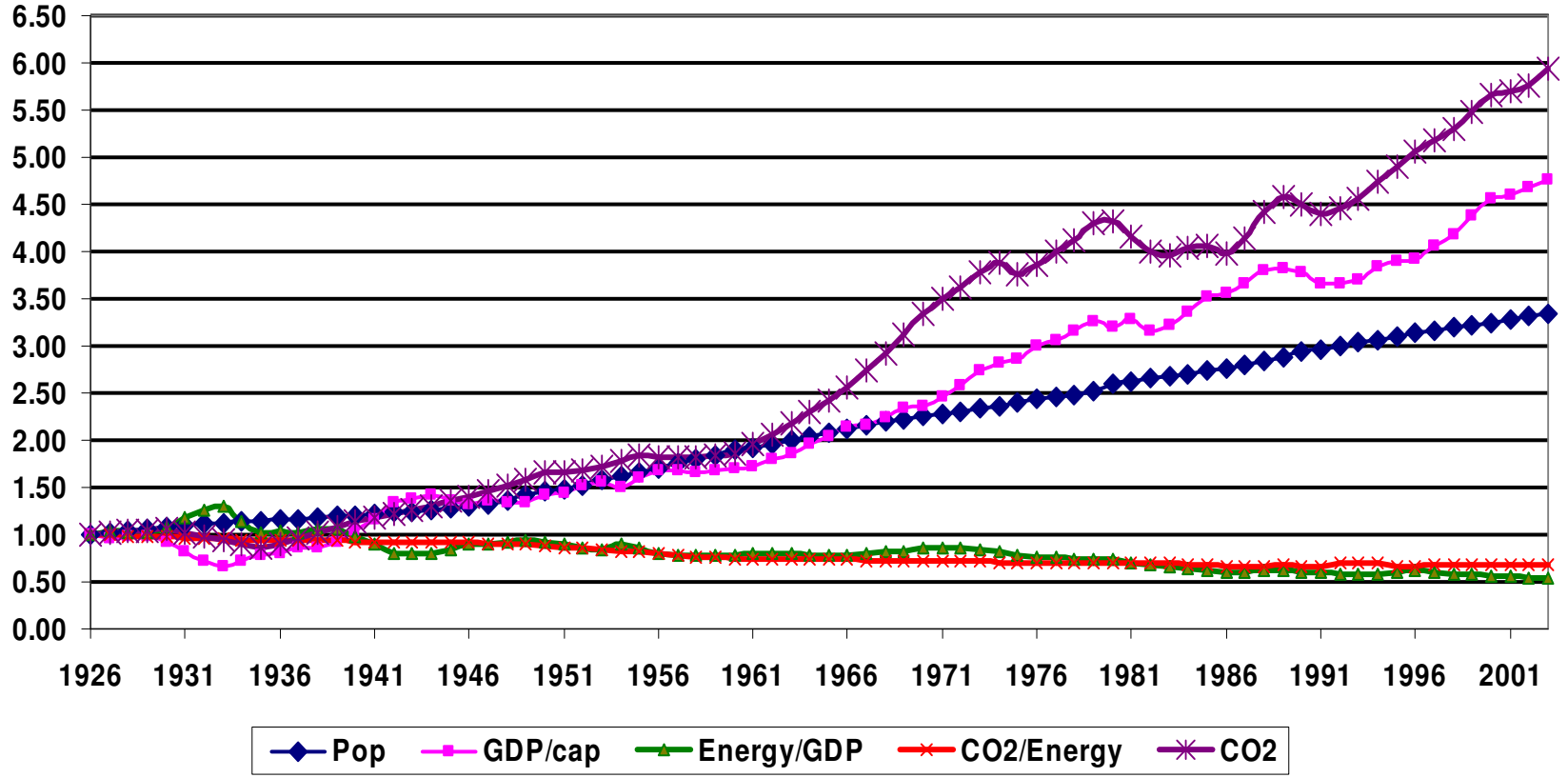
Canadian Domestic Demand for Primary Energy, 1926-2003



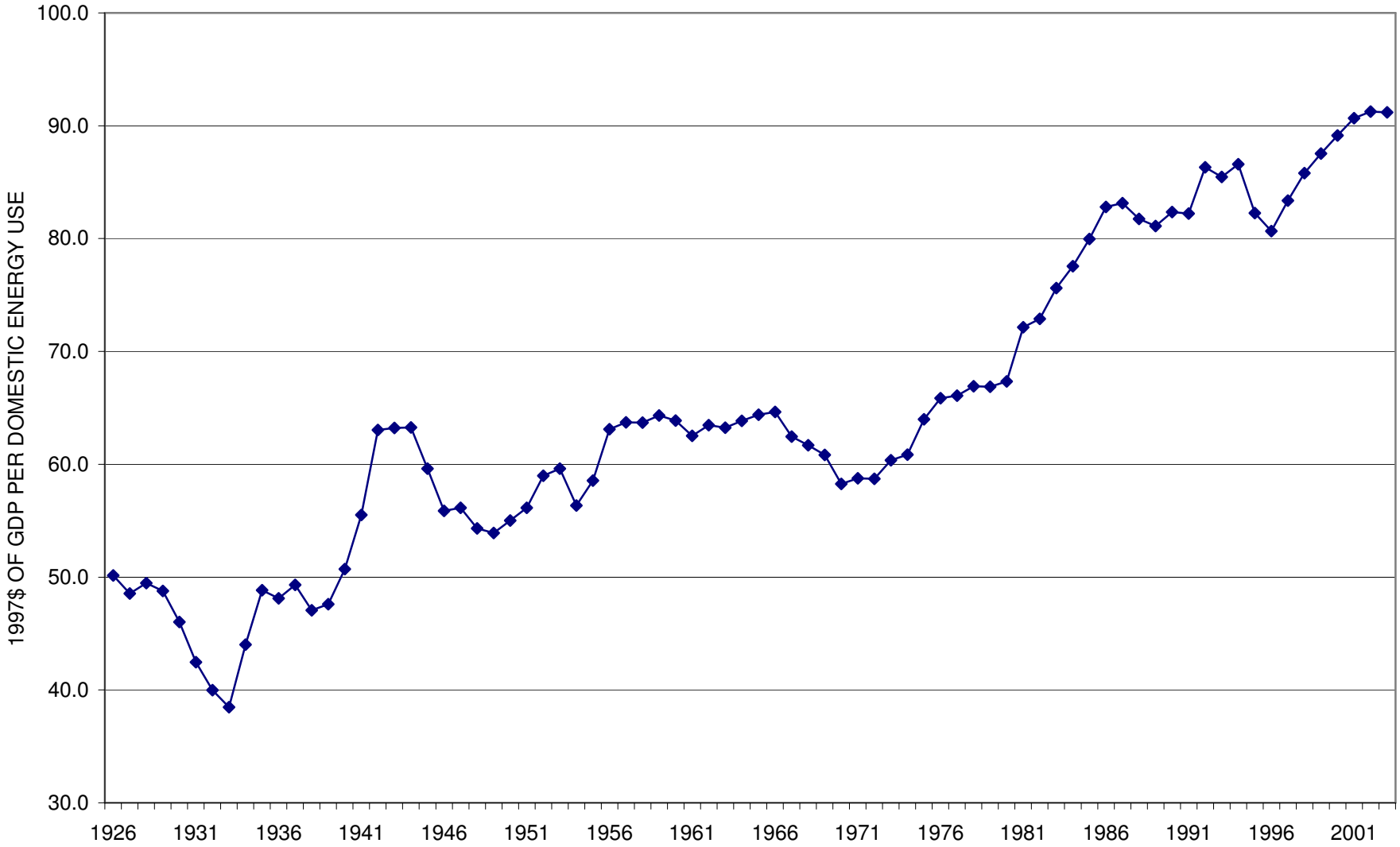
Population, GDP, Energy and CO2 in Canada, 1926-2003



