

# Fugitive Methane Emissions from the Oil and Gas Sector: A Valuable Offset Project Type under a U.S. Climate Change Program

## Executive Summary

Fugitive methane emission reductions from the oil and natural gas sector can serve as a valuable source of carbon offsets within a U.S. climate change program. While generally not as well understood as fugitive emissions from such sources as landfills, mines or livestock farms, these emissions from oil and gas systems share many of the same scale and process characteristics, making them equally well-suited to provide a robust supply of offsets. As with other sources of fugitive methane emissions, those from the oil and gas sector would require a disproportionate amount of time and expense to measure and monitor under a cap due to the large number of sources. However, unlike other sources of fugitive methane emissions which have featured prominently in the offset discussion, the treatment of these emissions from the oil and gas sector under a future cap-and-trade system remains highly uncertain. This uncertainty has a chilling effect on the development of projects that could begin reducing emissions today, as companies struggle to determine the value of taking early action in light of regulatory uncertainty. To begin reducing emissions at the lowest cost, fugitive methane emission reduction projects from the oil and gas sector should be included in a positive list of eligible offset project types within the framework of a federal climate change program, just as fugitive methane emissions from mining, agriculture, and landfills have already been established.

Designating oil and gas sector fugitive emissions as eligible offsets will provide the private sector with the signal it needs to begin investing in and developing emission reduction projects. The sooner project implementation can begin, the sooner the U.S. can generate a supply of permanent, additional, domestically-sourced offset credits to provide cost-containment for consumers and businesses in the first years of a climate change program, and help the U.S. get a head start on achieving its national emission reduction goals.

## Context: Cap-and-Trade

The objective of a cap-and-trade program to address greenhouse gas (GHG) emissions is to achieve a desired level of reductions at the lowest overall cost to the economy. Rather than require all regulated entities to reduce their emissions equally, cap-and-trade moderates costs by providing regulated entities with flexibility in meeting their compliance obligation. Entities that can reduce emissions at lower cost than others have an incentive to do so, as they can sell these reductions to other entities also under the cap. A well-designed program thus encourages the most cost-effective reductions to occur first, thereby minimizing overall compliance costs and providing time for new or more expensive emission reduction technologies to be developed or deployed.

### Including oil and gas fugitive methane emissions on a positive list of offset project types in climate legislation will:

- ✓ Provide a **robust supply of domestic emission reductions** that are quick to implement, additional, and permanent.
- ✓ Enable a source of near-term, high-quality offsets to provide **cost-containment** for regulated companies and energy consumers.
- ✓ Spur action to **reduce emissions** from sources that are difficult to address under a cap.
- ✓ Stimulate demand for **U.S. technology and jobs** required to implement and administer emission reduction projects.
- ✓ **Simplify program administration** to focus limited resources on overseeing larger sources of emissions in the economy, which are easier to measure and monitor.

One of the fundamental issues in designing an effective cap-and-trade program involves determining which sources of emissions should be covered under the cap. Since monitoring and reporting of emissions can entail significant cost, large stationary sources of GHG emissions are most easily regulated under a cap. This approach enables the majority of economy-wide emissions to be addressed without the undue administrative burden on industry and the government of regulating hundreds of thousands of small, disparate point sources of emissions.

However, many emission sources not covered under the cap for program efficiency reasons may still represent attractive emission reduction opportunities. In many cases, these reductions can be achieved at lower marginal costs of abatement than reductions from sources inside the cap, and should thus be encouraged through a compliance-based offset program.

## The Role of Carbon Offsets

A carbon offset credit (or “offset”) is an instrument reflecting the value of the reduction, avoidance or sequestration of a unit of carbon dioxide equivalent (CO<sub>2</sub>e) that is generated from an unregulated sector or facility. Offsets, for example, may be generated from projects that capture and destroy methane from landfills, or switch to the use of lower-carbon fuels (e.g., coal to natural gas) for small-scale captive power generation. Offsets allow emission reductions generated at a lower cost of abatement outside the boundary of a regulated system to satisfy a percentage of the reduction requirements within the capped system, providing capped entities with a source of low-cost credits that can be used to help meet their compliance obligation. This flexibility provides valuable cost-containment relief for the economy under a climate change program.

