White Paper
Recommendations to Address
Flaring Issues, Solutions and Technologies

FOR MORE INFORMATION
PLEASE CONTACT:

RICH HAUT
RHAUT@HARCRESEARCH.ORG
281.364.6053

TOM WILLIAMS
TWILLIAMS@LEIDLLC.COM
713.201.3866

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Development of Useful Tools Designed to Monetize Stranded Gas

As emerging regulations related to the flaring of associated gas during the production of oil wells across the country continue to influence operations, the oil and gas industry operators are faced with potentially having to install and utilize equipment aimed at the reduction of emissions from natural gas flaring. While natural gas flaring is seen as a considerably less polluting alternative to venting methane directly into the atmosphere, new rules slated to go into effect from states and the EPA this year will ultimately force operators to find an alternative to the flaring of natural gas.

The process dubbed 'green completion' or 'reduced emissions completions (REC)' promotes the use of stranded gas at the well site or nearby communities by use of various technologies available in the marketplace. For most operators, however, evaluating these technologies, reviewing alternatives and selecting the correct one for that particular region can be a daunting task.

The Environmentally Friendly Drilling Systems (EFD) Program, managed by the Houston Advanced Research Center (HARC), teamed up with the Petroleum Technology Transfer Council (PTTC) and initiated a research effort to address the issue of gas flaring and stranded gas by utilizing existing novel technologies aimed at monetizing gas at the wellhead. Recognizing the aforementioned emerging regulations as well as the economic benefits of capturing flare gas, the overall objective of the Flaring Issues, Solutions and Technologies (FIST) project is to develop and demonstrate technologies specifically designed to utilize stranded gas and even reduce or eliminate the need to flare emissions associated with oil production. In other words HARC and PTTC hope to help operators make money from their stranded gas while conforming to new EPA rules.

As the FIST initiative evolved, it became clear the issues associated with gas flaring vary across regions, are more pressing than anticipated, with complex regulatory, economic and infrastructure issues. This study enabled us to identify a number of technical and potentially economic solutions that need to be further investigated and demonstrated.

RECOMMENDATIONS

Based on information gathered to date, it is recommended that the following items be reviewed and potentially investigated further.

- Infrastructure is a key issue and is a major critical path item. Efforts need to be directed to enable early installation of infrastructure (gathering lines, power lines, etc.). Options should be investigated concerning how operators and regulators may be proactive in order to develop a fast track/streamline process. In addition, infrastructure regulations vary by region, there is a need for process to exchange ideas and practices between policy makers.

- To address various flaring aspects, states need to make it a priority goal, and some have. Regulatory bodies within a state will need to work together, including: oil and gas commissions, department of natural resources, environmental agencies, public utility and commissions where regulations and regulatory issues on forming co-ops need to be addressed. The IOGCC is in an excellent position to lead this effort. Specific items that these task groups need to consider are:

- Address barriers to access gathering and power lines. (These could be state or local specific.)
- Emission/Air Quality Credits
- Financial incentives from states to offset their investment in new solutions. (This should be temporary.)

- Demonstration of technologies need to be performed to enable economics of various options to be determined. Multiple options need to be investigated to handle the regional variations that exist.

- To assist operating companies in risk management and the decision making process, further work should be undertaken to develop a decision management system to screen technologies related to mitigating flaring. This should include:
  - Evaluation of technologies that mitigate flaring including:
    - Transformation off stranded gases into salable products
    - Reduction of emissions in a cost effective manner
    - Determination of how technologies and processes could further reduce the need to import hydrocarbon commodities
  - Analysis of field results of selected technologies that producers may use to mitigate flaring, including emissions measurement
  - Providing useful compilation information and data for operators, regulators and landowners.
  - Determining how GIS technologies may be used to provide a tool for infrastructure decision tool and development plan. This could be a part of the EFD Land Use Site Selection Information Technology (LUSSIT) tool.
  - Expansion/re-organization of the EFD Best Management Practices site to include best available technologies on a regional basis.

PROBLEM IDENTIFICATION

The FIST project was planned to be conducted in phases. Phase 1 of the project began with seeking information from oil and gas operators working in various regions to better understand their specific needs and the potential impact of emerging regulations. Specifically phase one looked at gas quality, quantity, current amount gas being flared and wells currently shut for lack of sufficient infrastructure, proximity to infrastructure such as power lines, roads and liquid pipe lines, and regional regulatory barriers to name a few.

