

# **BIOFUELS AND THE POSSIBILITIES FOR A LOW CARBON TRANSITION IN THIS CENTURY**

**PRESENTATION TO  
“SCALING UP BIO”**

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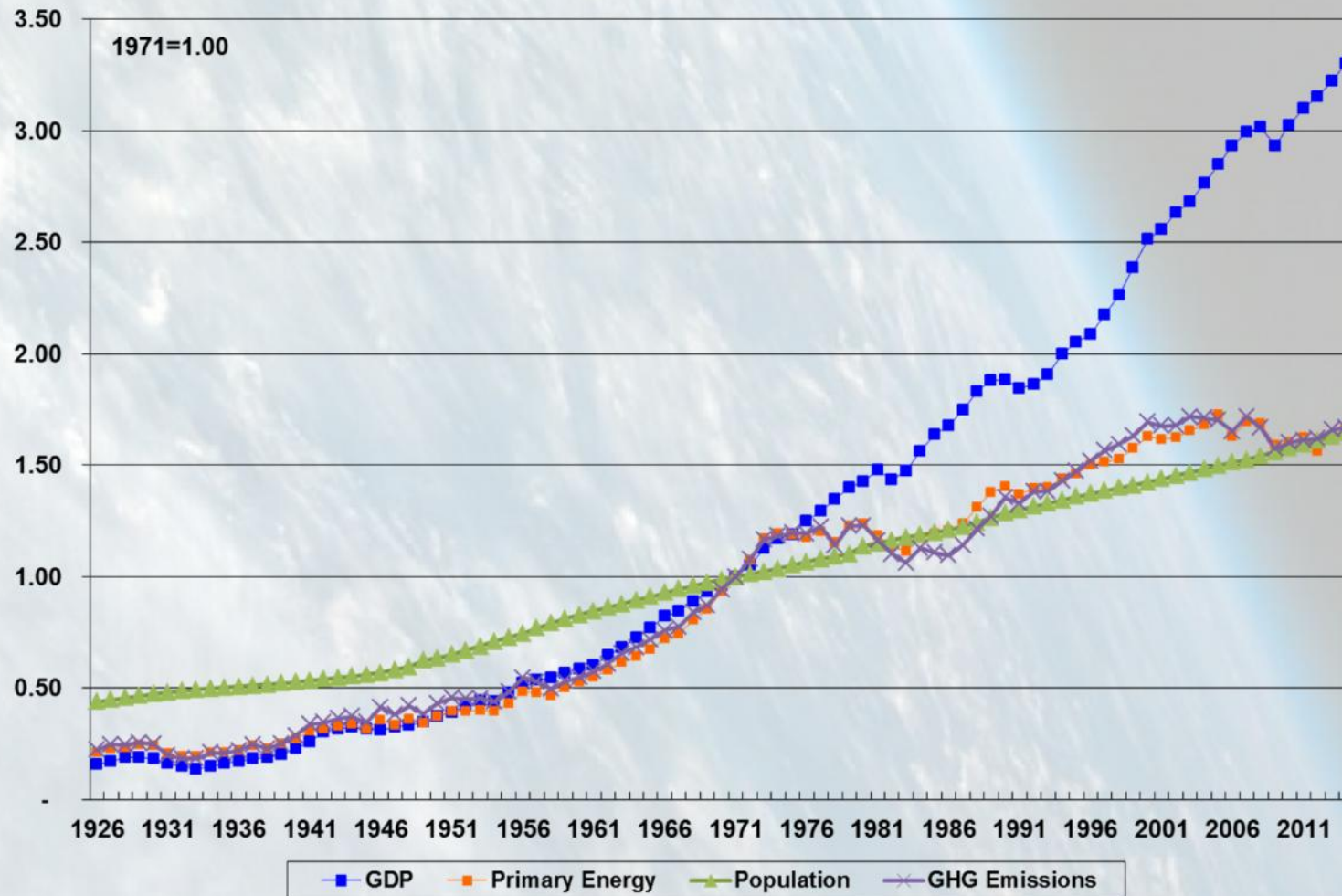
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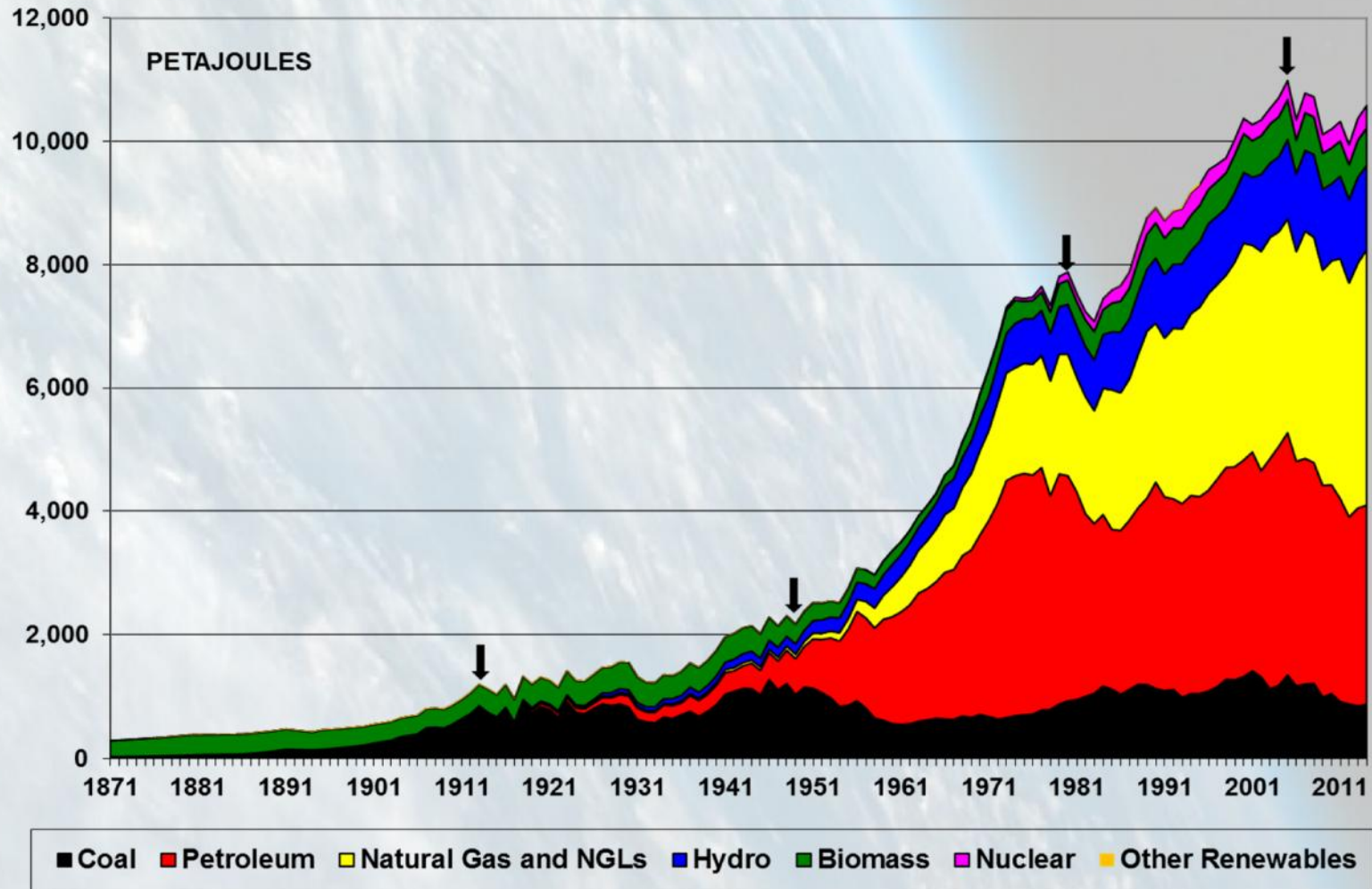