All of the economic modeling performed on federal climate change proposals introduced in Congress to date has shown that one of the most important drivers of future allowance prices is the available volume of offsets in a system<sup>1</sup>. In particular, the EPA’s modeling of the Lieberman-Warner Climate Security Act (S.2191) of 2008 illustrates how allowance prices fluctuate depending upon the level of offsets permitted in a program. For example, under a scenario where offsets are not allowed and all reductions are required to be generated from within covered sectors, allowance prices increase 93% compared to the scenario contemplated in S.2191 which included the use of offsets<sup>2</sup>. In another scenario where the use of offsets from domestic and international sources is unlimited, allowance prices fall 71% compared to S.2191<sup>3</sup>.

In addition to cost-containment, a robust, well-structured offset program also provides a number of other valuable benefits. Offsets provide incentives for entities in uncapped sectors or with uncapped facilities to reduce emissions, thereby expanding the number of sources from which emission reductions can be generated across the economy and helping the U.S. to achieve its national GHG reduction objectives. A well-designed offset program can also facilitate economic growth opportunities through the deployment of new emission reduction technologies, as well as new applications and markets for existing technologies. Enabling the most cost-effective reductions to be achieved first – wherever they are located – provides time for new process and technology innovations to occur while keeping energy costs more affordable for energy consumers and businesses. In addition, by designing an offset program that allows for consideration of new project types, the U.S. private sector can serve as a laboratory of innovation with clear incentives to devise new ways to reduce emissions, deploy new technologies, create skilled jobs, and unlock GHG emission reductions from new sectors and activities.

### What Are Fugitive Methane Emissions?

Fugitive methane emissions are generally defined as process emissions that are intermittent, dispersed, or inconsistent in flow, methane concentration or occurrence. In addition to being generated from such sources as livestock farms, mines and landfills, fugitive methane emissions occur throughout the oil and natural gas industry as a result of normal operations, routine maintenance and system disruptions.

<sup>1</sup> “Insights from Modeling Analyses of the Lieberman-Warner Climate Security Act (S.2191)”, Innovative Policy Solutions to Global Climate Change, In Brief. Pew Center on Global Climate Change. (May 2008)

<sup>2</sup> “EPA Analysis of the Lieberman-Warner Climate Security Act of 2008, S.2191 in 110<sup>th</sup> Congress”. U.S. Environmental Protection Agency, Office of Atmospheric Programs. (March 14, 2008)

<sup>3</sup> Ibid.

## Ensuring Program Integrity: What Makes a Good Offset?

Carbon offsets must be generated from projects that meet high standards for environmental integrity. To meet these goals, an offset program must be designed to recognize projects that meet the following criteria:

- **Additional** – Emission reductions should exceed any regulatory requirement, going above and beyond “business-as-usual” or common practice. There are a variety of ways to measure additionality, though a common approach in the U.S. has been to use performance-based standards that set clear rules upfront for project eligibility and additionality<sup>4</sup>.
- **Permanent** – Emission reductions must be permanent; projects that sequester carbon (such as forestry projects) must have appropriate contingencies to account for reversals that may occur.
- **Real** – Emission reductions must be generated from operating projects and offset credits should be awarded only after reductions have been achieved.
- **Verifiable** – Emission reductions should be periodically reviewed and approved by an independent third-party, and should be properly registered to ensure proper crediting and tracking, and to eliminate potential for double-counting.

## U.S. Offset Opportunities

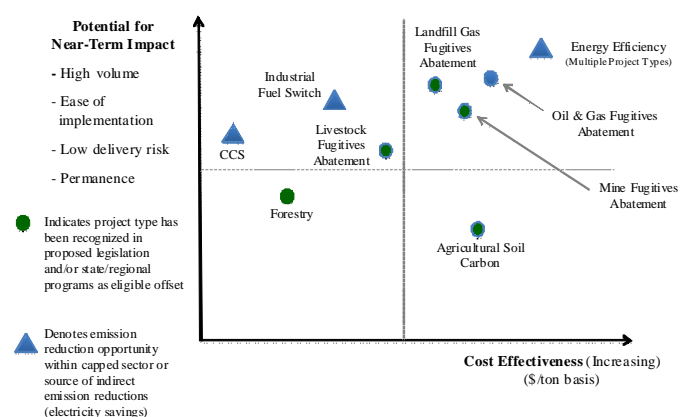
Offset opportunities tend to be concentrated in sectors where there are challenges associated with including emission sources under a cap; for example:

- Where the aggregate level of sector emissions may be too low to warrant coverage under a cap;
- Where the individual sources of emissions are small, numerous, or present administrative challenges for regulatory oversight on an economy-wide basis; or
- Where the ongoing monitoring and reporting of emission reductions (or sequestration) is unduly burdensome for an entire industry relative to the emission reduction benefits achieved by including such emissions under a cap.

