Chevron Corporation Quantification of GHGs Based on Methods from the American Petroleum Institute

IPCC Expert Meeting on Application of 2006 IPCC Guidelines to Other Areas

Sofia, Bulgaria

July 2014

Introduction

- Responsible for Chevron’s corporate GHG reporting
- Provide support to business units for complying with GHG regulations

Agenda

- Overview of Chevron's GHG Inventory Methodology
- Examples of IPCC Methodologies Used for Facility-level Reporting

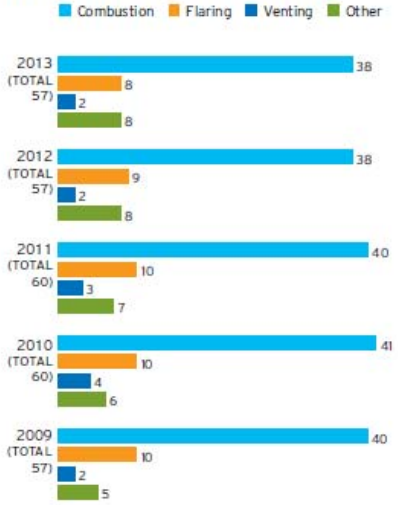
Chevron GHG Inventory Overview

- Chevron has publicly reported its GHG emissions since 2002

Performance Data

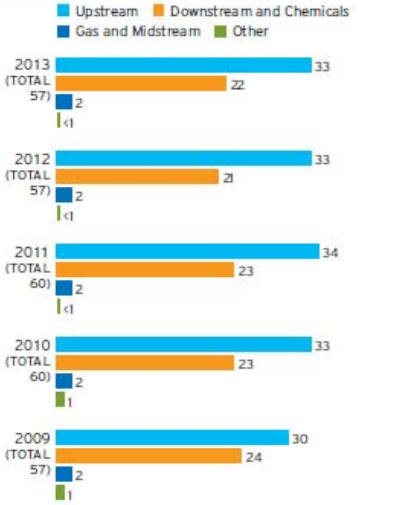
GHG Emissions by Source[1]

Millions of metric tons of CO_2 equivalent



GHG Emissions by Sector[1]

Millions of metric tons of CO_2 equivalent

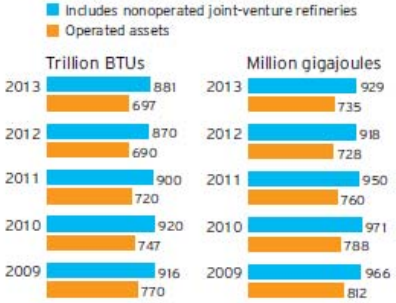


Total GHG Emissions by Type[1,2]

Millions of metric tons of CO_2 equivalent

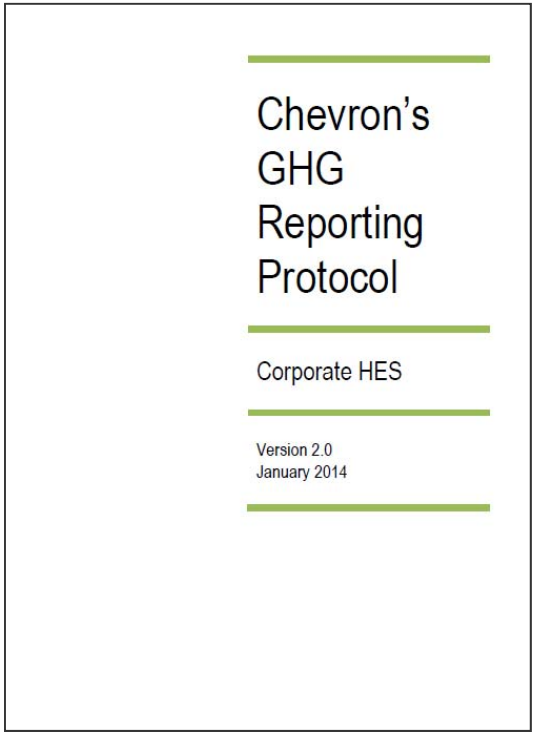
	Direct	Indirect	Grid Credits	Net
2013	57	≈0	0	57
2012	58	−2	0	57
2011	62	−2	0	60
2010	63	−3	0	60
2009	60	−2	−1	57