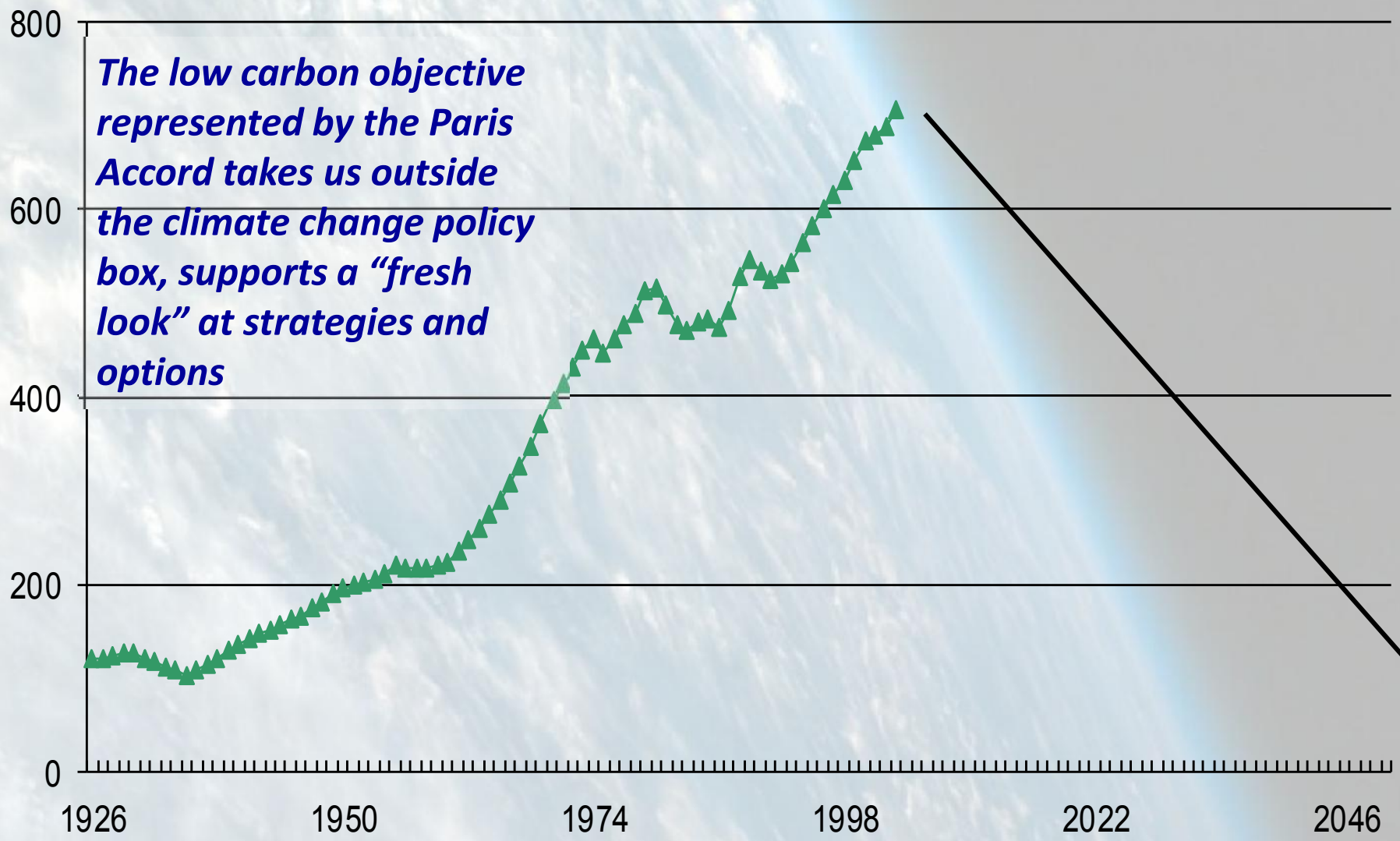
# Relative Growth of Population, GDP, Primary Energy and GHG Emissions, 1926-2013, Canada



