# Flaring, Incinerating and Venting Reduction Report for 2010

BC Oil & Gas COMMISSION

## About the BC Oil and Gas Commission

The BC Oil and Gas Commission (Commission) is an independent, single-window regulatory agency with responsibilities for overseeing oil and gas operations in British Columbia, including exploration, development, pipeline transportation and reclamation.

The Commission's core roles include reviewing and assessing applications for industry activity, consulting with First Nations, ensuring industry complies with provincial legislation and cooperating with partner agencies. The public interest is protected through the objectives of ensuring public safety, protecting the environment, conserving petroleum resources and ensuring equitable participation in production.

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# 1. Introduction

In 2007, the provincial government announced the BC Energy Plan, situating British Columbia at the forefront of environmental and economic leadership.

In March 2008, the Commission's Flaring, Incinerating and Venting Reduction Guideline for British Columbia (Guideline) came into effect. With natural gas conservation a key objective, the Guideline provides regulatory guidance for flaring, incinerating and venting at all wellsites, facilities and pipelines regulated under the Oil and Gas Activities Act. New wells, facilities and pipelines are designed to conform to the Guideline.

This third annual report, covering the 2010 calendar year, details progress made in meeting the objectives of reducing and eliminating flaring, incineration and venting in British Columbia. While this report and the Guideline speak to all flaring, incineration and venting sources, information is provided to specifically address progress made toward meeting BC Energy Plan reduction targets.

### BC Energy Plan targets

**2011**

reduce routine flaring by 50 per cent

**2016**

eliminate all routine flaring[1]

reduce flaring from other sources:
- well testing
- underbalanced drilling
- gas processing plants

### Progress made to 2010

**26%**

reduction in annual flared volumes since 2006

**4%**

reduction in total flared volumes between 2009 and 2010

**60%**

reduction in solution gas flaring since 2006

**18%**

reduction in well cleanup and well test flaring from 2009 to 2010 The

Goal to eliminate all continuous solution gas flaring that meets an economic threshold for conservation has been achieved.

1 The BC Energy Plan defines routine associated gas flaring as gas that meets an economic threshold for conservation.

## 2. Achievements in 2010

The BC Energy Plan set an interim goal of a 50 per cent reduction of routine flaring at producing wells and production facilities by 2011, with the final goal of elimination of all routine gas flaring by 2016.

In 2010, the Commission made further progress toward these targets. Achievements in 2010 include:

- A four per cent reduction in total flared volumes from 2009 to 2010.
- Annual flared volumes have decreased 26 per cent since 2006, the baseline year[2].
- A 60 per cent reduction in solution gas flaring since 2006 and a 93 per cent reduction since 1997.
- From 1996 to 2010, natural gas production increased by 49 per cent and the amount of gas flared per unit of natural gas production decreased by 59 per cent.
- The requirements in the Guideline resulted in the elimination of all routine (associated) solution gas flaring that is economical to conserve.
- Ninety-seven per cent of solution gas is currently conserved.
- Well cleanup and well test flaring decreased by 18 per cent from 2009 to 2010 due to increases in inline testing in the Montney and Horn River Basin plays.
- The Commission continued implementation of process and regulatory changes promoting gas conservation and reduction of the overall impacts of flaring operations. These changes are outlined in the Economics and Conservation section.

The BC Energy Plan goal to eliminate all continuous solution gas flaring that meets an economic threshold for conservation has been achieved. Solution gas flaring has declined from the single largest flaring source in 1997 to the smallest flaring source, and now accounts for seven per cent of all flaring in British Columbia. In 2010, 97 per cent of solution gas production was conserved.

The Commission continues to focus on the reduction of gas flaring, incinerating and venting resulting from upstream oil and gas industry activities in British Columbia through the implementation of the Guideline. The significant achievements toward BC Energy Plan goals that are communicated in this report have been accomplished through:
Increased scrutiny of flare applications.

- Economic assessments of associated (solution) gas flares.
- Improvements to existing facilities.
- Greater emphasis on design of new facilities to reduce flaring.
- Policy changes (for example, temporary pipelines and flowlines to unproven wells).

2 The baseline year, 2006, is the year prior to introduction of the BC Energy Plan.

# 3. Flaring, Incinerating and Venting

Flaring is a disposal method for combustible gases associated with petroleum and natural gas production, processing and transportation. Flaring may occur at a wellsite during underbalanced drilling, well testing and completion operations where a well is allowed to flow and there is no gas conservation in place. Flaring at a wellsite may occur continuously if the well is designed for production of oil or other liquid hydrocarbons and if gas is produced along with the liquids. This gas is referred to as solution gas. At gas processing plants, flaring is typically used for gas disposal when process upsets occur.

Incinerating is a controlled combustion of natural gas, mixed with air, in a chamber designed to ignite and burn the gas with no visible flame above the unit. For the purposes of natural gas management and disposition reporting, incinerated gas must be reported as flared. Combustion of natural gas in incinerators is not considered an alternative to conservation.

Venting is an intentional, controlled release of uncombusted gas into the atmosphere without flaring or incinerating. The practice is restricted primarily to gas streams that do not support stable combustion. Venting is not an acceptable alternative to flaring and is only allowed where the operation may be conducted safely and flaring or incineration is not practical.

**Figure 1**: Some flare stacks contain a fan at the base that induces extra atmospheric air, producing greater combustion and making the flare a more efficient burn, which results in fewer emissions to the atmosphere.

**Figure 2**: Conservation is defined as the recovery of natural gas, mainly utilized for sale. The gas can also be used as fuel for production facilities and other useful purposes, such as power generation and beneficial injection into an oil or gas pool (for example, pressure maintenance and enhanced oil recovery).

# 4. Management and Conservation

The Commission is committed to the ongoing development and support of an innovative and efficient regulatory framework for all oil and gas activities in British Columbia. As a Crown corporation, the Commission is granted authority to regulate oil and gas activities by means of provincial legislation, and on Oct. 4 2010, the Oil and Gas Activities Act replaced the Petroleum and Natural Gas Act and the Pipeline Act.