This paper outlines the findings of problem identification workshops held in key flaring markets in the lower 48 states, a thorough literature search and an industry survey. This information will be used to aid in the development of a screening tool prototype that can be used to begin the evaluation of flaring of existing flaring technologies. A Technical Readiness Level (TRL) Assessment on each technology identified will be conducted.

Phase 2 objectives include documenting selection criteria, selecting field test sites and developing a detailed planning for phases 3 and 4. Phase 3 will include detailed engineering and design for field demonstrations as selected by partnering companies. Phase 4 will include field trials, documentation and the continuation of the program to maintain the web site, additional field testing, and training.

During Phase 1, some technologies immediately emerged that were already available for implementation or could be adapted for use. Other technologies were identified that are also currently being progressed. Two technologies were identified that the EFD Program began performing case studies on:

- Using flare gas to generate heat for an organic Rankine cycle to generate electricity
- Using a gas process system to generate compressed natural gas (CNG) that can be transported to other sites for use

IDENTIFYING THE ISSUES

Each problem identification workshop was conducted in similar fashion beginning with opening remarks aimed at introducing the topic, operator question and answer where operators shared their specific issues related to flaring, industry presentations aimed at the evaluation of existing technologies, and regulatory presentations.

Houston, Texas: The first problem identification workshop was held in Houston and began with Dr. Rich Haut from EFD presenting an overview of the topic of using novel technologies to monetize gas at the wellhead. Following his remarks Dr. Haut led an operator discussion aimed at identifying the specific needs of the operators in the room. After this discussion John Westerheid, General Manager: Unconventional Resources Vertical for GE discussed, Gas Monetization Networks. Then Audrey Mascarenhas, President and CEO of Questor Technologies discussed their work in combustion, heat recovery, and power generation. Finally Rob Stewart from Bingo Interests discussed how Bingo approaches the issue of flaring.

Morgantown, West Virginia: Later the same month the next problem identification workshop was held in Morgantown West Virginia. As with the Houston event the day began with a presentation from Rich Haut highlighting the issues for the group immediately followed by a question and answer session led by Dr. Haut. Following the Problem identification workshop Audrey Mascarenhas from Questor Technology discussed revisited here discussion from Houston. Don Moss from Wellhead Energy Systems discussed Bill Pollock, Managing Partner at NEOgas North America, Inc. discussed options in the field for converting flare gas to alternate energy sources. Dr Mike McCawley from the WVU Department of Occupational and Environmental Health Sciences discussed Direct-Reading Monitoring of Horizontal Gas Well Flaring Operations. Finally the day concluded with a panel discussion with Robert Keatley from the West Virginia DEP, Scott Kell, OH DNR and Marvin Combs from the KY DNR.

Denver, Colorado: In October the group conducted its third problem identification workshop in Denver. Once again opening remarks were made by Rich Haut who once again provided an overview of the program followed by the question and answer session. After Dr. Haut Gary Kaufman from Holland and Hart discussed Colorado and North Dakota Air Regulations. Later that day Audrey Mascarenhas from Questor Technology revisited her presentation for the Colorado audience after which John Fox from ElectraTherm discussed Unconventional Flare to Power. Finally, Jakob Norman from Mesa Natural Gas Solutions LLC discussed Natural Gas-powered engines.

San Antonio, February 2015: Rich Haut, presented an EFD program overview and workshop results; Beth Everage, Consumer Energy Alliance, how states have responded to citizen concerns about air quality due to federals lack of effort; Hemant Mallya, ICF, Lifecycle of a Flare Gas Recovery Project discussed decision making process in implementing a flare recovery project; Brian R. Cebull – Innovative Flare Capture Solutions, GTUIT a market leader in flare gas capture in North Dakota; Richard Roby – LPP Combustion, LLC Enabling the use of electric power for oil and gas sites from flare gas and NGL's; Toby King – BINGO Interests, Optimizing Natural Gas Fueling Solutions; Susan Stuver TAMU IRNR, – Advanced Methods for Open Path FTIR Technology; Lee Clapp, TAMU Kingsville, Evaluate a wireless sensor network for monitoring composite ambient air; Bill Wren UT McDonald Observatory; Flaring and Drilling boom in Permian is having an impact on the Observatory due to light pollution; Panel Discussion – Community & Landowner Issues - Peter Bella (Environmental and Public Interest Consulting), Monty Dozier (Texas A&M University AgriLife Extension), Hugh Fitzsimons (Shape Ranch), Colin Leyden (Environmental Defense Fund), John McFarland (Graves Dougherty Hearon & Moody).

