



British Columbia: Climate Change and Energy Policy

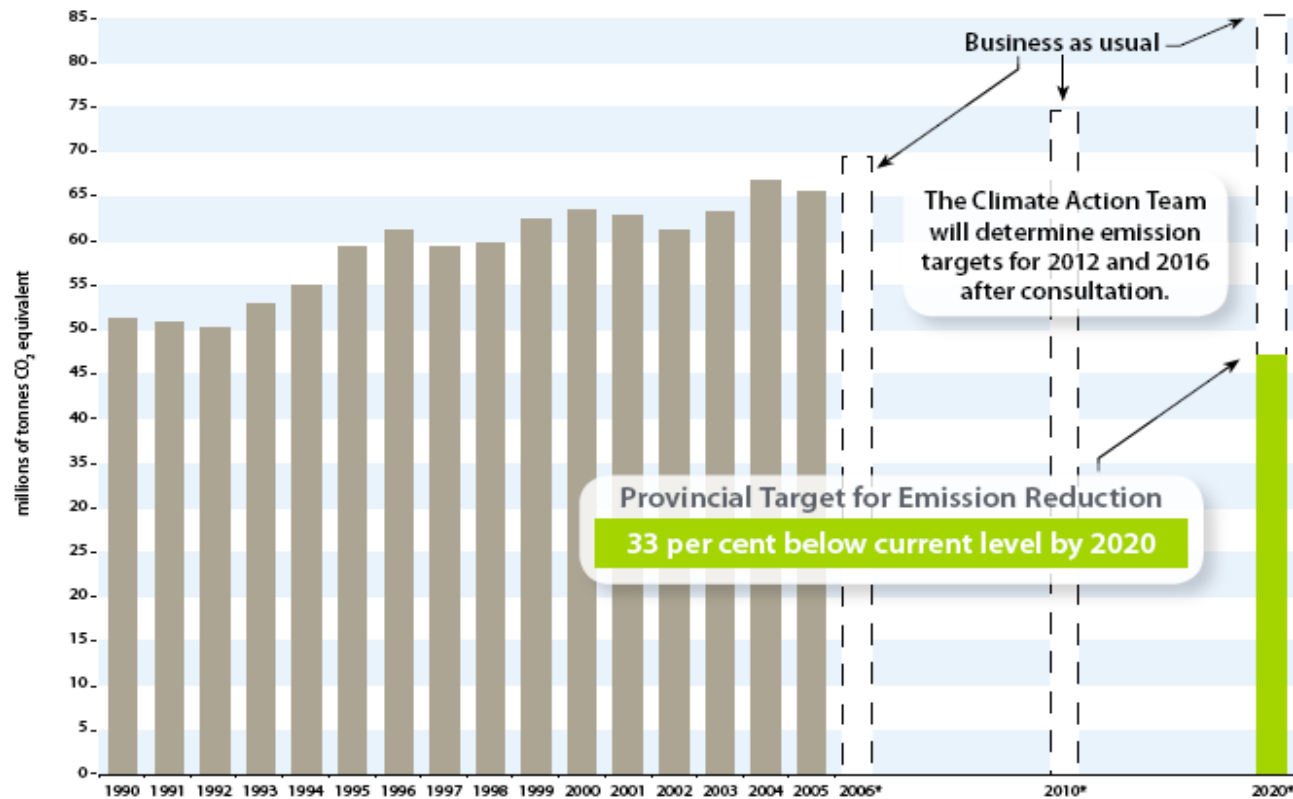
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Resources



BC Climate Action Target:

*reducing BC's GHG emissions by at least
33% below current levels by 2020*

B.C. GREENHOUSE GAS EMISSIONS (1990 – 2020)



Provincial Target for Emission Reduction
33 per cent below current level by 2020

The Climate Action Team will determine emission targets for 2012 and 2016 after consultation.

