AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
GPO

THE NEW DOMESTIC ENERGY PARADIGM: POTENTIAL FOR SMALL BUSINESSES AND THE ECONOMY

HEARING

BEFORE THE

SUBCOMMITTEE ON AGRICULTURE, ENERGY AND TRADE

OF THE

COMMITTEE ON SMALL BUSINESS
UNITED STATES
HOUSE OF REPRESENTATIVES

ONE HUNDRED THIRTEENTH CONGRESS

FIRST SESSION

HEARING HELD
JUNE 20, 2013

Small Business Committee Document Number 113–025
Available via the GPO Website: www.fdsys.gov

U.S. GOVERNMENT PRINTING OFFICE

81–700 WASHINGTON : 2013

For sale by the Superintendent of Documents, U.S. Government Printing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512–1800; DC area (202) 512–1800
Fax: (202) 512–2104 Mail: Stop IDCC, Washington, DC 20402–0001

HOUSE COMMITTEE ON SMALL BUSINESS

SAM GRAVES, Missouri, *Chairman*
STEVE CHABOT, Ohio
STEVE KING, Iowa
MIKE COFFMAN, Colorado
BLAINE LUETKEMER, Missouri
MICK MULVANEY, South Carolina
SCOTT TIPTON, Colorado
JAIME HERRERA BEUTLER, Washington
RICHARD HANNA, New York
TIM HUELSKAMP, Kansas
DAVID SCHWEIKERT, Arizona
KERRY BENTIVOLIO, Michigan
CHRIS COLLINS, New York
TOM RICE, South Carolina
NYDIA VELÁZQUEZ, New York, *Ranking Member*
KURT SCHRADER, Oregon
YVETTE CLARKE, New York
JUDY CHU, California
JANICE HAHN, California
DONALD PAYNE, JR., New Jersey
GRACE MENG, New York
BRAD SCHNEIDER, Illinois
RON BARBER, Arizona
ANN McLANE KUSTER, New Hampshire
PATRICK MURPHY, Florida

LORI SALLEY, *Staff Director*
PAUL SASS, *Deputy Staff Director*
BARRY PINELES, *Chief Counsel*
MICHAEL DAY, *Minority Staff Director*

CONTENTS

OPENING STATEMENTS

	Page
Hon. Scott Tipton	1
Hon. Patrick Murphy	2

WITNESSES

John W. Larson, Vice President, Economics & Country Risk, IHS Global Insight, Washington, DC	3
Simon Ormerod, CEO, Ajax Rolled Ring & Machine, York, SC, testifying on behalf of the Forging Industry Association	5
Chuck Grobe, Commissioner, Moffat County, Craig, CO	7
Sean Meyn, Director of the Florida Institute for Sustainable Energy, University of Florida, Gainesville, FL	8

APPENDIX

Prepared Statements:	
John W. Larson, Vice President, Economics & Country Risk, IHS Global Insight, Washington, DC	20
Simon Ormerod, CEO, Ajax Rolled Ring & Machine, York, SC, testifying on behalf of the Forging Industry Association	25
Chuck Grobe, Commissioner, Moffat County, Craig, CO	30
Sean Meyn, Director of the Florida Institute for Sustainable Energy, University of Florida, Gainesville, FL	36
Questions for the Record:	
None.	
Ansers for the Record:	
None.	
Additional Material for the Record:	
The Benefits of Natural Gas Production and Exports for U.S. Small Businesses - Raymond J. Keating, Chief Economist, Small Business & Entrepreneurship Council	43
University of Florida - Sean P. Meyn	92

THE NEW DOMESTIC ENERGY PARADIGM: POTENTIAL FOR SMALL BUSINESSES AND THE ECONOMY

THURSDAY, JUNE 20, 2013

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SMALL BUSINESS,
SUBCOMMITTEE ON AGRICULTURE, ENERGY AND TRADE,
Washington, DC.

The Subcommittee met, pursuant to call, at 10:00 a.m., in Room 2360, Rayburn House Office Building. Hon. Scott Tipton [chairman of the subcommittee] presiding.

Present: Representatives Tipton, Mulvaney, Luetkemeyer, and Murphy.

Chairman TIPTON. The hearing is now called to order and I would certainly like to thank our witnesses for being here on time. Sorry we were not. We did have votes going on, but I certainly appreciate your patience. I am joined here by Ranking Member Murphy, and we also have Representative Mulvaney here as well. And I certainly thank you for your time.

I would like to thank all of our witnesses for appearing at today's hearing to be able to discuss job creation potential of the domestic oil and natural gas development.

Until very recently, many geologists, energy market participants, and policymakers assumed that the overall rate of domestic oil and natural gas production had peaked and had entered into a permanent period of decline—a scenario that could result in higher energy prices, an increase in oil and gas imports, and the imposition of measures intended to reduce demand for petroleum as a fuel source.

However, the advent of new technologies and changes to market fundamentals has led to a paradigm shift in the energy outlook of the United States. Where there was once energy scarcity, there is now a potential for an energy bounty.

According to a number of recent studies of the United States' oil and natural gas resources, America now has the potential to supplant a significant portion of foreign oil imports with domestically produced oil, and it has the ability to be able to produce enough natural gas to satisfy domestic demand and offer natural gas export opportunities.

As impressive as these gains are, this Committee is most interested in the potential economic and job creation benefits of domestic oil and natural gas production as they may accrue to small businesses and developing those resources responsibly. Overall, 88 per-

cent of domestic oil and natural gas producers are classified by the United States Small Business Administration as small businesses. If America's oil and gas potential is fully realized, oil and gas producers could create up to 600,000 new jobs by the year 2020.

In addition to jobs created directly by producers, more than 900,000 indirect jobs could be created at supplier firms supporting oil and gas development. This number would be in addition to more than 1.4 million induced jobs created as the economic effects of oil and gas development flow throughout the broader economy. These potential benefits to the United States, small businesses, and rural communities are truly extraordinary.

At the same time, while domestic oil and natural gas production has many benefits, it is not the silver bullet solution to all of our nation's energy economic and environmental needs. Rather, it is an element of an "all of the above" strategy that must be used to promote long-term energy independence for our country.

I look forward to hearing from today's witnesses and hearing their views on these issues, and I would now like to yield to Ranking Member Murphy for his opening statement.

Mr. MURPHY. Thank you, Mr. Chairman. And I would like to thank the witnesses for their time with us here today.

During the last decade, energy prices have risen dramatically. In fact, 10 years ago today oil was trading around $30 a barrel and a gallon of gas was $1.45. Since then, we have seen it reach highs of nearly $150 a barrel and then drop back down to around $100 a barrel where it is today. In the last year, it has become not uncommon for a gallon of gas to be around $4 a gallon depending on where you live. With these prices, innovative energy technologies and alternative energy sources are critical, and in many cases, small businesses are leading the way, whether they are working to develop new sources of energy, rethinking how we use existing fossil fuels, or making improvement to the electrical grid, these entrepreneurs have become agents of change in the energy industry, engineering new ideas and jobs that come from them. The reality is the more domestic options we have for energy, the better it is for everyone. With all these alternatives on the table, the U.S. is better positioned to reduce its dependence on foreign oil over the long term, and small business leaders are the ones who allow us to reach this goal.

In my home state of Florida, we are seeing this change firsthand, particularly in the area of solar energy. This is not surprising in a state with an abundant source of fuel for that—sunshine. Florida is quickly becoming a leader in this sector and is one of the nation's largest suppliers of utility-based solar power. Small businesses in Florida are not just installing solar systems in homes and businesses; they are developing in manufacturing the cutting-edge technologies upon which these systems are built. With more than 430 companies and nearly 16,000 workers, my home state has one of the largest concentrations of suppliers of silicon and other solar module components in the U.S.

Another area that shows great promise is biofuels where Florida is also a top producer. Small businesses making biofuels can draw on our state's huge volume of biomass feed stock, including sugar cane, citrus residues, and urban wood waste. This production ac-

counts for about seven percent of total U.S. biomass output. Further, some of the most advanced biomass energy research is conducted at Florida universities, leading to the development and production of new, cutting edge biofuels.

Small businesses also play a key role in traditional energy innovation. This clearly is evident with regard to natural gas exploration. Shale gas in particular has created new jobs for specialty manufacturers, drilling service companies, and regional heavy equipment companies across the United States. As they grow, so do the local economies where demand is created for restaurants, hotels, and many other service companies.

I look forward to hearing how we can continue to support energy-focused small business. We must find sensible ways to invest in the energy sources of tomorrow while ensuring that traditional fossil fuels can be used in an efficient and clean manner today. Determining the proper mix of these policies is often challenging but that is why this hearing today is so important.

I also look forward to understanding what barriers these innovative companies face, as well as hearing whether government should play a greater or lesser role. The challenges of small businesses are the challenges of this Committee, and we are committed to ensuring that small firms continue to benefit from the recent developments in the energy industry. Thank you.

Chairman TIPTON. Thank you.

If the Committee members have opening statements prepared I ask that they be submitted for the record.

I would like to take a moment to be able to explain the timing lights that are in front of you. The light will start out as green. You have five minutes for your testimony. Once we get down to one minute, the light will turn yellow, and finally, it will turn red. And at that time, if you could wrap up we would appreciate it.

We would now like to be able to go ahead and start with our panel. First, I would like to be able to introduce our first witness, Mr. John Larson. He is vice president of Economics and Country Risk at IHS Global Insight, an economics forecasting firm. His most recent work is focused on measuring the potential employment contributions of unconventional oil and gas development in the United States economy, the subject of today's hearing.

Mr. Larson, I appreciate your willingness to be testifying before our Committee, and we look forward to your testimony.

STATEMENTS OF JOHN LARSON, VICE PRESIDENT, ECONOMICS AND COUNTRY RISK, IHS GLOBAL INSIGHT; SIMON ORMEROD, CEO, AJAX ROLLED RING AND MACHINE; CHUCK GROBE, COMMISSIONER, MOFFAT COUNTY; SEAN MEYN, DIRECTOR, FLORIDA INSTITUTE FOR SUSTAINABLE ENERGY, UNIVERSITY OF FLORIDA

STATEMENT OF JOHN LARSON

Mr. LARSON. Great. Thank you, Chairman Tipton, Ranking Member Murphy, and distinguished members of the Committee. It is an honor to speak with you today.

As you have rightly pointed out, the United States is in the midst of an unconventional oil and gas revolution that is fun-

damentally changing the energy position that we enjoy in the world today. It is also improving our global competitiveness and helping to stimulate a manufacturing renaissance.

Since 2009, our company has been engaged in several studies to better understand the economic contributions associated with this revolution, and we will be releasing a study in July that will focus specifically on the manufacturing benefits and implications.

So far, the unconventional activity is supporting 1.7 million jobs in this country. Looking towards the future, the industry will support three million jobs by the end of the decade. At a time of great concerns about federal budgets, it is also important to note the revenue implications associated with this revolution. Total government revenue from unconventional activity accounted for $62 billion last year and will rise to 111 billion by 2020. By 2035, unconventional activity is expected to generate 2.5 trillion in cumulative revenues to the federal and state governments.

These impacts are also meaningful at a state level. In Colorado, for example, unconventional activities supported 78,000 jobs in 2012 and generated 1.5 billion in state and local taxes.

But there is also a very important impact beyond those states that actually enjoy geographic activity around this unconventional revolution, and that is, in fact, 30 percent of all jobs are found in states that do not actually have a geographic play in this activity.

If you look at Florida, for example, the state currently has about 36,000 jobs and $181 million in revenue generated through the supply chains across the country that help enable this unconventional activity to take place. A key reason, obviously, for this profound economic impact, both at the national level and the state level, is that this industry combines a capital-intensive industry with a broad domestic supply chain. As many of you know, this industry is really a homegrown result of our technology, innovation, and know-how. And so what that means is that dollars spent here, stay here in domestic suppliers.

Equally impressive are the larger macroeconomic effects attributed to the savings brought about by lower natural gas prices and the corresponding electricity prices. In our study of the economic and employment contributions of shale gas in the United States, we identified how lower natural gas prices will increase industrial production 2.7 percent by 2015, and 4.7 percent by 2035. And for households we identified, these lower prices cascade through the economy resulting in savings to consumers. It increases annual disposable income by nearly $1,000 by 2015.

What does all this mean for manufacturing specifically? Several factors are shifting the economics in favor of onshoring and refueling a resurgence of manufacturing in the United States. First, global labor wage rates for many offshoring locations have significantly outpaced the U.S. wage increase narrowing the wage gap. Second, in an increasingly advanced manufacturing world, technology is shifting the balance away from the importance of low cost labor and toward high skilled work forces. And third, in a rapidly evolving energy landscape, the fundamentals around supply chains and offshoring are shifting. Higher oil prices, as you pointed out Ranking Member Murphy, which have tripled in the last decade, have significantly increased transportation costs, making the offshoring

less attractive. Also, in the United States, the unconventional revolution is creating significant competitive advantage for both energy intensive industries and energy industries that rely on natural gas and their derivatives with feedstocks. As a result, companies are now talking about planned investment that will appear in the hundreds of billions of dollars in this country.

All together, this unconventional revolution has already had a major impact. It is fundamentally transforming U.S. energy supply and contributing to the growth in government revenues, manufacturing, and economy-wide employment. Its significance will continue to grow as it unfolds, and these hearings I think provide a timely opportunity for assessing that impact and the significance that it will have in many dimensions.

And I am pleased to answer Committee questions. Thank you.

Chairman TIPTON. Thank you, Mr. Larson. We appreciate your testimony.

I would now like to be able to introduce our next witness, Mr. Simon Ormerod. Am I getting that correctly?

Mr. ORMEROD. That is right.

Chairman TIPTON. Okay, great. Thanks.

He is CEO of Ajax Rolled Ring, a material forging manufacturer located in York, South Carolina. Mr. Ormerod is currently serving as president of the Forging Industry Association, and is testifying today on behalf of FIA.

Mr. Ormerod, thank you for appearing today, and we look forward to your testimony.

STATEMENT OF SIMON ORMEROD

Mr. ORMEROD. Thank you. Chairman Tipton, Ranking Member Murphy, and members of the Subcommittee, thank you for the opportunity to testify before you today on the economic benefits of increased domestic supplies of natural gas and oil. And specifically, how those benefits might impact a small business like mine.

My name is Simon Ormerod, and I am the CEO of Ajax Rolled Ring and Machine based on York South Carolina. I am currently the president of the Forging Industry Association. The FIA is the primary trade association representing the bulk of forging capacity in North America.

Forging is the oldest known metalworking process, where metal is heated and formed under high pressure into a wide variety of high-strength parts using anything that rolls, floats, or flies.