Industry Survey, April 2015 – 62 responses. Survey results from operators, service providers and consultants with operations throughout the US.

The EFD Program team also participated in a number of meetings across the US that focused on expanding the use of natural gas. Findings and recommendations from presenters are included in this report.

Flared Gas Data

Since 2010, the amount of gas flared in the US has increased by nearly 60% and was last reported by the EIA in 2013 to be roughly 260 billion cubic feet per year. This growth has primarily come from North Dakota, Texas, and Wyoming, the three biggest contributors to flaring. All three states have experienced massive growth in oil-rich shale developments in the past 5 years. With the price of oil hitting heights of over $100, natural gas gathering, transporting, and processing has not been a priority for some of the industry.

This is becoming not only an environmental concern but also a concern over the waste of a natural resource. North Dakota's lack of infrastructure has led an almost 400% increase in the amount of flared gas since its boom nearly 5 years ago. Using EIAs 2012 reported amount of roughly 80 billion cubic feet of natural gas flared in North Dakota, that amount equates to around 81 trillion Btu's of potential energy. When you compare that to what the state consumed in energy in the same year for residential use, 64 trillion Btu's, it becomes evident that a significant amount of potentially clean burning energy is being wasted.

	Total Flared Gas (MMcft)		Total Produced Gas (MMcft)	
	2010	2013	2010	2013
Total US	165,928	260,394	26,816,085	30,005,254
North Dakota	24,582	102,855	113,867	347,787
Texas	39,569	76,113	7,565,123	8,211,255
Wyoming	42,101	34,622	2,514,657	2,047,757
Other States	59,676	46,804	16,622,438	19,398,455

Before the shale boom in the US, 0.7% of the produced natural gas was flared in the entire US. In 2013, the percentage increased to 1.01%. Approximately 0.8% is flared in Texas and 1.2% in Wyoming. Economically, this is a significant amount. 1.01% of the total produced gas is roughly 260,000 million cubic feet. Based off of varying market prices, this flared gas could potentially equate to hundreds of millions to a couple billion dollars' worth of revenue per year.

Key Findings

Throughout the workshops, meetings, survey and other information gathering methods, various themes emerged with the highest priority being:

1. Infrastructure – the lack thereof, the need for gathering lines, pipelines, power lines, and other near to well markets.
2. Communication – need for various regulatory agencies (environmental, natural resources, utilities) to communicate as well as the need for various organizations within an operating company to fully collaborate (production, drilling/completion, gas sales, etc.)
3. Technology – need to further identify, develop and demonstrate technologies on a regional basis

The following is a list of key findings from the workshops, survey and other efforts:

- In Denver participating operators discussed the fact that wellhead gas is inconsistent in its composition and therefor in its BTU delivery.
- Dealing with the liquids is very expensive when thinking about transportation, stability and price.
- Dual fuel engines that are being used to power drilling rigs can use CNG, but they still need diesel because of variation in the load on the engines.
- For significant horsepower needs, operators still need diesel, the CNG does not deliver the necessary power.
- It takes a lot of processing to remove impurities and raise the volume of gas to the correct pressure of 3600 psi for transport and once at the wellhead the pressure has to be reduced to go into the engine.
- Operators state that Bakken's #1 problem is gas supply because of significant pressure drop in the system when gas processing plants are put in the gathering system.
- LNG will be very important but it is much more expensive to make the economics favorable need to build a big plant and have cooperation from multiple producers.
- Multi-well drilling and production pads are advantageous because gas produced from one well can be converted to CNG and used for drilling successive wells. The CNG can also be used for heating facilities and frac fluid.
- Designing the gathering lines to include new technologies in an effective way is a possible area for technological advance.
- Another problem with many of the shale oil plays is the rapid increase and decline in gas volume over time. This makes it more difficult to plan and utilize a supply of gas that is ephemeral in nature.
- Royalty issues are becoming a big deal. If you produce and use on the same site that is provided for in most leases, but if you use the gas from one lease to help drill the well on a separate lease then you have a problem. A royalty payment may be required.