Business as usual

* Projections of GHG emissions based on a business as usual scenario

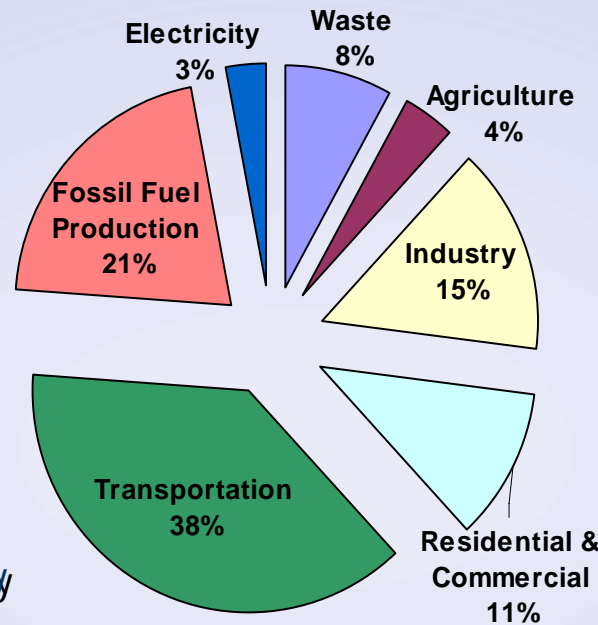
Climate Action Planning and Energy Plan

Climate Action/Energy Plan

- BC target: 33% under 2007 by 2020
 - target implies 9.6 tonnes per person
- Electricity
 - Coal thermal carbon capture and sequester only
 - New fossil fuel net zero GHG
 - All electricity net zero by 2016
- Upstream Oil and Gas
 - 2000 emissions by 2016
 - No flaring processing plants & producing wells

Taking Action in Every Sector

- ✓ Electricity
- ✓ **New facilities zero GHG emissions**
- ✓ **Zero net GHG emissions from existing power plants**
- ✓ **Self sufficiency**



- ✓ Fossil Fuel Production & Industry
- ✓ **Cap and trade system**

- Waste
- ✓ **Landfill methane capture**

- Agriculture
- ✓ **Anaerobic digesters**
 - ✓ **Improved fertilizer application**
 - ✓ **Bioenergy**

- Transportation
- ✓ **Tailpipe standards**
 - ✓ **Low carbon fuel standard**
 - ✓ **Hydrogen highway**
 - ✓ **Transit**
 - ✓ **Green Communities**

- Residential & Commercial
- ✓ **Green Building Code**
 - ✓ **Green developments**
 - ✓ **Smart metering**
 - ✓ **Energy retrofits**
 - ✓ **Energy efficiency standards**