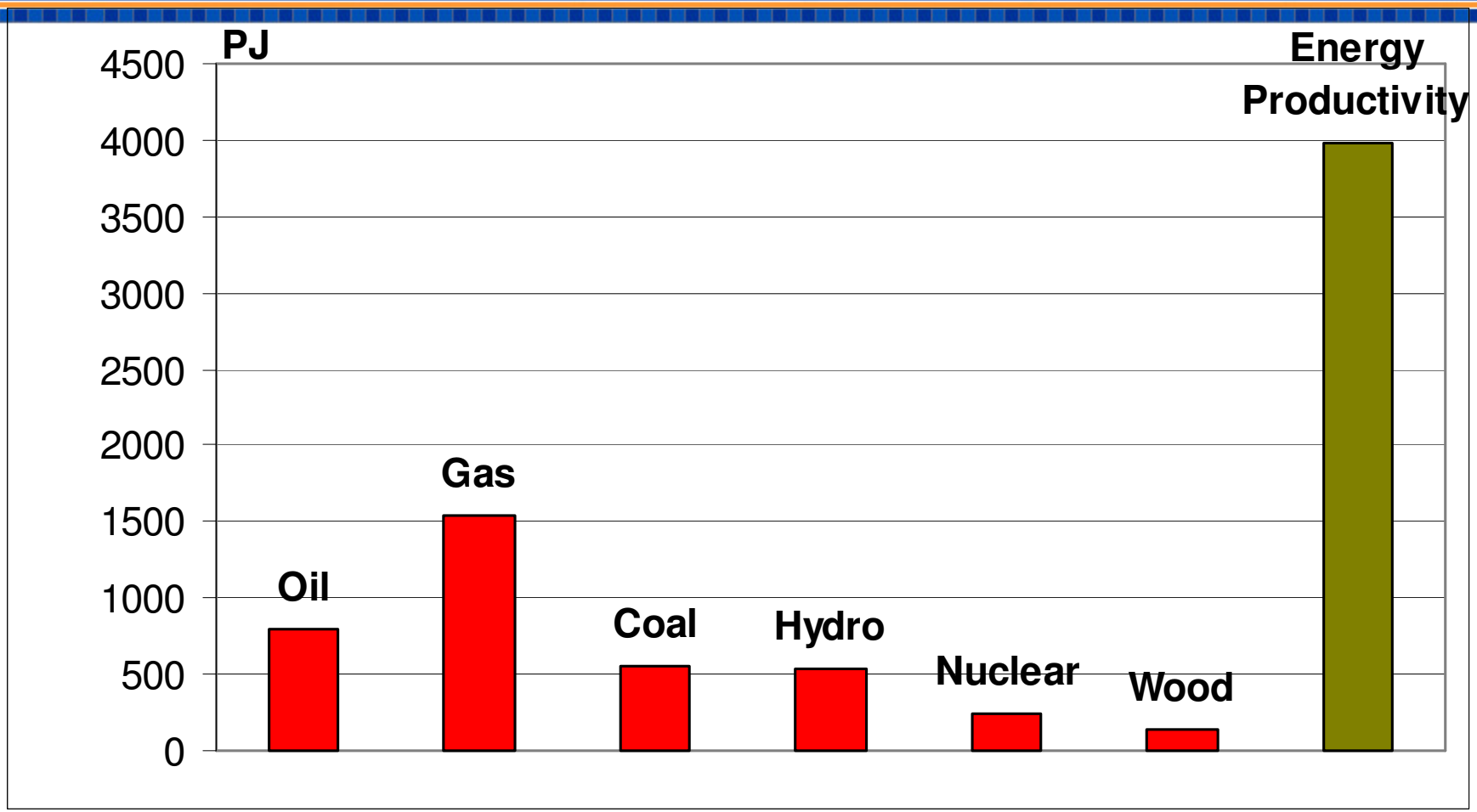
Canadian Energy and CO2 -- KAYA Factors



Energy Productivity of the Canadian Economy, 1926-2003



Energy Growth in Canada, 1970-1998



Low Emission Futures and the Canadian Context

- Ongoing population growth
- A large and growing fossil fuel production sector oriented to export markets
- Energy intensive industrial production, although declining
- Fuel and electricity relatively inexpensive

