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CANADA

## Canada's Greenhouse Gas Emissions: Developments, Prospects and Reductions

Office of the Parliamentary Budget Officer  
April 21, 2016

## Why this study?

- PBO mandate to examine trends in Canadian economy

Index 1990=100

Year	Emission level (Index 1990=100)	Emission relative to GDP (Index 1990=100)
1990	100	100
1991	100	100
1992	101	101
1993	102	100
1994	105	100
1995	108	100
1996	110	100
1997	112	98
1998	115	95
1999	118	92
2000	120	88
2001	122	85
2002	120	82
2003	122	80
2004	125	78
2005	122	75
2006	120	72
2007	125	70
2008	115	68
2009	118	65
2010	115	62
2011	118	60
2012	115	58
2013	118	55

— Emission level — Emission relative to GDP

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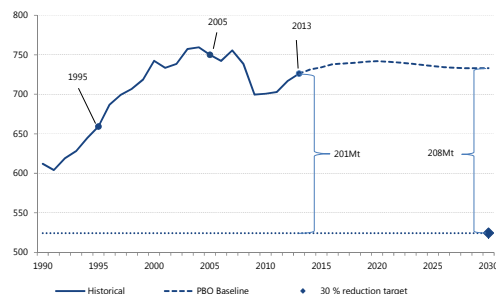
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## Projected emissions

- Canada's commitment to COP21 in Paris
- Projection based on baseline growth

Millions of tonnes of carbon dioxide equivalents



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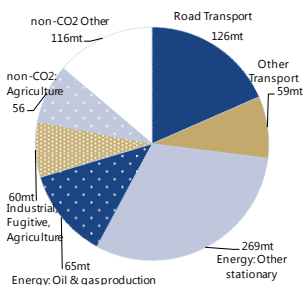
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## Diversity of emissions: sectoral

- Sectoral have had different experiences – particularly those related to transport

Whole economy (in mtCO<sub>2</sub>e)



Sub-sector

2013

Electricity generation	12.1% (88 mt)
Transport services (less aircraft, rail, and pipeline)	25.2% (178 mt)
Oil & gas production, refining, and distribution	23.2% (169 mt)
Agriculture and waste products	11.7% (89 mt)
Buildings (commercial and residential)	10.3% (75 mt)
Chemicals manufacturing	4.7% (34 mt)
Iron and steel manufacturing	1.8% (13 mt)
Cement manufacturing	1.4% (10 mt)
Land use, land-use change and forestry	-2.0% (-15 mt)

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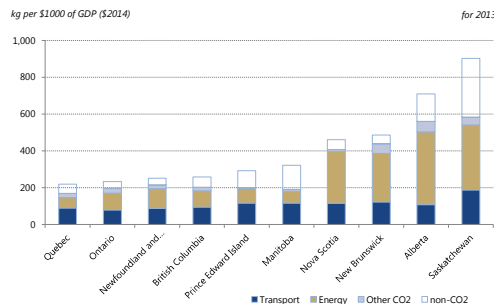


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## Diversity of emissions: regional

- Regions are also highly diverse – though similar for road and off-road transport



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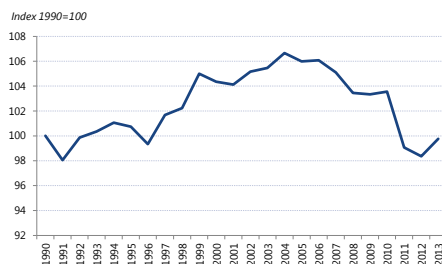
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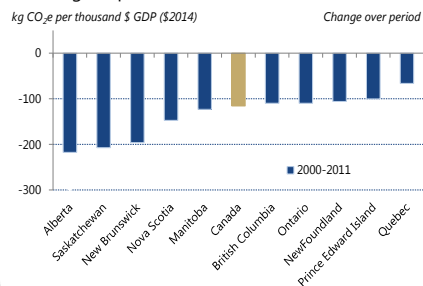
## Responsiveness to incentives

- When the price of emission-causing fuel goes up, emissions go down

Light-vehicle emissions per person



Change in provincial emissions



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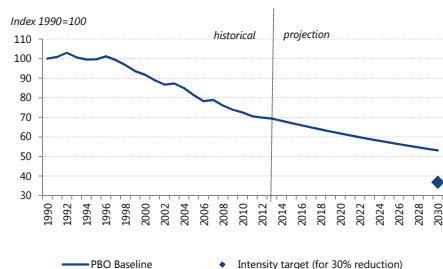


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## Projection based on trends