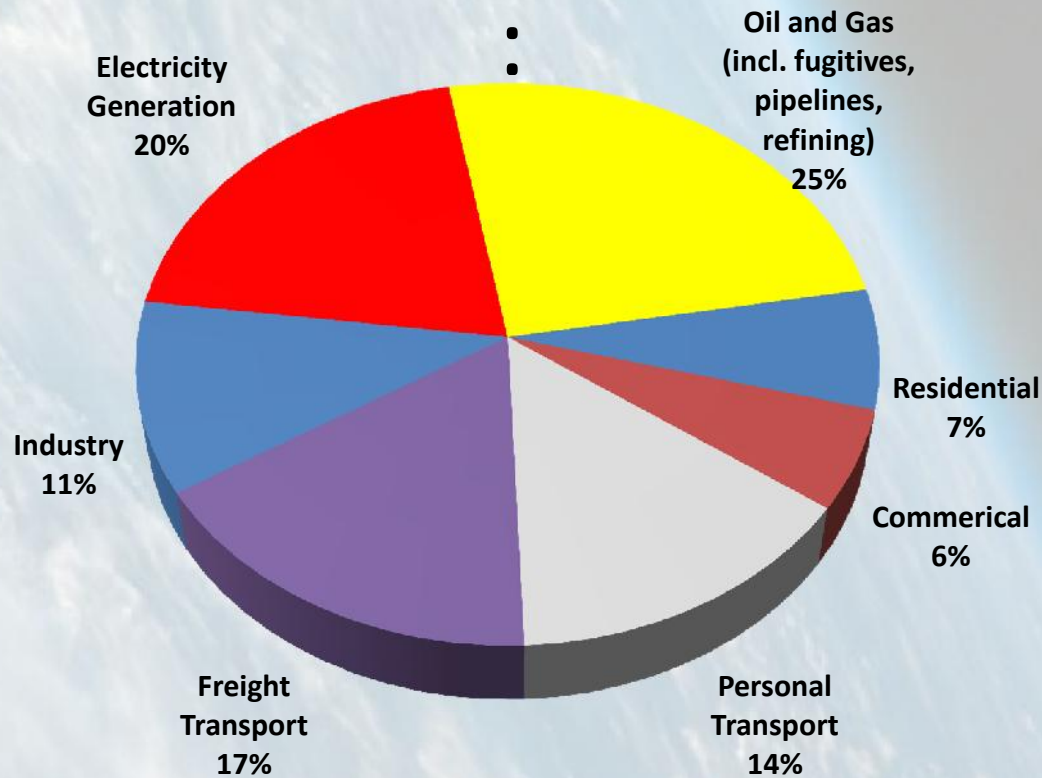


# Primary Fuel and Electricity Use in Canada, 1871-2013





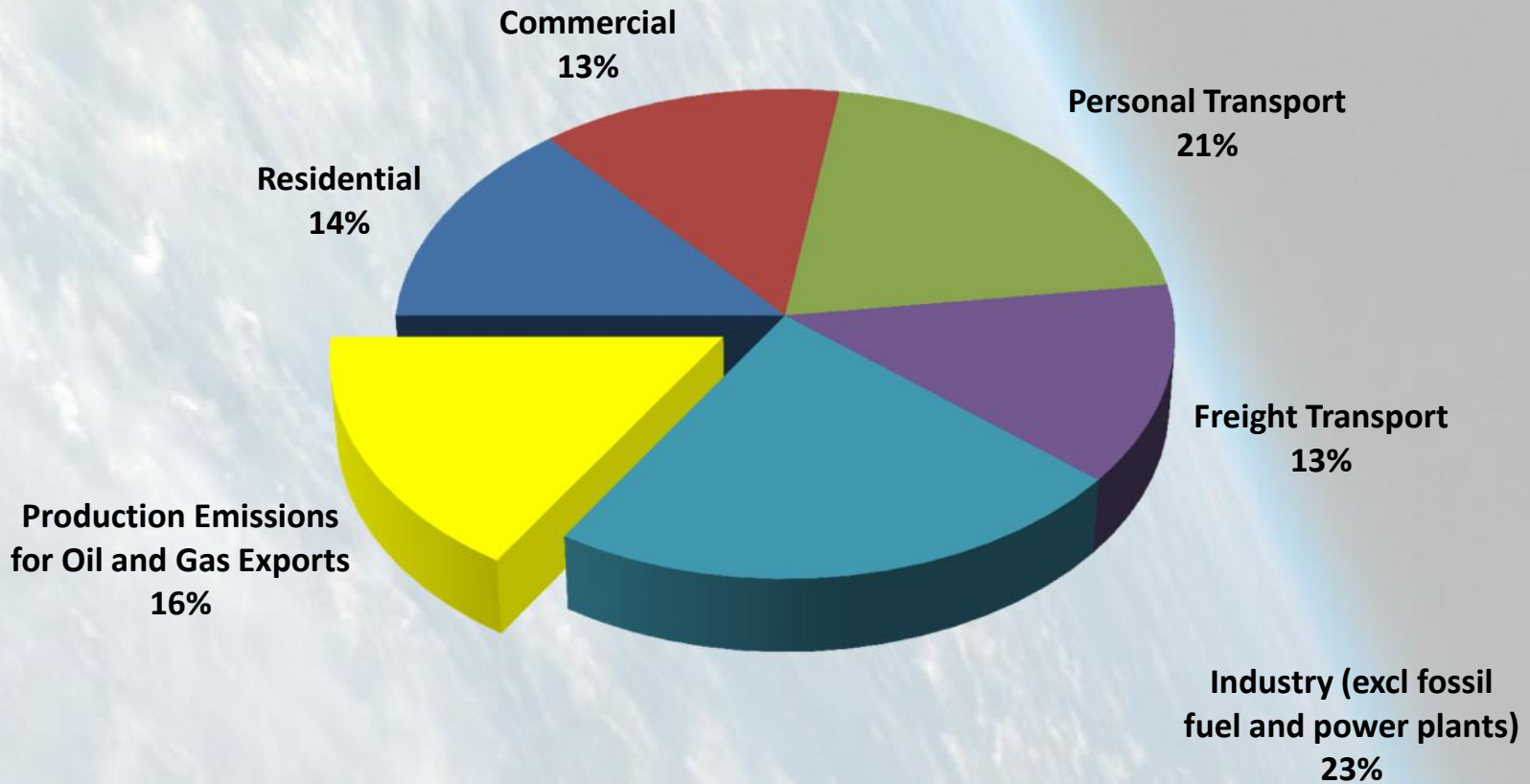
When Canadian GHG emissions are allocated according to where they take place, the picture looks like this; just over half (55%) of Canada's energy-related greenhouse gas emissions are emitted from tailpipes, chimneys and smokestacks where fossil fuels are burned – the other 45% are emitted by the energy commodity industry itself (power plants and fossil fuel industry):