The Commission is an active participant in the Canadian Flaring and Venting Regulators Forum. Through such avenues, the Commission is able to examine other jurisdictions and adopt practices most beneficial to British Columbians. For example, the Commission endorses the recommended strategies of the Clean Air Strategic Alliance's (CASA) objective hierarchy and framework for management of all sources of gas flaring, incinerating and venting.

In accordance with the expectations of the objective hierarchy, operators must evaluate three options:

1. Can flaring, incinerating and venting be eliminated?
2. Can flaring, incinerating and venting be reduced?
3. Will flaring, incinerating and venting meet performance standards?

Also adopted from CASA is the Solution Gas Flaring/Venting Decision Tree (next page). This support tool uses a tree-like graph to demonstrate how each element is to be considered and implemented, where appropriate.

The Commission supports this decision process. Operators must apply the decision tree to all solution gas flares and vents greater than 900 $m^3$/day. In referring to these three options, the Commission collectively considers more than just economics, but also impacts on the public, environment and interests of British Columbians.

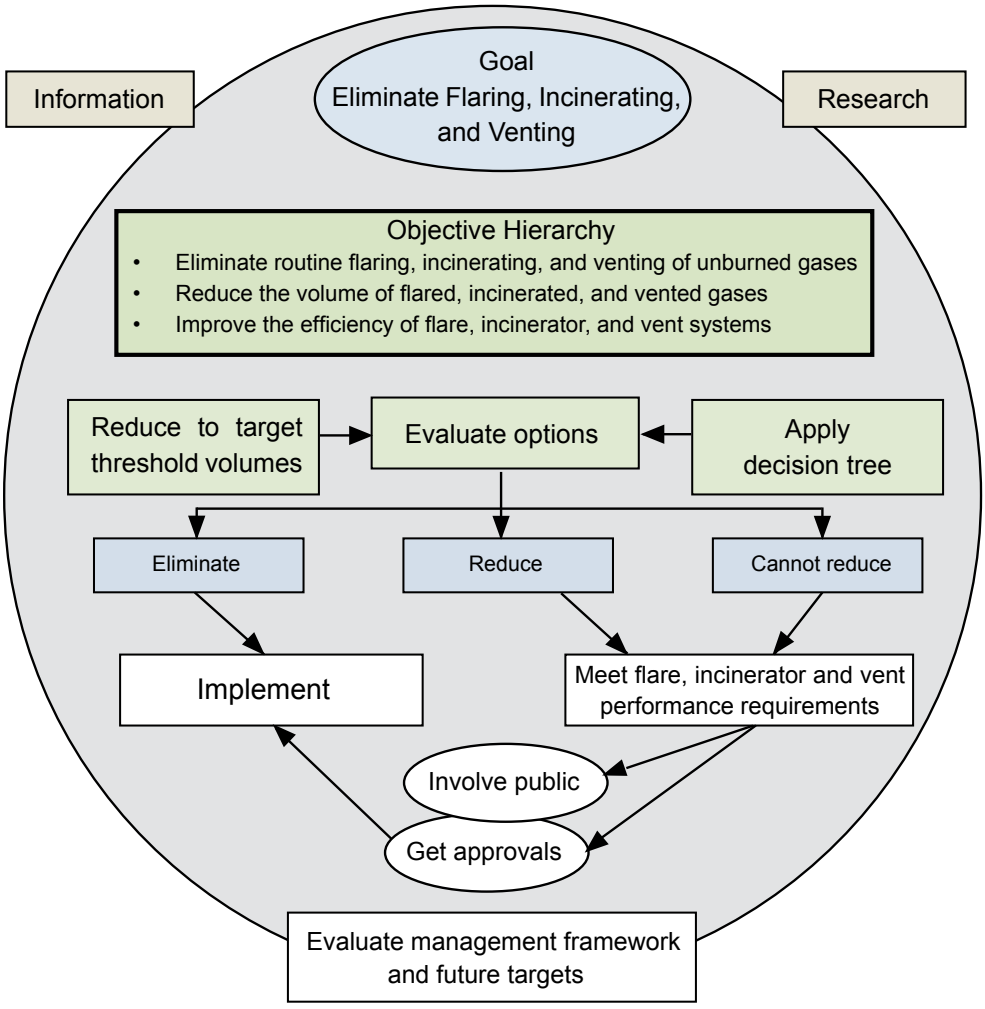



**Figure 3:** CASA's objective hierarchy

In March 2008, the Guideline came into effect, which supports the regulatory requirements for flaring and venting set out in the Drilling and Production Regulation, and ensures that expectations are clear, consistent and create a level playing field.

The goals of the Guideline are to:

1. Reduce emissions and utilize or conserve natural gas resources by minimizing flaring and venting.
2. Ensure that flaring and incinerating are conducted in a safe and responsible manner.
3. Permit venting only where conservation or combustion of natural gas is not feasible.

The Guideline contains: an assessment process to reduce or eliminate flaring and venting; flaring volume thresholds and time limits; public notification requirements; performance requirements for flare stacks and incinerators and flare measurement and documentation requirements.

