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Positive Economic Effects Associated with Hydraulic Fracturing

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Introduction

Hydraulic fracturing is currently occurring in many towns across the United States, and the natural gas obtained from hydraulic fracturing is helping to make the U.S. self-sufficient in terms of energy. Becoming self-sufficient for energy allows the U.S. to spend less money because of decreased importing expenses, and not relying on other countries as energy sources provides the U.S. with more internal stability. Natural gas companies also pay the government money in taxes. All of these are positive economic aspects that benefit the country.

This paper examines economic effects and how they relate to controversial aspects of hydraulic fracturing. One controversy addressed in this paper is whether the U.S. has enough natural gas for it to be a long-term solution. Another controversy looked into is whether the natural gas companies are paying the government a fair amount of money in taxes.

Hydraulic fracturing is a national topic that affects the entire nation's economy. Although state and local issues are present, debates of whether the U.S. should export gas is a national topic. Everybody should be aware of the controversy and issues before making a decision about this complex topic.

Background and Overview

Looking into the positive effects is important in making a fair judgment about an issue. Hydraulic fracturing does have some negative side effects that will be discussed in other papers, but the U.S. obtaining its own natural gas also has many benefits. Economic factors are also longer lasting than environmental factors because companies can easily change environmental factors by ceasing to use harmful chemicals, but cannot easily change industry-wide economic factors. Nationwide economic issues will always be an important part of hydraulic fracturing.

This paper will discuss the economic impact of hydraulic fracturing on the United States, including the number of jobs created by the industry, taxes being paid by these companies, and amount of gas profits currently being made. It will draw conclusions about the economic impacts of hydraulic fracturing, and evaluate whether more natural gas companies will help the U.S., and whether current regulations are good for the country.

Hydraulic fracturing companies also pay the individual landowners to lease their land, and pay the state government money, which in some states gets handed to the affected towns. These points are all examples of short-term economic effects on towns and states. People often neglect to think about the larger picture.

Many of the problems people currently have with the natural gas industry are the short-term economic effects and the negative environmental effects. Natural gas companies tend to come into towns with many people leading to a booming economy, then leave and cause the town to “bust.” These are the simplest problems to fix. To make an educated decision as to whether an increase in natural gas extraction and natural gas companies should occur, one must look at long-term effects and decide the potential benefits of hydraulic fracturing.

Jobs

One of the most important economic indicators of a new industry is the number of jobs created. Growth in an industry is also an important factor because it is indicative of long-term potential in the new industry. According to a 2009 report, *The Contributions of the Natural Gas Industry to the U.S. National and State Economies*, the U.S. has had a significant increase in the number of natural gas workers between 2006 and 2008. As seen below in Figure 1, the number of natural gas workers in 2006 was 517,233 workers, and that number steadily increased to 622,412 workers in 2008. This information was the most recent data at the time of this report’s release. The positive trend in the number of employees shows that the natural gas industry is capable of growing, and that when the industry grows new job opportunities become available. (1)

Figure 1: This figure shows the number of job Direct Natural Gas-Related Employment by Industrial Category, U.S. Totals

(Annual average workers)

	2006	2007	2008
<i>Natural gas extraction</i>	89,683	99,504	112,064
<i>Drilling and support activities for natural gas operations</i>	148,598	185,514	192,961
<i>Natural gas distribution</i>	115,170	114,941	115,853
<i>Natural gas pipeline construction</i>	56,794	66,137	75,558
<i>Manufacture of field machinery/equipment for natural gas operations</i>	33,794	38,642	41,452
<i>Site preparation services for natural gas operations</i>	25,993	33,329	35,349
<i>Pipeline transportation of natural gas (includes storage)</i>	27,685	27,431	27,078
<i>Geophysical services for natural gas operations</i>	6,108	6,847	7,365
<i>Building/repairing offshore platforms used in natural gas operations</i>	5,111	5,624	5,845
<i>Natural gas liquid extraction</i>	4,670	4,842	5,179
<i>Manufacture of compressors used in natural gas lines</i>	2,196	2,226	2,229
<i>Manufacture of pumps used in natural gas wells</i>	1,431	1,465	1,480
Total Direct Jobs	517,233	586,502	622,412