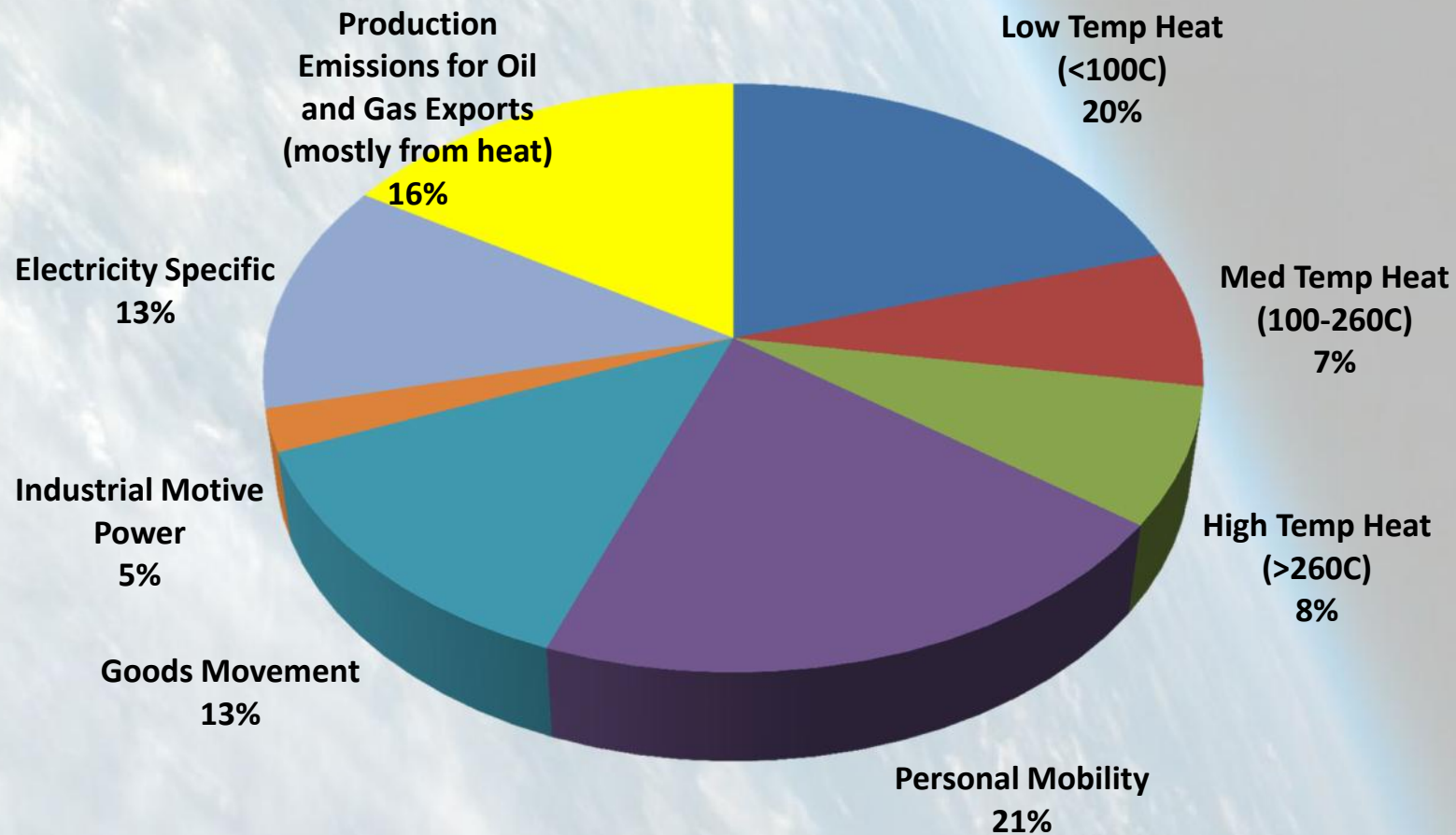
*In this view, the residential and commercial building emissions here do not include the emissions associated with their electricity consumption.*