    - Who is responsible to pay, the company producing the oil and associated gas, the company using the gas to create the CNG and transport to next site? Laws have not caught up with the variety of situations that are being encountered.
    - Continental is avoiding the problem in the Bakken by paying full royalties on everything being produced including gas that is flared.
- Need for modeling software to deal with multiple wells with flow variations and variations in consumer requirements.
- Need a steady stream of production.
- Need to find ways to deal with slugs of liquids (water and hydrocarbons).
- On public and federal lands there is a long process to get approval for flaring gas. Government is royalty holder. For these reasons companies don't want to be involved with federal land.
- Distance from infrastructure – distance and capacity of pipelines, pressure requirements at the pipeline. Hydrocarbon liquids are a real problem. There is currently a glut, pipelines are full and trucking the liquids is expensive.
- Distinguishing the type of liquid can be critical. Condensates produced from gas wells can be sold outside of the country because the prohibitions on selling oil products do not apply.
- CO_2 regulation by EPA is important. CO_2 is a byproduct of methane burn.
- Aggregate facilities and save money – create coops. These are difficult to negotiate between companies, but could ultimately create the economy of scale to make some of these technologies work for smaller companies.
- Distance between pad producing energy and pad needing energy. Once again reducing this distance through pad drilling can be critical.
- Permitting new technologies - the EPA likes know technologies and tend to be very slow to approve new technology.
- Fugitive emissions: There was some conflicting discussion of what FLIR guns (infrared cameras) are showing around wellsite tanks. Discussion that FLIR guns are actually showing VOCs not methane.
- Uses for the methane: heat, cool, water vaporization, lighten hydrocarbons. Use the heat produced from flare gas to vaporize waste water to avoid injection or heat fluids for hydraulic fracturing.
- Issues surrounding variations in gas production related to rapid decline. Economic factors make it less feasible to build significant gas gathering lines if production is going to drop. Once again having multi-well pads can mitigate these costs.
- At the session at WVU operators point was that drilling either under-balanced (as has been the common practice in the vertical section) or over-balanced will affect the volume of gas going through the flare. This can be controlled somewhat by managed-pressure drilling.
- One participating company operates 60-70% with field gas or LNG; the goal is to have no diesel on site.
- The cost of conversion to LNG and to winterize the equipment were factors to be considered.
- The change in engine technology, with more dual-fuel options, has been beneficial.
- Regarding the source of field gas used as on-pad fuel was addressed by the operator working with both high- and low-pressure gathering systems, so they can gather and compress flare gas on-site with a mobile unit, use what they need and sell remaining product, or put it in line with produced gas for sale.
- Al Yost (NETL) offered additional comments on "energy assist" in which 20-30% of the water is replaced by natural gas.