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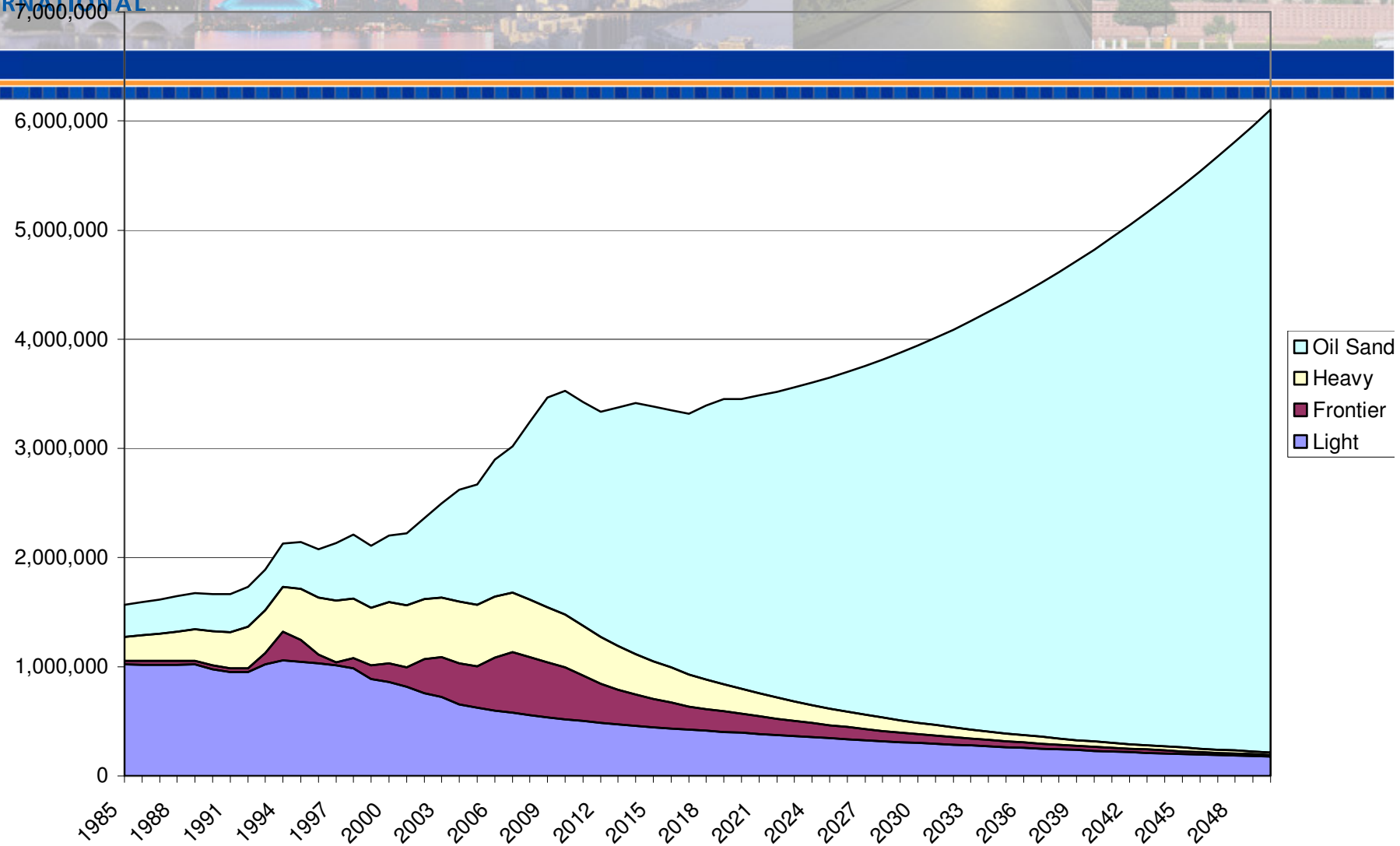
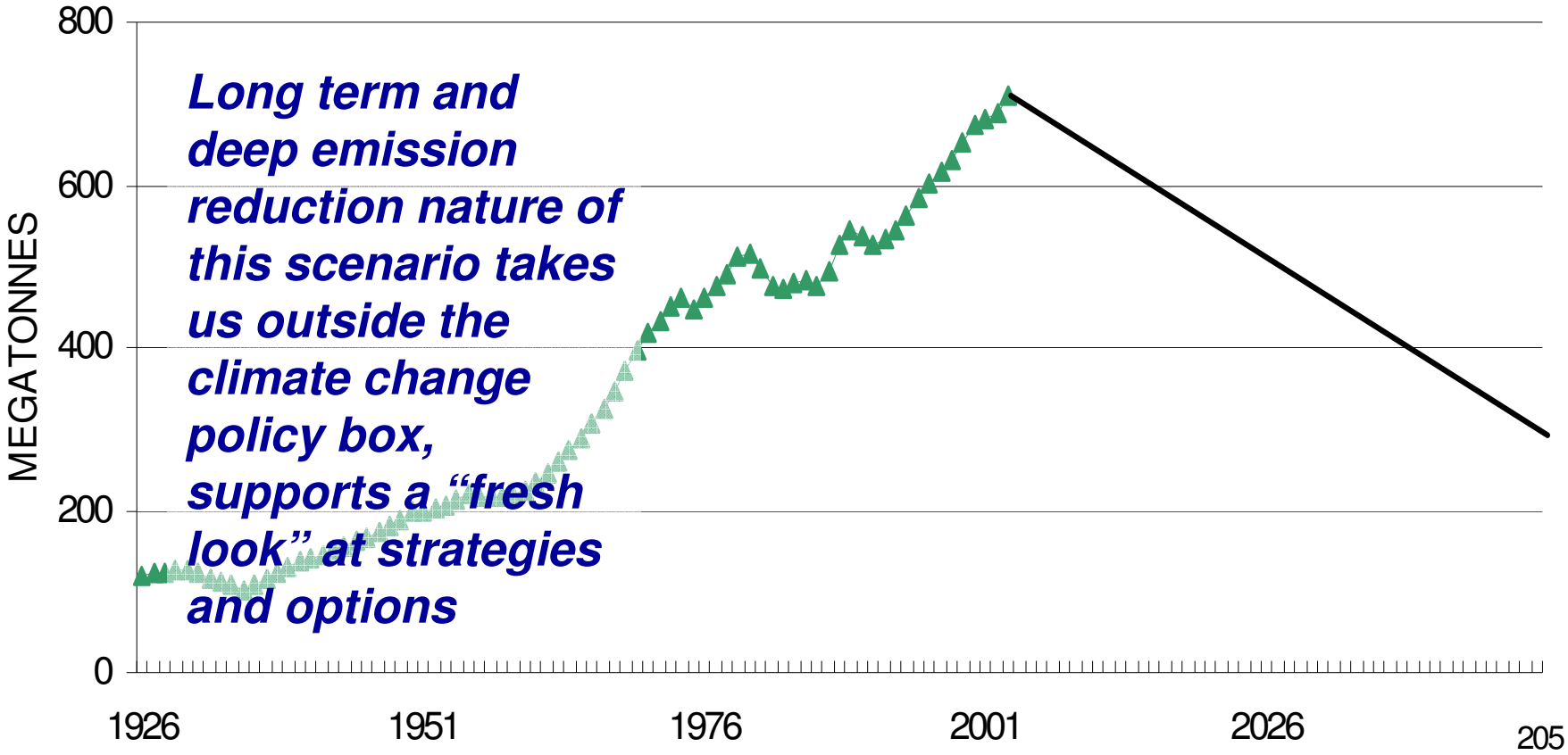
Oil Production (bbl/day)