My company has approximately 100 employees and has been in York, South Carolina since 1980. We are a custom manufacturer of seamless rolled rings used in such critical industrial components as bearings, gears, flanges, and valve seat rings applied in end-use markets such as power generation, mining, and construction equipment, oil and gas, petrochemical, defense, rail transportation, and a wide variety of general industrial applications. The rings we make range from 7.5 to 100 inches in diameter and weigh from 15 to 3,500 pounds.

The modern forging process is both capital-intensive and energy-intensive. Adding a new production line for our company would cost in excess of $15 million, and we have significant expenditure on equipment every year due to the intense wear on the equip-

ment. We are also a major user of natural gas and electricity in our region. Given those requirements, it may surprise you to know that most forging plants are small and medium-size businesses. Specifically, 95 of FIA's approximately 200 members qualify as small businesses. Forged parts are strong and reliable and therefore, vital in performance of critical applications. It would take fully my allotted five minutes to name all of the components that contain forgings, but they are found in virtually all industries, and applications include automotive, aerospace, defense, power generation, mining, rail, hand tools, and even golf clubs.

Forgers, like Ajax, are in a unique position to comment on the overall benefits to the economy created by the increased supplies of domestic natural gas and oil we are now enjoying in the U.S. Increased exploration for oil and gas is not only beneficial to our cost structure through lower priced energy, but also leads to increased amount for our forgings. My company makes forged rings that are used in gears and bearings and flanges that are subsequently sold to valve, pipe, and flange manufacturers in the oil and gas fields. Our products are also sold to manufacturers of drills, pumps, and many other oil and gas related equipment applications. Other forgers make critical parts such as the forged drill bits without which the hydraulic fracturing or fracking activity in our country would not be possible. Our industry is, in fact, integral to the increased supply of domestic natural gas we are seeing today.

Demand for forged rings that we supply for valves used in oil and gas pipelines has risen by 20 to 30 percent in the past two years. We have added at least 10 new positions in that time for both forging and precision machining activities. The exacting requirements of those valves, many of which are for subsea applications, are such that only stainless steel forgings of the very highest standards and machine-to-tolerances of thousandths of an inch are acceptable.

But for forgers, the benefits of this energy boom are not limited to increased demand for our products. Natural gas is a key import and a cost-driver in our manufacturing process, so we also benefit from stable pricing of that energy source. Most forgings are processed at temperatures up to 2,300 degrees Fahrenheit, with subsequent heat treating done up to 1,900 degrees Fahrenheit—so using natural gas or electric furnaces. Therefore, forgers require adequate, stable, and affordable supplies of natural gas and electricity to make the critical parts we make for nearly every industry sector imaginable. As recently as 2008, we were challenged with significant natural gas price volatility. Prices ranged from $5.80 for a million BTU to $12.70. When natural gas is a key import and a key cost driver, that market volatility makes it extremely difficult to plan for some of the investments I mentioned earlier.

Forgers' other key raw material is, of course, steel. The metal producers also require natural gas as a key import and a low and stable gas price helps them to keep metal prices low for our customers. So today, with the abundant natural supplies of natural gas being extracted and sold in the U.S., we have confidence in the stability and competitive price of the market.

So in conclusion, it would be remiss if I did not point out the FIA believes strongly that the U.S. must avoid enacting unnecessary

regulatory barriers to increase domestic supplies of oil and gas. Polices that artificially increase prices or restrict supplies will certainly have a direct negative impact on the entire oil and gas supply chain regardless of company size, but they would also negatively affect hundreds of small manufacturers like Ajax and other forging industry supply chains. Policies that encourage safe exploration and development of domestic energy sources are critical to the continued revival of manufacturing, including the forging industry.

Thank you for the opportunity to appear before you today, and I look forward to your questions.

Chairman TIPTON. Thank you, Mr. Ormerod. And I apologize to my colleague, Mr. Mulvaney. I did not see the note that he was going to introduce. So if you would like to make a comment to welcome him, certainly feel free.

Mr. MULVANEY. You did a fine job.

Chairman TIPTON. Okay. Thanks.

Mr. Ormerod, I thank you for your testimony.

Our next witness is a member out of my home district in Colorado, Mr. Chuck Grobe. He is currently serving as county commissioner for Moffat County in Colorado. Prior to his recent election as commissioner, Mr. Grobe served two terms as mayor of Hayden, Colorado, and prior to that he served for six years on the Hayden Town Council. In addition to his service in elected office, Mr. Grobe has been active in the Associated Governments of Northwest Colorado.

Mr. Grobe, I would like to thank you for making the trip here, and we look forward to your testimony.

STATEMENT OF CHUCK GROBE

Mr. GROBE. Thank you, Chairman Tipton, Ranking Member Mr. Murphy, and the other members of the Committee for inviting me for this important hearing.

Moffat County is the second largest county in Colorado, with over three million acres of land, 60 percent of which is managed by federal government. The top 10 taxpayers in Moffat County are all energy related, 20 coming from oil and gas.

Our citizens have had a history of working in the energy field, agriculture, and recreation, and through this we have worked on a very cooperative working relationship with organizations and people in the community to work through our controversial use of public lands. One of these was Vermillion Basin, which a decade ago was in negotiation working on an agreement to be able to get gas reserves out of there. It is a 77,000 acre parcel of land with 200 billion cubic feet of natural gas. We worked up a collaboration and had an agreement where we would only have a one percent disturbance to the land at any one given time. But entirely due to political reasons, the agreement was overturned by Washington politics, and because of that, the economic loss to the area and to the state were $700 million worth of revenue from that source—$25.6 million would have been taxes coming to Moffat County. Of that, 53 percent would have been to the school districts; $7.7 million in bonus payments; $87 million in federal royalties partially returned to cities and counties; $43.75 million was the State of

Colorado's share of the royalty; and $77 million of ad valorem and severance tax payments. And that is just from 77,000 acres of the 1.8 million under federal control.

Regulatory uncertainty, unnecessary federal regulations, frivolous lawsuits, and a lack of political courage by the current administration to allow development of these new oil and gas resources puts jobs in our area in jeopardy. Congress must struggle with national rules, such as hydraulic fracking with BLM. Trends of increased regulation in the oil and gas industry have manifested locally through creative avoidance of federal lands where now most of our leases and everything are on private land which costs 8-1/2 times more for the leases than if we were on federal land.

Colorado is filled with beautiful scenery and abundant wildlife. Current technology allows us to work harmoniously with the two areas and still produce energy. Being home of the largest concentration of greater sage grouse in Colorado, we have been working for decades to protect and improve the habitat and improve the population of the sage grouse, because without the natural resources we would not be what we are either.

Finding balance where both wildlife and oil and gas can thrive seems to employ as many biologists and rig hands. The past week and a half since I got the invitation, I have been talking to a lot of our small businesses in Craig and in Moffat County, and the volatility and the uncertainty of natural gas production has been on everybody's comments. From starting a welding business that was shut down in 2008 where they had to retool and move in a different direction and now all of their work in the oil industry is outside Colorado, to another business that refused to be involved with oil and gas development because it comes in fast but his quote was "it leaves even faster." So with the federal regulations where we are it is hard to keep and draw small businesses into being profitable. Thank you.

Chairman TIPTON. Thank you, Mr. Grobe.

I would now like to be able to yield to Ranking Member Murphy so he may introduce our final witness.

Mr. MURPHY. Thank you.

Mr. Meyn is a professor of Electrical and Computer Engineering at the University of Florida, where he also holds the Robert C. Pittman Eminent Scholar Chair and serves as the director of the Florida Institute for Sustainable Energy. The Institute brings together research capabilities with a goal of creating a sustainable energy future. It encompasses more than 150 faculty members and 22 energy research centers at the University of Florida. In the last few years alone, the University of Florida has received more than $70 million in federal and state research funds to conduct energy research. Thank you.

STATEMENT OF SEAN MEYN

Mr. MEYN. Thank you very much, Ranking Member Murphy, and Chairman Tipton, and the members of the Committee. Yes, it is a great pleasure to be here to speak today.

I have been working in the area of complex systems and controlled them for half of my life. The energy grid is a beautiful example. And it is an exciting time to be working in this area be-

cause I can remember the revolution in the telecommunications area of the 1990s where in the 1980s it seemed like an impossible problem. It seemed like there was no science to support management of this incredibly complex grid for communications, and within five years these impossible problems were solved by people who understood how to think about complex systems like the network. We pick up our phone today and we think, oh, it is so easy, but if you knew the mathematics and science that went into this phone it would blow your mind. It looks like abstract nonsense, the information theory, computer science that came into that. And so today this is a very similar situation where people feel that it is too complex to deal with and I think it is no harder than the telecommunications problem.

There has been incredible innovation lately for two reasons that I have seen. The Department of Energy has helped some very risky but innovative small businesses and some have failed and some have been incredibly successful. There are some examples in Florida that have been fantastic. And the Federal Energy Regulatory Commission has made some changes to the market structure which has completely changed incentives in the power area. So the impact has been incredible how just slight changes of rules—it is like SimCity. Change the rules a little bit, the whole world changes.

In their point there are, I guess, four themes. I concur that cheap natural gas is absolutely going to change the economy in many, many positive ways, and I am very pleased to hear the comments that we do have to think about—well, first of all, I am very happy to hear the comments from Mr. Larson about the entire supply chain. The macro effects are absolutely critical, and that is what really concerns me about too much talk about exporting our natural resources considering how much value added they can be here.

I strongly want to say that it is unwise to put all of our energy in one natural gas basket. The forecast on natural gas prices, you can get anyone to give you a different forecast, and the Black and Veatch forecast shows the prices going up very steadily while coal prices are being flat. And that uncertainty is dangerous. So we want a diverse energy portfolio for national security. And again, the macro effect is incredible—the number of small businesses that will be involved.

So back to my first comments. The telecommunications evolution has resulted in innovations in hardware but some of the biggest challenges were scientific, dealing with congestion and the grid level issues. And they took an incredibly, impossibly complex problem and with cooperation between R&D labs and mathematicians in my field they are able to crack these problems. So it seems completely transparent today. Cell phones seem trivial. And I think we can do the same thing with the grid.

And particularly, the state of Florida. I do not see why we do not have 30 percent solar today. I just do not know why we do not have that. We know how to deal with the volatility. I think that the science is there, and we have to just get started. We will need power engineers and we will need the same breed of scientists who helped to build the telecommunications grid.

So in terms of needs, the energy was defunded for 20 years at the university, so there are practically no professors in power sys-

tems anymore, so that is clearly going to need to change. And universities need support. I hope the Federal Energy Regulatory Commission continues the good work they are doing. In the last year or so they finally realized they are not incentivizing a responsive generation, the sort of regulation needs of the grid. And they have only just realized this.

And I hope the Department of Energy—even though there have been failures, there have been incredible success stories of the risky businesses that they have supported. And so I hope that they continue. I know it has to be watched, but I hope they continue to help out crazy ideas. It does not take that much money to help a small business succeed.

Thank you for giving me this opportunity.

Chairman TIPTON. Thank you for your testimony.

We will now begin our series of questioning, and I would like to start with Mr. Mulvaney.

Mr. MULVANEY. Thank you, Mr. Chairman. Thank you to all four gentlemen for coming.

A couple questions for Mr. Ormerod first and then some questions for the broader panel.

Mr. Ormerod, in your written testimony—you did not get a chance to talk about it much in your verbal testimony—but in your written testimony you specifically mention the Keystone XL Pipeline and the impact that would have in your industry. Would you mind taking a few minutes and tell us specifically what that project means not only six months on but a year on, two years out? Tell me what that project means to the forging industry.

Mr. ORMEROD. That project would be very significant for the forging industry. It is, as you can imagine, on a pipeline of that scale and that size, there is a lot of critical components that have to be put in place to make sure that the oil transported is going to be transported in a very safe way. The forgings are—that is what they are absolutely made for. They are made for those critical applications. So there will be rings for flanges. There will be a lot of forging connections put in place to make that pipeline, to support the pipeline, to make sure it is a safe pipeline. So I think it will be very significant for the forging industry.

Mr. MULVANEY. As you know, one of the things I like to do when I am back home is tour manufacturing facilities, and I was touring one last week and asked what I thought was a fairly straightforward question and I got a very straightforward answer. I asked one of the manufacturers. I said, "What can Congress do?" Give me three things that Congress can do to help create manufacturing jobs, create an environment where we can grow manufacturing jobs. And the answer I got was very insightful because the person did not hesitate for a second. They said, number one, keep energy prices down. Number two was regulation. Number three was the tax code.

I would be curious to know, Mr. Ormerod, if you would put those in the same order, and if so, why?

Mr. ORMEROD. Certainly, energy is a critical cost driver for our business, so for us, as I talked about in my testimony, we have to heat up the steel in order to be able to forge it, so we heat it up either by using electricity or using gas. Mostly gas. And then we

have to also use gas to treat the forgings after we have processed them. Energy, I would say, has been very volatile over the years, over the past few years for us, and it has created a lot of difficulty for us with the energy prices going up and down. So yes, to put energy at the top of the list, I would absolutely concur with that.

Mr. MULVANEY. Mr. Larson, you mentioned the natural gas and its impact—lower natural gas prices have a tremendous impact on economic activity. I have heard that before. I have heard it not only from the folks who are using natural gas to heat metal to forge it but also from the chemical industry. It is actually a growth industry now in the United States because of the low cost of natural gas.

Could you walk through for the record, please, why you think low natural gas prices would have such a dramatic economic impact?

Mr. LARSON. Yeah, you are correct. There is a profound impact, and it stems from, first, all industry needs low costs of input to allow them to thrive in a competitive environment. You have to remember we are in a global-linked economy.

Mr. MULVANEY. And I do not want to cut you off but this is someplace we have a tremendous competitive advantage over manufacturers overseas.

Mr. LARSON. That is correct. Our prices are right around a third of what they are in, for example, Asia; a little more than a half of what they are in Europe. So there is a tremendous competitive advantage that all companies that rely on energy, either as an input or feedstock, enjoy relative to their global competitors. That is the first thing.

The second thing is you talked about volatility. It was mentioned earlier today. The ability to have stable, as well as low prices is very important, too. And if you look at where we were in the volatility prior to this unconventional revolution to where we are today, that volatility has been significantly contracted, so there is more certainty in the environment overall.

And then there is the knock-on effect. So it is not just the chemical industries who are going to be hugely competitive; we are already seeing large increases in production and output from those, and I think you are going to see the chemical industries be very, very successful going forward. There is a whole knock-on effect from that supply chain. You think about all the chemicals that go into manufacturing an automobile. We have talked about the steel that goes into it. You talk about the chemicals from the floor mats to the plastic that goes into all these. All those are knock-on effects and those costs are passed on. And at the end of the day what it means is, as I mentioned in my testimony, consumers are actually benefitting as well. So now you have the households having about $1,000 more in their pocket by 2015 as a result of all these passed-on savings to consumers. That flows right back into the economy as the consumer can now step back out and spend that $1,000 in other ways.