- Gas turbines generate electricity for the frac pumps. Again, the goal is to eliminate diesel engines on the frac trucks.
- Initially, water flows back but as the volume of water decreases and gas flow increases, a decision point is reached that flaring is necessary. The second decision point is reached when gas goes into the line and flaring is stopped.
- In regard to pressure that is too high to complete their program limiting pressure to 80% of burst pressure, using a bigger wellhead, or running an oscillation sleeve could provide positive results.
- The electricity is regulated in PA, but not in WV, so it is easier to get electricity onto the grid in PA, is harder in WV.
    - More importantly, the low cost of electricity produced by coal-fired power plants results in a lower market price for any electricity generated on-site for sale.
    - This drastically effects the economics on on-site production of electricity for sale versus on-site use.
- Dealing with the liquids is very expensive when thinking about transportation, stability and price.
- Variability of gas quality and volumes
- Major barriers to electrification of gas
- For significant horsepower needs, operators still need diesel, the CNG does not deliver the necessary power
- Multi-well drilling and production pads are advantageous because gas produced from one well can be converted to CNG and used for drilling successive wells; or generate power to supplement operations.
- Need a steady stream of production.
- Need for modeling software to deal with multiple wells with flow variations and variations in consumer requirements.
- Gas prices and excess of NGL price has made it more difficult to make NGL process a no cost to the operator. Penalties in N Dakota for flaring provide cost incentives.
- Challenges for right sizing and cost recovery are the result of rapid gas rate declines, variability to BTU and liquid variability and non-steady flow rates. Led to small modular designs.
- Systems being developed with variable sizes of power generation options from 60 KW for on-site power to 40 MW from fracturing operations.
- Using gas from flaring for powering dual fuel engines has several challenges: inadequate supply for drilling, no infrastructure, variability of gas quality, issues of gas slippage when used in in the engines. A need for emissions control systems.
- Drilling boom in Permian is having an impact on light pollution. Night sky is being lit up with oil and gas industry activity. More focused lighting is needed and more efficient, the better it is for night sky.
- Issue with using a 'temporary' solution for a permanent problem.
- Implementing a mini grid that grows as an asset is developed could be a solution but dealing with forming a co-op, leases and land owners make it difficult.
- Pipelines charge operators more for accepting field gas.
- Power purchase pricing and access must be fair and allow this as a cost effective option
- Perspective: Give pipeline owners incentives to accept field gas. Give companies payback options for flare capturing technologies
- Incorporate incinerator technology to maximize gas combustion during flaring when required or is necessary.

- We need to use low oil prices as the perfect opportunity for developing science and get ahead of the curve before EPA comes out with methane rules. We need to inform EPA of the best management practices after thorough research and be proactive. Gave a classic example of how land owners need to wait for pipeline to get built before agreeing to give permit to drillers.
- The current NSPS QuadO is a regulatory tool that results in reduced flaring. Ease of pipeline installation would improve infrastructure which would increase natural gas production and provide a mechanism for reducing flaring. Since natural gas has a smaller CO_2 footprint than other fossil fuels, that would increase the use of NG.
- The issue is not incentives for the operators but to have incentives for local infrastructure to build systems to gather this scattered flare gas. Natural gas pipelines are not the answer here what is needed is new innovative ideas, have local electrical co-ops buy back electricity or create local co-ops to gather isolated gas and process into some liquid form that is easier to transport than natural gas (CNG or LNG)

TECHNOLOGIES

Along with identifying the key issues associated to flare gas mitigation, the initial stage includes gathering a list of potential solution providers for flare gas mitigation. At this point, 44 companies have been identified to provide some level of technology to address these issues. This list contains technologies that are covering the spectrum in terms of technical readiness level.

There are companies, like GE, that are providing solutions that are already in the commercial phase and being used at the wellsite, while there are others that are only in the concept phase and everything in between. Determining what level the technologies is at is important for operators to understand how much investment if will take to bring it to field operations.

This demand for flare mitigation, through environmental concerns and looming regulations, is increasing. With this increased demand, entrepreneurs and inventors are discovering novel ways to handle it through the use of different technologies and methods. Some of this technology has been built from the ground up while others are bringing technology currently used in different sectors and industries to solve this problem. Gulf Coast Green Energy, Pioneer Energy, and Wellhead Energy Systems are a few companies that are providing unique methods to handle gas flaring.

- Gulf Coast Green Energy is a distributer for ElectraTherm's power generator known as the Power Plus. This generator uses waste heat from natural gas to provide onsite power. The Power Plus utilizes a closed-loop organic rankine cycle to boil working fluids into gas. This technology has been used to create energy from hot springs, biomass, landfills, and others. Gulf Coast Green Energy sees its potential in the oil and gas industry to minimize flare gas and is currently setting up a field trail to test its application in the Bakken.

- Pioneer Energy has developed a mobile platform that that can go into a well site and separate natural field gas into methane and NGLs. This system is called the Mobile Alkane Gas Separator System (MAGS). The methane is used to generate onsite power while the NGL's can be sold to market. MAGS is a mobile platform that sits on one 40 foot trailer and comprises of four unit operations; Compression, Dehydration, Refrigeration, and

Separation. With this system, lean methane, residue gas (to generate onboard power for the MAGS system), and Y-Grade Liquids can be separated and distributed as needed.