Energy Related Carbon Dioxide Emissions In Canada, 1926-2050



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Elements of Method – LCS for Canada

- Current work restricted to energy-related greenhouse gas emissions, which constitute about 80% of Canadian GHG emissions
- Normative, target-oriented scenario approach – 60% reduction in GHG emissions by 2050, relative to current levels.
- Conventional demographic and aggregate economic growth projections adopted
- End use focus, with full cycle emission factors. Power plant and fossil fuel industry emissions allocated to end users
- Oil and gas production assumed independent of Canadian demand
- Full cycle emission factors, with power plant emissions and emissions of oil and gas sector allocated to end users (emissions associated with oil and gas exports treated separately)
- Emission reductions close gap between a reference scenario or "top line" and the targeted emissions level – "gapology".

Elements of Method – LCS for Canada

- Centre for Spatial Economics provided macroeconomic forecast to "seed" the initial scenario
- Systematic Solutions Energy 2020 model for simulation of emission scenario and emission reduction policies
- Historical analysis of activity drivers to calibrate model and inform scenario analysis
- Interviews with industry leaders to explore plausible long term futures for major industries in Canada
- Results presented in the form of "Socolow" wedges
- Only a single illustrative scenario presented at this time
- Next steps: Economic analysis of scenario and details of policy roadmap

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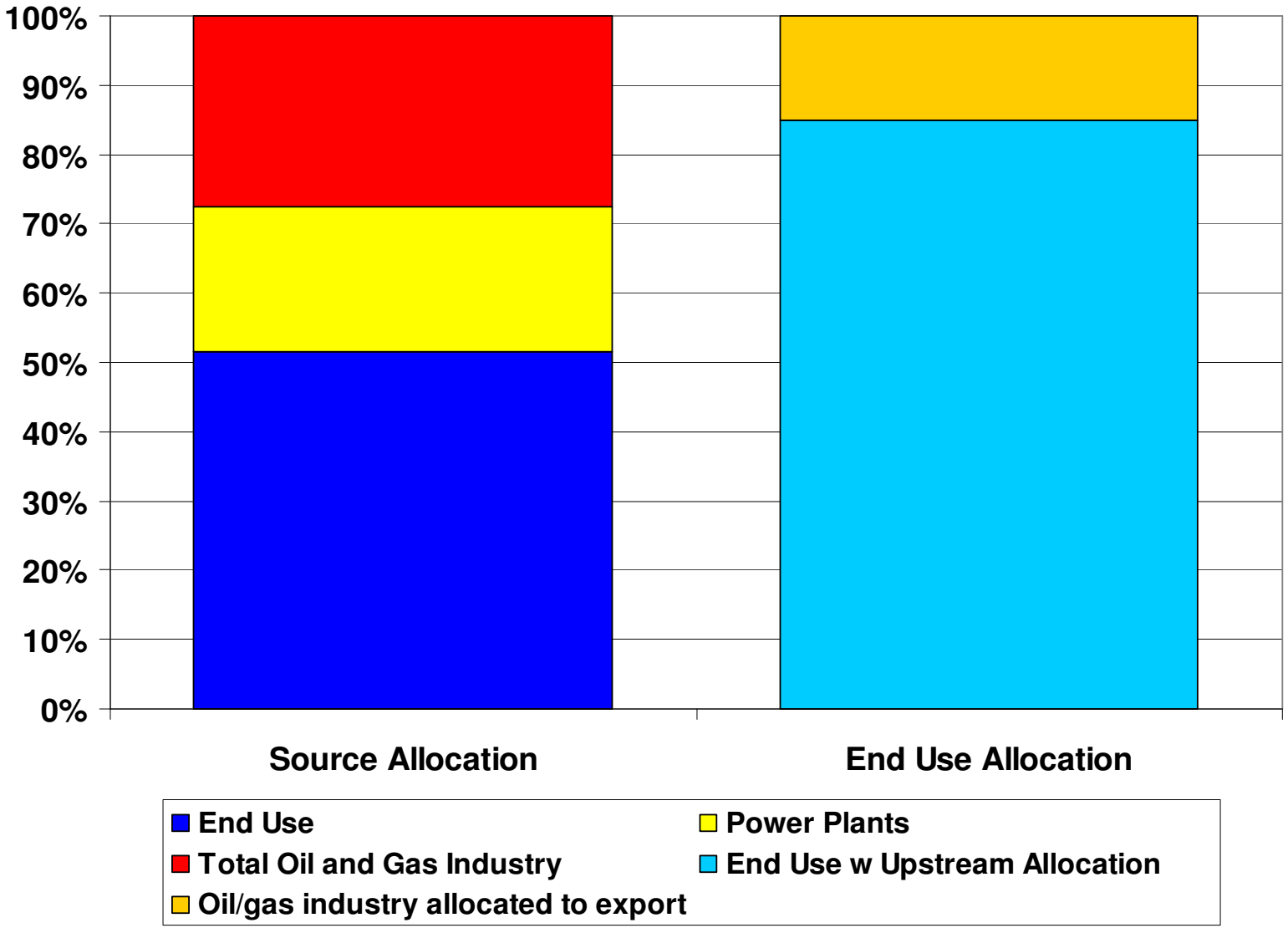
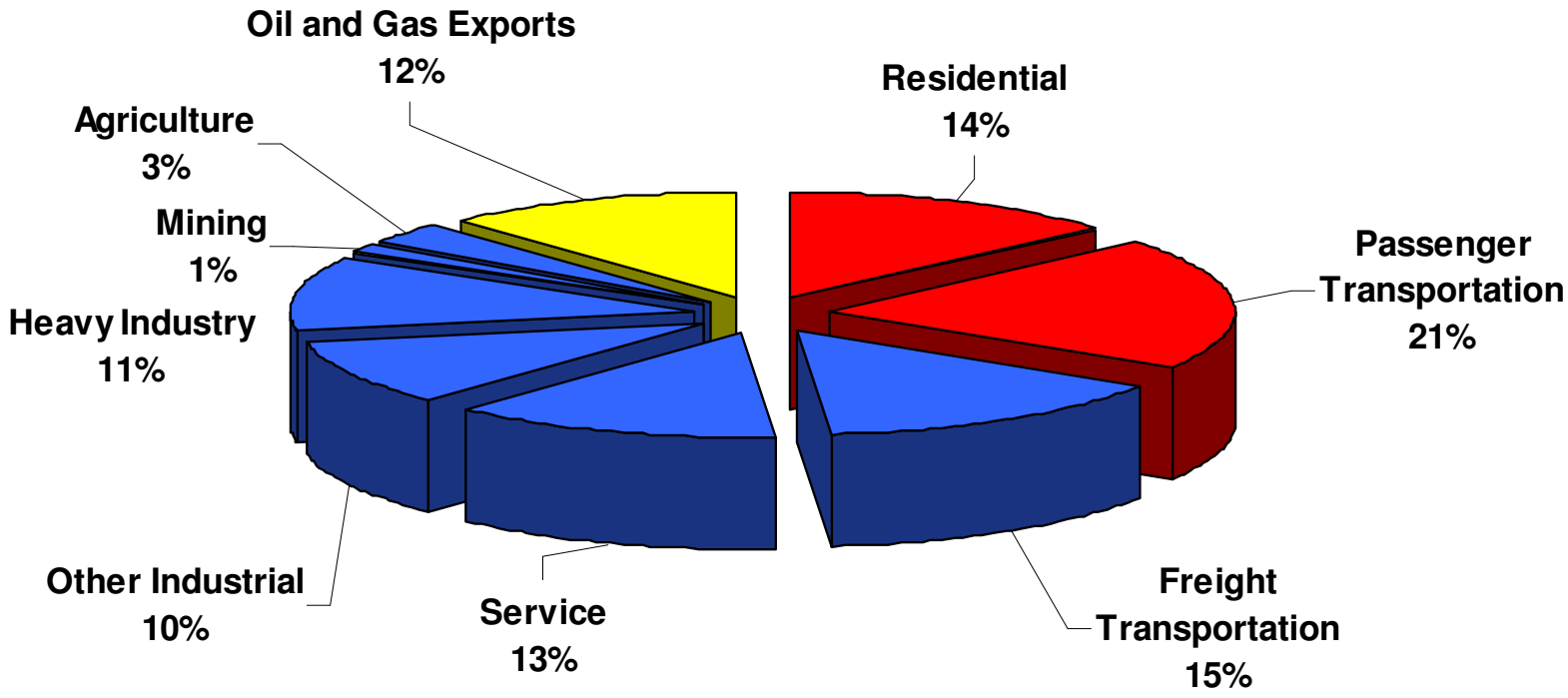
Energy Related GHG Emissions in Canada,Source Allocation vs. End Use Allocation