Mr. MULVANEY. Thank you, Mr. Larson.

Mr. Chairman, I think it bears noting that these are the types of jobs that both parties say, and rightly so, that we want to grow in this country. These are heavy manufacturing jobs. We are talking about forging metals. We are talking about chemicals. This is

the type of opportunity that we have in large part now because of your relatively low injury prices. We should be doing what we can to maintain that competitive advantage.

Thank you for the opportunity.

Chairman TIPTON. Thank you, Mr. Mulvaney.

I would now like to yield to the ranking member for his questions.

Mr. MURPHY. Thank you, Mr. Chairman.

Mr. Meyn, you spoke briefly about the grid and some o the opportunities there. What are the biggest impediments to putting these strategies into practice right now?

Mr. MEYN. Well, there is an issue in the fact that reliability is very reliable until you get it. And so basically right now in the Pacific Northwest, the people who regulate the grid would pay anything to get regulating resources, and it is very, very valuable. But nobody will come there to do it because as soon as they go there the value drops to zero. And so it is very difficult to design markets around this, and basically reliability is like a public good problem. Everyone wants a clean park but nobody is willing to pay for it. And I think we are almost forced to have some help from the government on just the reliability end. Of course, we can have energy markets, but reliability is something that is very difficult to have markets for.

Mr. MURPHY. Have there been pilot programs or other countries that are doing this better that we should be looking toward?

Mr. MEYN. Everyone has made the same mistakes. Germany installed all this wind without thinking at all about how much they needed to deal with the volatility issue. Switzerland has been much more thoughtful about this and they have actually, you know, they have generalized storage in all their large buildings, things like this to absorb volatility from renewable. But it is all so new. It is only the last few years and mistakes have been made all over the world. But they are learning quickly and so, for example, I have given the reports as examples. For example, ALCOA now has deals with utility companies to ramp up and down their consumption of electricity as a way of regulating the grid. The wind starts blowing; they ramp up production. That sort of thing. And that is going on all over the country. And the U.S. is a leader in those ideas, actually. And that is something that is going to grow quite a bit.

Mr. MURPHY. Thank you.

You also mentioned the increase in natural gas. We have all seen it. What do you feel the effect of that will be on some of the alternative energy sources—the cleaner the biofuels?

Mr. MEYN. The beautiful thing about natural gas is it is incredibly responsive. So it is a way to have a lot of renewable energy. You can have 50 percent renewable energy easily in the Pacific Northwest if you have got gas turbine generators next door that can ramp up and down and regulate the system. Coal cannot do that. Nuclear cannot do that. So natural gas is a regulation. Just like an airplane, it is like the flaps on the wings of an airplane. It stabilizes the grid. It is incredibly valuable in that sense.

Mr. MURPHY. Thank you.

Mr. Ormerod, we have seen the wind industry has grown dramatically. I think last year I read that more than 13,000 megawatts were installed. How does this affect your industry?

Mr. ORMEROD. Well, the wind industry is a great—there is a lot of demand for forgings that go into a wind turbine, whether they be bearings, gears, the main shaft. All those things, they are all critical applications, of course, so that is a good source or good need for forged products which are supplied to these critical applications.

So yeah, for the wind market, if the wind market would have grown to be a steady demand in the wind market, that is certainly very good for our industry.

Mr. MURPHY. Okay.

Mr. Grobe, you noted in your testimony about the lack of our government looking into natural gas on federal lands. I am curious, is there some potential, is there maybe—I am just thinking out loud here—something we should be looking into? We all know what a public-private partnership is, but expanding that model and looking at a partnership where you have the federal government, the state, the local, and private businesses involved, all coming up with an agreement where there is some sort of cost sharing where maybe a percentage of profits go back to renewables and alternative energies and resources. I think most people would agree that we should be taking advantage of our domestic energy fuels but maybe in 50 years that is not necessarily the answer. As technology progresses, as wind gets better and solar and thermal and everything else, that that is eventually the future but right now we need this bridge, and natural gas is a great opportunity. But if we got all the players invovled—the state, the local, federal—that we might be able to make a little more ground. Any thoughts on that?

Mr. GROBE. I think so. That would bring some sort of stability to the regulations because our problem that we are seeing is every election it seems to change where we have businesses depending on this kind of direction to go in and then all of a sudden a new person ends up in power, whether it is a governor or the president or whatever and the pendulum swings another way stopping business or halting it all together, you know, where if we have that stability, which I agree would be great, then we could move forward in a constant direction because right now, like I said, we have collaboratively worked with agencies to come up with an agreement but then it depends on what Washington says is whether we can follow through with it.

Mr. MURPHY. Okay. Thank you.

I always get a different answer on this one so I am hesitant to ask. But fracking. Every time we have different panels you always hear different answers on this. So what are your thoughts on fracking? On its effects on the environment? Perhaps how far we have come in the last 40 years of fracking that we should be aware of? And what do folks in your area think?

Mr. GROBE. People in Moffat County are supportive of fracking as long as it is done in the proper fashion with encasing the wells and making sure that we are not influencing other aquifers and stuff like that, where the technologies have moved in that direction. But that is a whole can of worms, and it is an interesting de-

bate in Moffat County, but if you go across the border into Routt County, they are trying to rewrite regulations themselves. So it is interesting as you move between counties within Colorado or you move within states, everybody is looking at it differently and that is where I like your idea of everybody getting together, come up with one plan, and let us move forward.

Mr. MURPHY. Thank you.

Last question, Mr. Chairman.

Mr. Larson, I do not know if you heard Mr. Meyn's testimony. He spoke briefly about some of the concerns of the United States shipping liquefied natural gas and what that could do to prices. Just interested in your thoughts, how you think it would affect businesses and prices in the long run.

Mr. LARSON. Yeah. I think it is an important thing. The risk I actually think around the price domestically from LNG exports comes more from the ramp up in demand domestically inconsistent with the underlying infrastructure to get the resources to the market if you will, to where that demand is. The supply is not the issue. It is sort of a peak demand situation. If you look at what is happening in the global market, global market LNG exports or imports are about 33 BCF a day. We have on the books applications to the DOE for about 28 BCF a day. And so there is no way that all these facilities will be market viable. The market will self contain the number of facilities that will be built out of the states. It is probably going to cap out somewhere around 5 BCF a day because of the global market. And so I think the bigger risk is how you manage it and how you think about the internal infrastructure ensuring that we are able to connect supply to demand.

You can point to an example. For example, in the Northeast where even with all this abundance we ended up actually importing LNG this year simply because we do not have the pipeline to move the resources from where they reside to where the demand is.

Mr. MURPHY. Great. Thank you.

Chairman TIPTON. Thank you, Ranking Member.

Mr. Luetkemeyer, would you like to proceed with your questions?

Mr. LUETKEMEYER. Thank you, Mr. Chairman.

Mr. Larson, I would like to follow up on your last comment with regards to we do not have enough pipeline constructed right now to haul all the natural gas demand. How much more do we need? Is it not located correctly, dispersed correctly around the country? Can you give me some information on it?

Mr. LARSON. Yes. I cannot give you actual miles. I think what I will say is that the really exciting part about this unconventional revolution is there is sort of a democratization of energy. If you think about the old energy map of the United States, it is sort of gravitated towards the traditional energy states. That is being flipped on its head with this unconventional revolution. States have really fundamentally shifted, and so now we have got this geographic diversity of where our resource base is and where the in-demand markets are. And a lot of our pipelines are set up right now to move in the wrong direction. And so we do need to significantly change our pipeline infrastructure, add a lot more miles to connect, in particular from the inlands. I will give an example. On

the oil side, in the Bakkan, we are railing out between 500,000 and 600,000 barrels a day of oil. The ability to connect that through something like a Keystone XL would be significant to take that capacity off of the rail and allow it to move to market faster. So there is, I think, a strategic evaluation that needs to be made in this country about where our pipelines are situated relative to where demand is, and where our resource supply resides.

Mr. LUETKEMEYER. Thank you.

Mr. Grobe, first, thank you for your public service. I know sometimes it is a rather thankless situation, so——

Mr. GROBE. Thank you.

Mr. LUETKEMEYER. I appreciate your willingness to step up and serve. Obviously, from the situation with the oil leases and the activities in your area there, there is a lot of leadership that needs to take place and I am sure you are in the middle of that.

Can you give us just a little bit of an insight into—the oil recently has been up in the Dakotas, you know, that is mostly on private land. And in your testimony here you have got some very significant figures of oil, gas, and coal in Colorado. Can you give us a little insight? I assume most of that is on federal land; is that correct?

Mr. GROBE. No, actually, the older drillings and stuff, a lot of it has been on BLM, but here the past 10 years or so it has been primarily private land.

Mr. LUETKEMEYER. Oh, really?

Mr. GROBE. Because the regulations are so stringent on federal land. That is where I stated in my testimony, the written testimony is their private land cost 8-1/2 times more leasing than federal land but they are moving to private land because of the regulations federally.

Mr. LUETKEMEYER. Okay. And so the lease that you talked about losing here, that was on federal land; is that right?

Mr. GROBE. Yes.

Mr. LUETKEMEYER. Okay. And the reason for that was? You were rather general in your testimony.

Mr. GROBE. The secretary of the interior flew over and said, "No, we are not going to allow that to happen." So that is why.

Mr. LUETKEMEYER. Okay.

Mr. GROBE. And that was a collaborative effort between all the agencies in our area.

Mr. LUETKEMEYER. Okay.

Mr. Meyn, you, in your testimony, said that you got $70 million worth of research last year for your school.

Mr. MEYN. Last year? Oh, no. No. Seventy million?

Oh, excuse me.

Mr. LUETKEMEYER. Did I misunderstand you?

Mr. MEYN. Oh, yes. Absolutely. I gave——

Mr. LUETKEMEYER. Where does 70 million——

Mr. MEYN.—a total. I am not sure, actually. I do not remember. The disclosure?

So I received research funding from the AFOSR and from NSF for the past—since 2006. It might add up to that much money for graduate students and supporting lab.

Mr. LUETKEMEYER. Okay. So my question was what do you do with the money? What kind of research do you do?

Mr. MEYN. I work on understanding large network systems. How do you understand a power grid, for example. How do you control it? Resource allocation problems. Once you have wind that is 4 gigawatts and zero, how do you control the resources to stabilize the whole system?

Mr. LUETKEMEYER. Do you submit reports to anybody on that?

Mr. MEYN. Yeah. Annual reports to the NSF and AFOSR.

Mr. LUETKEMEYER. Does anybody use the data?

Mr. MEYN. Well, does anyone use the data?

Mr. LUETKEMEYER. That is a pretty important question.

Mr. MEYN. Absolutely. I am just trying to think about how to answer it because I have been working in the markets area for 10 years and I think that FERC has listened to me. I think the new market structures are in part from my discussions with, for example, Dick O'Neill there for the last years.

In terms of the control issues, I think Pacific Northwest National Labs, for example, is using these ideas in a lot of their pilot programs. All this is very new, you know, it has only been the last—there was almost no wind in the Pacific Northwest several years ago and now there is 4 gigawatts. Things are changing so fast it is hard to answer.

Mr. LUETKEMEYER. Your response leaves me speechless.

Thank you, Mr. Chairman.

Mr. MEYN. No, but there has to be a follow up then because why is that? My graduate students are now working at Houston trading companies and on Wall Street and they are professors in various places. This is long-term research. I do not do research—I am not a consultant. I am looking at what the world will look like in 10, 20 years.

Chairman TIPTON. Thank you.

I appreciate the questions that we have had from our panel members. I would now like to start out with Mr. Larson. One of your comments when we were talking about affordable, reliable energy, you took it down to the base important thing I think for our communities, for our nation, when you started talking about families, about moms being able to get kids to the soccer match, and to be able to buy groceries, and to be able to fill up that gas tank, and to be able to turn on heat in the winter. Just to be able to protect our families.

So I guess my first question, Mr. Larson, is many of the members of this Committee, we do, indeed, represent rural areas, and my own district, as Mr. Grobe will testify, is not only largely rural but many of these counties and communities are located on or near federal lands. Has your first every studied the potential implications of expanded energy development in more of a micro sense in regards to the rural areas? Because we certainly see pockets of prosperity in metro areas in Colorado and I think elsewhere.

Mr. LARSON. Yeah. I appreciate the question.

So as we looked at this, we did not draw down into sub-state levels, if you will. I mean, we looked at it by state by state, but I think you are absolutely accurate in saying I think one of the inter-

esting things about this opportunity is how impactful it has been in the rural communities. It really is changing the face of some of these rural communities, and that is a double-edged sword. My family comes from North Dakota and they have been living in the Bakkan area, and so they have enjoyed the upside of the evolution of this unconventional revolution in Dickenson and Williston and everything, but there is also the sort of change that it has brought about to these communities from this influx of activity and a change of your sort of way of life. That said, I think it is important to think about those pocketbook issues. The average community, the average household, $1,000, that is a lot of purchasing power that is brought back home so that individuals can enjoy a higher standard of living. And that is what this is. Lower energy prices ensure higher standards of living for everyone in the country.

Chairman TIPTON. Simply by creating American energy security right here at home with American resources.

Mr. Grobe, maybe you would like to be able to speak to that. When the secretary flew over Moffat County and said "not here, not now," how did that impact communities? People that you and I know in our district?

Mr. GROBE. That was pretty devastating because we were looking at the potential and these are good facts that we presented to the group that came together and agreed on this one percent disturbance. So when something like that happens, it just kind of takes the wind out of your sail because we are trying to move in a positive direction, work with small businesses, get them established, and that is where I was talking about earlier where the whims of the federal government kind of blow and we need to get some stability there.

Chairman TIPTON. So just for clarity on this, in Moffat County, and I believe this has been replicated on the west slope of Colorado, brought together environmental groups, brought together industry, brought together community leaders such as yourself, other interested parties were able to come to an agreement, and what some in Washington considers flyover country, and I guess we are there, they are able to swoop over the top and just say not here and completely upend all of the efforts at the local level; is that correct?

Mr. GROBE. That is correct. Because those collaborative efforts have been going on for eight or 10 years, and to have that just swept away without even stopping and talking to the locals, that was pretty disappointing.

Chairman TIPTON. Right.

Just as an aside, how important is coal in your district?

Mr. GROBE. Very important because we have a Craig generating station there and two coal mines in our county that 80 percent of our top 10 taxing entities are from coal.

Chairman TIPTON. Right. We were just talking about fracking just a moment ago. You and I know a lot of the people that live and work there. These are family people. They love their families. Is it your sense that they are making a committed effort to make sure that we are doing this responsibly?

Mr. GROBE. Oh, yes. Every turn we are looking at better ways to perform and work with the avenues and work with the government to make sure that it is clean and energy efficient.

