

Chevron's Experiences in Methane Mitigation



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**GMI Middle East Meeting
Washington, D.C.
October 3, 2012**



- Chevron's position and actions on climate change
- Focus: methane mitigation in Production operations
 - Systematic approach
 - Case studies
 - IR camera
 - Replacement of Pneumatics

Chevron Views on Climate Change



Position Statement: *“At Chevron, we recognize and share the concerns of governments and the public about climate change. The use of fossil fuels to meet the world’s energy needs is a contributor to an increase in greenhouse gases (GHGs) — mainly carbon dioxide (CO2) and methane — in the earth’s atmosphere. There is a widespread view that this increase is leading to climate change, with adverse effects on the environment.”*

Seven principles for addressing climate change

- Global Engagement
- Energy Security
- Maximize Conservation
- Measured and Flexible Approach
- Broad, Equitable Treatment
- Enable Technology
- Transparency

Four-fold action plan

- Reducing emissions of GHGs and increasing energy efficiency
- Investing in research, development and improved technology
- Pursuing business opportunities in promising, innovative energy technologies
- Supporting flexible and economically sound policies, and mechanisms that protect the environment

Take aways:

- Integration of climate change into existing business strategies; no “climate change strategy”
- Business approach: Coordinated, low cost compliance

A variety of systems and tools to manage the various aspects of the GHG issue

- GHG Inventory
- Long-Term GHG Forecasting
- Carbon Price Forecasting
- Capital Projects Tools
- Carbon Markets
- Mitigation Planning
- Technology Deployment

Tools For Capital Project Greenhouse Gas Management

This collection of tools was developed and is maintained by Corporate HES with support from Corporate Finance. The tools and guidelines are structured to support capital project development and decision making by the capital project management processes such as Project Execution Planning and Decision Analysis, and are regions where Chevron does business. Because of the rapidly changing nature of the greenhouse gas regulations in all parts of the world, please continue to check this site for updates to guidance and GHG data.

This suite of tools is meant to help project teams assess the quantity of GHG emissions that will be generated for mitigation, and the costs and credits associated with project emissions. The basic approach is to estimate project emissions as well as the annual costs associated with each unit of emissions. The product of this estimate is the annual cost of carbon emissions associated with the project. All Major Capital Project teams include GHG analyses in their appropriation requests (GO-36).

The [Screening tool](#) is an appropriate first step for guidance on new projects. If you are further down the line you may want to begin with the Screening Tool or skip to the [Project Execution Planning Guidelines for GHG](#) overview of the capital project GHG management process. You may find many parts of this analysis iterative to determine the best solution for your application. **The assessment of greenhouse gas (GHG) considerations begin in CPDEP Phase I or II.**

CPDEP Phase I Tools



Screening tool

A good starting place, this interactive tool will provide guidance as to the level of GHG analysis needed for your project and help you decide which tools/resources to use next.



GHG Emissions Estimation

This Excel spreadsheet tool will produce detailed estimates of project GHG emissions based on fuel use and other activity levels that you input. It will also estimate a simple annual forecast of emissions.



Project Execution Planning Guidelines for GHG

Explanatory guidelines to address GHG management in each CPDEP phase.

CPDEP Phase II



Guidance Documents

Chevron's Renewable Energy & Energy Efficiency Spectrum

Spans technology maturity pipeline



Advanced Energy Research

ETC provides stage-gate reviews, analysis, and testing of promising new energy technologies for Chevron Opcos.

Implementation: Chevron Energy Solutions (CES)

CES helps institutions, businesses and Chevron Opcos improve their facilities by engineering and constructing infrastructure projects that **increase energy efficiency, reduce energy use and ensure reliable, high-quality power** for critical operations.

Chevron Technology Ventures (CTV)

CTV champions **innovation, commercialization, and integration of emerging technologies** and related new business models within Chevron.

Global Power

CGP, the Center of Excellence for power generation, **develops, generates and sells power** and associated services as an integral part of Chevron's value chain, with power operations known as "world-class" in safety and reliability.