For example, there are thousands of livestock farms in the U.S., from which fugitive methane emissions associated with manure management practices account for approximately 7% of the country’s total methane emissions, or, less than 1% of total U.S. GHG emissions<sup>5</sup>. The annual costs to industry that would be required to continuously monitor, measure, reduce and report emissions, along with the annual costs to government that would be required to monitor and enforce reductions under a cap would be very high relative to the potential total reductions that could be achieved. In contrast, the opportunity to generate offset credits for sale into the cap-and-trade system establishes an economic framework that incentivizes such emission reductions to occur when they are cost-effective relative to other abatement options in the economy.

Because they face one or more of the three challenges listed above and are also a source of domestic GHG emissions,

**Emission Reduction Project Types  
Cost and Value Comparison**



<sup>4</sup> Offset project protocols recognized under the EPA Climate Leaders Program and the Climate Action Reserve utilize performance-based standards to assess project eligibility and additionality.

<sup>5</sup> Executive Summary, Table ES-2: Recent Trends in U.S. GHG Emissions and Sinks. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006*. (April 2008)

### How are Oil and Gas Methane Fugitives Treated Under Other Programs?

Oil and gas methane fugitives are currently neither regulated nor included under the cap of the European Union's Emissions Trading Scheme or the U.S. Regional Greenhouse Gas Initiative. California, under AB32, has proposed to exclude these emission sources from the cap-and-trade system and instead implement new regulations to control them. (This is estimated to provide emission reductions of just over 1 million tons of CO<sub>2</sub>e by 2020.) Oil and gas methane fugitive emission sources are much less prevalent in California's economy than they are in the national economy.

methane abatement from the agriculture, mining, and waste sectors, and carbon sequestration in the agriculture and forestry sectors are generally considered to be more appropriately accounted for under an offset program. Potential offset projects from these sectors include those that capture and destroy or utilize fugitive methane emissions from livestock farms, underground mines, or landfills, or where CO<sub>2</sub> is sequestered through reforestation.

Methane projects are particularly attractive as offset projects. Methane has a global warming potential 21 times that of carbon dioxide, so reductions of fugitive methane emissions generate immediate and significant environmental benefits. In addition, unlike sequestration projects, reductions of methane emissions are permanent. They can also be accurately measured and verified, and generally be implemented in the near-term using existing, proven technologies. Methane reduction projects can supply covered entities with a source of high-quality offset credits that, especially in the first several years of a federal program, will be critical in helping to "bridge the gap" between emissions reductions that are needed in the near-term and the time that is still needed for the development and commercialization of new technologies like carbon capture and sequestration for direct abatement of the largest GHG emission sources.

### Oil and Gas Methane Fugitives: Where Do They Fit?

One of the primary challenges of developing a climate change program lies in determining the most economical, efficient and beneficial way to address various sources of emissions. Just as regulating fugitive methane emissions from all livestock farms in the U.S. under a cap would likely prove costly relative to the collective benefits, the prospect of regulating fugitive methane emissions from the oil and natural gas sector presents notable challenges for both industry and government.

In 2006, the EPA estimated that carbon dioxide emissions from the combustion of oil and natural gas for electricity generation and commercial, industrial and residential end uses totaled over a billion and a half tons of CO<sub>2</sub>e.<sup>6</sup> In contrast, fugitive methane emissions from the oil and gas sector were estimated to total approximately 130 million tons of CO<sub>2</sub>e.<sup>7</sup> These fugitive methane emissions account for less than 2% of total U.S. GHG emissions, and are generated from numerous and disparate sources located throughout production, processing, transmission, distribution, and storage processes.<sup>8</sup> For example:

- The U.S. natural gas transmission and distribution system alone is comprised of over 200,000 miles of high-pressure interstate pipelines, 1.4 million miles of low-pressure delivery pipelines, 2,000 compressor stations and 300 underground storage facilities.<sup>9</sup>
- The current methodological basis used by the EPA to estimate methane and non-combustion CO<sub>2</sub> for natural gas systems is a detailed study undertaken in 1996 by the Gas Research Institute and the EPA, which characterized fugitive methane emissions and established standardized emission rates from over 80 pieces of equipment and activities in the natural gas sector.<sup>10</sup>

#### Regulatory Fact: Clean Air Act Requirements

Some sources of fugitive emissions in the oil and natural gas sector are regulated by the EPA under the Clean Air Act (CAA) for Volatile Organic Compounds (VOCs) and Hazardous Air Pollutants (HAPs). These regulations do not cover GHG emissions. Other sources of fugitive emissions, such as landfills that exceed certain thresholds, are likewise subject to CAA regulations.