Chairman TIPTON. Mr. Larson, does this new petroleum resource potential in our country mean that we can solely rely on oil and gas for energy needs or are they just part of that broader strategy that we need to be able to embrace of that "all of the above," including coal, nuclear power, hydropower?

Mr. LARSON. Yes. I think it is all part of an "all of the above" strategy. I think those who talk about energy independence do not recognize the international linkages that exist. We are always going to have a relationship with Canada, for example, and Mexico around energy. And so there are important strategic relationships. I think it is also important to point out that most of our refining capacity is set up for some of the heavy sour crude from, for example, Venezuela or the oil sands from Canada. So we are always going to be in a position we are going to want to import some of that oil. The beauty is that we can refine that oil and export it and change some of our trade dynamics. In fact, in 2011, for the first time in a quarter century, the United States was a world leader in refined petroleum products. So I think there are some really exciting opportunities but as was alluded earlier, all these other energy sources creating diversity in, for example, our power generation, if you will, is important. There is value in diversity. We learned that from grade school on. You do not put all your eggs in one basket. You want diversified energy portfolios.

Chairman TIPTON. As you can hear, they are preparing to call votes but I do have one final question for Mr. Ormerod.

When we are looking at the game changers that you had talked about in terms of being able to provide energy needs and revitalize the manufacturing in this country, would it be a correct assessment that maybe the secret weapon that the United States has had to not only be able to create jobs and good paying jobs and still be competitive against people that can afford to pay far less in foreign countries on a production level has been affordable energy in this country? Is that a fair statement?

Mr. ORMEROD. Well, it certainly helps a lot. The energy costs that go into producing the steel that we use and also the processing of that steel is very significant to us. So if we can get cheap steel and we have got cheap energy to actually process the steel at our place it makes a very big difference to us.

Chairman TIPTON. Great.

Thank you all so much. We certainly appreciate your patience at the beginning of this hearing, and we are doing the other portion of our job in terms of the voting.

I would like to be able to submit with unanimous consent to the record a report on the Benefits of Natural Gas Production and Exports for U.S. Small Businesses because the big guys may be able to play and to be able to generate, but small businesses is the number one job creator in this country and the domino effect that we see from responsible development of these resources down to the local restaurant, I do not believe that we can overstate.

So with that, so ordered.

Once again, I thank all the witnesses for appearing at today's hearing and for your valuable insights that you provided to this Committee. As I mentioned in my opening statement, the potential benefit for these energy resources to our nation are truly extraordinary. At the same time, Congress should avoid the temptation of putting all of our eggs in one basket, entrusting the economic security of this country to just two energy sources. In addition to oil and natural gas, the United States also possesses significant coal and hydropower resources. Advances in technology are increasing the capacity and reducing the cost of renewable energy as well. There is some potential for nuclear energy that we can use in this country, as well as wind and solar. In short, what I believe we truly need is that "all of the above" energy strategy.

I would like to be able to ask unanimous consent that members have five legislative days to be able to submit statements and supporting materials for the record.

Without objection, so ordered.

This hearing is now adjourned. And again, thank you for being here.

[Whereupon, at 12:33 p.m., the Subcommittee was adjourned.]

APPENDIX

COMMITTEE ON SMALL BUSINESS

Washington, DC • June 20, 2013

PREPARED TESTIMONY:

By John W. Larson [1]

Chairman Graves, Ranking Member Velazquez and distinguished members of the Committee on Small Business, it is an honor to speak with you today about the economic growth and employment opportunities being fueled by our country's unconventional energy revolution.

The United States is in the midst of an unconventional revolution in oil and gas that, it becomes increasingly apparent, goes beyond energy itself. Since 2009, our company has engaged in numerous studies to better understand and accurately quantify the dramatic economic contributions associated with this unconventional revolution. Today, the exploration and production industry driving this unconventional revolution supports 1.7 million jobs across a vast supply chain—a considerable accomplishment given the relative newness of the technology. That number could rise to 3 million by 2020. In 2012, this revolution added $62 billion to federal and state government revenues, a number that we project could rise to about $111 billion by 2020.[2] What is now becoming clear is that the exploration and production industry contributions to the economy and the lower costs of energy brought about by this abundant growth in supply is helping to stimulate a manufacturing renaissance and improve the competitive position of the United States in the global economy—further stimulating job creation in the United States.

Where did the unconventional revolution come from?

The unconventional revolution has unfolded rapidly. As recently as just a half-decade ago, during the period preceding the Great Recession, it was widely assumed that a permanent era of energy shortage was at hand. American's demand for oil and natural gas

[1] John Larson is the Vice President and global leader for customized analytic and economic solutions within IHS Economics & Country Risk Group.

[2] IHS, *America's New Energy Future: the Unconventional Oil and Gas Revolution and the United States Economy, vol. 1 National Economic Contributions* (October 2012) and *vol. 2, State Economic Contributions* (December 2012).

was increasingly focused on non-dramatic sources. The country, it seemed, was on a path to spending several hundreds of billion of dollars more every year on imports to meet oil and natural gas demand. How different things look today.

US crude oil output, after a nearly 40 year decline, has increased dramatically—by 46% since 2008.[3] Net petroleum imports have fallen from 60% of total consumption in 2005 to 36% in the first four months of 2013. The decline is due, in part, to moderating energy demand during the slow recovery in the wake of the Great Recession, however, greater fuel efficiency in autos and a slowing of the growth in total vehicle miles will continue to constrain the growth of demand. But, the decline in imports has also been achieved through significant supply side changes resulting from that dramatic increase in U.S. oil production. The largest element of this increase in production comes from what has become the newest major advance in energy development: tight oil. In fact, oil imports in 2012 would have cost the United States around $70 billion more and increased our trade deficit a little over 10%—were it not for the increase in production capacity brought about by tight oil since 2008.

With respect to natural gas, in just seven years, US natural gas production has risen from 51 billion cubic feet (bcf) per day to 66 bcf per day—a 27% increase. This rapid rise was driven primarily by shale gas production. In 2000, shale gas accounted for just 2% of total natural gas production. Today, shale gas accounts for nearly 44% of total natural gas production. This rapid rise in unconventional production has also enhanced US energy security. Five years ago, due to constrained production, the United States seemed locked into importing increasing amounts of liquefied natural gas (LNG) and was heading towards spending as much as $100 billion dollars on future imports to meet domestic demand. Now, these newly unlocked resources ensure that the United States will need, at most, minimal LNG imports to balance supply with demand. Instead of debates over US imports, there is the prospect of exporting some of the domestic surplus, as well as the potential for using natural gas in some classes of vehicles.

What is the economic impact of the unconventional oil and gas revolution?

While various states had begun to home in on the economic development aspects of shale gas and tight oil, it was only in last several years that its significance for the national economy started to come into focus. We have undertaken a series of studies to assess the economic impact of the unconventional revolution. The first two—released late last year—examined the national and state-by-

[3] *Energy Information Administration,* Monthly Energy Review (May 2013).

state impacts.[4] We are now extending that study to assess the impact on manufacturing—which will be released in July 2013.[5]

So far, this unconventional revolution is supporting 1.7 million jobs—direct, indirect, and induced. Looking towards the future, the industry will continue to contribute to strong job growth bringing the total to 3 million workers by the end of this decade. At a time of great concern about the federal budget, it is also important to note the important revenue implications associated with this energy revolution. Total revenues flowing to governments from unconventional activity amounted to $62 billion last year and will rise to $111 billion by 2020. This does not include revenue from traditional oil and gas activity. By 2035, unconventional activity is expected to have generated nearly $2.5 trillion in cumulative government revenues since 2012.

It is also notable that, owing to the long supply chains, the job impacts are being felt across the United States, including in states without significant shale gas or tight oil activity.[6] That is to say, when it comes to unconventional activity, a state does not need to have a major unconventional play within its geographic boundaries to benefit economically from the activity. In fact, nearly 30 percent of all jobs associated with the unconventional energy revolution are found in states with no appreciable unconventional activity. For example:

- In Missouri, economic activity associated withy supply-chains that supported unconventional activity in 2012 contributed nearly 38,000 jobs to the state and generated almost $290 million in state and local taxes.
- In New York, a state that currently bans unconventional activity, 44,000 jobs along with $1 billion in state and local taxes can be attributed to activities supporting the supply-chain associated with shale gas and tight oil in other states across the country in 2012.

A key reason for the profound economic impact of the unconventional activity is the fact that it combines a capital-intensive industry with a broad domestic supply chain. The United States is a leader in all aspects of the unconventional industry, which means that most of its suppliers are domestically-based, and that means a larger portion of the dollars spent are supporting domestic jobs in trucking, steel fabrication, aggregates, heavy equipment manufacturing, hotels, housing, and restaurants, among others.

---

[4] *IHS, America's New Energy Future: the Unconventional Oil and Gas Revolution and the United States Economy, vol. 1 National Economic Contributions* (October 2012) and *vol. 2, State Economic Contributions* (December 2012).

[5] *IHS, America's New Energy Future: the Unconventional Oil and Gas Revolution and the Manufacturing Renaissance, vol. 3* (July 2013)

[6] Producing states are defined as those that are part of the 20 largest unconventional oil and natural gas producing plays in the US Lower 48, such as the Bakken and Marcellus Shale plays. Non-Producing states are not part of the 20 largest unconventional oil and natural gas producing plays in the US Lower 48 and are not part of an emerging oil or natural gas play in the 2012 to 2035 forecast horizon. These states may be part of plays that are currently producing oil and/or natural gas, but nevertheless are classified as non-producing states, because current production is relatively small and the prospect for future unconventional production is unknown.

But there is now an even bigger positive impact for our economy that is beginning to be recognized. In addition to these specific contributions to the economy, there are larger macroeconomic effects attributed to the savings brought about by lower natural gas prices and corresponding electricity prices. In our study, *The Economic and Employment Contributions of Shale Gas in the United States,* we identified the following two important macro-economic implications stemming from lower natural gas prices:

- For U.S. based industries, the abundance of affordable natural gas means lower input and feedstock prices. As a result, industrial production—the measure of output from manufacturing, mining, and utility industries—will increase 2.7 percent by 2015 and 4.7 percent by 2035.
- For households, these lower prices cascade through the economy, resulting in a $926 increase in annual average disposable income in 2015. By 2035, annual average disposable income per household will have increased by more than $2,000.

Manufacturing Renaissance?

The impact on manufacturing is notable. Several factors are shifting the economics in favor of on-shoring and fueling the resurgence of manufacturing in the US. First, global labor wage rates for many off-shoring locations have significantly outpaced US wage increase, narrowing the wage gap. Second, in an increasingly advanced manufacturing world, technology is shifting the balance away from the importance of low cost labor toward higher skilled workforces. Third, rapidly evolving energy landscape is fundamentally shifting the traditional economics around supply chain as:

(1) higher oil prices, which have tripled in the last decade have significantly increased the transportation costs making off-shoring less attractive;

(2) the unconventional revolution in the US, which has ushered in a new era of affordable and abundant domestic natural gas, is creating significant competitive advantages for both energy intensive industries and industries that rely upon natural gas derivatives as critical feedstock to production.

As a result, companies are now committing or planning investments that in total appear to range into hundreds of billions of dollars.[7] The US chemical industry is particularly well positioned to capitalize on the benefits of this unconventional revolution. This industry is highly energy intensive using energy inputs, mainly natural gas and natural gas liquids, as both the major fuel source and feedstock. The US chemical industry's feedstock prices are now among the lowest in the world. As a result, the US is gaining a decisive competitive advantage in the cost of producing basic petrochemicals like ethylene, ammonia, methanol, and their downstream derivative products.

[7] American Chemistry Council, *Shale Gas, Competitiveness, and New U.S. Chemical Industry Investment—An Analysis of Announced Projects* (May 2013)

A large number of chemical companies, for instance, have announced plans to build or expand facilities in North America with capital expenditures totaling close to $100 billion.[8] Will all be built? Time will tell. But what is striking is that, just five years ago, these companies would have scoffed if they had been told that they would be investing back into the United States. The investments are coming both from US based companies, which are "onshoring" in response to lower energy costs, and from foreign companies.

Conclusion

Altogether, the unconventional oil and gas revolution has already had major impact in multiple dimensions—beginning with U.S. energy supply and costs and now extending to government revenues, manufacturing, and the wider economy. Its significance will continue to grow as it continues to unfold. These hearings provide a very timely opportunity for assessing that impact and significance in its many dimensions, and I am pleased to respond to the committee's questions.

[8] *IHS, Energy and the New Global Industrial Landscape: a Tectonic Shift?* (January 2013), p. 2.

TESTIMONY OF SIMON ORMEROD,

CEO of AJAX ROLLED RING & MACHINE

PRESIDENT, FORGING INDUSTRY ASSOCIATION

BEFORE THE

U.S. HOUSE of REPRESENTATIVES COMMITTEE ON SMALL BUSINESS

SUBCOMMITTEE ON AGRICULTURE, ENERGY & TRADE

June 20, 2013

Chairman Tipton, Ranking Member Murphy, and Members of the Subcommittee, thank you for the opportunity to testify before you today on the economic benefits of increased domestic supplies of natural gas and oil on manufacturing in general, and the forging industry in particular.

My name is Simon Ormerod, and I am the CEO of Ajax Rolled Ring & Machine in York, South Carolina. I am also the current President of the Forging Industry Association (FIA) and am honored to testify on FIA's behalf. Headquartered in Cleveland, Ohio, FIA is the primary trade association representing the bulk of forging capacity in North America.

Forging is the oldest known metalworking process, where metal is heated and then formed under high pressure into a wide variety of high-strength parts used in anything that rolls, floats or flies. Virtually any metal can be forged, from aluminum to zirconium. The process is usually performed by preheating the metal to a desired temperature before it is worked.

Ajax Rolled Ring & Machine was established in 1980 and has approximately 100 employees. We are a custom manufacturer of seamless rolled rings that are used in a variety of critical industrial components including bearings, gears, flanges, and valve seat rings for end-use markets such as power-generation including steam and gas-turbine, wind energy, mining and construction equipment, oil & gas, petrochemical, defense, rail transportation, and a wide variety of general industrial applications. We make rolled rings that range from 7.5 to 100 inches in diameter and weighing from 15 to 3,500 pounds, using carbon, alloy, and stainless grades of steel as well as certain non-ferrous grades such as copper.

The modern forging process is both capital-intensive and energy-intensive. Adding a new production line for our company would cost in excess of $15 million, and we have significant expenditure on our equipment every year due to the intense wear on the equipment. We also are a major user of natural gas and electricity in our region. Given those requirements, it may surprise you to know that

most forging plants are small and medium-sized businesses. Specifically, 95 of FIA's approximately 200 members are small businesses. Focusing just on our forging producer members, 50 out of 110 are small businesses. Approximately half of our supplier members are small businesses. 55% of FIA members have sales below $30 million. Only 12% have sales over $120 million. These plants provide over 35,000 well-paid jobs and benefits. In 2012, the average hourly rate for a forge employee was $19.28 with an additional $9.48 of benefits paid by the employer.