EMERGING



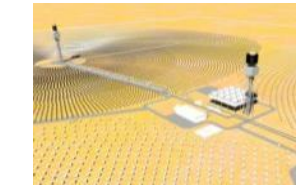
Ocean Energy



EGS



Recovered Energy



Solar-to-Thermal



Solar PV



Wind



Geothermal

DEMONSTRATION



Energy Storage



Biofuels



Bioenergy

COMMERCIAL

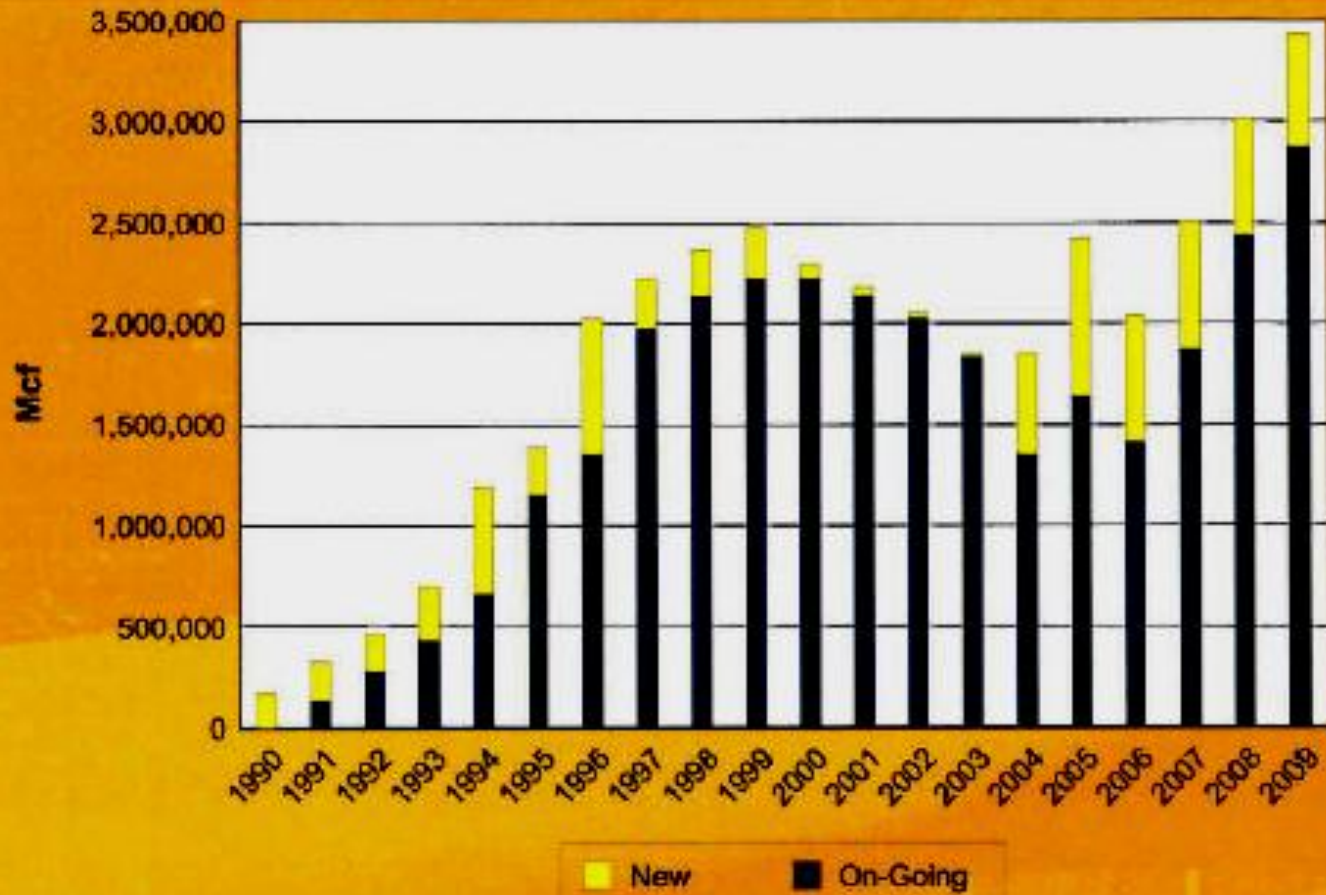


Fuel Cells



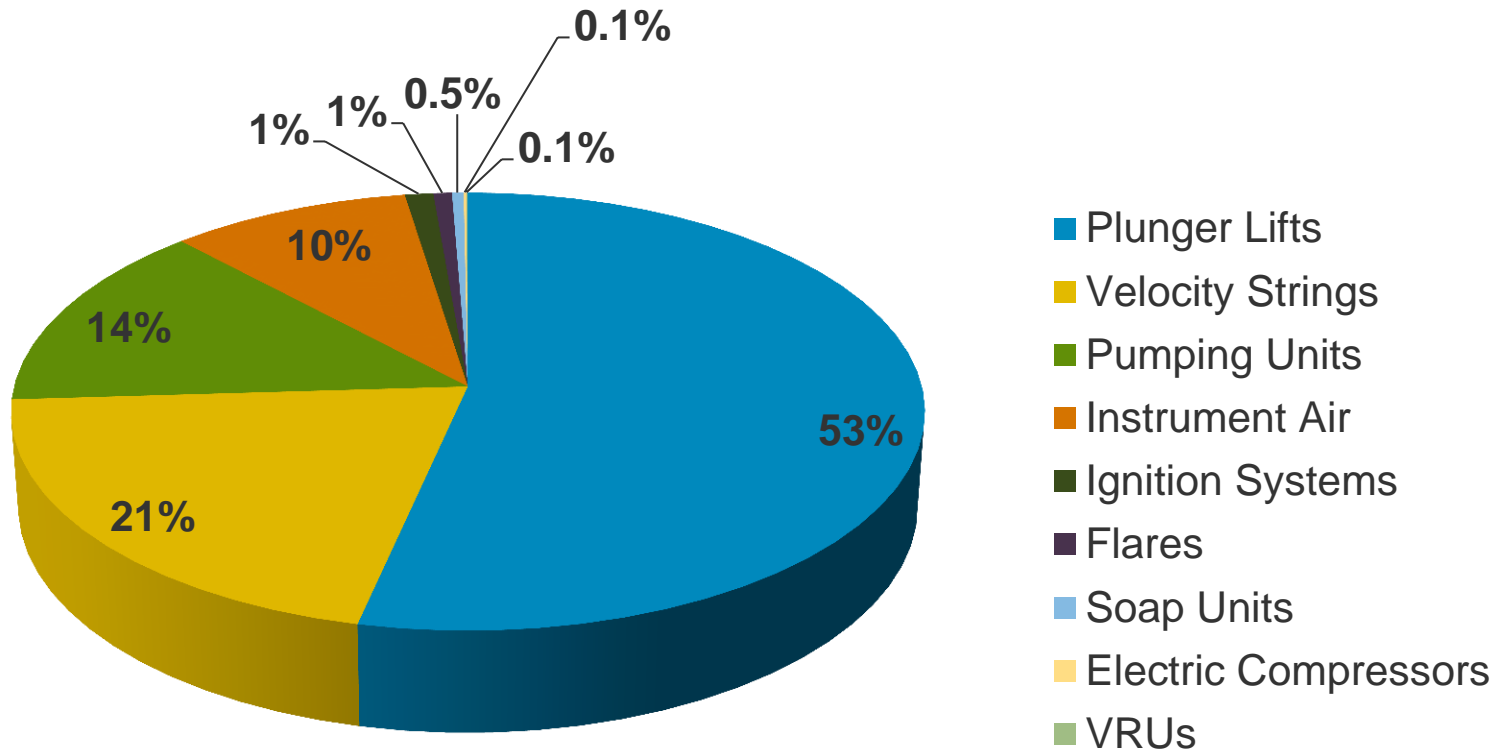
Energy Efficiency

Chevron's Historical Methane Emission Reductions



Cumulative Total: 36,959,948 Mcf since 1995

Types of Emission Reductions--2010



Methane Emission Mitigation Strategy



1. Opportunity identification
2. Opportunity prioritization
3. Action plan development
4. Plan deployment
5. Look backs



- IR Gas Camera
 - Tank battery inspections
 - Compressor inspections and installations
 - Wellhead inspections
 - Vent/Flare audits
 - Gas driven equipment (i.e. diaphragm gas actuated equipment)
 - Gas engine driven pumping units
 - Energy efficiency assessments
 - Reliability assessments

Opportunity Prioritization



- Cost
- Financial hurdles
- Ease of implementation
- Capital or expense
- Operational timing
- Origin of development
- Scalability/best practice candidate
- Safety and environmental
 - Emissions
 - Regulatory impact – current and future



- Involvement of right personnel
 - HES
 - Facilities and/or Production Engineers
 - Field personnel: Mechanics, Electricians, Construction Reps, etc.
- Training required