<sup>6</sup> Section 3: Energy, Table 3-10. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006*. (April 2008)

<sup>7</sup> Section 3: Energy, Tables 3-34 and 3-39. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006*. (April 2008)

<sup>8</sup> Major Methane Emissions Sources and Opportunities to Reduce Methane Emissions, U.S. EPA Natural Gas STAR Program, Basic Information. Available at: <http://www.epa.gov/gasstar/basic-information/index.html#sources>.

<sup>9</sup> "Discussion Paper for a Natural Gas Transmission and Distribution Greenhouse Gas Reporting Protocol" Final Draft Report. Prepared for the California Climate Action Registry and World Resources Institute by URS Corporation and the LEVON Group. (June 6, 2007)

<sup>10</sup> Natural Gas Systems, Section 3.7. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006*. (April 2008)

- The EPA also estimates methane emissions from the oil industry using emissions factors and activity factors for 64 different industry activities.<sup>11</sup>

First and foremost, maintaining the integrity of a cap relies upon a high level of measurement frequency and accuracy for the purposes of establishing an emissions baseline, setting levels of emissions reductions in relation to the baseline, and monitoring ongoing compliance with reduction targets. These requirements present a significant challenge to regulating oil and gas fugitive methane emissions under a cap. For example, it is widely recognized that the emission factors currently used to estimate oil and gas fugitive emissions for the U.S. inventory are outdated and require revision. In addition, these fugitive methane emissions derive from hundreds of thousands of disparate sources throughout the country. Using current data on these emissions to establish an accurate initial baseline is not only fraught with uncertainty, but significant costs would be required to develop an accurate emissions baseline and reduction targets commensurate with the level of precision expected of other capped entities.

For these reasons, independent climate policy analysts have recommended addressing oil and gas methane fugitives through an offset program rather than under a cap.<sup>12</sup> Allowing reductions of these emissions to serve as offsets would provide valuable benefits for energy consumers, industry, and regulators. Under an offset program, companies would have an incentive to invest in technology and develop projects in exchange for the ability to sell offset credits, thereby creating incentives for industry to proactively measure, monitor and verify emission reductions according to project-specific protocols where tools such as direct measurements can be employed. In addition, recognizing oil and gas fugitives as offsets would also provide benefits to local and national government agencies. Given the challenges of regulating emissions from hundreds of thousands of pieces of equipment under a cap, the burden placed on both industry and government would likely be quite high relative to the potential reduction benefits that would be achieved from wide-scale regulation.

In addition, oil and gas fugitive emissions can serve as an important source of offset credits. While oil and gas methane fugitives are a relatively small percentage of total U.S. GHG emissions, these emissions represent approximately 24% of the potential available supply of domestic methane-based offset credits,<sup>13</sup> and, could, under certain scenarios, represent between 13-15% of the projected total volume of domestic offsets allowed under an economy-wide climate change program<sup>14</sup>. Almost all federal climate change proposals introduced to date have been economy-wide in scope, meaning that the majority of the emissions in the U.S. would be regulated under a cap. Using the caps set forth under the Lieberman-Warner Climate Security Act of 2008 as an example, if the total volume of domestic offsets allowed was set at 15% of the cap in 2012, covered entities could use approximately 866 million tons of offsets. Yet, estimates of domestic offset supply from the project types generally recognized to offer immediate and permanent reductions (thus, excluding land-based sequestration) amount to only approximately 568 million tons of reduction potential<sup>15</sup>. In addition, because this figure only represents total potential and not reductions achievable, it is reasonable to expect that only a fraction of the potential reductions will be viable in the first years of a climate change program.

Given the demonstrated role that offsets have in minimizing program costs, there is a critical need to ensure there is an adequate supply of offset credits from domestic sources that represent permanent emission reductions. Recognizing oil and gas methane fugitives under an offset program will help to ensure that there is sufficient supply of domestic offsets that offer near-term, additional and permanent reductions, and valuable cost-containment relief to consumers and businesses.