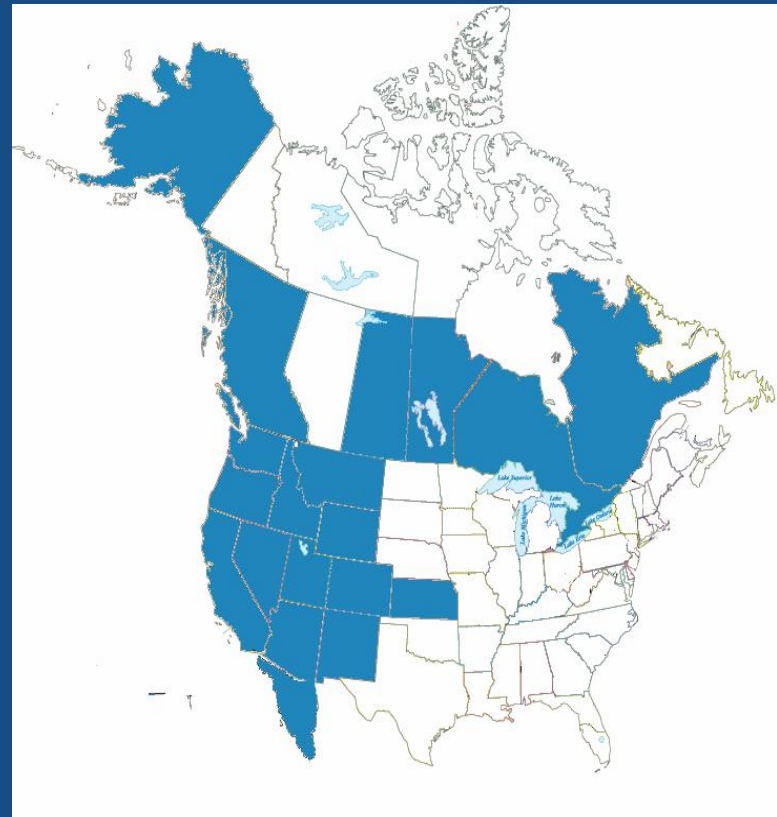
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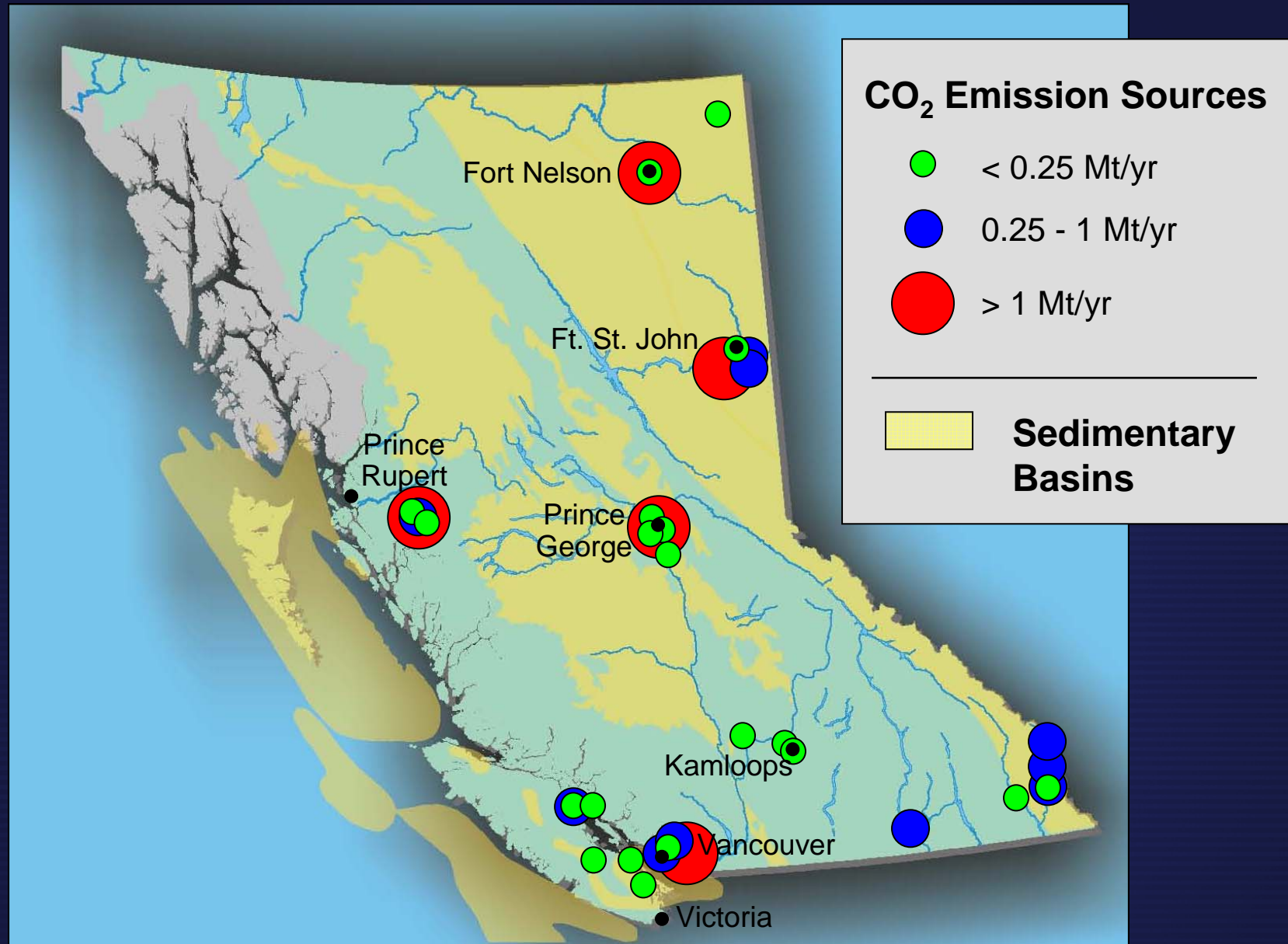
Carbon Tax