- Labor market
- Existing paradigms
- Level of expertise
- Company or contract
- Pilot or project
- Success metrics

Look Back



- Track and trend results
- What worked
- Continuous improvement
- Network sharing

DI&M Demonstration Study - IR Camera



- Conducted a pilot study in the Permian Basin
- Scanned facilities using IR Gasfinder camera
 - Gas plants, CO2 Plant, Compressor stations, Tank batteries, and Satellite stations
- Quantified leaks with a high flow sampler
- Determined a dollar amount for associated leak volumes



IR Camera Observations – Demo Study



– Compressor Leaks

- Distance pieces
- Flanges
- Valve stems
- Seals



– Tank Leaks

- Hatches
- Enardo valves
- Vent lines

– Valves/Fittings/Flanges

- Instrument gas leaks
- Cryogenic valves

– Fluid levels in tanks

IR Gasfinder Camera Findings – Demo Study



- Camera results
 - 112 total leaks recorded (60 from gas plants)
- Gas plant quantification results
 - Estimated leak volume: 100,000 Mcf/yr
 - Estimated annual revenue lost: \$2.1MM
 - Natural gas (processed), field gas (unprocessed), and propane
 - Wide range in leak volumes - difficulty bagging leaks



– Mizer Pilot Valve

- Complete controller replacement or controller retrofit available. Current BU policy specifies low bleed pneumatics for new installation