- Wellhead Energy Systems has developed a platform, GridFox, to convert stranded natural gas into electricity that can been used onsite or sold to the electrical grid. While GridFox was developed for stranded gas wells, it can be implemented at a wellsite during and after drilling activities to capture separated natural gas that otherwise would have been flared. This is a proven technology and currently in use across the US.

- LPP Combustion, in late 2014, demonstrated their new technology at the North Dakota State University's campus. LPPs, which stands for Lean, Premixed & Prevaporized, technology uses untreated natural gas from the well-head for electric power generation. They have developed a unit that consists of a gas turbine and skid-mounted fuel conditioning system. This fuel conditioning system takes the flared gas and vaporizes and blends it with nitrogen to create gas that's burned efficiently in a turbine to generate electricity. The unit demonstrated in North Dakota powered a 30 kilowatt electrical generator, however generators up to 30 MW could be used.

Other technology and uses include

- Removing CO_2 out of the natural gas to be re-injected for EOR purposes
- Gas-to-liquids process though the use of SMR and Fischer-Tropsch to create synthetic crude, Ethanol, Methanol, and/or Formalin.
- Using flare gas to produce Nitrogen Fertilizer
- Turbines to produce electricity
- Installing temporary gathering lines or converting gas to CNG or LNG to power drilling and hydraulic fracturing operations.

Various data is being collected for every technology that minimizes natural gas flaring. This is being done with the intention of screening technology by the well operators' needs and restrictions found at the wellsite. This data is split into three main groups, Production factors, Gas factors, and Applications listed in more detail below. This list of data also takes into account the TRL of the solution; is it in concept phase, field trial phase, or commercial use.

Production Factors

- End Product – What will be produced (electricity, liquids, CO_2.)
- Production Rates – What produced gas rates will the technology handle, what rates will the technology produce the end product at.

Gas Factors

- Gas Treatment – Is gas required to be treated, who treats the gas?
- Gas Composition Tolerance
- Compliance with environmental regulations?

Applications

- Use – What will technology be used for? (Power onsite equipment, sell electricity to grid, produce liquids for sell)
- Currently Used/Technical Readiness – Is the technology being used? Has it been through a field trial or tested at any level?

- States/Regions of Operations – Onshore, Offshore, US only, International, Extreme Weather…
- Additional Support Required – Who provides maintenance, general care, and monitoring?
- Economics – Capital and Operations Costs

Additional Notes

- Permitting, Reliability, Gas Supply, Efficiency of Process, Total Life Cycle

Company	BluBox Energy	Pioneer Energy	GridFox	Recapture Solutions
Production Rates	250 KW for one Unit, It is scalable with more units	Can produce 10,800 kWh/Day and 1,700 gal/Day	Anywhere from 500kW to 2MW per unit, depends on needs	Can create 50kw - 400kw, able to add larger units though
Products	Electricity, either for on site power or sell to grid	Electricity, liquids	Electricity	Electricity, liquids
Distance to Infrastructure	Quarter Mile would be Ideal	N/A, electricity produces is meant for drilling or production operations	Close, only if producing electricity to sell to grid	Close, only if producing electricity to sell to grid
Gas Treatment	Only been tested on wet gas, will accommodate for H_2S	Very flexible, will install gas treatment if necessary.	Gas needs to be treated before entering. Gridfox can be outfitted with a treater	Will install treatment technology as needed
Composition Tolerance	Will adjust to any tolerance	?	N/A	?
Use	Zero Emission, eliminate flare, produce electricity for onsite or sell	Each unit can process over 200,000 scf/day of gas. The unit will simultaneously produce liquids for sale and electricity for on site power	Will produce 3 phase electricity at 480 Volts with 24/7 base load operation. Can be used to power site, provide back up power, or sale to grid	Electrical power to either sell to grid or power production equipment. Can also purchase flare to strip liquids out of and sell
Technology Currently Used?	2 Units have been build, sort of tested	Still in test phase	They attempted a test run by drilling their own well, the well did not produce required production rates. Still looking for a pilot well.	Yes, mostly located in Texas
Where can It be used?	Current Operations are in Colorado, willing to expand anywhere	Meant to be mobile, installed in a shipping container and can be transported by truck anywhere.	Anywhere in the US	Texas for now, willing to expand
States/Regions of Operations	Mainly Colorado	Across the US	Across the US	Texas
Additional Support required?	They handle all support and maintenance , computer monitored	Additional support is provided by Pioneer either remotely or onsite	Provide by them	No, Recapture will handle everything.
Additional Notes	Units are small compared to others, transported by pickup to remote locations. 43 MCF is required to operate. Power companies like the idea of these. Caterpillar Generator	Is looking for a pilot well to test technology. Technology has been highly published	Appear to be more in the business of selling power to the grid.	They offer two services; natural gas power generation and flare gas purchasing.