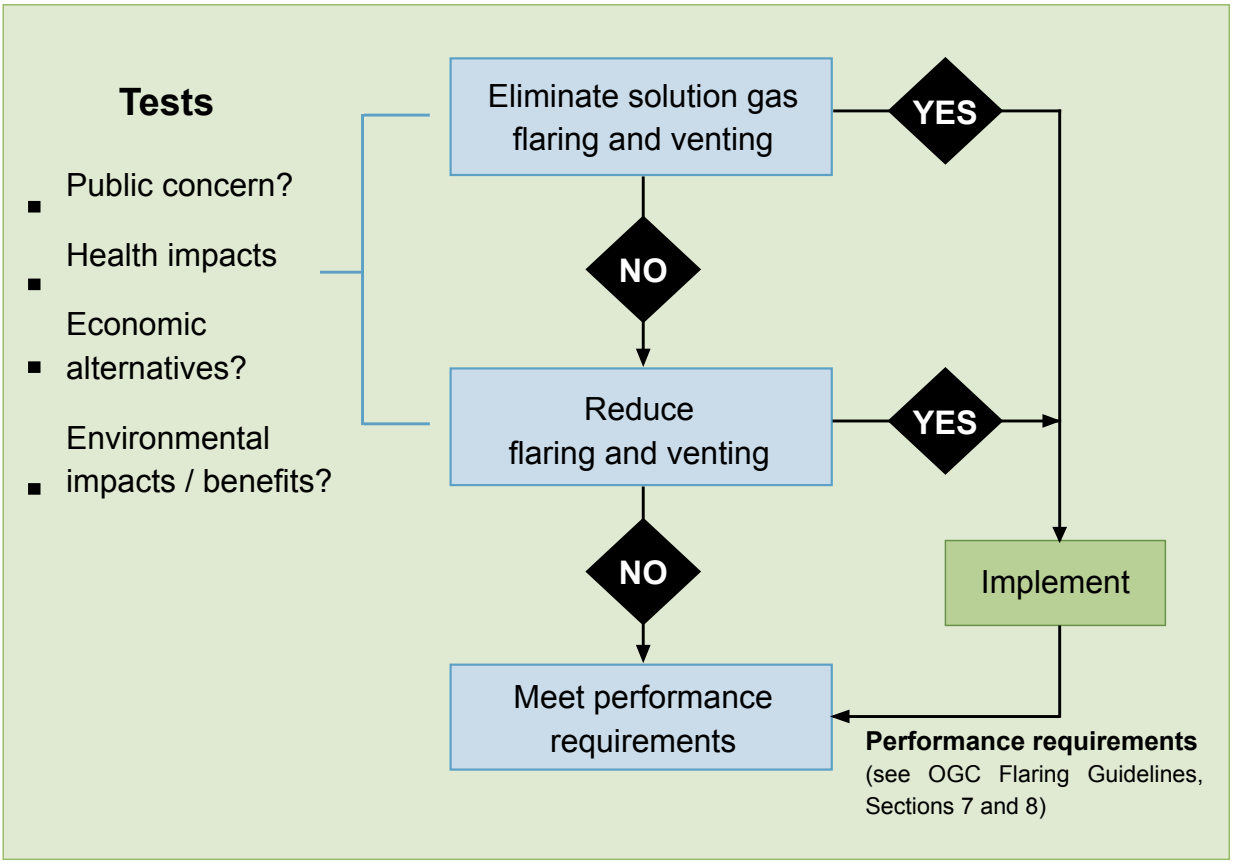



**Figure 4:** CASA's decision tree

# 5. Resource Conservation

There are five major sources of flaring:

- Solution gas
- Well cleanup and testing
- Production facilities
- Underbalanced drilling
- Gas processing plants

## 5.1 Solution Gas

Solution gas flaring is flaring that occurs predominantly at oil producing wells and oil batteries.

The Guideline defines a threshold of 900 $m^3$/day per site for evaluating the economics of gas conservation. Operators are required to conserve solution gas at sites where economic analysis indicates Net Present Value (NPV) of -$50,000 (negative $50,000). All economic analysis of associated gas flaring must be conducted in accordance with standard criteria set out in the Guideline.

NPV is defined as the total present value (PV) of a time series of cash flows.

$$NPV = \sum_{t-1}^{T} \frac{C_t}{(1+r)^t} - C_o$$

**Figure 5:** NPV Equation

The Commission's efforts to reduce solution gas flaring have been successful. Since introduction of the Guideline in 2008, operators have conducted economic assessments of all solution gas flares greater than 900 $m^3$/day and, as a result, have implemented conservation at several solution gas flaring sites.

Regardless of economics, operators are required to conserve solution gas when flared volumes are greater than 900$m^3$/day per site and the flare is within 500 metres of an existing residence.

At the present time, there are no remaining solution gas flares that meet criteria for conservation as outlined in the Guideline.

The BC Energy Plan goal to eliminate all continuous solution gas flaring that meets an economic threshold for conservation has been achieved. Solution gas flaring has declined from the single largest flaring source in 1997 to the smallest flaring source, and now accounts for seven per cent of all flaring in British Columbia, down one per cent from last year.

In 2010, 97 per cent of solution gas production was conserved.

## 5.2 Well Cleanup and Testing

Well cleanup and well test flaring is conducted once a well is completed and prior to placing it into production.

Well cleanup flaring ensures that sufficient contaminants have been removed from the gas stream to allow the well to be produced safely. Excess sand can cause abrasion, resulting in failure of surface equipment and pipelines. Excess water or carbon dioxide may cause internal corrosion of pipe and components and may result in process upsets at downstream facilities, resulting in flaring at those locations.

Well testing involves flowing a well so pressure and flow data may be collected. The data is used in mathematical models to predict reservoir behaviour and estimate reservoir parameters, including reserve estimates and expected flow rates. Flow rate data is used for economic analysis and engineering design to determine if sufficient gas supply justifies related investments in pipelines and facilities.

Changes to the Drilling and Production Regulation require all flaring required for well cleanup and testing activities to be approved in the well permit. Flaring for well work-over and maintenance activities are limited to 50 $10^3m^3$/year unless approved in the permit. These new requirements ensure that all flaring receives close scrutiny at the time of permit approval and expands opportunities for consultation with area residents regarding flaring operations.

The changes replace the previous notification thresholds for well test and cleanup flaring:

- 600 $10^3m^3$ for exploratory wells.
- 400 $10^3m^3$ for development wells.
- 200 $10^3m^3$ for wells tied into a facility that is designed to handle production from the formation (that is, a producing well).

**Figure 6**: Vapour Recovery Unit (VRU): A unit composed of a scrubber, a compressor and a switch. The VRU's main purpose is to recover and condense vapours formed inside tanks. The switch detects pressure variations, in turn switching the compressor on and off. Vapours are drawn through the scrubber, where the liquid is trapped and returned to the liquid pipelines system or the tank, and the vapour recovered is pumped into gas lines.