Note: Italics indicate estimates by IHS Global Insight

Figure 1: This figure shows the number of jobs in different sectors of the natural gas industry by year for the years 2006, 2007, and 2008. The years are split into 13 separate categories of jobs. The number of total workers increased over the three-year period, and the number of workers in almost every category increased as well. HIS Global Insight (Sept. 2009). Retrieved from: <http://www.anga.us/>

The information from Figure 1 only describes the workers classified as “direct workers.” Indirect workers are people who work in industries reliant on the natural gas industry. The number of indirect workers from 2006 to 2008 is also accounted for in this report, and is shown to also be steadily increasing. In 2006, 620,078 indirect workers were reported, but 2008 had 723,121 indirect workers, an increase of over 100,000 workers. A third category called induced jobs was also summarized in this report. Induced jobs, which are jobs created by the money that indirect employees spend, showed an increase from 1,282,267 workers in 2006 to 1,482,818 workers in 2008. Although these jobs are not directly related to the natural gas industry, induced jobs still illustrate the positive economic impact of the natural gas industry on employment, and the upward trend in number of jobs due to natural gas companies. From these data, the number of jobs created from the natural gas industry was estimated to be around 3 million in 2008. (1)

President Obama has talked about the number of jobs hydraulic fracturing will create. He stated by the end of this decade, the number of drilling jobs created by the natural gas industry could be greater than 600,000 (2). The number used by Obama is supported and called a realistic estimation by other experts. This number shows that though the last report is slightly dated, the number of jobs created by the natural gas industry is still increasing. Also Obama’s estimate only includes part of the direct category, and does not include the indirect or induced categories from the 2009 report. Overall, the number of natural gas workers is steadily increasing and creating a new job market.

Taxes

Another economic consideration is how much money the federal government is making from the natural gas industry, and tax regulations or tax deductions involved in hydraulic fracturing. Taxes and tax deductions are important because they are a direct indicator of the economic effect of hydraulic fracturing on the government.

A recent report titled, *America’s New Energy Future: the Unconventional Oil and Gas Revolution and the U.S. Economy, Volume 3*, examined the amount of money paid by natural gas companies in taxes, and projections for future taxes. A chart from this report is in Figure 2. According to the report, in 2012, the industry paid over \$63 million in taxes to the government. This figure includes both the state and federal governments. That number is expected to increase significantly as the natural gas industry becomes larger and its profits increase. Projections show that by 2025 the amount of money paid by the industry in taxes is expected to double. The report also shows that between 2012 and 2025, the amount of money paid to the government by natural gas companies alone is expected to surpass \$1.4 trillion. This estimate only includes the natural gas companies themselves, and does not include taxes paid by industries related to hydraulic fracturing or the taxes workers pay. Industries related to hydraulic fracturing are expected to contribute over \$200

million in taxes, making the total amount of taxes from natural gas and related industries over \$1.6 trillion by 2025. (3)

Contribution to US Lower 48 Government Revenue due to the Unconventional Activity Value Chain: Base Case*					
(2012 \$M)					
	2012	2015	2020	2025	2012-25**
Upstream Energy Activity***					
Federal Taxes	28,903	42,132	50,167	55,620	644,286
Federal Royalty Payments	1,964	2,639	3,204	2,994	39,664
Federal Bonus Payments	148	167	150	138	2,139
State and Local Taxes	22,610	33,563	39,996	44,114	512,184
Severance Taxes	5,450	8,657	11,769	13,232	143,935
Ad Valorem Taxes	2,795	4,251	5,825	6,338	70,707
State Royalty Payments	715	1,050	1,359	1,443	16,767
State Bonus Payments	430	499	472	457	6,613
Total Government Revenue	63,015	92,957	112,943	124,335	1,436,294
Lease Payments to Private Landowners	504	712	915	1,103	11,696
Midstream and Downstream Energy Activity					
Federal Taxes	5,712	4,068	1,297	996	37,551
State and Local Taxes	4,038	2,771	871	669	25,582
Total Government Revenue	9,750	6,837	2,168	1,665	63,133
Energy-Related Chemicals Activity					
Federal Taxes	963	2,829	6,238	7,414	68,859
State and Local Taxes	695	1,928	4,191	4,981	46,350
Total Government Revenue	1,677	4,757	10,429	12,395	115,209
Total Activity					
Federal Taxes	35,598	49,026	57,702	64,030	750,696
Federal Royalty Payments	1,964	2,639	3,204	2,994	39,664
Federal Bonus Payments	148	167	150	138	2,139
State and Local Taxes	27,342	38,262	45,058	49,764	584,115
Severance Taxes	5,450	8,657	11,769	13,232	143,935
Ad Valorem Taxes	2,795	4,251	5,825	6,338	70,707
State Royalty Payments	715	1,050	1,359	1,443	16,767
State Bonus Payments	430	499	472	457	6,613
Total Government Revenue	74,443	104,551	125,540	138,395	1,614,636
Lease Payments to Private Landowners	504	712	915	1,103	11,696