	July 2008	July 2009	July 2010	July 2011	July 2012
Gasoline Cents/litre	2.41	3.62	4.82	6.03	7.24
Diesel Cents/litre	2.76	4.14	5.52	6.89	8.27
Natural Gas \$/GJ	0.4988	0.7482	0.9976	1.2470	1.4964
Coal \$/tonne	20.79	31.18	41.58	51.97	62.36

Western Climate Initiative

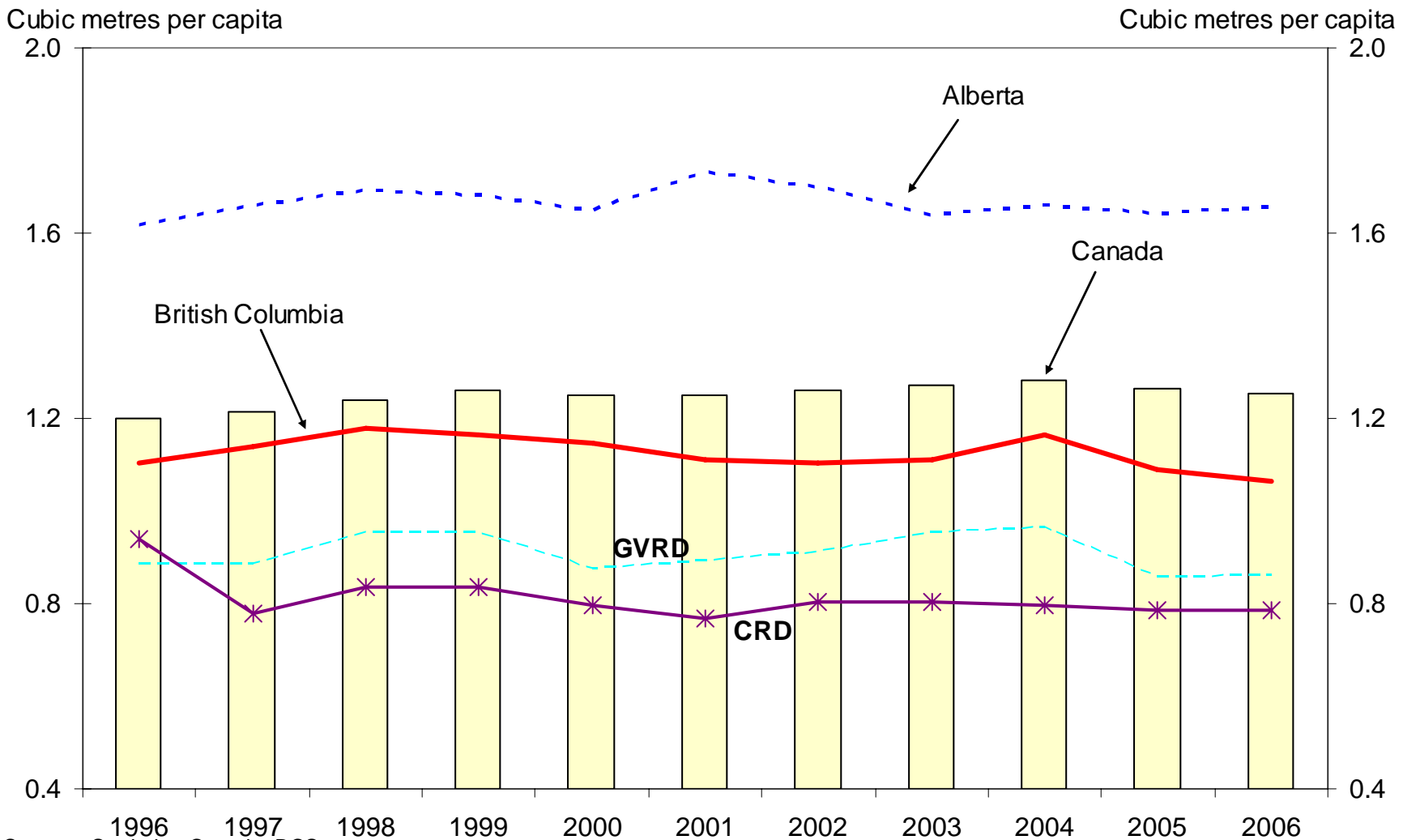
- **Cap & Trade system**
- **Launched in February 2007**
- **Regional goal set August 2007**
- **Complete design of cap & trade by August 2008**