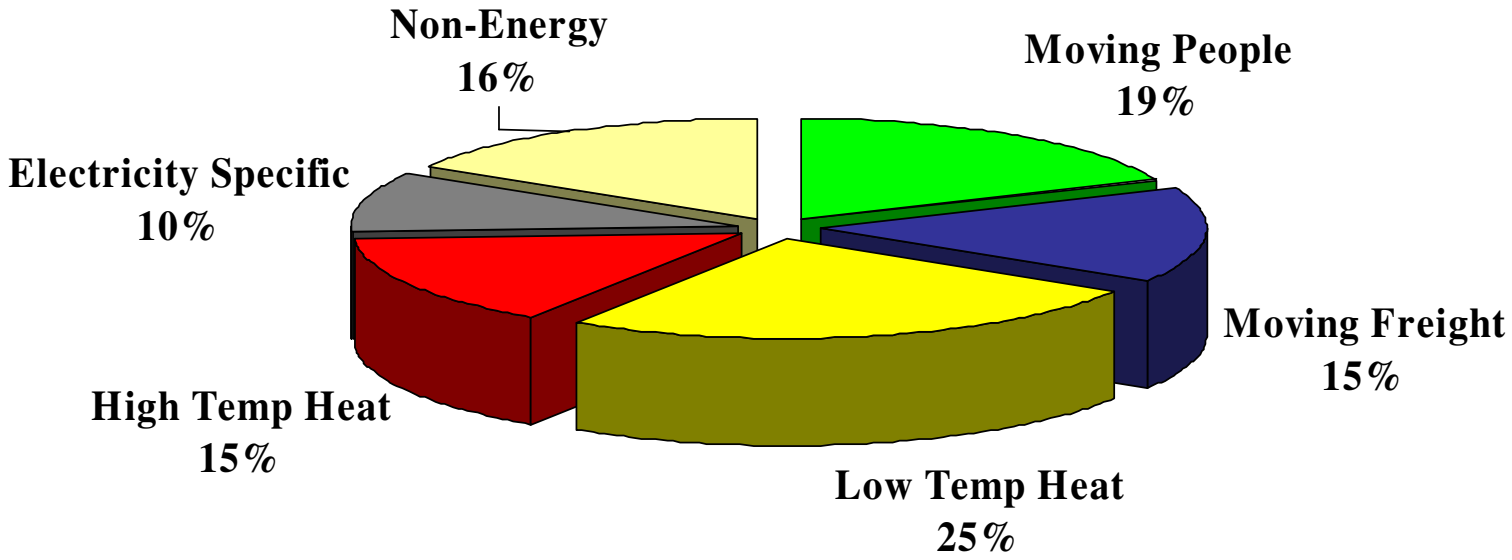


Energy-Related GHG Emissions by Sector in 2003

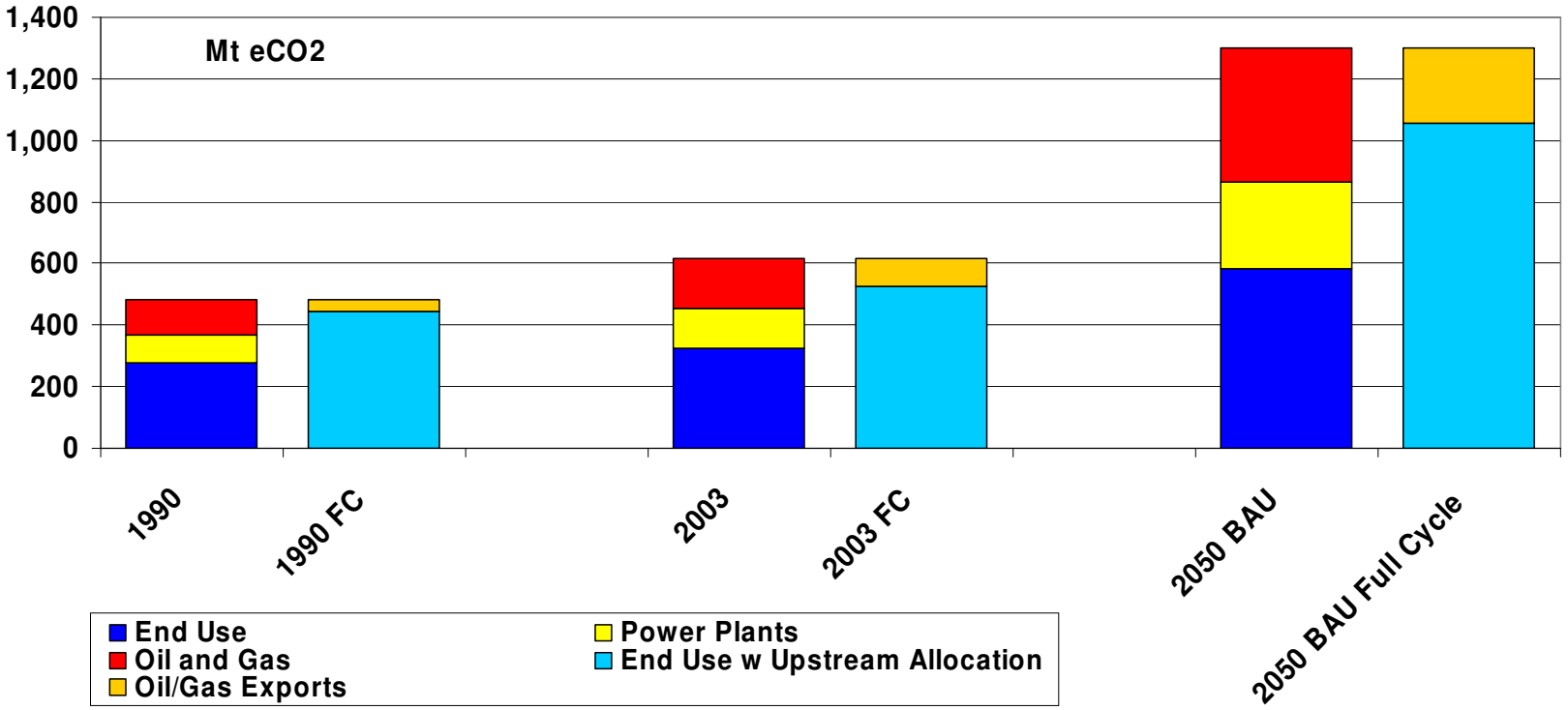
(with end use allocation of emissions from power plants and oil and gas production)