In 2012, custom forging accounted for nearly $10.6 billion of sales in North America. An additional $3–$5 billion in catalog and captive sales would bring the industry total for 2012 to the $13.6–15.6 billion range. Comprised of less than 500 forging operations in 38 states, Canada and Mexico, the largest U.S. presence of forging operations is in Ohio (77, Pennsylvania (63), Illinois (54), Michigan (54), California (38), Texas (41), New York (16), Indiana (18), Wisconsin (17), Kentucky (13), Massachusetts (10) and South Carolina (9).

In spite of the fact that the industry is populated by mostly small and medium-sized businesses, the forging industry is critical to the U.S. economy. We are, in fact, one of the corner stones of U.S. manufacturing.

Forged parts are strong and reliable and therefore, vital in performance-critical applications. Forgings are rarely seen or identified by consumers, because they are normally component parts inside assemblies. For example, forgings are necessary components in the following applications:

- **Automotive -** A single car or truck may contain 250 forgings, predominantly in the engine and transmission; 40% of all truck axle assemblies are comprised of forged components;
- **Aerospace -** structural, engine and landing gear parts of commercial and military aircraft are forged;
- **Defense -** a heavy tank contains over 550 separate forgings; the 120mm gun tube on the M1A2 battle tank is forged; the US Navy's Aegis Class guided missile destroyers are steered by 2 forged rudder stocks approximately 20 feet in length and weighing 35,000 pounds each; Cruise missile warheads and all penetrator bomb cases are forged; a standard artillery shell usually contains at least 2 forged components;
- **Power Generation -** pressure vessels, generator rotors, pump shafts, valve manifolds, valve bodies, turbine blades and shafts, pipes and fittings are forged for nuclear (commercial and naval), land and marine power generation equipment;
- **Wind Energy -** about 20 metric tons of forgings are used in a typical large wind turbine;
- **Oil and Gas Exploration -** hundreds of forgings are used in both an oil rig tension leg platform and a land-based drilling rig; in addition forgings are used in the transportation of oil and gas under high pressure;
- **Mining -** forgings up to 70,000 pounds are used in surface and underground mining equipment;

- **Rail -** The Association of American Railroads requires all axles to be forged for locomotives. The traction gears and the engine crankshaft and camshaft in locomotives are also all forged;
- **Medical -** Quality surgical tools and joint replacements require strong, lightweight forgings;
- **Tools -** Hammers and wrenches are forged; and
- **Sports -** Forged golf clubs allow more efficient transfer of energy from club to ball than traditional clubs—that equals more distance without swinging harder.

Forging is Both Energy-Intensive and Critical to the Energy Production Sector

Because we produce parts for the energy supply chain and are heavily dependent on adequate supplies of competitively priced natural gas and electricity, forgers like Ajax are in a unique position to comment on the overall benefits to the economy created by the increased supplies of domestic natural gas and oil we are now enjoying in the U.S. Increased exploration for oil and gas is not only beneficial to our cost structure, through lower priced energy, but also leads to increased demand for our forgings.

Direct Suppliers to the Oil & Gas Industry

As noted above, hundreds of forgings are used in both oil rig tension leg platforms, land-based drilling rigs and pipelines. My company makes gears, bearings and flanges that are sold to valve, pipe and flange manufacturers in the oil & gas field. Our products are also sold to the manufacturers of drills, pumps and many other related equipment applications. Other forgers make critical parts such as the forged drill bits, without which the hydraulic fracturing ('fracking') activity in our country would not be possible. This industry is responsible for much of the increased supply of domestic natural gas we are seeing today.

Demand for forged rings that we supply for valves used in oil and gas pipelines has risen by 20–30 percent in the past 2 years. We have added at least 10 new positions in this timeframe for both forging and precision machining activities. The exacting requirements of these valves, many of which are for sub-sea applications, are such that only stainless steel forgings of the very highest standards and machined to tolerances of thousandths of an inch are acceptable.

As many have noted, opportunities such as shale gas extraction and the potential Keystone Pipeline extension in the U.S. occur once in a generation. Shale gas extraction is already providing significant benefits to our economy, and the Keystone Pipeline extension promises to create a significant number of jobs during construction as well as provide cost-effective supplies of crude oil from a stable and friendly source. The FIA strongly believes that safe, responsible development of these energy sources will continue to fuel a U.S. manufacturing renaissance, and U.S. policies should not erect artificial regulatory barriers to their success.

Abundant Domestic Supplies of a Key Input to the Forging Process

In the case of natural gas, we benefit directly from the increased exploration, extraction and transportation of gas because we supply to the industry itself. Also, as natural gas is a key input and a key cost driver in our manufacturing process, we also benefit from stable pricing of that energy source.

Most forging work is done at temperatures up to 2300°F, with subsequent heat treating done at up to 1900°F, using natural gas or electric furnaces. Therefore, forgers require adequate, stable, affordable supplies of natural gas and electricity to make the critical parts we make for nearly every industry sector imaginable.

In 2008, natural gas prices were extremely volatile and supply was inadequate. Prices ranged from $5.8 per MBTU to $12.7 per MBTU. When natural gas is both a key input and a key cost driver, that market volatility makes is extremely difficult to plan and to remain globally competitive. In addition, the competitive nature of our industry means that such cost increases can rarely be passed on to the customer.

Forgers' other key raw material is metal, and for most forgers this means steel. The metal producers also require natural gas as a key input and a low and stable gas price helps them to keep metal prices lower for their customers. While the majority of the metal producers might not qualify as small businesses, their customers often are. These customers could be forging companies, such as Ajax, or else distributors, many of whom are also small businesses.

Today, with the abundant supplies of natural gas being extracted and sold in the U.S., we have confidence in the stability and competitive price of the market. Since the beginning of 2011, the price range has been between $1.95 MBTU and $4.50 MBTU. That means I can have confidence in my ability to be competitive, because I can predict the cost of one of my key inputs. I can also feel more confident in making investment decisions, which involve a longer time horizon, because I have more confidence that energy costs and supplies will be more stable. A further factor is our competitive position versus overseas forging companies. The fact that we have stable and low priced energy helps us to compete with these companies both in the U.S. and in overseas markets.

Conclusion

It is easy to see the immediate effect on job creation in the towns and states where shale gas extraction is actively being conducted. It is a logical next step to consider the increased jobs that suppliers to the oil & gas industry, like Ajax, have been enjoying as a result of this increased gas exploration and extraction activity. Your subcommittee has already heard from small businesses that will be directly impacted by the building of the Keystone Pipeline extension. For those of us that supply directly to the oil and gas industry, demand for forgings has slowed somewhat now that the extraction is

actually taking place. Approval of the Keystone Pipeline extension would obviously generate significant new demand.

However, because natural gas is also an input and key cost driver in my manufacturing process, the stable, adequate supplies of less expensive domestic natural gas means that there is more activity in many sectors, whether for defense applications, rail applications or general industry and the long term benefits will be significant.

The U.S. must be very cautious in enacting regulatory barriers to increased domestic supplies of oil & gas. Policies that artificially increase prices or restrict supplies would certainly have a direct negative effect on the entire oil & gas supply chain regardless of company size. But they would also negatively affect hundreds of small manufacturers like Ajax and others in the forging industry supply chain that provide critical components to almost every industry you can imagine—and that means everything from airplanes to hand tools to hip joints. That is why we believe that policies that continue to encourage safe exploration and development of domestic energy sources are vital to the continued revival of U.S. manufacturing, including the forging industry.

Thank you for the opportunity to appear before you today. I look forward to your questions.

Testimony of Moffat County Commissioner Charles G. Grobe

In front of

Small Business Subcommittee on Ag, Energy and Trade

June 20, 2013

Thank you Chairman Tipton, Ranking Member Murphy, and other members of the subcommittee for holding this important hearing. My name is Chuck Grobe, and I am a county commissioner from Moffat County, Colorado. When combined, the coal, uranium, vanadium, oil shale, shale-oil and natural gas in our region has the potential to power our nation for generations as technologies continue to unlock and enhance their energy potential. I will be sharing with you the benefits of oil and natural gas production related to job creation in Northwest Colorado.

Moffat County is the second largest county in Colorado with just over 3 million acres of land, 60% of which is federally managed. Our public and private lands host a variety of uses that sustain our economy and culture. The top ten taxpayers of Moffat County are all energy related, and 20% of our tax base is supplied from the oil and gas sector. The Yampa River runs through the middle of our county and hosts endangered fish along with sport fish. The Sagebrush Steppe in our county hosts some of our state's largest cattle ranches, various oil and gas operations, coal mines, a power plant, and Colorado's largest Greater Sage Grouse populations. In the past and future, coal has and will play an important role in the economic well-being of Moffat County. The Mancos and Niobrara formations exist throughout Colorado (and other states) and hold the promise of great prosperity for Western Colorado. In fact, recently, the most prolific Niobrara well in Colorado was drilled in neighboring Garfield County and is the highest producing shale well in Colorado to date. Our citizens have a history of generations being employed by the agriculture, energy, and recreation sectors all receiving various nationally recognized awards for land animal conservation. Most importantly, our community has decades of on-the-ground examples of collaborative efforts that bring varous interest groups to the tables to reach agreement on the most controversial public lands issues.

Vermillion Basin:

One of these issues is that of the Vermillion Basin. The Vermillion Basin is a 77,000 acre cold desert shrub land that hosts a 200 billion cubic feet natural gas resource as well as equally valued scenery and wildlife. Over a decade ago, and very early in the Bureau of Land Management's land planning process, the Moffat County Commissioners acknowledged the environmental values of Vermillion Basin as well as its natural gas potential. Moffat County proposed to protect those environmental values while encouraging the local economy through natural gas development, having

only the absolute highest reclamation standards known to work in the high desert ecosystems of the Vermillion Basin. Moffat County then led the consensus building process between all affected governments and agencies, known as Cooperating Agencies, to agree to protect 99% of Vermillion Basin while only utilizing 1% of the surface at any given time. For several years, the local Bureau of Land Management office backed this plan. Entirely due to political reasons, the locally supported plan of protecting 99% of Vermillion Basin's surface was overturned by Washington politics, and Vermillion Basin is currently inaccessible to natural gas development. The economic losses of not developing Vermillion Basin translate to:

- $700 million of natural gas resource that would be extracted (sold at $3.50/mcf)
- $25.6 million to Moffat County Taxing Districts (Moffat County School District, Colorado Northwestern Community College, Craig Rural Fire Protection District, City of Craig, Town of Dinosaur, Colorado River Water Conservancy District, and Moffat County)
- $7.7 million in bonus payments split between the State and Federal government and partially returned to counties and cities within Moffat County (leased at $100/acre Moffat County average 2008–2010)
- $87 million in federal royalties partially returned to cities and counties within Moffat County
- $43.75 million of the State of Colorado's share of royalty
- $77 million of ad valorem (i.e. production) and severance tax payments

With the uncertainty of conducting business where situations such as the Vermillion Basin example carry the day, where political will rather than facts dictate the outcome, small businesses across our region cannot afford to risk the finances to start or grow business that do not have regulatory certainty and businesses cannot provide reliable employment.

Excessive local, state, and national regulations on the oil and gas industry cause volatility to our economies:

Despite the good news of jobs and new revenues on the horizon, the promise of prosperity for rural Western Colorado is obstructed by a very dark cloud. Regulatory uncertainty, unnecessary federal regulations, frivolous lawsuits, and the lack of political courage by the current administration to allow development of these new oil and gas sources, puts our jobs potential in jeopardy. Quite often political will, rather than facts, dictate whether or not to develop particular energy projects. Unfortunately, this misguided approach has had numerous consequences for small businesses and our economics across the region. Regulatory uncertainty for the oil and gas industry has a negative impact on small businesses. Wages in the oil and gas industry are 51% higher than most other industries in the state. These are good paying jobs. Oil and gas employees stay at our local hotels, eat in our restaurants, and shop on main street. Many companies have chosen to focus their efforts in states with

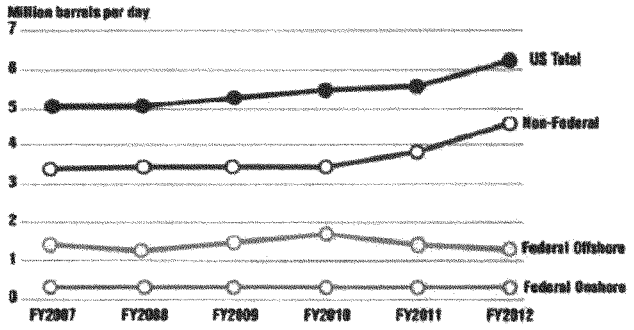
pro-development policies. As a result, Colorado has lost important revenues and jobs.

To demonstrate how companies desire to avoid regulation, in Northwest Colorado, the Niobrara Shale-oil project has been heavily explored for the last couple years. The Niobrara oil resource straddles Routt and Moffat County equally. The USGS identifies the Niobrara oil resource as similar acreage in each county, similar depth in each county, and generally regards the geophysical opportunity for extraction equal in each county. Each of these counties has long standing, tremendously different philosophical perspectives on drilling. Moffat County generally has a blue-collar work force that make a living in the energy industry and their elected officials have traditionally represented such. Routt County is more of a resort area and is regarded by the state Oil and Gas Commission as one of the most regulatory restrictive counties in the state on oil and gas development. Last year, 20 wells were drilled in Moffat County exploring the Niobrara oil resources. Given the equal geologic opportunity to explore the Niobrara oil resource, one would expect a similar number of wells in Routt County. However, solely due to public desire and a long history of elected officials representing that public desire in the form of regulation, only one (1) well was drilled last year in Routt County.

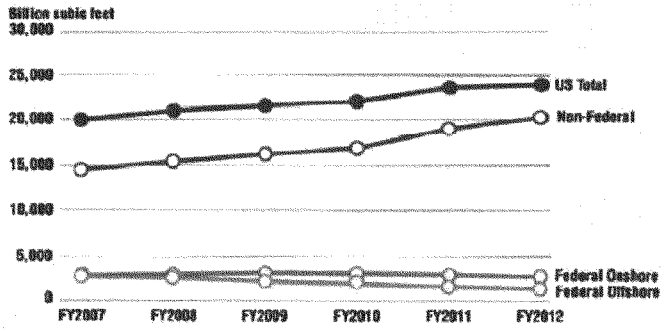
This same trend experienced locally was translated to the state level in 2008 when, due to additional regulatory burdens placed on the state by the Colorado General Assembly, significantly more strigent rules were placed on oil and gas operators through a new rulemaking process of the Colorado Oil and Gas Commission. The new rules gave Colorado national recognition as one of the most highly regulated states in the nation for oil and gas development. While the State will broadly acknowledge a general increase in applications to drill and the oil and gas associations will pubically acknowledge industry continues to drill in Colorado; this is not because of the additional rules, but in-spite of the rules.