The Commission recognizes that well test and cleanup flaring in proximity to populated areas is a concern to residents. The Commission released an inline testing directive in April 2010 requiring inline testing of all wells approved after that date that are located within 1.25 kilometres (km) of a residence and three km of suitable pipeline infrastructure (Directive 2010-03). New requirements in the flaring guideline should help reduce the impact of flaring operations by increasing the use of incineration near populated areas.

Regulatory and policy changes implemented by the Commission, and the maturation of the Montney and Horn River plays (which are developing increased infrastructure, multi-well pads and refinements in operational practices), have combined to reduce the quantity of well cleanup and well test flaring by 18 per cent between 2009 and 2010.

### 5.3 Production Facility Changes

Since the Guideline was brought into effect, the Commission has worked with operators on production facility designs, ensuring all reasonable options are considered in an effort to eliminate or reduce flaring. As a result, numerous engineering technologies and other provisions have

allowed for further incorporation of flaring and venting reduction options. Where conservation is possible, the Commission's ultimate goal is to approve applications that conserve gas.

Emission reduction opportunities are reviewed in detail during the facility application review process. For example, vapour recovery unit (VRU) installation is required at all new and expanded facilities where the installation of such equipment is feasible. Where conservation is not feasible, incineration may be used to reduce the impact of continuous flaring at facilities in close proximity to populated areas.

Industry is utilizing solar powered equipment, such as pumps at single-well facilities. The use of solar powered equipment to run small pumps at new facilities, rather than using propane or natural gas, eliminates the need to burn or vent gas.

**Figure 7**: Encana's GWD gas recovery project near Fort Nelson.

Low-pressure gas is being used to drive electrical generators to power equipment at remote facilities. Flare stack designs are changing to reduce pilot and purge gas volume requirements.

The Commission encourages the use of new innovations to minimize flaring and venting. From 2009 to 2010, production facility flaring increased by six per cent. The increase resulted from an increase in the number of gas production facilities and a six per cent increase in gas production.

### 5.4 Underbalanced Drilling

Underbalanced Drilling (UBD) is a procedure used to drill oil and gas wells where wellbore pressure is kept lower than fluid pressure in the formation being drilled. As a well is drilled, formation fluid flows into the wellbore and up to the surface. This is opposite of the usual situation, where the wellbore is kept at a pressure above the formation to prevent formation fluid entering.

One of the primary advantages of UBD is that, due to reduced hydrostatic pressure in the well, drilling mud does not invade the formation and cause formation damage. Depending on the reservoir properties, formation damage may permanently impair the productivity of a well. Traditionally, UBD has allowed for little flexibility in reducing the amount of flaring due to the sensitivity of the formation to damage if oil- or water-based drilling fluid is used. Recently, industry introduced technology to allow recovery and recycling of gas used in UBD operations.

The majority of UBD in British Columbia is conducted for the production of sweet natural gas from the Jean Marie formation northeast of Fort Nelson. In 2008, Encana Corporation initiated a UBD or Gas While Drilling (GWD) gas recovery project. The project involves use of natural gas as a drilling fluid, allowing gas to be recovered and conserved instead of flared during the drilling process. In

2009, all Encana wells in the Jean Marie formation utilized GWD technology. This resulted in a reduction in UBD flaring of 85 per cent between 2008 and 2009.

Between 2009 and 2010, UBD flaring increased by 114 per cent. While the total quantity of UBD flaring in 2010 was still less than one-third of the amount in 2008, there was a significant increase from 2009 to 2010, which resulted from a nine per cent increase in the number of UBD wells that were drilled and flaring from four wells that were not drilled with GWD technology.

**Figure 8**: Murphy's Tupper Plant, one of the state-of-the-art facilities in northeast B.C., is specially designed with sulphur recovery systems to remove sulphur from natural gas.

### 5.5 Gas Processing Plants

Gas processing plants can be a significant source of emissions and flaring, and Commission efforts have focused on conservation as a priority during the application review stage. The Commission is the regulator for 45 per cent of gas processing plant capacity in British Columbia. The National Energy Board regulates the other gas processing plants.

All applications for gas plants and large production facilities submitted to the Commission in 2010 were required to install flare gas measurement equipment. The use of measurement equipment in place of engineering estimates provides accurate, verifiable data for compliance and reporting purposes.

In reviewing plant applications, the Commission focuses on engineered solutions to minimize emissions and flaring. New gas plants are increasingly designed to accommodate a wide range of inlet fluid conditions so that in the future well cleanup and well tests can be conducted directly into pipelines, reducing the need for flaring at the well site.

An example of specific conservation design strategy is the installation of VRUs at most new gas plants. Additional flaring restrictions require plant capacity to be reduced and eventually shutdown in the event of a failure of the VRU or acid gas recovery systems.

Additional flaring restrictions will require plant capacity to be reduced and eventually shutdown in the event of a failure of the VRU or acid gas recovery systems.

One major strategy being utilized at gas plants in the province is reduction of acid gas (gas containing hydrogen sulphide or carbon dioxide) flaring by using an injection well for disposal. This process injects the acid gas into deep underground formations that do not contain commercial hydrocarbons. Acid gas injection is currently being utilized at the Keyera Caribou gas plant, the expanded Spectra West Doe gas plant and other plants in the northeast.

An alternative to injection is sulphur recovery. Murphy's Tupper plant was designed to strip sulphur from acid gas. The sulphur recovery unit became operational in the second quarter of 2009.

It is a best practice to design gas gathering systems, plants and facilities to aid in minimizing the need for flaring and enhancing conservation. From 2009 to 2010, gas processing plant flaring decreased by one per cent. During that period, gas production increased by six per cent.

# 6. Summary of Flared Volumes

Overall, industry achieved a 39 per cent reduction in total gas flared from 1996 to 2010. Flare volumes from the five major sources of flaring in British Columbia from 1996 to 2010 are summarized in Appendix 1.