Total Energy Consumption[3]



Chevron GHG Inventory Overview

- Chevron has publicly reported its GHG emissions since 2002
- Corporate GHG Reporting Protocol



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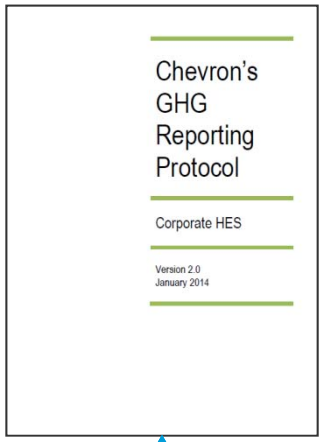
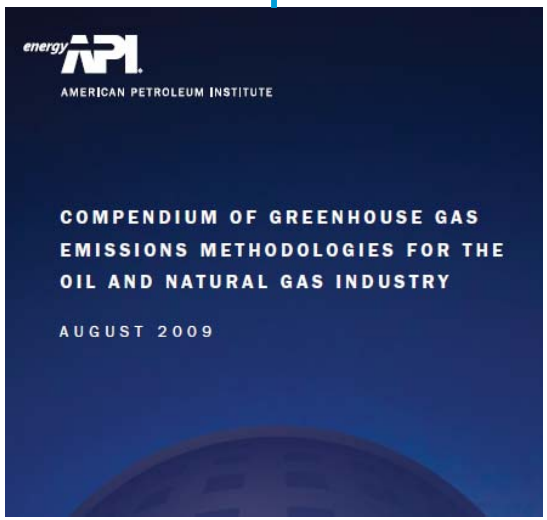
Business units may use methodologies required by local governments in place of API





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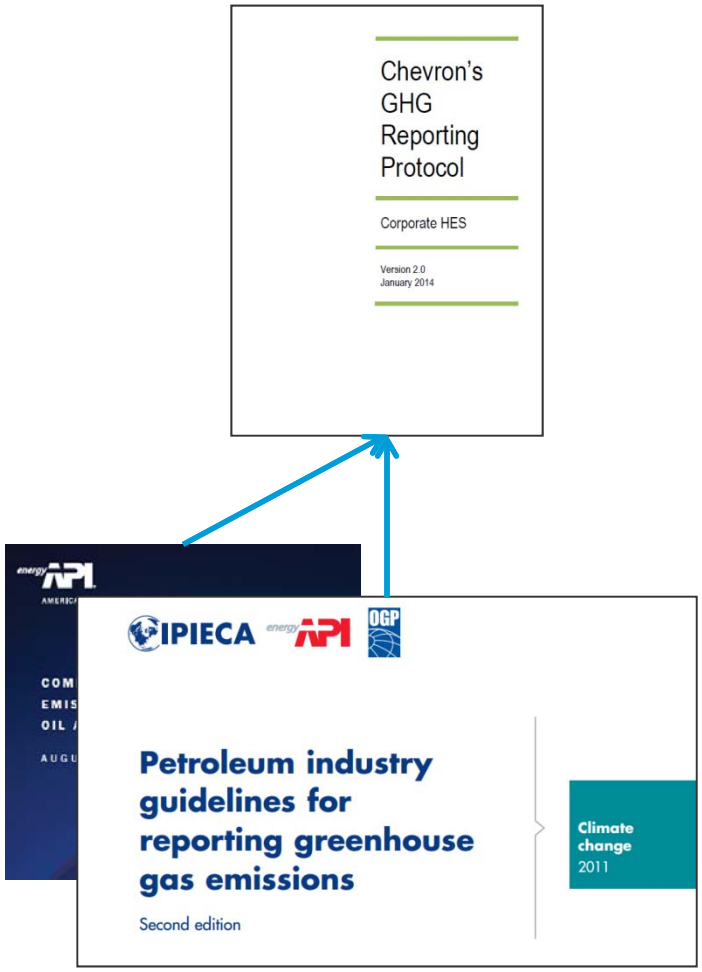

