



# Methane to Markets

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## **Methane Emissions Inventory Development**

**International Workshop on Methane Emissions Reduction  
Technologies in the Oil and Gas Industry  
Lake Louise**

**14-16 September 2009**

# GHG Inventory Overview

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- What are the goals of a GHG inventory?
- How important is a protocol?
- How do you decide on quantification?
- What guidance documents are available?
- What is verification? Why should I do it?
- What are the pit-falls in GHG inventories?

# Goals and Reporting Requirements

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- Goals and requirements vary by protocol
  - National reporting (UNFCCC, 1992 Rio Summit)
  - Corporate reporting (mandatory or voluntary programs)
  - Project reporting to track effectiveness
  - Carbon markets verification of reductions

## Common goals include

- Informing stakeholders on policy risks
- Participating in carbon markets
- Recordkeeping of voluntary efforts

## Example requirement:

- Country reporting for UNFCCC provides progress versus base year

# Emissions Inventory Protocol

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- A protocol provides common reporting standards to develop emissions inventories
- A protocol is the basis for verification of results
- National level
  - UNFCCC / IPCC
- Corporate level
  - WRI
  - ISO 14064 part 1 – GHG inventory, accounting & reporting
  - IPIECA
  - Voluntary programs
- Project level (carbon markets)
  - Clean Development Mechanism
  - ISO 14064 part 2 – GHG project level accounting & reporting
  - Voluntary registries

# Key Aspects of a Protocol

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A protocol lays out structure of an inventory by specifying:

- **Applicable GHGs**
  - Gases will depend on industry sector
- **Baseline**
  - Period against which all future inventories are compared
- **Boundaries**
  - Define breadth of operations, extent to include direct and indirect emissions, and interfaces with other operations
- **De Minimus**
  - Reporting threshold for an emissions source
- **Materiality**
  - Acceptable margin of error in emissions estimates that will not affect decision making when considering inventory results
- **Quantification Methods**
  - Top down versus bottom up; factors versus measurement

# Protocol - Examples

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Issues answered by a thorough protocol

A corporate entity (reporting unit) needs to determine if mobile source emissions are within the inventory scope


A business unit needs to determine if it should expend resources to quantify N<sub>2</sub>O emissions along with CO<sub>2</sub> and CH<sub>4</sub>

A facility must determine if an outgoing pipeline and its associated emissions are within its inventory boundaries or in an adjacent reporting unit inventory

# Quantification Methodologies

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- Transparency is a vital inventory principle
  - Emission factors, general (IPCC, API)
  - Emissions factors, facility-specific
  - Engineering calculations
  - Direct measurement
  
- Rigor of quantification ties back to inventory goals and to cost-effectiveness
  - Emission factors are a common quantification method where the primary protocol goal is informational
    - **Lower accuracy and less cost**
  - Direct measurement often required when transacting in carbon markets
    - **High accuracy and higher cost**



Increasing  
accuracy  
and effort

# Quantification Methodologies - Examples

A protocol specifies appropriate quantification methods based on desired level of accuracy and cost

UNFCCC stipulates use of the revised 2006 IPCC guidelines as quantification methodology for COUNTRY reporting



Table 2-3-3: Federal Greenhouse Gas Emissions by Sector, 1990-2010

Sector	1990	2000	2010
Electricity and Heat	11.1	11.1	11.1
Manufacturing and construction	11.1	11.1	11.1
Transportation	11.1	11.1	11.1
International aviation and shipping	11.1	11.1	11.1
Land use, land-use change, and forestry	11.1	11.1	11.1
Total	11.1	11.1	11.1

2.3.4 Temperature and Distribution

The temperature data provided in this report are the result of a model that simulates the greenhouse gas concentration in the atmosphere and the resulting temperature. The model uses data from a wide range of sources, including satellite data, ground-based observations, and reanalysis data. The model output is presented in this report as a global average temperature anomaly relative to the 1950-1980 average. The model output is presented in this report as a global average temperature anomaly relative to the 1950-1980 average.

The API Compendium provides quantification guidelines, several approaches, for entity (COMPANY) reporting of typical industry emissions sources, often referenced in corporate GHG protocols



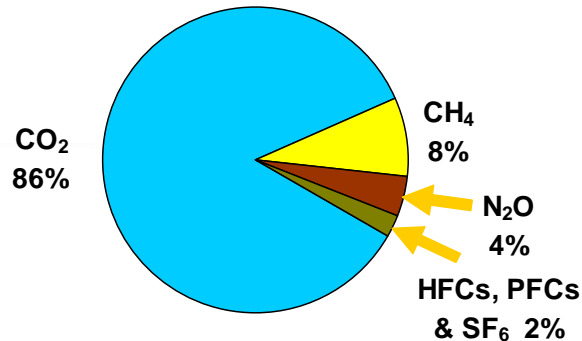
CDM AM0023 stipulates direct measurement of emissions before and for subsequent intervals after leak repair using specific methods such as the High Flow Sampler® or a rotameter