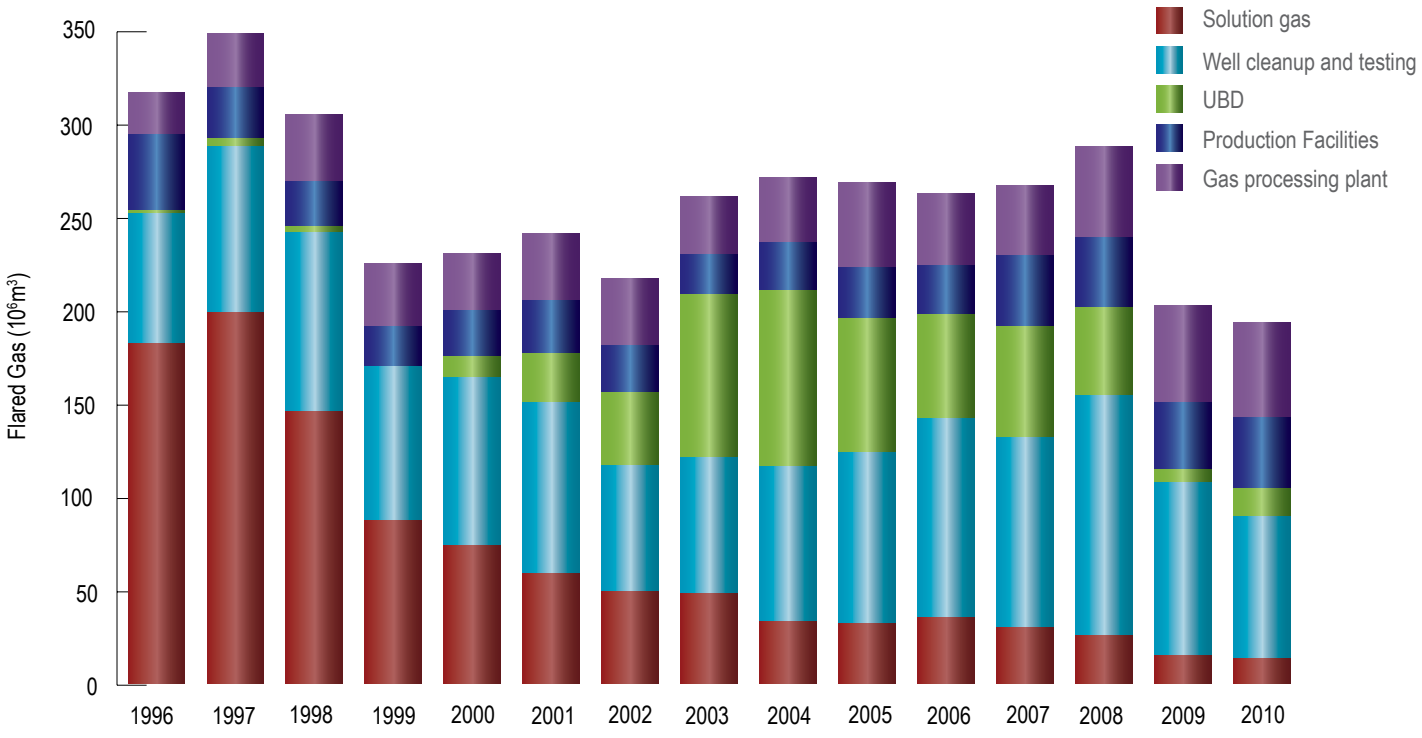
Historically, solution gas has been the largest contributor to flared gas volumes in British Columbia. In 1996, solution gas flaring accounted for almost 58 per cent of the flare volume. The volume of flared solution gas has declined steadily over time and in 2010, flared solution gas accounted for seven per cent of the total flared gas volume for British Columbia.

Well cleanup and test flaring averaged 33 per cent of total flared gas over the 13 years. A noticeable drop occurred in 2002 when the number of wells drilled decreased, resulting in decreased necessity of well test flaring. Reductions in well cleanup and test flaring from 2009 to 2010 resulted from policy changes that encourage the use of inline testing and the continued maturation of the Horn River and Montney plays.

UBD accounted for the most significant flare source in 2004 at 34 per cent of the total volume. Changes in UBD flaring prior to 2008 were caused primarily by changes in activity levels. The advent of GWD technology in 2008 has resulted in significant decreases in flaring from UBD, down to eight per cent of total annual volume in 2010.

Gas processing plant flaring accounted for 26 per cent of flaring in 2010. The Commission is the regulator for approximately half of the gas processing plant capacity in British Columbia. Figure 1 depicts the breakdown of flaring by source from 1996 to 2010.

**Figure 9**: Flared volume broken down by sources for 1996 to 2009



## 6.1 Solution Gas Conservation

As illustrated in Figure 10, there was significant improvement in the conservation of solution gas between 1996 and 2000. Conservation rates reached 97 per cent in 2010. There is limited scope for additional improvements in total solution gas conservation. Currently, 40 per cent of solution gas flaring is continuous solution gas flaring. The remaining 60 per cent of solution gas flaring results from other operations such as plant maintenance, process upsets, purge gas and pilot gas. Figure 11 (next page) shows the summary of solution gas produced versus solution gas flared between 1996 and 2010.