Figure 2: This figure shows how much money natural gas companies paid the government in taxes during 2012, as well as projections for 2015, 2020, 2025 and 2012-2025. The amount of taxes paid by industries directly related to hydraulic fracturing is also shown. HIS Global Insight (Sept. 2009). Retrieved from: <http://www.anga.us/>

One controversial tax deduction in hydraulic fracturing is Intangible Drilling Costs (IDCs). IDCs are defined as “all expenses an operator may incur at the well site that don’t – by themselves – produce a physical asset for the producer” (4). In hydraulic fracturing, an IDC is essentially anything that needs to be done in order to obtain the natural gas, such as surveying the land, fuel expenses, and labor. These companies get tax deductions for any IDC, which can account for up to 90% of the cost of drilling the well (5). IDC deductions are controversial because they allow companies to get money back very quickly and significantly cut the cost of creating new wells. Recently some politicians have tried to abolish IDC tax deductions (6), but many supporters of hydraulic fracturing say IDCs are similar to tax breaks other industries receive. Some sources also claim IDCs are necessary for natural gas

companies and that without IDCs companies would not be able to expand, hindering economic growth and job creation for the entire industry (5).

Research and Development

Another important economic factor is the research and development (R and D) that natural gas companies are putting their money into. Much of the R and D is related to the industry and making hydraulic fracturing an easier and more efficient technique. Some R and D is useful and can be applied outside of the natural gas industry (7).

One area of research that natural gas companies have devoted a large amount of money to is 3D and 4D seismic imaging. 3D seismic imaging is the process of obtaining a 3D image of the oil or gas reserves under the ground using data obtained from above the ground. 4D seismic imaging takes that process one step further and monitors the oil or gas over time. Both processes have clear industry benefits, but can also be used for research and other science projects outside the industry. (8)

A second area of research where natural gas companies have spent a lot of money is in natural gas powered automobiles. These vehicles have potential to revolutionize the automobile industry because a majority of cars and trucks currently on the road run on gasoline. Natural gas burns cleaner than gasoline, so its use as an alternative fuel source will lead to a reduced impact of driving on the environment (9). Despite natural gas companies' spending money on this research, because the current infrastructure is so well defined, it will be difficult to accomplish. Because most cars and trucks run on gasoline, fueling stations across the country are made to serve gasoline. Making enough natural gas stations will be difficult, so most likely, this will not occur for a long time (10).

A third area of research that natural gas, and outside companies have spent a lot of money on is in liquefying natural gas. By converting natural gas to liquid rather than its typical gaseous state, its volume is reduced by 260 times. This process makes natural gas significantly easier to handle and transport. Mobile LNG (liquid natural gas) significantly reduces the cost of transporting natural gas, and therefore is a great asset for industries (11). Converting natural gas to a liquid form can also make natural gas an easier fuel source for potential use in automobiles someday as volume is an important factor with cars (12).

Amount of Natural Gas

How much natural gas in the U.S. is needed for the country to become energy-independent? Many people who endorse hydraulic fracturing use energy independence as a reason for the U.S. to pursue fracking and obtain its own energy. Currently the U.S. is reliant on foreign nations to meet its energy quota. Becoming self-sufficient would not only make the country less dependent on foreign nations,

but would also help the economy because domestic gas decreases the cost of natural gas by removing shipping costs and tariffs.