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<sup>11</sup> Petroleum Systems, Section 3.8. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006*. (April 2008)

<sup>12</sup> Bluestein, Joel. "Coverage of Natural Gas Emissions and Flows Under a Greenhouse Gas Cap-and-Trade Program", Pew Center on Global Climate Change. (December 2008)

<sup>13</sup> The U.S. EPA in the *Inventory of U.S. Greenhouse Gas Emissions and Sinks (April 2008)* estimates that oil and gas methane fugitives generate approximately 130.9 million tons of CO<sub>2</sub>e annually, or, approximately 23.5% of the 555.3 million tons of CO<sub>2</sub>e generated from all methane sources per year in the U.S.

<sup>14</sup> Using Senate Bill 3036 as a basis, under a scenario where up to 15% of the cap can be met with domestic offset credits (866 million tons in 2012), 130.9 million tons of CO<sub>2</sub>e/year from oil and gas methane fugitives represents approximately 15.1% of total allowable offsets. Under different a scenario where a fixed amount of offsets of 1 billion tons is allowed, oil and gas methane fugitives represent approximately 13.1% of total allowable offsets.

<sup>15</sup> This figure represents total methane emissions from all sources in the U.S. Inventory, as well as SF<sub>6</sub> emissions from electrical transmission and distribution. This figure does not include land-based CO<sub>2</sub> sequestration potential or N<sub>2</sub>O emissions abatement from agricultural soil management.

## **Benefits of Oil and Gas Fugitive Offsets**

The characteristics of oil and gas fugitives, and the potential impact they could have on containing the costs of a climate change program suggest that the benefits of addressing these emissions as offsets will outweigh those of addressing them under a cap. These benefits, which extend directly to the environment, U.S. businesses and consumers, entities regulated under the cap, the government, and oil and gas companies, include:

### **Environmental Benefits**

- Under an offset program, companies have an ongoing incentive to maximize the level of emission reductions that can be achieved from a sector, thus producing the maximum benefit for the environment. This is particularly important with methane emissions, which have 21 times the global warming potential of carbon dioxide.

### **Consumer Benefits**

- A robust supply of offsets in a climate change program moderates compliance costs for regulated entities, and, therefore, energy consumers.
- Consumers avoid increases in energy prices which could result from oil and gas companies passing through the investment costs incurred to achieve reductions in fugitive methane emissions required by regulation.

### **Economic Benefits**

- Offsets promote private sector investment in emission reduction projects that stimulate demand for new technologies, and open up growth opportunities for companies with existing technologies that enable emission reductions.
- An offset market creates new jobs in service and product industries that design, finance, implement and administer projects.

### **Regulated Entity Benefits**

- Covered entities have access to a near-term source of high-quality offset credits that can be used to help cost-effectively meet a compliance obligation.
- Covered entities can source verifiable, permanent offset credits that have been generated from U.S.-based projects.
- Investments required to reduce emissions can be funded by private sector investors in the carbon market, rather than by the covered entities themselves.

### **Government Benefits**

- An offset program creates positive incentives for companies to invest in technology, develop projects, and proactively measure and verify emission reductions in a sector that would be difficult to regulate under a cap.
- A program administrator can stay focused on overseeing the large, material sources of emissions in the economy and avoid diverting limited resources necessary for monitoring and enforcement of smaller sources of emissions.
- The private sector is empowered to serve as a laboratory for developing new emission reduction project types.

### **Oil and Gas Company Benefits**

- Companies have a market incentive to invest in emission reduction projects that will generate offset credits that can be sold to other companies in the cap-and-trade system.

- Regulated companies avoid uncertainty associated with receiving approvals for cost-recovery for investments made to comply with a climate change program.
- Technology can be scaled to address both domestic and international markets as demand for offsets increases globally over time.

### **Removing Barriers to Action**

Despite the environmental and economic benefits of addressing fugitive methane emissions from the oil and gas sector as offsets, the treatment of these emissions under a future climate change program remains highly uncertain. This uncertainty has a chilling effect on the development of projects that could begin reducing emissions today, as companies struggle to determine the value of taking early action in light of risks associated with regulatory uncertainty. To provide more clarity for companies and foster investment in these important project types, fugitive methane emission reduction projects from the oil and gas sector should be included in a positive list of eligible offset project types within the framework of a federal climate change program, just as fugitives from mining, agriculture, and landfills have already been designated. The sooner the private sector can begin implementing these projects, the sooner the U.S. can begin to generate a supply of high-quality, domestically-sourced offset credits that will be accessible in the first several years of a climate change program. This will help lower the costs of reducing GHG emissions across the economy, and enable the U.S. to get an immediate start on achieving its national emission reduction goals.