- Consistency of improvements in GHG intensity
- Faster growth is not necessarily a problem: more money



- 208 mt reduction needed in 2030 (more than all vehicles today)

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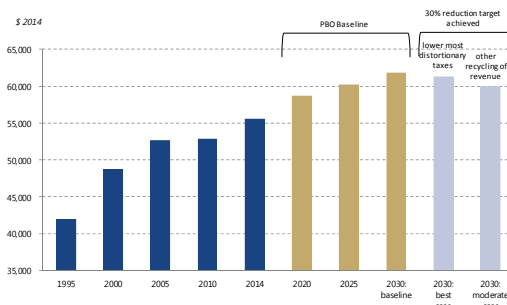


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## Mitigating emissions

- Growth will slow (mildly): incomes will continue to increase



	GDP per person
2014	\$55,500
PBO baseline for 2030	\$61,800
Range with reductions to achieve target	\$60,000 to \$61,200

- Actual result depends on specifics of implementation

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## Caveats

- To avoid large costs, sources of emissions should all face the same unit cost of abatement
- This means new measures have to be integrated into existing measures
  - Avoiding double burden
- Complexity of emissions sources
  - Likely to require multiple instruments
  - Each will have to be costed when price is implicit
- Regional diversity makes it a challenge

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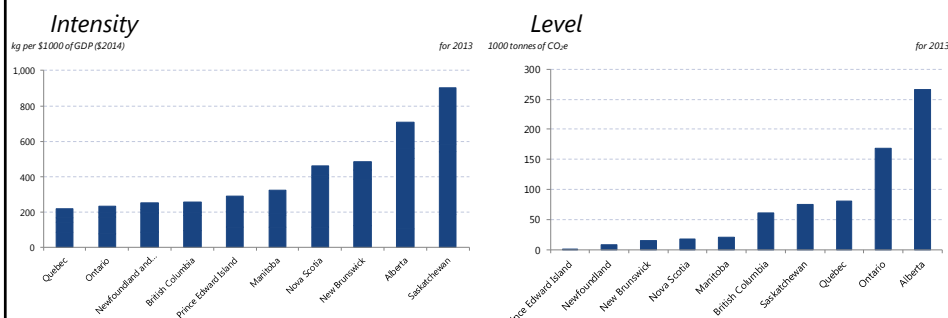


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## Regional dimension

- Some provinces will inevitably do more, but all will contribute: pan-Canada effort



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## Means of abatement

- Implicit or explicit pricing
  - Explicit: carbon taxes or tradable permits
  - Implicit: regulations or subsidies
  
- E.g. a carbon tax raises the price of gasoline since there is a fixed relationship burning gasoline and emissions
  - \$100 carbon dioxide tax raises gasoline by 24 cents/litre
  - People drive less, and buy more fuel-efficient cars

## Means of abatement

- Both direct and indirect pricing alters the cost of activities that generate emissions
  - Create incentives to innovate
  
- Effect can be difficult to foresee
  - Acid-rain program in US used tradable permits; it cost much less than initially projected

## Sources of abatement

- What is achievable given what we know today?

Cost per tCO <sub>2</sub> e	Sector	Measures	Emission reduction (tCO <sub>2</sub> e)
\$10	Agriculture	Converting marginal agricultural lands	6
\$25 to \$50	Iron and steel	Improve energy efficiency and more use of direct reduction iron and electric arc furnaces	2
\$30	Agriculture and waste	Capture methane emissions from landfills	12
\$12 to \$57	Electricity	Shift to renewables/wind, and carbon capture and storage	50
\$60	Agriculture	Lower methane emissions from cattle	3.2
\$15 to \$75	Forestry	Selective harvesting, better use of harvested area, long-lived wood products	17
\$43 to \$100	Oil & gas extraction, refining, distribution	More use of low-emission sources of heating, carbon capture and storage	40
\$60 to \$100	Transportation	Greater use of hybrid technologies, lightweight materials	69
\$65 to \$100	Chemicals	Increased urea production, carbon capture and storage	3
\$40 to \$108	Cement manufacturing	Clinker substitution, fuel substitution, carbon capture and storage	5
Total			207

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## Questions about this report?

**Mostafa Askari**

Assistant Parliamentary Budget Officer

mostafa.askari@parl.gc.ca

613-992-8045

## Background briefing

**Philip Bagnoli**

philip.bagnoli@parl.gc.ca

613-286-2687

Visit our website [www.pbo-dpb.gc.ca](http://www.pbo-dpb.gc.ca) and look for the report under the publications tab.

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