According to the U.S. Energy Information Administration (EIA), the U.S. is currently dependent on foreign nations for around 40% of its total petroleum consumed, and that number is the lowest since 1991 (13). As seen in Figure 3 below, 55% of imported petroleum comes from Organization of the Petroleum Exporting Countries (OPEC) nations. Historically, the U.S. does not have great relationships with OPEC nations, yet is forced to spend billions of dollars on importing petroleum from these countries. OPEC nations are not very stable, and because they control such a vast oil empire, they have a monopoly on their product. The organization can raise its prices on a whim whenever it wants, impacting the U.S. greatly. (14)

2012: Top sources of imported petroleum to the United States million barrels per day and percent share of gross and net imports ¹			
Import sources	Gross imports	Exports to import source	Net imports
Total, all countries	10.596	3.184	7.412
OPEC countries	4.256 (40%)	177	4.078 (55%)
Persian Gulf countries	2.151 (20%)	0.088	2.144 (29%)

Figure 3: This figure from the EIA website shows the amount of petroleum imports and exports for the U.S. As seen above, the image shows the U.S. imports around 7.4 million barrels per day more petroleum than it exports. The figure also shows that 55% of the net imports come from OPEC countries. U.S. Energy Information Administration. Retrieved from: <http://www.eia.gov/>

According to the EIA, with estimates of the 2.2 trillion cubic feet of natural gas in the U.S. and using the current rate of energy consumption, the U.S. has enough natural gas to last 92 years (15). The amount of natural gas in the U.S. compared to other nations can be seen in Figure 4. Using this alternative source of energy can potentially make the U.S. less reliant on foreign nations for energy. Doing so would not only ensure economic stability for almost a century, but also would decrease the price of natural gas and remove OPEC's stronghold on the U.S. (13)

GLOBAL GAS RESERVES

Using fracking to access shale gas would vastly increase gas resources in many countries. Russia and the Middle East are not included because their large reserves of easily accessible gas will render shale gas less important there.

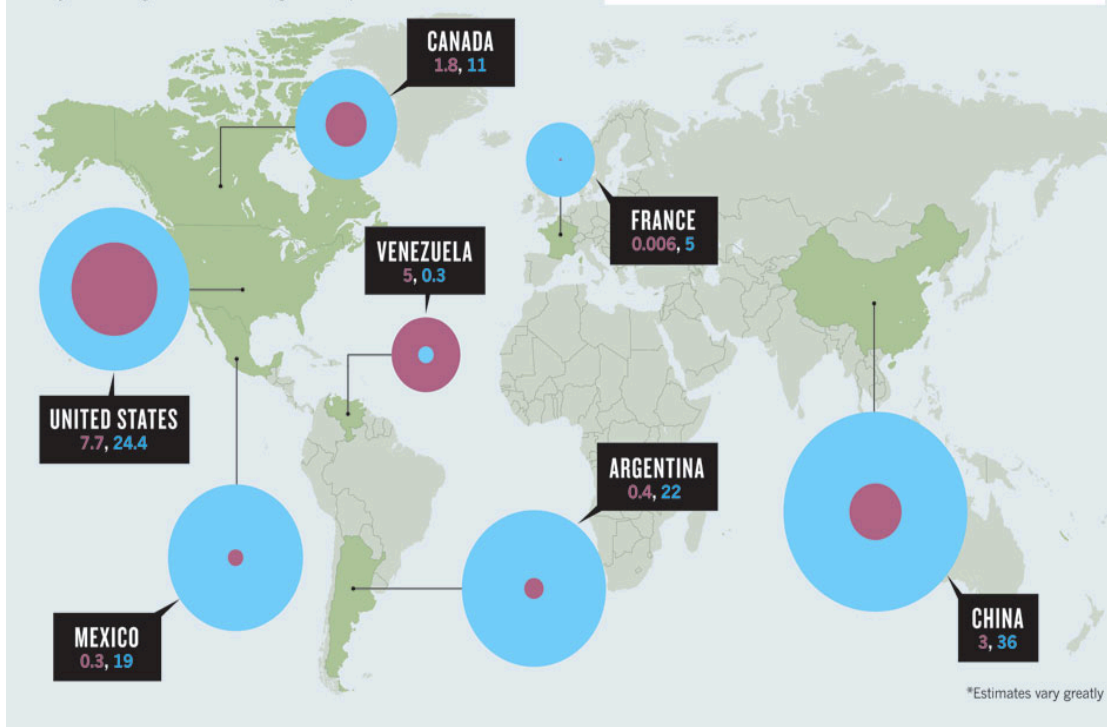


Figure 4: This figure illustrates the amount of natural gas available in many countries around the world, and the amount of technologically recoverable shale gas resources. The image clearly shows that the U.S. has a large amount of natural gas compared to other countries, indicating this alternative source of energy can greatly help meet our energy needs if properly harnessed. *Natural Gas: Should Fracking Stop?* Nature (2011).