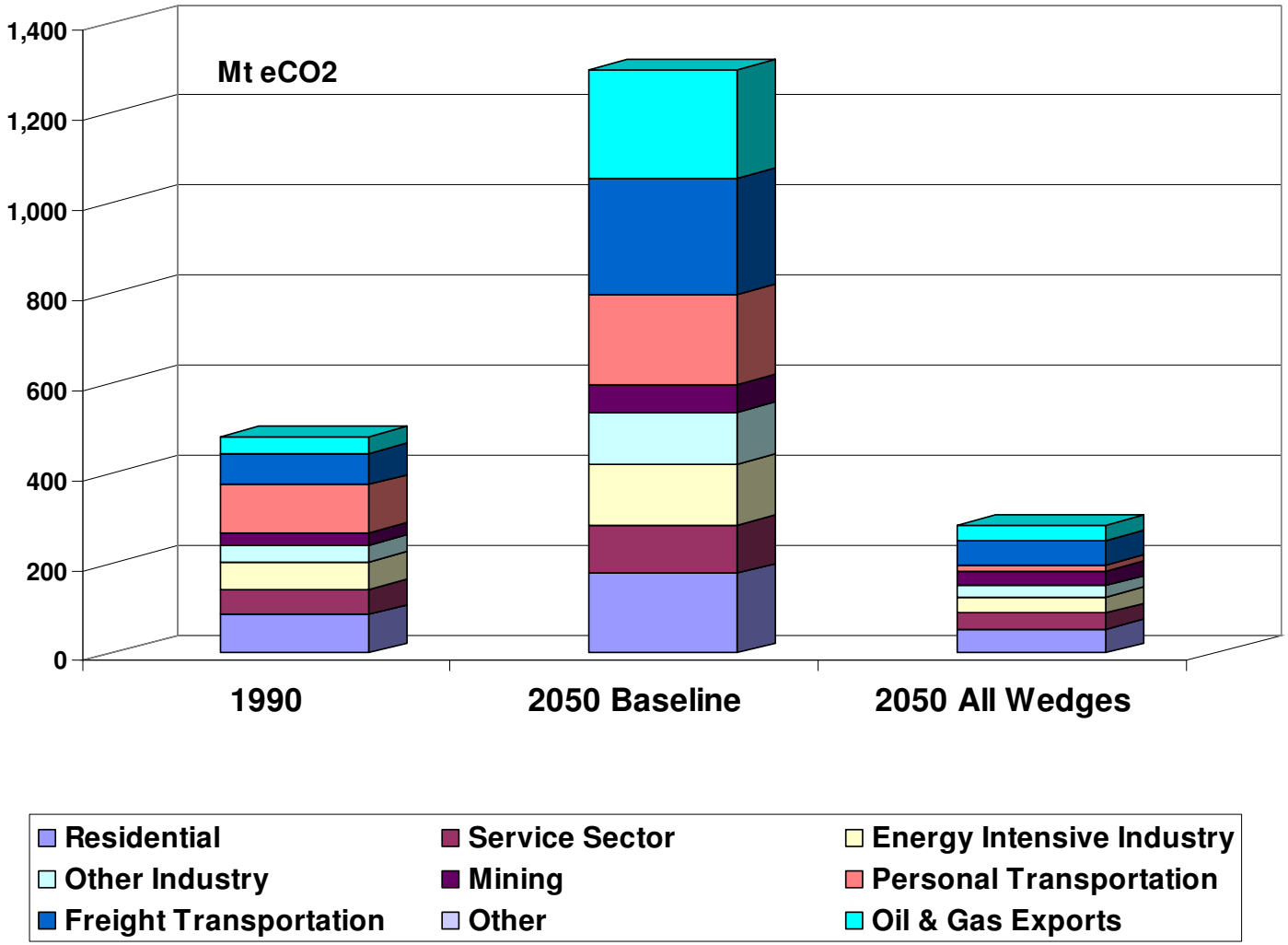
Greenhouse Gas Emissions by End Use



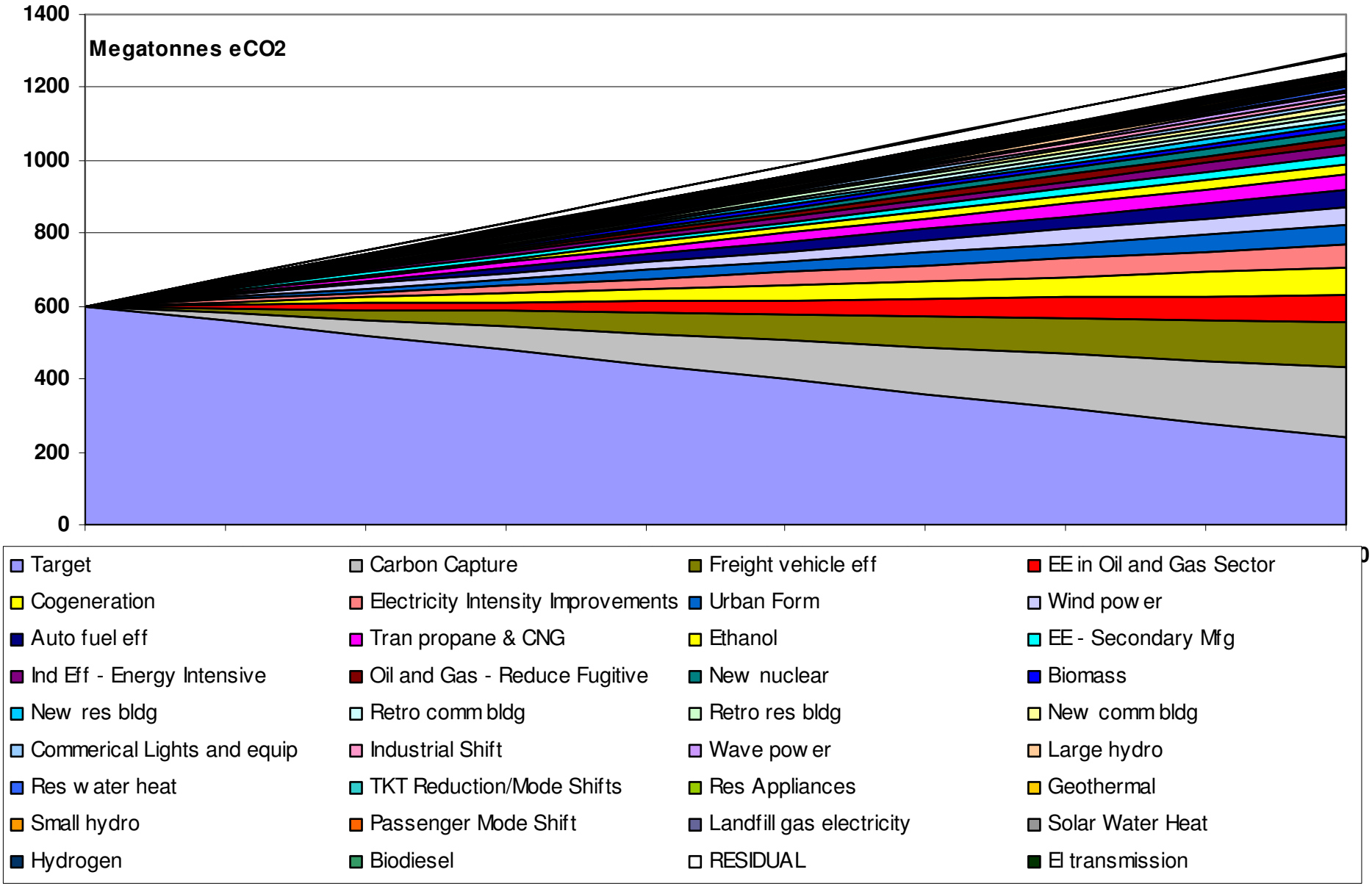
Energy-Related CO2 Emissions in Canada, 1990, 2003 and 2050 "BAU"