**Figure 10**: Solution gas conservation-time history

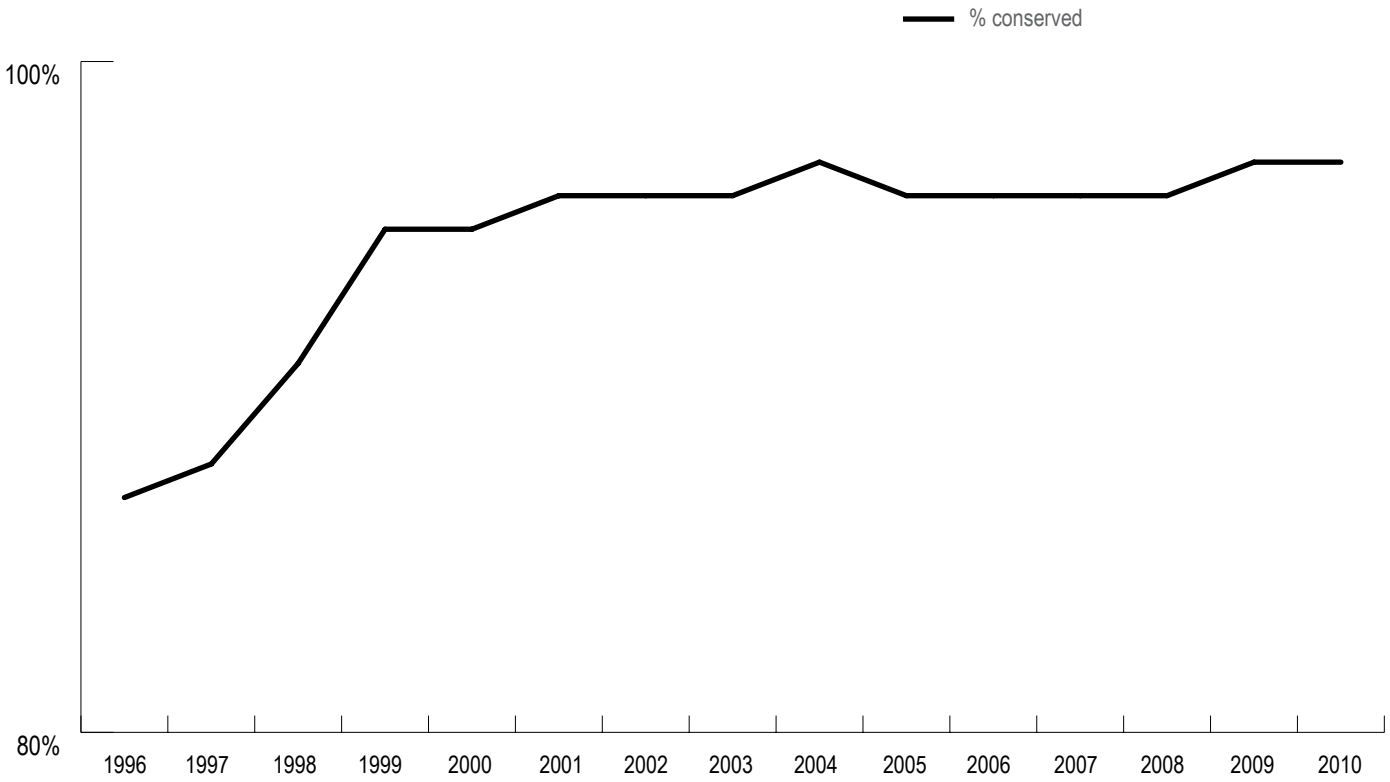
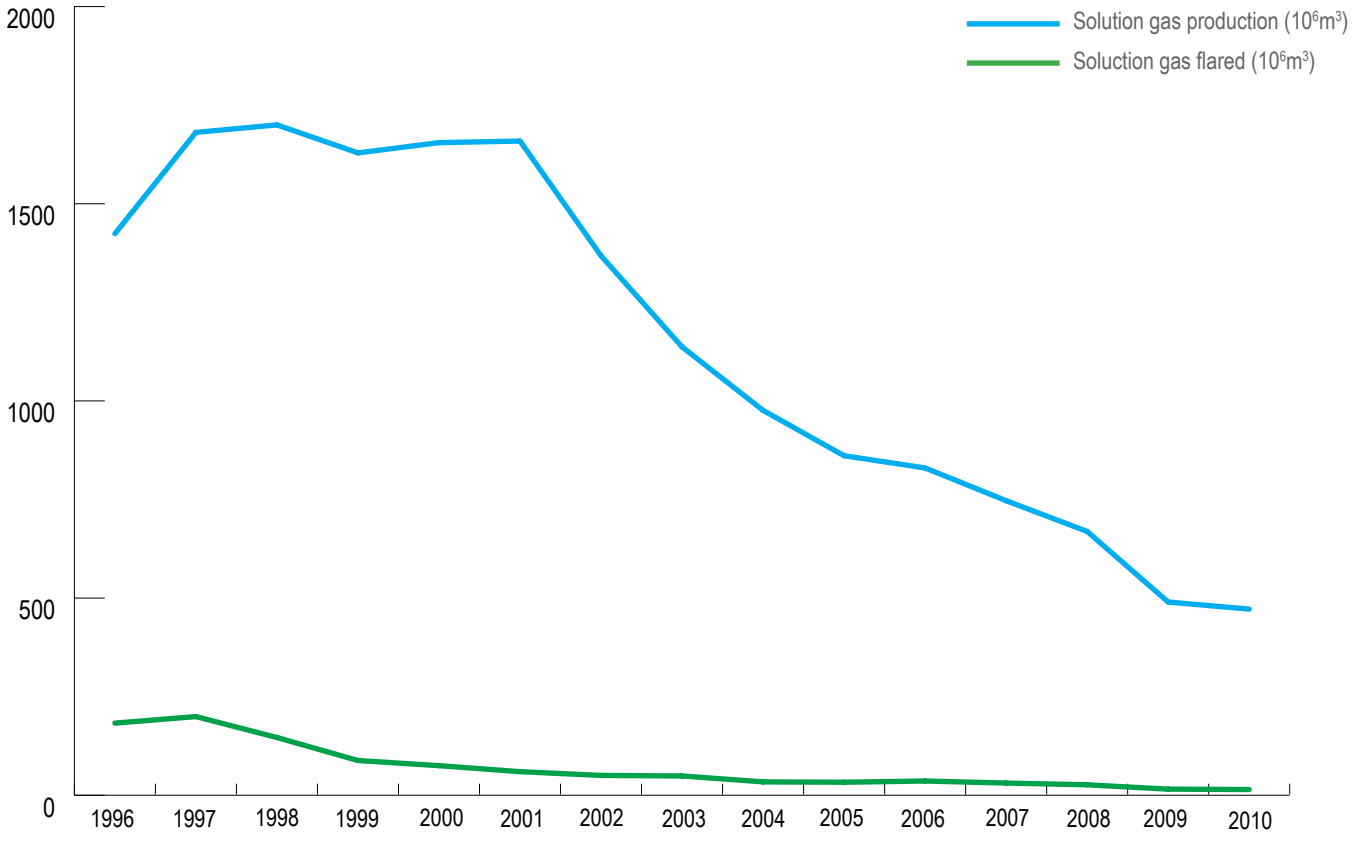