Conclusion

Based on these findings, in terms of economics, natural gas is benefiting the U.S. and is a good long-term solution for its current energy situation. The number of jobs created by hydraulic fracturing is high and continually rising. With an increase in the number of natural gas companies wells drilled, the number of jobs can continue to increase for a while. In addition to the number of jobs, natural gas is more stable than foreign oil from an economic standpoint because the U.S. will not be reliant on foreign nations, particularly OPEC nations, for its energy.

The controversial aspect of only focusing on economics is that hydraulic fracturing still has problems. Some problems not covered include the environmental harm caused by gas extraction methods, and that natural gas is only a temporary solution. All natural gas extraction does is prolong the problem of running out of energy sources. The interview that follows, with Matt Henderson, the Shale Gas Assets Manager of Penn State's Marcellus Center for Outreach & Research (MCOR),

confirm that natural gas is a good short-term alternative, but as a non-renewable resource, it is not a good long-term solution. Current estimates show the U.S. has enough natural gas to last around 92 years, and if the efficiency of natural gas extraction increases significantly in the U.S., possibly 115 years. This amount of time is by no means a permanent solution, so though hydraulic fracturing is currently having many positive economic effects, it will only help the U.S. for finite amount of time.

Interview

I interviewed Matt Henderson, the Shale Gas Assets Manager for Penn State's MCOR. During our field trip, Matt spoke about some R and D currently being worked on. His answers below are paraphrased.

1. What R and D is the natural gas industry currently working on?

I can talk generally. There are a lot of different entities out there and the companies themselves are working on research for applications of natural gas. One project is gas to liquid. There is also the mobile LNG (Liquid Natural Gas). They use mobile LNG on the rig operations and completion operations. Of course there are fleet conversions out there. So they are doing some research on how they can have small liquefaction plants so they could take the gas and liquefy it, or have mobile LNG where they could take it from sites where they're doing the drilling or completion activities, or use it for onsite power. You're seeing that spread out across manufacturing, commercialization.

It is kind of in that research phase, where they are trying to make it more effective. It is one of those things where they are trying to do it, and it can be done, but the price is too high. They are trying to eliminate some of those steps so the end result could be comparable and competitive to the price of crude oil and the crude oil refining process.

2. Can any current R and D be applied outside of the hydraulic fracturing industry, or is it all industry specific?

They are applying it outside the industry too. The industry has more of an incentive to use their product, use their gas versus using oil from overseas or imported as a fuel source, but it is being applied elsewhere. The vehicle conversion is a great example. You see the industry taking the lead definitely, but you are seeing it is becoming widespread across fleet conversions trucks. You see UPS, FedEx, some other fleet carriers out there, and some long road truck companies are doing that as well. You see it in multiple industries.

As far as the power conversion, you are seeing commercial and industrial centers are looking to do that. There are some good examples of that going on. Procter and Gamble in Wyoming County is a great example on a larger scale. Trying

to get their energy on the grid (meaning sell excess energy they make).

But when you look at smaller industrial sites such as hospitals, where they could generate electricity or have their own power source. And they could either sell it to the grid or use it onsite.

3. With all these energy projects, do you think hydraulic fracturing will become a long-term solution for the U.S. energy problems or is it more for smaller projects?

It is relative and all what you consider long term. Originally natural gas was talked about as a bridge fuel until we could get solar to become cost effective so I think it is going to help us get there but I don't think hydraulic fracturing will become a long term solution. You know, we are using a coal-based or carbon-based resource that is non-renewable. That is not going to be a useful solution to the energy problem.

4. How long term do you think natural gas is then?

It has extended us, and our need as a nation to get the renewables to become cost effective. It is good until we can work on getting the renewables more cost effective, but it seems that those projects are being put on the back burners. You do not see as much federal or state money out there working to get those technologies. It is not going to be the solution. Is it going to be the solution in my life, your life? Yes. I think we are going to have enough energy from hydraulic fracturing and the gas and oil industry. But in generations to come? No. It is not going to be the final solution 100 or 200 years from now.