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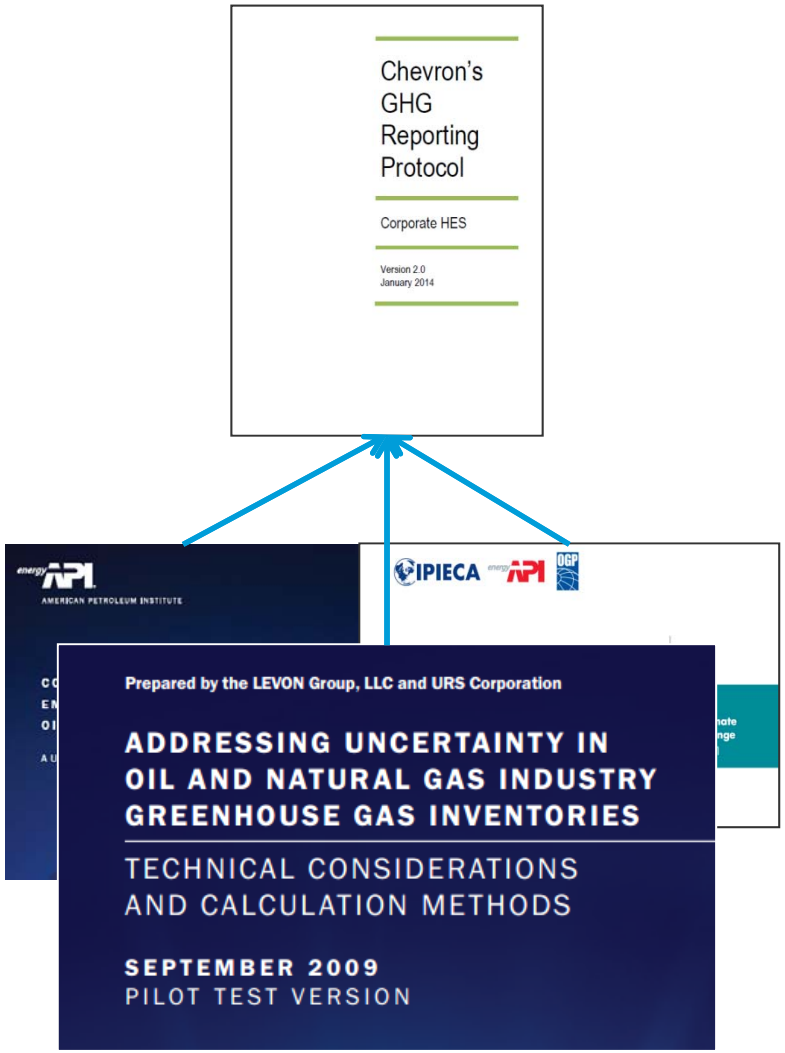
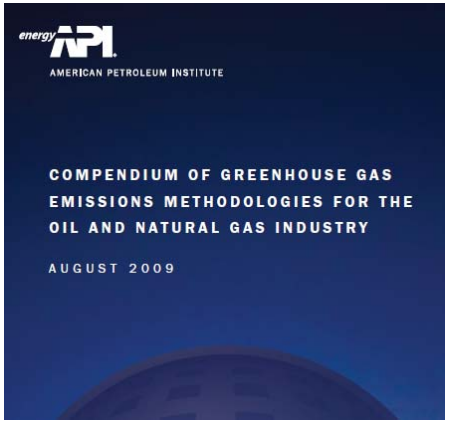
- Uncertainty assessments also based on IPIECA guidance



American Petroleum Institute Compendium Background

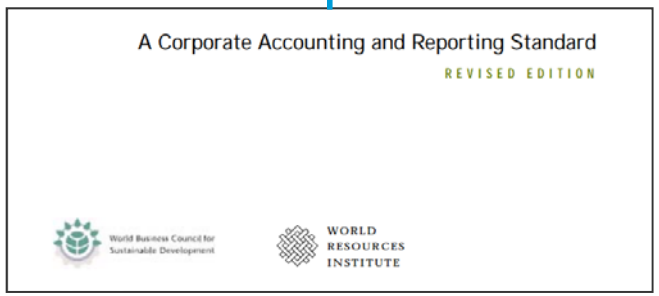
- Represents oil and gas industry best practices for estimating GHG emissions
  - Collaborated with other industry-related protocol development organizations
  - Began in 2001
- Emission factors drawn from sources including:
  - US Energy Information Administration
  - US Environmental Protection Agency
  - IPCC
  - Industry data
  - Forums
  - Foreign regional associations or governmental agencies