**Figure 11**: Solution gas production versus flaring by years



# 7. Economics and Conservation

Under the Guideline, companies are required to perform an economic analysis on all sites with solution gas flaring. If the Net Present Value (NPV) of gas being flared is greater than a defined economic threshold (-$50,000), companies are required to conserve gas. As of February 2009, economic analyses were performed on 14 single-well batteries, resulting in seven wells being tied-in and conserving gas.

During March 2009, an additional 10 battery locations were identified to meet Guideline criteria for running conservation economics. Flaring non-compliance letters were sent to the wellsite operators and conservation economics for the wellsites were completed and reviewed by the Commission. For conservation projects that met the Commission threshold, regulatory measures, including well tie-ins (and in extreme cases, well shut-ins), were implemented.

Solution gas conservation projects have reduced solution gas flaring by 35.8 $10^6 m^3$ since the introduction of the Guideline. The approximate value of conserved gas is $5.8 million and the total value of royalties is estimated to be $716,000[4].

Fuel and flared gas is currently subject to the carbon tax – the rate as of July 1, 2010 for burning natural gas is 99.76 cents per gigajoule.

## 7.1 Additional Commission Initiatives

In order to assist the continual improvement of rules and regulations and improve efficiency, the Commission is continually assessing internal processes and sector practices. The following summary describes major regulatory and policy changes that the Commission has implemented to reduce flaring and flaring-related impacts.

1. Flaring, Incinerating and Venting Reduction Guideline for British Columbia (February 2008):
    - Required economic analysis and conservation of solution gas flares.
    - Established notification thresholds for well test and cleanup flares.
    - Established flaring duration limits for well test and cleanup flares.
    - Established gas plant flaring volume limits.
    - Required operators to log all flaring and venting events.
    - Required all flare and vent sources to be evaluated using the CASA decision tree analysis.
    - Required operators to develop and implement a fugitive emissions management plan.

2. Temporary Surface Pipelines Information Letter (August 2008):
    - Implemented a process to allow the use of temporary surface pipelines for well testing.

4 Estimate based on Sproule and Associates B.C. West Coast – Station 2 average price for 2008-2010, assuming 10 per cent shrinkage and an average royalty rate for conservation gas of 11.9 per cent for 2010, 11.9 per cent for 2009 and 13.6 per cent for 2008.

3. Rescinded the Pipelines to Unproven Wells Policy (January 2009):

- This policy required a well to be proven prior to the construction of a pipeline. The policy was rescinded to facilitate inline testing.

4. Inline Testing Directive (April 2010):

- Requires the inline testing of all new wells within 1.25 km of a residence and three km of suitable pipeline infrastructure.

5. Updated Drilling and Production Regulation:

- Eliminated flow testing requirements for development wells. Flow testing is only required for exploratory wells.
- Required approval of all well test and cleanup flaring in the well permit. This will increase transparency and opportunities for consultation.
- Required approval of all continuous flaring at facilities in the facility permit. This will increase transparency and opportunities for consultation.
- Regulatory requirement to develop and maintain a fugitive emissions management program.
- Regulatory requirement that all flaring and venting must be minimized.

6. Updates to the Flaring Guideline:

- Improved flaring reporting system for wells.
- Requirement to install flare meters at large compressor stations and gas processing plants.
- Measures to reduce the impacts of flaring operations near populated areas.

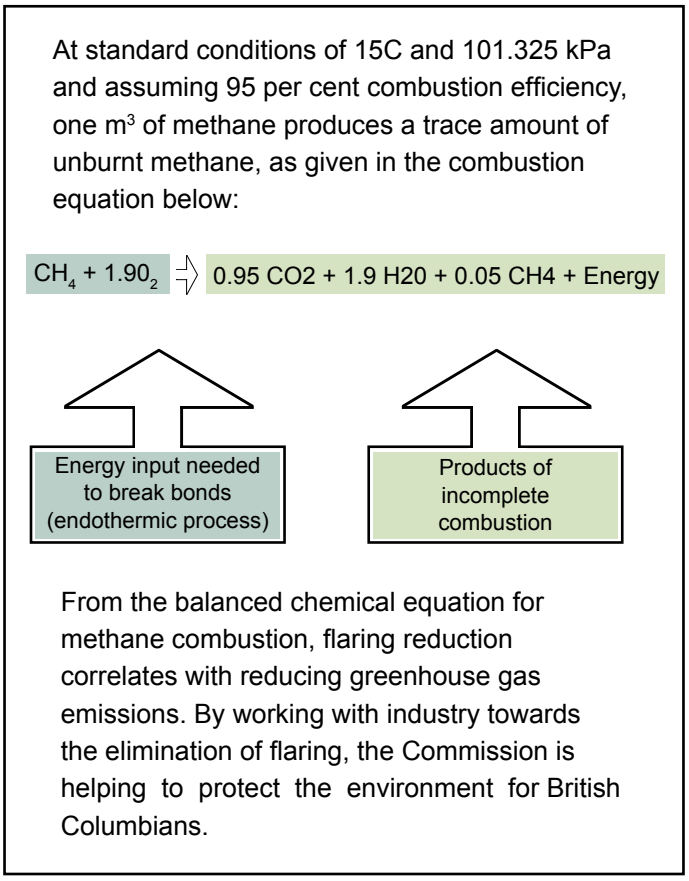



**Figure 12**: Balanced chemical equation for methane combustion

## 8. Flaring, Incinerating and Venting – Moving Forward

Looking ahead, the Commission will be working with operators to ensure they consider and work through all flaring, incinerating and venting options, including:

- Elimination.
- Reduction when elimination is not possible. For instance, if there is a lack of available infrastructure like pipelines and facilities in the vicinity due to remoteness of activity.
- Improvement of the efficiency of flare, incinerator and vent systems.