# GHG Emissions Inventory Examples

- Inventory of US Greenhouse Gases and Sinks

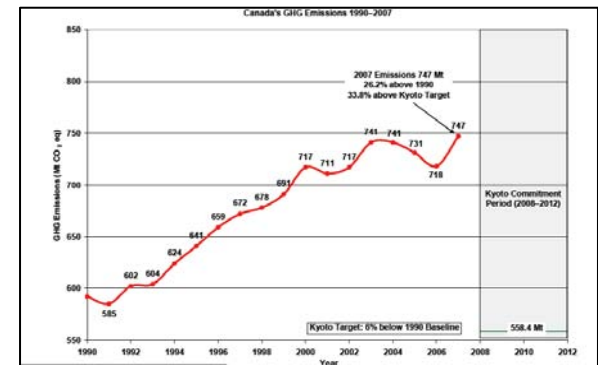
2007 US GHG Emissions - 100-year GWP



- Facility results published online by Environment Canada

- Environment Canada GHG Inventory

1990 - 2007 GHG Emissions



# Inventory Verification

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- Corporate Greenhouse Gas Verification Guideline, ERT 2004
- ISO 14064 Part 3
  - Standards for conducting verification audit
  - Qualification of a verifier
- Tier 1, 2 and 3 verification
  - Desk-top versus field audits
- Audit opinion
  - Objective: no material misstatements relevant to intended use of the inventory
  - Materiality standard

# Issues common to corporate inventory audit findings

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- Incomplete protocol
  - No identification of scope (WRI defines Scopes 1, 2, 3)
  - No definition of de minimus
- Boundaries
  - Corporations specify outside boundaries
  - Corporations often don't specify internal boundaries
- Emissions Factors
  - Published factors MAY NOT match your operations
- Consistency
  - Differences between similar BUs, between years
- Transparency
- Record Keeping/Record Retention