GHG Emissions by Sector



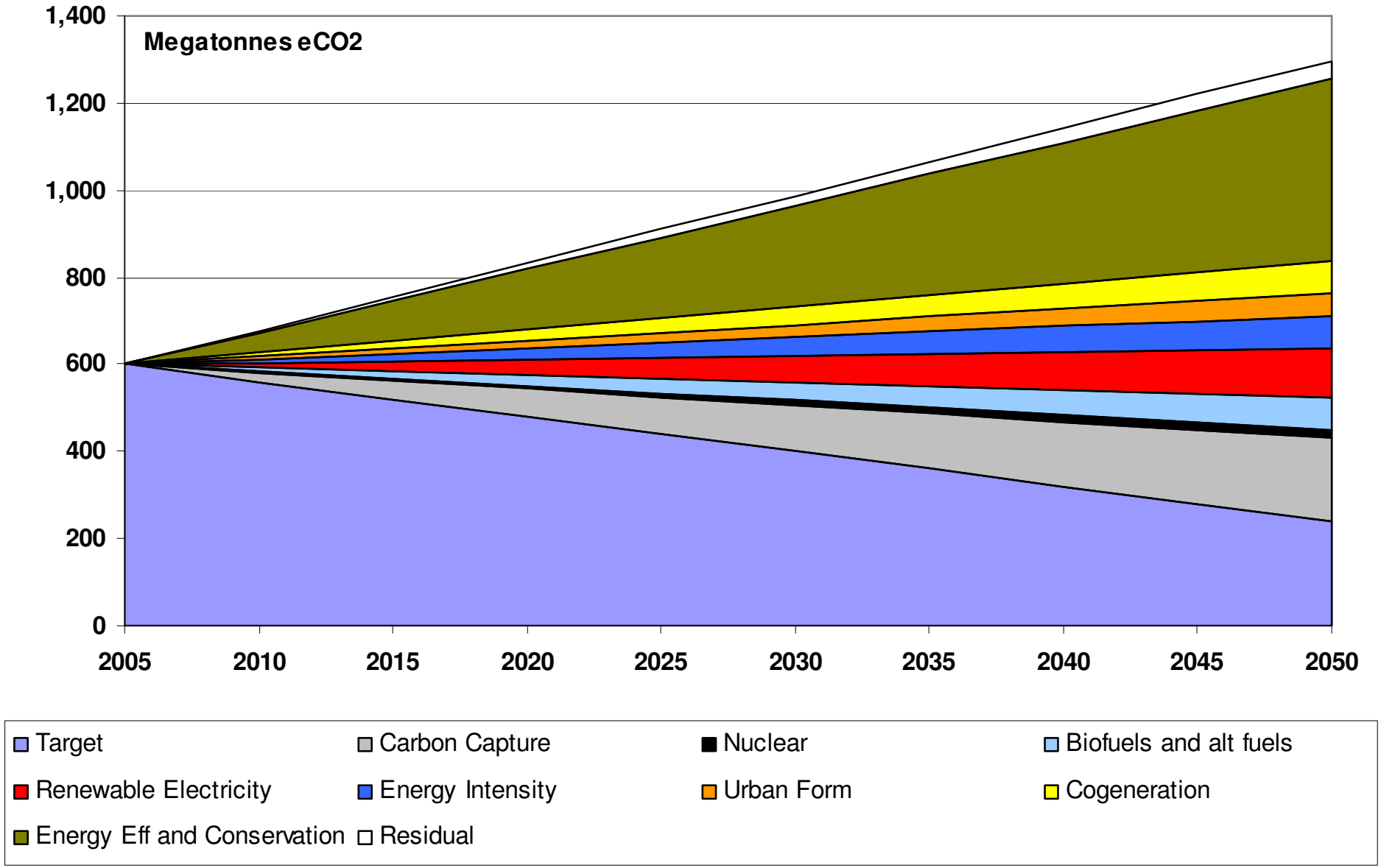
GHG Reduction Wedges for Canada -- All Wedges



The Top Seven Reduction Wedges

Wedge	Mt eCO2
Carbon Capture	191
Truck efficiency improvement	126
EE in Oil and Gas Sector	74
Cogeneration	73
Electricity Intensity Improvements	65
Urban Form	52
Wind power	50
Personal vehicle fuel efficiency	46

GHG Reduction Diagram for Canada -- Aggregate Wedges



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Sustainable, Low Emission Futures – The Technologies

- A doubling, and then a redoubling, of energy efficiency, delivers benefits more effectively and on a larger scale than all the other options – low emission future not possible without this.
- Combined heat and power is also an essential element of the low emission future
- Renewable electricity (wind, solar) developed on a base of much more efficient electricity use
- Energy efficient urban forms that allow access with lower rather than higher levels of mobility
- Biofuels – can they be developed sustainably?
- Carbon capture and storage technologies are necessary IF oil and gas production in Canada proceeds as expected

The long term, deep reduction scenario, combined with the full cycle allocation of emissions, reshapes the climate change response agenda:

- ✓ Less emphasis on large final emitters, more on end use efficiency
- ✓ Current investments are key opportunities for long term reductions (buildings, industrial production technology, urban planning, etc)
- ✓ Scaling up technology *deployment* capability is critical (business, financing and manpower infrastructure)
- ✓ Solutions are being developed in a globalized market for energy-related technologies – other economies are moving aggressively to capture these opportunities
- ✓ Emissions from growth oil and gas production do not block the possibility of a low emission future for Canada, provided CCS technology can be successfully deployed
- ✓ The power sector in a low emission future is transformed. Efficiency and electricity productivity improvements continue, and renewable electricity (wind, wave, PV, etc) develops globally as a growth industry. Combined heat and power production is a “must have”.

Key Lessons and Strategic Directions

- Must be comprehensive
- Integrated Approach
- Long lived capital stock is a priority
- Synergies exploited
- Air pollution reductions and other co-benefits are key drivers of successful emission reduction

Comprehensive

- Single largest wedge is carbon capture and storage at 18% of gap and truck and off-road fuel efficiency at 12% of gap; there is no “silver wedge”.
- In aggregate, demand side delivers 53% of the gap (efficiency, intensity improvement, cogeneration), but it is distributed broadly; renewable electricity and alternative fuels account for another 18%.

Integrated Approach

- We started with 1,600 Mt of emission reductions from the wedges when counted separately, greater than projected BU emissions in 2050. When combined in an integrated scenario, total emission reductions dropped by nearly 40% to 1,000 Mt, just enough to fill “the gap” between BU and the target.
- Electricity demand and supply interaction is strong.
- Emissions intensity of energy production sector, including CCS, interacts strongly with efficiency.
- Demand side measures interact with each other.

Lost Opportunities

- Even on a 50 year time frame, lost opportunities are here now (new buildings, urban infrastructure, industrial capital)
- The world is preparing for a carbon constrained economy – businesses and economies are moving ***NOW*** to sell into this future (energy efficient technology, carbon capture and storage, renewable energy technology, etc)

Synergies

- Emission reductions are consistent with some exogenous trends in Canadian society – these synergies can be exploited to promote lower emissions (urban redensification, refurbishment of post-War infrastructure, higher value added industrial production)

Collateral Benefits

- Co-benefits of emission reduction will be critical to success:
  - Reduced air pollution and improved public health
  - Higher performance buildings
  - Economic competitiveness in global market
  - Enhanced urban environments
  - Employment generation across a broad spectrum of skills and professions
  - Technological advancement

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Implementing Low Emission Futures – The Eye of the Needle

- Low emission futures have policy implications well beyond conventional energy policy. They must be developed in a broader context of sustainable development
- Energy price based strategies necessary but not sufficient
- Technology deployment fundamentally economic, but constrained by underdeveloped organizational and financial infrastructure, entrenched advantage of commodity suppliers, and externalization of environmental costs.
- Global marketing, rapid deployment will characterize demand side developments.
- Local authorities must engage; community transformation
- Climatic conditions will deteriorate for decades, regardless of mitigation effort
- A discontinuity in the climate change response policy environment can be expected on the 2050 time scale