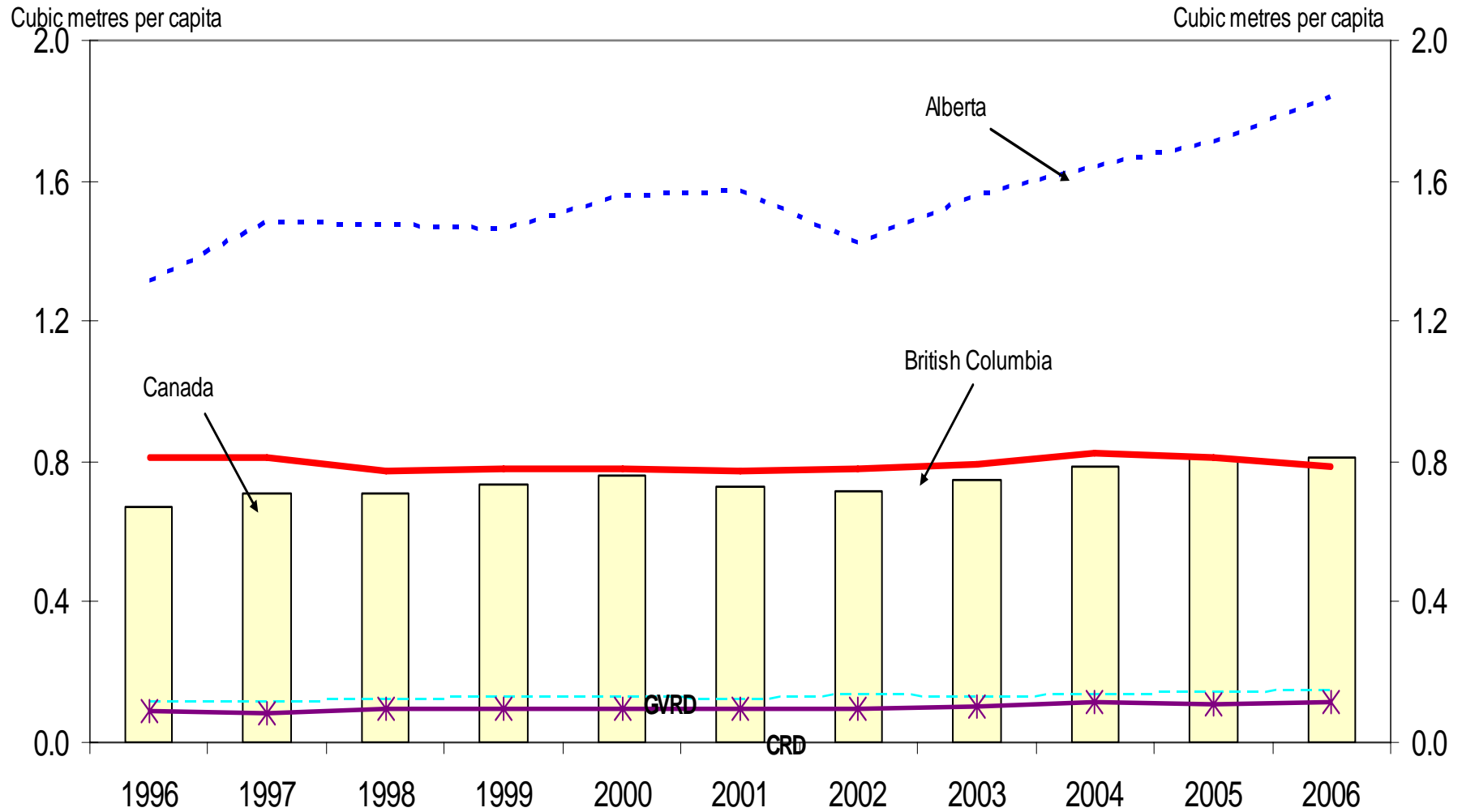
**Reported GHG emissions in BC = 13.9 Mt CO₂e/yr. (21% of total emissions)
 - only large sources (>0.1 Mt) required to report**