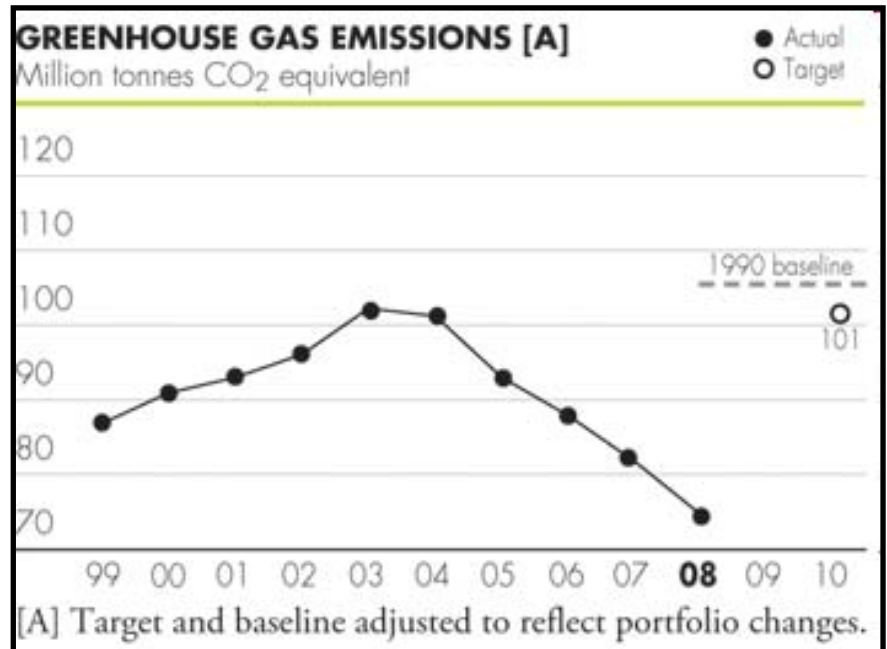
# Corporate Inventory Example

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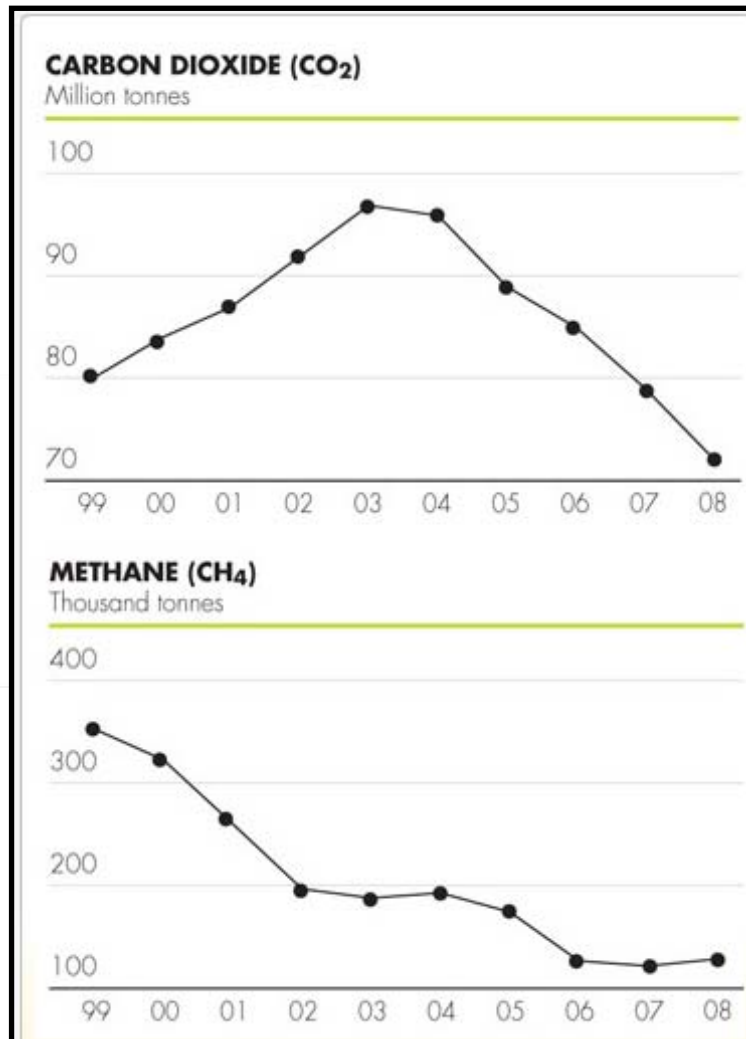
- Shell corporate inventory
  - In 1998 set corporate target of 5 percent greenhouse gas emissions reductions from 1990 base year by 2010
  - Uses IPIECA guidelines
  - Equity share basis
  - CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs
  - Quantifies direct emissions (scope 1), indirect (scope 2), and product end use (scope 3)

# Shell Corporate GHG Inventory

- Largest Reductions
  - Phasing out continuous venting of natural gas
  - Phasing out continuous flaring of gas
  - Energy efficiency
  - Portfolio changes



# Shell Corporate GHG Inventory



- Carbon dioxide represented over 95% of total GHG emissions in 2008
- Methane represented 3.5% of GHG emissions in 2008
  - Ended all continuous venting of natural gas produced at oil wells in 2003

# Resources

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- Environment Canada 2007 Inventory Summary
  - [www.ec.gc.ca/pdb/ghg/inventory\\_report/2007/som-sum\\_eng.pdf](http://www.ec.gc.ca/pdb/ghg/inventory_report/2007/som-sum_eng.pdf)
- Environment Canada Technical Guidance for Facility GHG Reporting
  - [www.ghgreporting.gc.ca/ghg-ges/page15.aspx?lang=en-CA](http://www.ghgreporting.gc.ca/ghg-ges/page15.aspx?lang=en-CA)
- Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2007
  - <http://epa.gov/climatechange/emissions/usinventoryreport.html>
- UNFCCC reporting guidelines on annual inventories
  - [unfccc.int/resource/docs/cop5/07.pdf](http://unfccc.int/resource/docs/cop5/07.pdf)
  - [unfccc.int/resource/docs/2004/sbsta/08.pdf](http://unfccc.int/resource/docs/2004/sbsta/08.pdf)
- WRI Corporate Standard
  - [www.ghgprotocol.org/files/ghg-protocol-revised.pdf](http://www.ghgprotocol.org/files/ghg-protocol-revised.pdf)
- ISO 14064 Standard
  - [http://www.iso.org/iso/catalogue\\_detail?csnumber=38381](http://www.iso.org/iso/catalogue_detail?csnumber=38381)
- IPIECA Petroleum Industry Guidelines
  - [www.ipieca.org/activities/climate\\_change/downloads/publications/ghg\\_guidelines.pdf](http://www.ipieca.org/activities/climate_change/downloads/publications/ghg_guidelines.pdf)
- IPCC Emissions Factors
  - [www.ipcc-nggip.iges.or.jp/EFDB/main.php](http://www.ipcc-nggip.iges.or.jp/EFDB/main.php)
- API Compendium
  - [www.api.org/ehs/climate/new/upload/2004\\_COMPENDIUM.pdf](http://www.api.org/ehs/climate/new/upload/2004_COMPENDIUM.pdf)
- Corporate Greenhouse Gas Verification Guidelines
  - <http://www.ieta.org/ieta/www/pages/getfile.php?docID=677>