Significant changes captured by the Guideline are contributing to overall improvements in gas utilization through:

- Solution gas economic analysis.
- Requirement to assess all flares for elimination or reduction.
- Gas plant flaring volume limits.
- Temporary facilities for inline tests.
- Flare gas minimum heating value.

Additionally, alternatives to flaring are provided in the Guideline. These include redirection of gas to nearby plants, use of clustering for solution gas and temporarily injecting gas back into a gas cap of an oil pool or gas reservoir. The Commission recognizes that currently evolving technologies and practices may not be addressed by the Guideline and is prepared to accept innovative solutions, practices and technologies designed to help reach Guideline goals.

The Commission continues to implement and improve upon the steps laid out in the Guideline while encouraging stakeholders and industry to pursue innovative ways of reducing flaring in British Columbia. Ensuring optimal recovery of oil and gas resources continues to remain a key focus of the Commission.

# 9. Glossary

**Acid Gas**
Gas that is separated in the treating of solution or non-associated gas that contains hydrogen sulphide ($H_2S$), total reduced sulphur compounds and/or carbon dioxide ($CO_2$).

**Clustering**
Clustering is defined as the practice of gathering the solution gas from several flares or vents at a common point for conservation.

**Combustion efficiency (CE)**
The CE quantifies the effectiveness of a device to fully oxidize a fuel. Products of complete combustion ($CO_2$, $H_2O$ and sulphur dioxide) result in all of the chemical energy released as heat. Products of incomplete combustion (for example, CO, unburned hydrocarbons, other partially oxidized carbon compounds, $H_2S$ and other reduced and partially oxidized sulphur compounds) reduce the amount of energy released. For the purposes of this guideline, CE is reported as the percentage of the net heating value that is released as heat through combustion.

**Conservation**
The recovery of solution gas for use as fuel for production facilities, other useful purposes (for example, power generation), sale or beneficial injection into an oil or gas pool.

**Conservation Efficiency**
Conservation efficiency (%) = (Solution gas production – Flared – Vented) / (Solution gas production) x 100.

**Continuous flaring, incinerating, venting**
“Continuous” means flaring, incinerating or venting of gas from any source that occurs on a continuous or near continuous basis during normal operations whether or not the gas can be conserved.

**Fugitive Emissions**
Unintentional releases of gas resulting from production, processing, transmission, storage and delivery.

**Gas Facility**
A system or arrangement of tanks and other surface equipment (including interconnecting piping) that receives the effluent from one or more wells that might provide measurement and separation, compression, dehydration, dew point control, $H_2S$ scavenging, line heating, or other gas handling functions prior to the delivery to market or other disposition.

**Intermittent flaring, incinerating, venting**
“Intermittent” means flaring, incinerating or venting that occurs for a limited duration, whether

predictable or not and includes well cleanup and testing, maintenance, process upsets and emergencies.

**Oil Battery**
A system or arrangement of tanks or other surface equipment or devices receiving the effluent of one or more wells for the purpose of separation and measurement prior to the delivery to market or other disposition.

**Routine flaring, incinerating, venting**
"Routine" means continuous flaring, incinerating and venting where conservation of the gas is reasonably expected to generate a net present value greater than zero and the flaring, incinerating or venting is not required for safety or environmental purposes.

**Solution Gas**
For the purposes of this guideline, solution gas is gas contained within oil which is released from the liquid when pressure is decreased or temperature is increased.

**Sour Gas**
Gas that contains $H_2S$. Depending on $H_2S$ concentrations, sour gas may pose a public safety hazard if released or may result in unacceptable odours if vented into the atmosphere.

**Source**
All gas flared, incinerated, or vented from a single operating site, such as an oil battery or a multiple-well pad.

**Sulphur emissions**
For the purposes of this guideline, this includes all air emissions of sulphur-containing compounds, including $SO_2$, $H_2S$, and total reduced sulphur compounds (for example, mercaptans). Sulphur emissions from flare stacks are expected to be primarily the form of $SO_2$, with minor amounts of other compounds.

**Venting**
The intentional controlled release of uncombusted gas.

# 10. APPENDIX A

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | % Change |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | |
| Solution Gas | 182.9 | 199.5 | 146.4 | 88.1 | 75 | 59.8 | 50.3 | 48.9 | 33.9 | 33 | 36.1 | 30.9 | 26.5 | 15.9 | 14.5 | -9% |
| Well Cleanup and Testing | 69.8 | 89 | 96 | 82.7 | 90 | 91.7 | 67.6 | 72.9 | 83.4 | 91.7 | 107 | 101.9 | 128.5 | 92.7 | 75.9 | -18% |
| UBD | 1.4 | 4.5 | 3.1 | 0.1 | 11 | 26.4 | 38.9 | 87.3 | 94.1 | 71.5 | 55.6 | 59.2 | 47.4 | 7 | 15 | +114% |
| Production Facilities | 40.9 | 26.9 | 24.3 | 21.3 | 24.8 | 28.4 | 25.3 | 21.8 | 25.7 | 27.4 | 25.9 | 37.9 | 37.5 | 35.9 | 37.9 | +6% |
| Gas Processing Plants | 22.7 | 29 | 35.7 | 33.7 | 30.6 | 35.4 | 35.7 | 31 | 35 | 45.7 | 39 | 38 | 48.8 | 51.7 | 51 | -1% |
| Total | 317.7 | 348.9 | 305.5 | 225.9 | 231.4 | 241.7 | 217.8 | 261.9 | 272.1 | 269.3 | 263.6 | 267.9 | 288.7 | 203.2 | 194.3 | -4% |

Flared Volumes $10^6 m^3$

Values reflect most current data