When the emissions of power plants and the oil and gas industry are pro-rated to the end use sectors, the emission source takes on a different look:



# Connecting greenhouse gas emissions to the energy service demands that drive them provides another perspective...



# Low Carbon Energy Futures – These five things must happen:

- Efficiency, efficiency and then more efficiency
- Electricity's role expands into transportation and heat
- Decarbonize the electricity supply
- **Sustainable production of biofuels**
- *Innovation to reduce fuel and electricity in provision of human needs, amenities*





# Low-Carbon Energy Futures: A Review of National Scenarios

January, 2013



## Decarbonization of Fuel and Electricity in Low Carbon Futures

Note the limits to electrification on a 2050 time scale; hence the biofuels imperative for achieving a low carbon outcome in this century

In 2009	Australia	Canada	USA	Finland	France	Germany	Sweden	UK
<b>Percent of end use energy provided by electricity</b>								
In 2009	24%	21%	21%	27%	23%	19%	33%	21%
In 2050	25%	45%	24%	43%	51%	27%	38%	41%
<b>Percent of all energy end use provided by renewable</b>								
In 2009	2%	13%	2%	8%	3%	3%	19%	1%
In 2050	48%	76%	>80%	67%	49%	52%	93%	31%
<b>Percent of electricity system powered by fossil fuels</b>								
In 2009	93%	23%	70%	37%	11%	61%	4%	74%
In 2050	26%	5%	10%	0%	23%	18%	0%	26%

# Bioenergy: Some Observations and Strategic Considerations

- Bioenergy plays a key role in any feasible pathway to meeting Canada's commitment to a mid-century low carbon transition.
- We know a lot about how to do this. Bioenergy is a well established component of Canada's primary energy supply: about 30 million tonnes (over 500 PJ) annually, mostly in the pulp and paper industry, but also including biofuel and residential heating. (By comparison, Canadian nuclear power production is currently about 350 PJ).
- As with the oil refinery industry, energy products produced in biorefineries will have a lower value than non-energy products.
- As electrification of light vehicles proceeds, the demand for carbon-free liquid fuels will shift to heavy vehicles, including trains and airplanes.



# Bioenergy: How big might it get?

- The necessary size of the biofuel industry in 2050 in a low carbon Canada is very “innovation dependent”. It depends on:
  - the demand for mobility and goods movement
  - the efficiency of personal and commercial vehicles
  - the extent of vehicle electrification
  - the efficiency with which primary biomass can be produced
  - the efficiency with which it can be converted to secondary commodities, particularly biofuels.
- Even with great progress in all these areas, a primary biomass supply of 150 million tonnes could be needed for bioenergy applications.
- The low carbon imperative requires that this supply be grown with sustainable silvicultural and agricultural practices while we simultaneously *increase* the natural carbon stock.