Just as in both the county and state examples above, Congress must struggle with national rules, such as the Bureau of Land Management's hydraulic fracturing rules. Trends of increased regulation in the oil and gas industry have manifested locally through creative avoidance of federal lands. For example, it is common in my county for Federal Exploratory Units, known as federal units, to now follow unusual aliquot descriptions to avoid as much federal surface and minimize the inclusion of federal minerals simply to decrease the federal regulatory footprint. In fact, the same 2010 University of Colorado study mentioned above reveals the fact that oil and gas companies focus activity three fold greater on private land sthan they conduct activity on federal lands. This trend is alarming considering the cost of leasing private lands in Colorado is 8.5 times greater than federal lands. Despite the added costs of moving into private lands to avoid regulatory burdens, the trend is growing. The Niobrara shale oils in Moffat County are almost entirely being explored on private or State Trust Lands surface. The trend of oil and gas companies increasing operations on private lands is not only local and statewide, but national. See graphs below.

U.S. Oil and Lease Condensate Production
Federal and Non-Federal Areas, FY2007-2012



U.S. Natural Gas Production
Federal and Non-Federal Areas, FY2007-2012



Source: *U.S. Crude Oil & Natural Gas Production in Federal and Non-Federal Areas*, Marc Humphries, Congressional Research Service, March 7, 2013.

Balancing wildlife interests with energy development:

The above mentioned December 2011 Colorado University School of Business study revealed statistics that provided insights about the importance of the oil and gas industry for our nation, Colorado and small businesses. "The OIL & GAS Industry in Colorado directly employs over 40,000 people and supports over 107,000 jobs in the state and provides $6.5 billion in total labor income and $31 billion in economic output annually."

Some important figures from the above referenced study are:

- $130 million to school and education funds solely from State Land Board leasing/royalties (oil and gas, 2012)
- The oil and gas industry pays over 90% of our state's severance tax.

For Moffat County:

- 629 producing wells owned by 41 different operators
- 44 horizontal wells were permitted in 2012 with 16 currently producing. This is a significant increase from years past. If this trend continues, there will be more significant oil production on significantly less acreage, in turn, this will mean significantly higher property tax revenues with less surface disturbance.
- Oil production in Moffat County has increased 25% from 2011 to 2012 which will be reflected in 2013 when 2012 taxes are collected.

The tax revenues provided from the industry provide critical resources for education and other important programs. Protesters who oppose development fail to make this connection and do not consider that many of the other programs they support receive revenues and royalties from the oil and gas industry.

Colorado is filled with beautiful scenery and abundant wildlife. Current technology allows for a balanced approach that respects the environment but still allows us to make best use of our natural resources. Being home to the largest Greater Sage Grouse populations in Colorado, Moffat County has long led planning efforts to assure the thriving of grouse populations while simulateneously protecting a vibrant local energy economy. Known as the "Elk Capital of the World," we constantly struggle between balancing timing stipulations recommended by the Colorado wildlife management agency and finding a window within the year for industry to operate. Finding the balance where both wildlife and oil and gas can thrive seems to employ as many wildlife biologists as rig hands!

Summary

In addition to my years of experience working for a local power generation plant and experience as a local elected official at both the city and county levels, I have spent several hours discussing these issues with local business owners around my community. The need for stability within local businesses is evident. I have found that the uncertainty of the oil and gas industry, because of additional regulations, has a ripple down effect on local businesses. A

local specialty industrial parts supply house has chosen to focus on supplying products to the local power plant and coal mines instead of the volatile oil and gas industry. While the entrepreneurial spirit still exists, a consistent theme of being beat down by state and federal regulations causes companies to look for new markets. For example, a welding and fabrication shop has diversified and begun servicing oil fields in other states. The higher wages cause local business to desire to stay in the oil and gas industry. However, additional regulation is mounting on their backs and gradually growing regulatory burdens drag them down. High paying jobs and the entrepreneurial spirit is still driving extracting oil and gas resources from Moffat County, yet limited access to federal lands is driving exploration to the private land. Wilderness Study Areas, wildlife stipulations, and additional state regulatory burdens provide resistance to recovery from a nation-wide recession.

College of Engineering
Department of Electrical & Computer Engineering

Sean Meyn
Robert C. Pittman Eminent Scholar Chair
Director Florida Institute for Sustainable Energy
445 New Engineering Bldg. PO Box 116230
Gainesville, FL 32611 352-392-8924

June 17, 2013

Re: Subcommittee on Agriculture, Energy and Trade ***The New Domestic Energy Paradigm: Potential for Small Businesses and the Economy***

Thank you for giving me the opportunity to provide my recommendations at this very important meeting.

There are exciting times ahead in the energy sector. The world will see disruptive technologies to deliver clean energy at low cost. U.S. businesses together with individuals from government and academia will work together to make sure that the United States leads the energy revolution.

To understand what is needed today, it is useful to look back at the telecommunications revolution of the 1990s. It was helpful that the U.S. had Internet infrastructure in place. Breakthroughs in computing and communication hardware were taking place regularly through cooperation between industry and academia. In addition, there were major systems level questions – the complexity of communication at such a large scale seemed intractable in the late 1980s. Answers to these questions took significant ingenuity that was possible only because of creative researchers in information theory, communications, signal processing, and computer science. These breakthroughs took place primarily in U.S. universities and R&D laboratories.

Today in the energy sector we are witnessing many breakthroughs in energy technology that are quickly implemented. The Pacific Northwest is powered primarily by wind energy on the windiest of days, and wind penetration in the state of Texas is equally remarkable. Solar is growing in New Jersey, Texas, California and Arizona, and natural gas prices have fallen dramatically because of new sources in North America.

Along with all of this success, the challenges faced today in the energy sector are very similar to what we faced in the early 1990s at the start of the telecommunications revolution. There is long-term uncertainty regarding traditional fuel costs, and other risks associated with natural gas and coal. As explained below, we are not growing systems and control technology quickly

UF UNIVERSITY of FLORIDA

COGNITION & CONTROL IN COMPLEX SYSTEMS

enough to keep pace with installation of renewable generation. Renewable generation is cheap, provided there is appropriate infrastructure.

In the remainder of this report I will highlight challenges along with potential solutions and business opportunities.

Sincerely,

Sean P. Meyn
Director Florida Institute for Sustainable Energy
Robert C. Pittman Eminent Scholar Chair
Electrical and Computer Engineering

Challenge: ***Determining the right energy mix***

The sudden drop in natural gas prices does not mean that our grandchildren will grow up in a land of cheap energy.

Coal generation companies are shutting down today since they cannot compete with energy obtained from gas-turbine generators[1], and there are suggestions that U.S. policy may be less favorable to renewable energy due to the new availability of domestic natural gas. In my state of Florida, utilities are increasing their natural gas mix dramatically. Florida Power & Light is converting their old power plants to natural gas, so that 70% of their power will be from this source.

[1] Ripe for Retirement: The Case for Closing America's Costliest Coal Plants, Union of Concerned Scientists. Nov.13, 2012 Press Release: www.ucsusa.org/news/press_release/ripe-for-retirement-0349.html. Full document: http://www.ucsusa.org/assets/documents/clean_energy/Ripe-for-Retirement-Full-Report.pdf

Long-term forecasts suggest that these trends may damage the U.S. economy in the long-run. The 25-year fuel price forecast prepared by Black and Veatch[2] predicts a steady rise in natural gas prices, and flat forecasts for coal.

It takes years to build a large coal plant and bring it online, and it can take decades to develop new technology. We cannot wait until the price of natural gas spikes because of demand, or because of environmental concerns from drilling or carbon emissions.

From a statewide perspective it is unwise to focus on a single resource. Florida is paying $60 billion a year today from fuel that is imported from out-of-state. Cheap sources of natural gas are very far from Florida.[3] With innovation and infrastructure, the Sunshine State could easily have 30% solar energy, along with energy from biofuels and other new technologies.

Saudi Arabia has realized the importance of diversity of their energy supply. Recently in the news, *Saudi Arabia is planning to move aggressively into renewable energy, with plans to install more solar and wind power in the next 20 years than the rest of the world has installed to date.*[4]

- We need forecasts like those prepared by Black and Veatch and the Energy Information Administration, but we must admit that the uncertainty in these forecasts is significant. Forecasting costs is difficult because cost depends on infrastructure. Imagine the cost of driving a car if we had no roads? In the case of electric power, the infrastructure includes transmission and distribution, but also the ancillary services that are put in place to ensure reliability, and reduce the impact of volatile supply and demand.
- It is critical to have a diverse energy portfolio so that we can quickly adapt to changes in energy costs. In addition to new generation sources, we will improve traditional sources. For example, clean coal (with carbon capture) may prove to be both economical and friendly to the environment. In Florida, new cheap methods to create ethanol from algae and cellulose are being developed at new companies such as Algenol and INEOS.
- There are business opportunities around the globe. For example, Germany and Denmark are eager (at times, desperate) to obtain technologies to better manage the grid in the face of high penetration of energy from wind and solar. Saudi Arabia will face similar needs in the future. Business and research ingenuity will meet the challenges faced at home and abroad.

---

[2] Black & Veatch 2013 ENERGY MARKET OUTLOOK AND INDUSTRY TRENDS ENERGY MARKET PERSPECTIVE – END OF YEAR 2012 http://bv.com/docs/reports-studies/2013-energy-market-outlook-and-industry-trends.pdf

[3] Where does fracking water go? Reuters. http://blogs.reuters.com/muniland/2011/12/30/where-does-fracking-water-go/

[4] Saudi Arabia Looks to NREL for Solar Monitoring Expertise. NREL feature article, May 13, 2013. http://www.nrel.gov/news/features/feature_detail.cfm/feature_id=2196

UF UNIVERSITY of FLORIDA

COGNITION & CONTROL IN COMPLEX SYSTEMS

Challenge: ***Supporting small business***

The challenges today are spelled out in an article by Robert P. Scaringe, President & Founder of *Mainstream Engineering Corporation*, published recently in Florida Today.[5] This company is involved in many aspects of energy techonology.

A significant challenge today is lack of credit, which is currently hindering manufacturing and job growth.

The energy sector is also hindered by a lack of highly trained individuals from universities. Over the past two decades, many universities stopped hiring in the power systems area because of lack of DOE funding. It is now difficult to find graduates in power systems.

Challenge: ***Responsive generation and storage to regulate the grid***

Nature can impact the grid dramatically in terms of energy demand, supply, and price.

In the winter of 2011, coal generators in Texas froze, causing a loss of supply. Figure 1 shows the resulting prices, which peaked on February 2nd. That same summer, similar prices were observed because of high temperatures, which resulted in enormous spikes in demand. Price swings like these are observed around the world, wherever there are short-term energy markets.

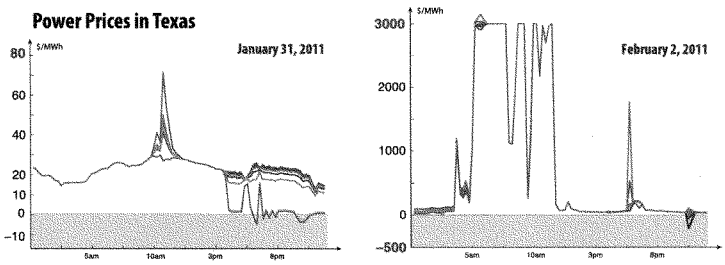


Figure 1: Power prices increase one-hundred fold during scarcity

[5] www.floridatoday.com/article/20130609/COLUMNISTS0205/306090002/Florida-must-do-better-by-manufacturing

Figure 2 shows typical energy supply from wind in the Pacific Northwest. This region often sees 4 GW of power from the wind – the same amount that would be obtained from four large gas-turbine generators, at an installation cost of *one billion dollars* per generator.

Unfortunately, there are days without wind. Also significant is the *variation* in wind generation output, which acts as a disturbance to the grid, much like an airplane flying through a thunderstorm.

FERC has recognized that incentives are needed for the creation of resources to mitigate the impacts of this volatility.

- Gas turbine generators are highly responsive, and hence can help to face this challenge.
- Much cheaper technologies will be developed in the future through batteries that can be charged and discharged.
- There are systems level question similar to the regulation problems faced in the Internet. The impact of volatility would be reduced with greater transmission across the western U.S. Deciding the best mix of transmission and generation is a highly complex problem, but no more complex than what we have solved in the past.

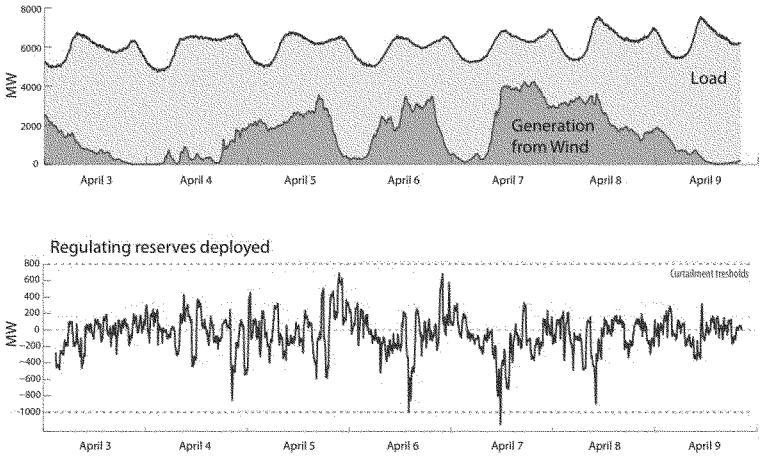


Figure 2: Energy supply from wind and reserve requirements in the Pacific Northwest during a typical week in the spring of 2013. Data obtained from the BPA website[6].

[6] BPA Balancing Authority Load and Total Wind, Hydro, and Thermal Generation http://transmission.bpa.gov/business/operations/Wind/baltwg.aspx

UF UNIVERSITY of FLORIDA

COGNITION & CONTROL IN COMPLEX SYSTEMS

Challenge: ***Consumer engagement***

The most exciting recent approaches to combating volatility of renewable generation have come from the demand side. Some of the recent innovation has been accelerated by FERC orders that have increased incentives for any assistance in regulating the grid.

There are millions of loads across the nation that are highly flexible – power consumption can be continuously altered by small amounts without significantly affecting the quality of service. The inherent flexibility of electric loads can form a strategic plan to address volatility in the grid. Through the use of appropriate control techniques, automated demand response can provide the same responsiveness that is obtained today through gas-turbine generation but at a fraction of the cost.