Domestic Sales of Motor Gasoline BC vs Other Jurisdictions



Source: Statistics Canada, BCStats
 GVRD - Greater Vancouver Regional District; CRD - Capital Regional District

Domestic Sales of Diesel Fuel BC vs Other Jurisdictions



Source: Statistics Canada, BCStats

GVRD - Greater Vancouver Regional District; CRD - Capital Regional District

- **2007 Energy Plan:**
 - 5% renewable fuel standard for Gasoline by 2010
 - 243 million litres required
 - 5% renewable fuel standard for Diesel by 2010
 - Canada: 2% by 2012
 - 183 million litres required

Low Carbon Fuel Standard

- **BC and Ontario signed an MOU with California**
- **May be some differences with California**
 - Starting point
 - Pathway model
 - Credits
 - Resources
 - Electricity
 - Natural Gas
 - Crude
 - Renewables

Low Carbon Fuel Standard

- **Life cycle**
- **Intensity target**
 - Average fuel carbon intensity gCO₂e/MJ
 - Performance Standard
- **Default values**
- **Point of Regulation**
 - Wholesale market
 - Compliance
- **Co-products**
- **Sustainability**



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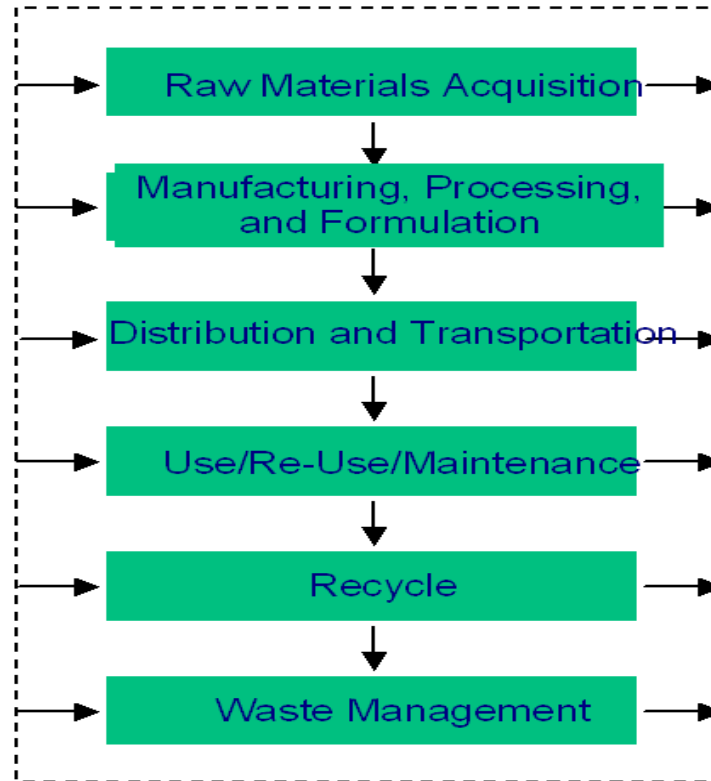
Life Cycle Stages