Important Sources

Many individuals, groups, organizations, and government agencies are involved in the economic effects of hydraulic fracturing. Four important groups that will be discussed in detail are: natural gas companies, America's Natural Gas Alliance, and specialists.

One important group involved in the economic aspects of natural gas companies is the companies themselves. Individual companies are the best resource for looking into economic factors as they have many statistics indicative of their economic effects. Natural gas companies might be biased, but they can provide information about the number of employees, policy information, and questions about their profits. In addition, many natural gas companies are publically traded companies, which means much of their economic data is freely available online. Looking up annual reports is an easy way to find answers for many questions about these companies' current and future projects, and how they spend their money. Companies often have a person responsible for communicating with the media, and those people typically have a background and expertise in discussing hydraulic fracturing. Keep in mind that company representatives might be biased in favor of hydraulic fracturing. A representative for Chesapeake Energy is Gordon Pennoyer,

Director of External Communications. His phone number is 405-935-8878, and his e-mail address is media@chk.com.

Another important group is America's Natural Gas Alliance (ANGA). ANGA is an educational organization that represents many large natural gas companies. To get information about company policies or general hydraulic fracturing or natural gas statistics, ANGA is a great resource. The organization is biased toward natural gas companies, but is also very helpful and employees typically have a background and expertise for hydraulic fracturing topics. A representative for ANGA is Dan Whitten, Senior Director of Communications. His phone number is 202-789-8490, and his e-mail address is dwhitten@anga.us.

A third important group involved in the issue is specialists in fields associated with aspects of hydraulic fracturing across the U.S. The best way to get into contact with somebody well educated on the issue is to contact unbiased people who study and are knowledgeable about economic policies. One contact is Dr. Timothy J. Conside, Director for the Center for Energy Economics & Public Policy at the University of Wisconsin. His phone number is 307-766-2543, and his e-mail address is tconsidi@uwyo.edu.

Additional Web Resources

<http://stateimpact.npr.org/> - **State Impact**

This website is run by journalists who try to report unbiased stories about hydraulic fracturing and natural gas companies. An economics section that focuses mainly on jobs and economic policy is available. The website is easy to use and contains many links to useful articles. Based on the content of the articles, the authors seem to be knowledgeable about these topics.

<http://www.cabotog.com/investors/annual-reports-10k/> - **Cabot Oil & Gas Annual Reports**

This link is part of the Cabot Oil & Gas main website, but leads to the annual reports. Reports for the past four years are available here, and the website is easy to use. The links are to PDFs, not other websites, and the economic information in these reports is all accurate and relatively balanced. This information is available because Cabot Oil & Gas is a publically traded company.

<http://www.anga.us/> - **America's Natural Gas Alliance (ANGA)**

This website is designed as an educational website that has information about economics and job creation. ANGA represents many natural gas companies and contains many reports, so is a good source for statistics. This source is biased in favor of natural gas companies, but still contains useful information. The website is easy to use and does not contain many links to other websites.

<http://www.api.org/> - **American Petroleum Institute (API)**

This website has an entire section about tax issues related to hydraulic fracturing and natural gas companies. Although API is biased in favor of natural gas companies, it contains a lot of useful information. The website is informative and contains sections about virtually every topic related to natural gas. The website is also easy to use and does not contain many links to other websites.

<http://nyagainstfracking.org/> - **New Yorkers Against Fracking**

This page has many well-written reports about the economics of hydraulic fracturing and natural gas. The organization is biased against hydraulic fracturing, and a majority of the website is one-sided. Many of the articles in the economics section focus on environmental aspects of hydraulic fracturing, but the website is easy to use and contains useful links nonetheless.

<http://innovationohio.org/fracking/> - **Innovation Ohio**

Although information on this website is mainly state-specific for Ohio, the economic information and information about jobs is useful. The website is easy to use and contains many links to articles. Innovative Ohio is a good resource for economic information and is easy to use, but is biased against hydraulic fracturing.

For More Information

- <http://www.theartsjournal.org/index.php/site/article/view/99/0>
- <http://www.energyfromshale.org/fracking-benefits>
- <http://www.economist.com/debate/overview/246>
- <http://www.eia.gov/analysis/studies/usshalegas/>
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