Boundaries – based on IPIECA guidelines

- Organizational Boundaries
  - Equity Share
  - Operational Control

WBCSD/WRI GHG Protocol



- Operational Boundaries
  - Scope 1 – Direct Emissions
    - Stationary combustion
    - Mobile combustion
    - Flaring
    - Venting
    - Process emissions
  - Scope 2 – Indirect
    - Imported electricity and steam
  - Scope 3 – Indirect
    - Product combustion

Emerging trends in carbon pricing mechanisms

- National and sub-national governments around the world are implementing carbon pricing mechanisms and/or mandatory reporting regulations

Government	Type of GHG regulation
US Federal	Mandatory reporting
California	Cap and trade
EU	Cap and trade
Australia	Cap and trade/tax
Kazakhstan	Cap and trade
South Africa	Carbon tax
South Korea	Cap and trade
Canada prov.	Cap and trade
China cities	Cap and trade

Emerging trends in carbon pricing mechanisms

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EU	Cap and trade	EU
Australia	Cap and trade/tax	ralia
Kazakhstan	Cap and tra	Kazakhstan
South Africa	C	South Africa
South Ko	trade	South Korea
Canada pr	Cap and trade	Canada prov.
China cities	Cap and trade	China cities

Leads to multiple calculation methods and potential challenges for linkage

Specific examples of IPCC methods used

- Kazakhstan Chevron facility
  - IPCC methodology used as a basis for accounting for national GHG mandatory reporting requirements and for cap-and-trade system
  - Noted a 3 million tonne CO2e difference between IPCC-based government method and API

Details on differences between API and Kazakhstan (RoK/IPCC) governmental method

Emission type	% difference (positive means RoK is greater)
Stationary combustion – diesel	-2%
Stationary combustion – gas	-3%
Vehicle combustion – rail	2%
Vehicle combustion – gasoline	-1%
Vehicle combustion – diesel	4%
Venting	0%

Details on differences between API and Kazakhstan (RoK/IPCC) governmental method

Emission type	% difference (positive means RoK is greater)	Comments
Leaks – Oil and gas production	14657%	Fugitives less significant in corporate API calculation – high H2S content means all piping must be welded and underground

IPCC EF range: 0.0000015 to 0.06 Gg CH4/10^6 m^3
(-12.5% to +800% uncertainty)
Chevron selected: 0.03 as ‘average’

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Leaks – Gas processing

Source	Description	Factor	Derivation
IPCC 1.B.2.b.iii.3	Default weighted factor for gas processing for developing countries	**0.15 – 0.25** tonnes CH4 per 10^6 m^3 produced (-40% to +250%)	Lower limit based on developed countries' factors (Canadian Ass.of Oil Producers 2004, API 2004, GRI/EPA 1996, EPA 1999)
API Table 6.2	Facility level average fugitive emission factors for gas processing plants	**1.032 tonnes** CH4 per 10^6 m^3 processed (+/- 82.2%)	GRI/EPA study v2 (1996)

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Flares	30%	Used tier 2 for RoK (default emission factor), vs tier 3 (composition) for corporate API

Emission Factor Uncertainties (IPCC GL 4.2.2.7.1)

- IPCC GL Vol 2 Ch 4 Fugitive Emissions
  - "These uncertainties … reflect the level of uncertainty that may be expected when the corresponding emission factors are used to develop emission estimates at the national level.
  - Use of the presented factors to estimate emissions from individual facilities or sources would be expected to result in much greater uncertainties."

IPCC and Republic of South Africa (RSA)

- RSA in the process of developing a carbon tax that will affect Chevron facilities
  - Mandatory GHG reporting methods being developed based on IPCC guidance
  - Subset (likely excluding fugitives) of those methods are expected to be used to calculate carbon tax
- Categorization of “process emissions”
  - RSA in discussions on the treatment of process emissions across industries to be covered by tax
    - “Process emissions” according to API include hydrogen plants, glycol dehydrators, fluid catalytic cracking units
    - IPCC makes no differentiation

Summary

- Chevron leverages the API Compendium as a basis for corporate reporting
- Chevron business units may opt to use local regulatory methods instead, if applicable
  - Growing numbers of national/sub-national carbon pricing mechanisms mean growing numbers of calculation methods
- IPCC methods for national level inventories are being used to calculate facility level emissions, including those with wide uncertainty ranges