The most obvious example is manufacturing industries that require large amounts of power. If they can tolerate some variability in energy supply, then the price for that power will be much cheaper. *Low cost energy will accelerate growth of manufacturing in the United States.*

Automated load tuning is not to be confused with demand-side management that amounts to load-shedding. These programs have been in place since the 1980s, and have grown modestly in recent years – see Figure 8.13 of the 2012 EIA Annual report[7]

The following list is far from complete. The success of these programs has been mixed, and some are in their infancy. The main message is that storage and ancillary service are cheap, if you know where to look for it.

- An important example is heating, ventilation and air-conditioning (HVAC) in a commercial building. In particular, if the rate of airflow in a large building is reduced or increased by a small amount for a short time, the indoor climate is not significantly affected. Studies are underway at the University of Florida.
- Pool-pumps are a highly flexible load. This flexibility is harnessed for load shedding today by utility companies such as Florida Power & Light. In the future they may provide much more service to the grid. It may be a decade or more before we witness significant demand response from other residential loads. Businesses will eventually be created to aggregate flexibility from millions of small loads.
- ALCOA, Walmart, and other large energy consumers have contracts in place with utility companies to help regulate the grid. Obviously there are many other manufacturing companies that will participate in the future.

[7] EIA Annual Energy Review http://www.eia.gov/totalenergy/data/annual/index.cfm

UF UNIVERSITY of FLORIDA

COGNITION & CONTROL IN COMPLEX SYSTEMS

- All of these resources could add up to enormous reductions in energy costs, because energy from wind and sun would be more attractive. As we introduce greater and greater complexity to the grid, we may borrow ideas from telecommunications to improve robustness of the energy network. The dynamics of a power grid are nothing like the Internet or a cellular network, so we will also create new science to regulate the grid of 2020 and beyond.

Biography Sean Meyn received the B.A. degree in mathematics from the University of California, Los Angeles (UCLA), in 1982 and the Ph.D. degree in electrical engineering from McGill University, Canada, in 1987 (with Prof. P. Caines, McGill University). He is now Professor and Robert C. Pittman Eminent Scholar Chair in the Department of Electrical and Computer Engineering at the University of Florida, the director of the Laboratory for Cognition & Control, and director of the *Florida Institute for Sustainable Energy*. His academic research interests include theory and applications of decision and control, stochastic processes, and optimization. He has received many awards for his research on these topics, and is a fellow of the IEEE.

For the past ten years his applied research has focused on engineering, markets, and policy in energy systems. He regularly engages in industry and academic panels on these topics.

The Benefits of Natural Gas Production and Exports for U.S. Small Businesses

Raymond J. Keating
Chief Economist
Small Business & Entrepreneurship Council

May 2013

SBE COUNCIL
Small Business & Entrepreneurship Council
www.sbecouncil.org

Contents

Executive Summary 3

Introduction 5

I. United States 6

II. Arkansas 11

III. Colorado 14

IV. Louisiana 17

V. North Dakota 20

VI. Ohio 23

VII. Oklahoma 26

VIII. Pennsylvania 29

IX. Texas 32

X. Utah 35

XI. West Virginia 38

XII. Wyoming 41

XIII. LNG Exports: Expand or Limit Opportunities? 44

About the Author 47

Endnotes 48

Executive Summary

The U.S. natural gas market has changed dramatically in recent years, as evidenced by a 55 percent decline in the annual average price of natural gas occurring between 2005 and 2011. While assorted market factors come into play, this reduction in natural gas prices has been a direct result of expanded natural gas production in the U.S. Increased production has been a boon for the energy sector, including for employment and business growth, especially in those states where natural gas production has expanded, with indirect benefits across the nation.

Export Opportunities. Looking ahead, the opportunity exists for exporting liquefied natural gas (LNG), given the large differential in natural gas prices in the U.S. versus elsewhere in the world, and rising global demand. Unfortunately, though, there is a movement afoot to have government limit LNG exports, based on the unfounded fear that LNG exports will dramatically drive up domestic natural gas prices. But the economy is not a zero-sum game. Expanded demand for U.S. natural gas internationally will be a net positive, resulting in greater U.S. natural gas production, increased investment, enhanced GDP growth, rising incomes, and more jobs.

Several studies have validated the abundance of domestic natural gas for international export. The International Energy Administration recently projected that "the United States becomes a net exporter of natural gas by 2020 and is almost self-sufficient in energy, in net terms, by 2035." In addition, a recent study for the Brookings Institution noted, "In their analyses, both Deloitte and EIA found that the majority – 63 percent, according to both studies – of the exported natural gas will come from new production as opposed to displaced consumption from other sectors."

This report looks at some of the tremendous benefits that have emerged for the U.S. economy due to a vast expansion in natural gas production in less than a decade. In particular, this report focuses on the growth in jobs and the number of small and midsize businesses in key energy sectors, including in states where natural gas production has increased and where such production is expected to expand. It follows that the U.S. becoming a leader in meeting global natural gas demand would be a clear benefit to the overall U.S. economy, and again, particularly in those states leading the way in natural gas production.

Rising Production. Natural gas production increased by 27 percent from 2005 to 2011. This increase in natural gas has come from high production levels from shale gas, which increased by 947 percent, due to a combination of horizontal drilling and hydraulic fracturing.

Expanded demand for U.S. natural gas internationally will be a net positive, resulting in greater U.S. natural gas production, increased investment, enhanced GDP growth, rising incomes, and more jobs.

Jobs Growth. For the U.S. overall, while total employment *declined* by 3.7 percent from 2005 to 2010, jobs *grew* by 27.6 percent in the oil and gas extraction sector; by 15.1 percent in the drilling oil and gas wells sector; by 38.5 percent in the support sector for oil and gas operations; by 47 percent in the oil and gas pipeline and related structures construction sector; and by 62 percent in the oil and gas field machinery and equipment manufacturing sector.

Small Business Growth. Meanwhile, the same contrast held in terms of changes in the number of businesses, including small business. For all of the U.S., total employer firms *declined* by 4.2 percent from 2005 to 2010, including a 3.7 percent decline in firms with less than 20 workers, and a 4.2 percent fall in firms with less than 500 workers. But within the energy sector, business growth in key industries has been striking:

- The number of oil and gas extraction employer firms grew by 3.1 percent, including growth of 2.5 percent among firms with less than 20 workers and 3 percent among firms with less than 500 workers.

- The number of drilling oil and gas wells employer firms grew by 7.2 percent, including 4.7 percent among firms with less than 20 workers and 7.3 percent among firms with less than 500.

- The number of oil and gas operations employer firms grew by 24.5 percent, including 24.5 percent among firms with less than 20 workers and 24.6 percent among firms with less than 500.

- The number of oil and gas pipeline and related structures construction employer firms grew by 5.1 percent, including growth of 3.5 percent among firms with less than 500 workers.

- The number of oil and gas field machinery and equipment manufacturing employer firms grew by 61.0 percent, including growth of 59.0 percent among firms with less than 20 workers and 62.7 percent among firms with less than 500 workers.

Small Business Population. At the same time, small and midsize firms overwhelmingly populate each of the energy sectors considered. Businesses with less than 20 workers came in at

- 91.3 percent of oil and gas extraction employer firms;

- 80.4 percent of drilling oil and gas wells employer firms;

- 84.7 percent of oil and gas operations employer firms;

- 63 percent of oil and gas pipeline and related structures construction employer firms; and

- 60.3 percent of oil and gas field machinery and equipment manufacturing employer firms.

It follows that the U.S. becoming a leader in meeting global natural gas demand would be a clear benefit to the overall U.S. economy, and again, particularly in those states leading the way in natural gas production.

In the 11 states examined in this report, the dominance of small and midsize firms populating energy industries held as well. Interestingly, the contrast between a national decline in overall jobs and businesses, and growth in key energy sectors often was even far more striking than the national differences. The general case of energy industries adding jobs and small businesses, as opposed to national declines, held in the 10 states – that is, in Arkansas, Colorado, Louisiana, North Dakota, Oklahoma, Pennsylvania, Texas, Utah, West Virginia, and Wyoming – where natural gas production was up markedly. (*A Summary Sheet for each state is available.*)

Opportunities Ahead. The expectation that nearly two-thirds of LNG exports would be met via new production speaks to further strong growth for small and midsize businesses, and for employment. At the same time, the minimal price impact that expanded exports might have on domestic prices would have small effects on domestic consumers of natural gas, especially given the enormous declines we've already experienced in natural gas prices. And even those small, potential price increases must be further offset against the effect of the overall positive for economic growth coming via expanded natural gas production. **Clearly, LNG exports guided by market forces mean further expanding opportunity for small and midsize businesses to be created, to grow, and to create jobs.**

Introduction

The U.S. natural gas market has changed dramatically in recent years. Consider the drop in natural gas prices. For example, the annual average price of natural gas (dollars/mil. BTUs) went from $9.014 in 2005 to $4.026 in 2011. That 55 percent decline generated considerable savings for U.S. households and businesses via electricity prices – given that 25 percent of electric power is generated via natural gas – as well as for a wide array of industries that use natural gas in their production processes.

While assorted market factors come into play, lower natural gas prices have resulted directly from expanded U.S. natural gas production. That increased production has been good news for the energy sector, including for employment and business growth, especially in those states where natural gas production has expanded, with indirect benefits spreading across the nation.

Looking ahead, the opportunity exists for exporting liquefied natural gas (LNG)[1], given the large differential in natural gas prices in the U.S. versus elsewhere in the world, and rising global demand. For example, in November 2012, the International Energy Administration reported: "The *WEO* finds that the extraordinary growth in oil and natural gas output in the United States will mean a sea-change in global energy flows. In the **New Policies Scenario**, the *WEO*'s central scenario, the United States becomes a net exporter of natural gas by 2020 and is almost self-sufficient in energy, in net terms, by 2035... While the regional picture for natural gas varies, the global outlook over the coming decades looks to be bright, as demand increases by 50% to 5 trillion cubic metres in 2035. Nearly half of the increase in production to 2035 is from unconventional gas, with most of this coming from the United States, Australia and China."[2]

Looking ahead, the opportunity exists for exporting liquefied natural gas (LNG), given the large differential in natural gas prices in the U.S. versus elsewhere in the world, and rising global demand.

The U.S. becoming a leader in meeting global natural gas demand would be a clear benefit to the overall U.S. economy, and particularly in states leading the way in natural gas production.

It's important to consider the benefits that accrue to workers, small businesses, individual states, and the U.S. economy when domestic energy production, such as in natural gas, expands. Let's review key points.

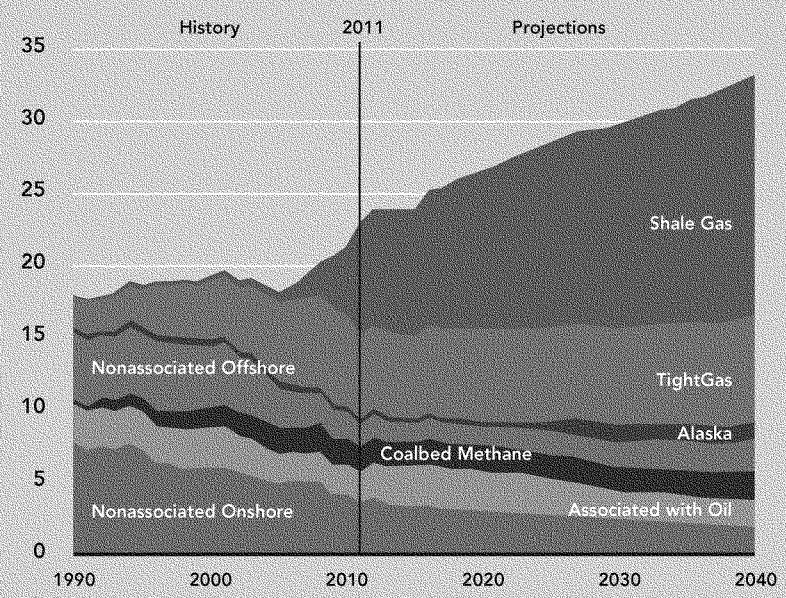
I. United States

After small increases throughout the 1990s, for example, natural gas production in the U.S. hit a high of 19.62 trillion cubic feet in 2001, and then declined for the following four years. In 2005, U.S. natural gas marketed production registered 18.05 trillion cubic feet, which was roughly the same level as in 1993. However, growth resumed, and natural gas production in the U.S. hit 23 trillion cubic feet in 2011, which was a 27 percent increase over 2005. All of the increase in natural gas production basically has come from shale gas, which increased by 947 percent from 2005 to 2011. What's behind this vast expansion in recent production, not to mention an expanded view of resources into the future?

The EIA explained, "Over the past decade, the combination of horizontal drilling and hydraulic fracturing has allowed access to large volumes of shale gas that were previously uneconomical to produce. The production of natural gas from shale formations has rejuvenated the natural gas industry in the United States."[3]

Looking into the future, the EIA "projects U.S. natural gas production to increase from 23.0 trillion cubic feet in 2011 to 33.1 trillion cubic feet in 2040, a 44% increase. Almost all of this increase in domestic natural gas production is due to projected growth in shale gas production, which grows from 7.8 trillion cubic feet in 2011 to 16.7 trillion cubic feet in 2040. Although the prospects for shale gas production are promising, there remains considerable uncertainty regarding

Figure 3: U.S. Dry Natural Gas Production by Source, 1990-2040



Source: This figure is from the *AEO2013 Early Release Overview*, U.S. Energy Information Administration, December 5, 2012

Table 1: U.S. Natural Gas Marketed Production

2005:	18,927.1 billion cubic feet
2011:	24,036.4 billion cubic feet

the size and economics of this resource... An analysis in the *Annual Energy Outlook 2012* (released June 2012) indicates that the uncertainty in the size and economics of the domestic shale gas resources could have a considerable impact on future domestic natural gas production and that 2035 shale gas production could be between 9.7 trillion cubic feet and 20.5 trillion cubic feet. U.S. total natural gas production is projected to range between 26.1 trillion cubic feet and 34.1 trillion cubic feet."[4]

For good measure, proved reserves of U.S. dry natural gas went from 192.5 trillion cubic feet in 2004 to 304.6 trillion cubic feet in 2010 – a 58 percent expansion.

This revolution in natural gas production – coupled with an increase in U.S. oil production (also due to the extraction technologies of hydraulic fracturing and horizontal drilling being applied, especially in Texas and North Dakota) – has provided considerable growth in the energy sector of our economy in recent years, while the overall economy has badly faltered.

It is important to keep in mind when looking ahead that projected resources and production in the areas of oil and natural gas usually turn out to be grossly under-estimated given innovations and improvements that occur in exploration and production technologies – as has been so glaringly the case with increases in both oil and natural gas production in recent years that were not expected a relatively short time ago.