FLARING AND THE INTERMOUNTAIN OIL AND GAS BMP PROJECT

The Intermountain Oil and Gas BMP Project (http://www.oilandgasbmps.org/index.php) includes several sources of information on flaring including:

- Background information on the Air Quality resource page;
- BMPs and resource documents catalogued in searchable databases; and
- Regulations catalogued in the searchable LawAtlas database (http://lawatlas.org/query?dataset=air-quality-with-oil-and-gas-development&id=54f89f99d42e07f4414d07ba).

Air Quality Resource Page

(http://www.oilandgasbmps.org/resources/air_quality.php)
The project's Air Quality resource page provides the reader brief, general information on flaring and additional links to more detailed articles, website and reports related to flaring. The page also provides information on other air quality issues regarding oil and gas development, including air quality standards and monitoring, new technologies for reducing air emissions, and information on on-going air quality studies.

BMP and Bibliographic Databases

The project's BMP Database is an on-line searchable database addressing surface resources affected by oil and gas development. The database includes both mandatory and voluntary BMPs currently in use or recommended for responsible resource management in the states of Colorado, Montana, New Mexico, Utah, and Wyoming. The BMP database is not intended to represent a consensus on what the best practices are for specific applications nor to advise users on the current legal requirements for specific locations. Rather, the database describes each practice and documents the source of the practice (who requires or recommends it in what specific applications).

A search of the BMP database (http://www.oilandgasbmps.org/bmpadvsearch.php) for flaring information (using "flare?" and "flare*", "Match any") yields a search result with 30 relevant records (BMPs) from 12 source documents, including a journal article, BMP handbooks, and environmental impact statements. (For the search result, go to: (http://www.oilandgasbmps.org/bmpadvsearch.php?mode=2&kw=flare%3F+flare*&match=any&cat%5B%5D=0&spec%5B%5D=0&loc%5B%5D=0&field%5B%5D=0&timing%5B%5D=0&disp%5B%5D=id&disp%5B%5D=title&disp%5B%5D=text&disp%5B%5D=pubName&citextra=1&showdocs=1&sortby=pubName&sortby2=locationName)) Authors of the source documents include federal government agencies (Bureau of Land Management, the Environmental Protection Agency, and the U.S. Fish and Wildlife Service), state representatives (the Western Governors' Association, New Mexico and IOGCC), and advocacy groups (Earthwork's Oil and Gas Accountability Project and the Energy and Biodiversity Initiative). Each of the source documents for BMPs and other documents provided on the Air Quality Resource page are catalogued in the project's searchable bibliography (http://www.oilandgasbmps.org/bibliosearch.php). Electronic copies (.pdfs) of the documents are accessible through links from a BMP search or through a direct search of the bibliography.

LawAtlas Database

Within the Intermountain BMP Project, the LawAtlas project provides a searchable, comparative law database for oil and gas development (http://lawatlas.org/oilandgas). The database is part of Public Health Law Research's online portal exploring variations in laws relating to current public health issues nationwide. The air quality component of the oil and gas database

(http://lawatlas.org/query?dataset=air-quality-with-oil-and-gas-development&id=54f89f99d42e07f4414d07ba) compares the air quality regulations of 12 states and includes several questions related to flaring, including requirements for continuous ignition source or auto-igniter flares, permitting requirements, and royalty requirements.

FOR MORE INFORMATION

http://efdsystems.org/index.php/

http://efdsystems.org/index.php/pbng/

http://efdsystems.org/index.php/fist

http://www.oilandgasbmps.org/

http://www.oilandgasbmps.org/resources/air_quality.php

http://lawatlas.org/query?dataset=air-quality-with-oil-and-gas-development&id=54f89f99d42e07f4414d07ba