- Retrofit LLCs with Wellmark Mizer Pilot Valves resulted in savings at an ave. of .6 mcf gas per day per install. Cost \$250 per valve, installs in 15 minutes. 80 installed last year with plans for 80 more by end of this year
- Plan to conduct before/after IR Gasfinder Camera survey 30, 60, and 90 days after installation

Two examples of the patented Mizer retrofits



Invalco Controller Retrofitted with Mizer Pilot Valve



Gas Driven Equipment



- Glycol dehydrator pumps driven by gas pressure and exhausted to vent stacks. Re-piping the exhaust to a contactor burner provided efficient gas use. Saving 200 mcf gas per day at \$7 mcf
- Spurred a Gas Driven Equipment Audit Business Unit wide
- At least 2 other locations being studied for replication possibilities

Other Technologies & Initiatives



- Standardizing VRU design and installation processes
- Evaluating electric and solar powered pumps and valves
- Reviewing use of instrument air instead of gas Maintaining cleaner instrument supplies
- Scheduling Energy Management/HES meetings
- Evaluating the benefit of dedicated Leak Detection Teams



- Chevron shares stakeholder concerns about the climate change issue
- Chevron is engaged in development of alternative energy
 - Research
 - Technology Ventures
 - Implementation
- Chevron Upstream Operations work proactively to systematically reduce emissions
 - Methane emission reduction
 - Energy efficiency
 - Reliability