Outputs

Inputs

Energy

Raw
Materials



System Boundary

Water Effluents

Airborne Emissions

Solid Wastes

Other Environmental
Releases



Use of products

- **GREET – Most Common in US**
- **GHGenius For Canada**
- **Same “seed code”**
- **GHGenius – Canada Specific Factors**



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GHGenius Model

- Based on a Lotus 123 spreadsheet model developed by Dr. Mark Delucchi, University of California, Davis in the late 1980's for estimating transportation emissions
- In 1998 Delucchi added some specific Canada information for a US DOE, NRCan project
- In 1999, Levelton Engineering was asked by NRCan to use the model for the Transportation Table of the National Climate Change Process

Model Background

- **Levelton moved the model from an Apple to a Windows environment, but still using Lotus 123.**
 - **Verified and updated the Canadian specific data,**
- **Separated results for Trucks from Buses,**
- **Added separate gases output tables,**
- **Added cost effectiveness, and**
- **Added the first new fuel cycle (NG to DME)**

Model background

- Since 1999 the model, now called GHGENIUS, has been used for studies for Agricultural and Agri-Food Canada, Natural Resources Canada, a number of the Provinces and some industries
- Many new pathways have been added so that there are now over 200 transportation fuel pathways in the model. Much more Canadian specific data in the model
- An Excel version is now available with an updated guide.
- Documentation includes an over 500 page GHGENIUS guide and numerous reports. Some Delucchi documentation is still relevant



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Model Scope

- **Covers raw materials production to end use.**
 - **Lifecycle Stages**
 - **Raw Materials Acquisition**
 - **Feedstock production and recovery**
 - **Feedstock transmission**
 - **Fertilizer manufacture**
 - **Land use changes**
 - **Leaks and flaring associated with fossil fuels**
- **Manufacturing**
- **Fuel production**
- **Fuel storage and dispensing**
- **Fuel dispensing**
- **Emissions displaced by co-products**
- **Vehicle operation**
- **Vehicle materials, assembly and transport.**

- **A variety of data sources used for inventory data**
- **For existing processes,**
 - **Statistics Canada**
 - **Industry reports**
 - **GHG Registries (formerly VCR)**
- **For new to Canada processes**
 - **Foreign operating data**
 - **Engineering studies**
 - **Basic scientific assessment**

Inventory Data

- Where possible relies on public data. US data relies heavily on US Census and DOE EIA data
- Generally uses industry averages rather than plant specific data
- The model is dynamic in that changes in one fuel cycle can effect many other cycles. Iterates to solve circular references
- Unlike some other models it allows the inputs to be in common units and the model calculates the energy impacts



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Interpretation Capabilities

- GHGENIUS can calculate emissions for any year between 1996 and 2050
 - Correlations for changes in energy and process parameters with time are stored in the model. Based on historical trends or in some cases forecasts, e.g. NEB for power and oil production
- Results are calculated for each stage of the lifecycle and for each contaminant
- Capable of estimating emissions in Canada, the United States, Mexico as well as regionally, east, central, or west in North America, and India
- Some pathways can be analyzed provincially

- **The model has grown to be quite large**
 - **46 sheets**
 - **Almost 200,000 cells with data or results**
 - **9.5 MB**
- **Compared to GREET, LEM and GEMIS**
 - **It has many more pathways**
 - **It has Canadian data**
 - **Easier to make changes to pathways**
 - **Much more detailed output**

Everything Looks Like a Nail.....

- **Ultimately Models are simply a policy Tool.**
- **Key questions regarding policy – the model doesn't answer**
- **Helps you shape your decision.**

- **Oil sands crude**
 - Carbon intensity declining
- **Default values**
 - Maximum, minimum, average, mean
- **Electricity**
 - Supply stack value or
 - Marginal resource

- **Land utilisation**
 - BC—30% fallow
 - Forestry
 - Productivity gains
- **Price relationship between fuel and food**
- **Food grade Vs. Fuel grade**
 - Tallow
 - Cellulosic ethanol
 - Second generation