As already noted (and see Table 1), U.S. natural gas marketed production grew by 27 percent between 2005 and 2011.

That expansion in production has led to growth in employment in the energy sector, while the overall economy experienced a decline in jobs.

Impact on Jobs

That expansion in production has led to growth in employment in the energy sector, while the overall economy experienced a decline in jobs.

Table 2 compares employment growth (all employment and business data from Census Bureau "County Business Patterns" unless otherwise noted) among employer firms in the overall economy, and in various energy industry sectors.

The difference in the employment story between the energy sector and the overall economy could not be starker. While overall employment fell between 2005 and 2010, jobs grew markedly in the energy sector given the striking expansion in domestic natural gas and oil production.

While U.S. total employment *declined* by 3.7 percent from 2005 to 2010, jobs *grew* by the following:

- 27.6 percent in the oil and gas extraction sector;[5]
- 15.1 percent in the drilling oil and gas wells sector;[6]
- 38.5 percent in the support sector for oil and gas operations;[7]
- 47 percent in the oil and gas pipeline and related structures construction sector;[8] and
- 62 percent in the oil and gas field machinery and equipment manufacturing sector.[9]

While U.S. employers overall shed 4.3 million jobs over this period, employers in the five energy industries included here directly added 146,000 jobs.

Table 2: Employment Growth Among Employer Firms, 2005-2010

Sector	2005	2010	Percent Change
Total	116,317,003	111,970,095	-3.7%
Oil/Gas Extraction	85,562	109,199	27.6%
Drilling Oil and Gas Wells	66,084	76,072	15.1%
Support for Oil and Gas Operations	136,038	188,468	38.5%
Oil and Gas Pipeline and Related Structures Construction	86,321	126,856	47.0%
Oil and Gas Field Machinery and Equipment Manufacturing	30,580	49,542	62.0%

Impact on Small Business

At the same time, and not surprisingly, while the number of businesses (in this case, employer firms) in the nation declined, business growth was strong among the energy sector. And it is critical to note the role and growth of smaller businesses.

Table 3 makes clear that expanded production in the energy sector has been a boon for small and midsize enterprises. Or, to look at it from a different angle, expanded energy production has been driven by small and midsize businesses.

For all of the U.S., total employer firms declined by 4.2 percent from 2005 to 2010, including a 3.7 percent decline in firms with less than 20 workers, and a 4.2 percent fall in firms with less than 500 workers. Again, compare those declines to the growth in energy industries over the same period:

- Among oil and gas extraction businesses, the number of employer firms grew by 3.1 percent, including growth of 2.5 percent among firms with less than 20 workers and 3.0 percent among firms with less than 500 workers.
- Among drilling oil and gas wells businesses, the number of employer firms grew by 7.2 percent, including growth of 4.7 percent among firms with less than 20 workers and 7.3 percent among firms with less than 500 workers.
- Among oil and gas operations businesses, the number of employer firms grew by 24.5 percent, including growth of 24.5 percent among firms with less than 20 workers and 24.6 percent among firms with less than 500 workers.
- Among oil and gas pipeline and related structures construction businesses, the number of employer firms grew by 5.1 percent, including growth of 3.5 percent among firms with less than 500 workers.
- Among oil and gas field machinery and equipment manufacturing businesses, the number of employer firms grew by 61.0 percent, including growth of 59.0 percent among firms with less than 20 workers and 62.7 percent among firms with less than 500 workers.

The growth in both jobs and small-midsize employer firms in the energy sector has been striking in recent years, once again especially given the abysmal performance of the overall economy.

Finally, it must be noted that the energy sector in fact is not all about huge enterprises. As noted in Table 3, each energy sector looked at here is overwhelmingly populated by small and midsize firms.

- Among oil and gas extraction businesses, 91.3 percent of employer firms in 2010 had less than 20 workers, and 98.6 percent had fewer than 500 employees.
- Among drilling oil and gas wells businesses, 80.4 percent of employer firms in 2010 had less than 20 workers, and 97.8 percent had fewer than 500 employees.
- Among oil and gas operations businesses, 84.7 percent

Table 3: Employer Firms – U.S. Total and Energy Industries, 2005-2010

U.S. Total Employer Firms

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	5,983,546	5,357,887	5,966,069	89.5%	99.7%
2010	5,734,538	5,160,404	5,717,302	90.0%	99.7%
Chg 05-10	-4.2%	-3.7%	-4.2%		

Oil/Gas Extraction Employer Firms

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	6,317	5,800	6,230	91.8%	98.6%
2010	6,513	5,947	6,420	91.3%	98.6%
Chg 05-10	3.1%	2.5%	3.0%		

Drilling Oil and Gas Wells Firms

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	1,833	1,509	1,791	82.3%	97.7%
2010	1,965	1,580	1,921	80.4%	97.8%
Chg 05-10	7.2%	4.7%	7.3%		

Support for Oil and Gas Operations

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	6,183	5,238	6,101	84.7%	98.7%
2010	7,696	6,522	7,601	84.7%	98.8%
Chg 05-10	24.5%	24.5%	24.6%		

Oil and Gas Pipeline and Related Structures Construction

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	1,612	1,075	1,561	66.7%	96.8%
2010	1,695	1,068	1,616	63.0%	95.3%
Chg 05-10	5.1%	-0.7%	3.5%		

Oil and Gas Field Machinery and Equipment Manufacturing

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	480	293	442	61.0%	92.1%
2010	773	466	719	60.3%	93.0%
Chg 05-10	61.0%	59.0%	62.7%		

of employer firms in 2010 had less than 20 workers, and 98.8 percent had fewer than 500 employees.

- Among oil and gas pipeline and related structures construction businesses, 63.0 percent of employer firms in 2010 had less than 20 workers, and 95.3 percent had fewer than 500 employees.

- Among oil and gas field machinery and equipment manufacturing businesses, 60.3 percent of employer firms in 2010 had less than 20 workers, and 93.0 percent had fewer than 500 employees.

Finally, in looking at the full picture of the impact unconventional oil and natural gas production – that is, "unconventional natural gas extracted from shale formations and from tight sands and unconventional oil extracted from shale and other dense rocks" – on the U.S. economy, IHS found:[10]

- "In 2012, capital expenditures will surpass $87 billion. These expenditures supporting the growth of unconventional oil and gas activity will reach $172.5 billion in 2020 and more than $353 billion in 2035."

- "Over 1.7 million jobs are attributable to unconventional oil and gas development today. These employment contributions are expected to rise to 3 million by the end of the decade and to 3.5 million jobs by 2035."

- "In 2012, unconventional oil and gas will contribute almost $238 billion in value added to the US economy. This contribution to gross domestic product (GDP) will increase more than 75% by 2020 to over $416 billion. By the final year of the forecast period, 2035, this will increase to nearly $475 billion."

Now let's consider the developments in key states experiencing expanded opportunities on the natural gas production front.

II. Arkansas

The increase in natural gas production has been dramatic in Arkansas via the Fayetteville Shale area. The state's natural gas production, as highlighted in Table 4, expanded by 462.7 percent from 2005 to 2011.

Table 4: Arkansas Natural Gas Marketed Production

2005:	190.5 billion cubic feet
2011:	1,072.2 billion cubic feet

Table 5: Arkansas Employment Growth Among Employer Establishments, 2005-2010

Sector	2005	2010	Percent Change
Total	1,017,424	965,474	-5.1%
Oil/Gas Extraction	637	1,666	161.5%
Drilling Oil and Gas Wells	692	2,456	254.9%
Support for Oil and Gas Operations	817	2,936	259.4%
Oil and Gas Pipeline and Related Structures Construction	588	1,334	126.9%
Oil and Gas Field Machinery and Equipment Manufacturing	NA	NA	NA

Impact on Jobs

Table 5 compares employment growth (again, all employment and business data from Census Bureau "County Business Patterns" unless otherwise noted) among employer establishments in the overall state, and in various energy industry sectors. The difference in the employment story between the energy sector and the overall economy is striking.

While overall employment fell between 2005 and 2010, jobs grew markedly in the energy sector given the expansion in energy production.

Arkansas total employment *declined* by 5.1 percent from 2005 to 2010, but jobs *grew* by the following:

- 161.5 percent in the oil and gas extraction sector;
- 254.9 percent in the drilling oil and gas wells sector;
- 259.4 percent in the support sector for oil and gas operations; and
- 126.9 percent in the oil and gas pipeline and related structures construction sector.

While Arkansas employers overall shed 51,950 jobs over this period, employers in the four energy industries (where data was available) included here added more than 5,600 jobs.

Impact on Small Business

At the same time, while the number of businesses (in this case, establishments) declined in the nation and in Arkansas (though at a slower pace of decline in Arkansas compared to the U.S.), the number of establishments grew strongly among Arkansas' energy sector. And it is critical to note the role and growth of smaller businesses.

Table 6 makes clear that expanded production in the energy sector has been a boon for small and midsize enterprises in the state. Or, to look at it from a different angle, expanded energy production has been driven by small and midsize businesses.

For all of the U.S., total employer establishments declined by 1.4 percent from 2005 to 2010, including a 3.5 percent decline in establishments with less than 20 workers, and a 3.1 percent fall in establishments with less than 500 workers.

In Arkansas, total establishments declined by 1.3 percent, including a 1.5 percent fall among establishments with less than 20 workers, and a 1.3 percent decline among those with less than 500 workers.

But compare those declines to the growth in these energy industries in Arkansas:

- Among oil and gas extraction businesses, the number of employer establishments grew by 14.6 percent, including growth of 13.1 percent among those with less than 20 workers and 14.6 percent among establishments with less than 500 workers.

- Among drilling oil and gas wells businesses, the number of employer establishments grew by 56.3 percent, including growth of 40.0 percent among establishments with less than 20 workers and 56.3 percent among establishments with less than 500 workers.

- Among oil and gas operations businesses, the number of employer establishments grew by 77 percent, including growth of 51.8 percent among establishments with less than 20 workers and 77 percent among establishments with less than 500 workers.

The growth in both jobs and small-midsize employer establishments in the energy sector has been striking in recent years, especially given the abysmal performance of the overall economy.

Finally, it must be noted that the Arkansas energy sector is not all about big energy businesses. As noted in Table 6, each energy sector looked at is overwhelmingly populated by small and midsize establishments.

- Among oil and gas extraction businesses, 93.1 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.

- Among drilling oil and gas wells businesses, 70 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.

- Among oil and gas operations businesses, 81.8 percent of employer establishments in 2010 had less than 20 workers, and 98.8 percent had fewer than 500 employees.

- Among oil and gas pipeline and related structures construction businesses, 48.3 percent of employer establishments in 2010 had less than 20 workers, and 95.3 percent had fewer than 500 employees.

Table 6: Establishments – Arkansas Total and Energy Industries, 2005-2010

Arkansas Total Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	66,039	57,236	65,844	86.7%	99.7%
2010	65,158	56,394	65,018	86.5%	99.8%
AR 05-10	-1.3%	-1.5%	-1.3%		
US 05-10	*-1.4%*	*-3.5%*	*-3.1%*		

Arkansas Oil/Gas Extraction Employer Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	89	84	89	94.4%	100%
2010	102	95	102	93.1%	100%
Chg 05-10	14.6%	13.1%	14.6%		

Arkansas Drilling Oil and Gas Wells Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	32	25	32	78.1%	100%
2010	50	35	50	70.0%	100%
Chg 05-10	56.3%	40.0%	56.3%		

Arkansas Support for Oil and Gas Operations Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	87	83	87	95.4%	100%
2010	154	126	154	81.8%	100%
Chg 05-10	77.0%	51.8%	77.0%		

Arkansas Oil and Gas Pipeline and Related Structures Construction Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	30	20	30	66.7%	100%
2010	29	14	29	48.3%	100%
Chg 05-10	-3.3%	-30.0%	-3.3%		

Arkansas Oil and Gas Field Machinery and Equipment Manufacturing Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	1	0	1	0%	100%
2010	2	1	2	50%	100%
Chg 05-10	100%	-	100%		

III. Colorado

The increase in natural gas production has been notable in Colorado. The state's natural gas production, as highlighted in Table 7, expanded by 44.5 percent from 2005 to 2011.

Table 7: Colorado Natural Gas Marketed Production

2005:	1,133.1 billion cubic feet
2011:	1,637.6 billion cubic feet

Table 8: Colorado Employment Growth Among Employer Establishments, 2005-2010

Sector	2005	2010	Percent Change
Total	1,936,264	1,955,336	1.0%
Oil/Gas Extraction	4,060	6,447	58.8%
Drilling Oil and Gas Wells	2,678	3,612	34.9%
Support for Oil and Gas Operations	4,381	7,648	74.6%
Oil and Gas Pipeline and Related Structures Construction	1,473	1,248	-15.3%
Oil and Gas Field Machinery and Equipment Manufacturing	NA	NA	NA

Impact on Jobs

Table 8 compares employment growth (again, all employment and business data from Census Bureau "County Business Patterns" unless otherwise noted) among employer establishments in the overall state, and in various energy industry sectors. The difference in the employment story between the energy sector and the overall economy is impressive.

While overall employment grew between 2005 and 2010 in Colorado – compared to a decline in the U.S. overall – jobs grew markedly in the energy sector given the expansion in energy production.

While U.S. total employment *declined*, Colorado total employment *grew* by 1.0 percent from 2005 to 2010. On the energy front, jobs *grew* by the following:

- 58.5 percent in the oil and gas extraction sector;
- 34.9 percent in the drilling oil and gas wells sector; and
- 74.6 percent in the support sector for oil and gas operations.

While Colorado employers overall added 19,072 jobs over this period, employers in the four energy industries (where data was available) included here added more than 6,363 jobs. That's one in three jobs added coming from these energy industries.

Impact on Small Business

At the same time, while the number of businesses (in this case, establishments) in the nation declined, in Colorado, the number of establishments grew, and they expanded robustly in the state's energy sector. And it is critical to note the role and growth of smaller businesses.

Table 9 makes clear that expanded production in the energy sector has been a boon for small and midsize enterprises in the state. Or, to look at it from a different angle, expanded energy production has been driven by small and midsize businesses.

For all of the U.S., total employer establishments declined by 1.4 percent from 2005 to 2010, including a 3.5 percent decline in establishments with less than 20 workers, and a 3.1 percent fall in establishments with less than 500 workers.

In Colorado, total establishments increased by 0.6 percent, including a 1.2 percent increase among establishments with less than 20 workers, and a 0.6 percent rise among those with less than 500 workers.

Again, compare the U.S. decline to the growth in these energy industries in Colorado:

- Among oil and gas extraction businesses, the number of employer establishments grew by 7.6 percent, including growth of 6.8 percent among establishments with less than 20 workers and 7.0 percent among establishments with less than 500 workers.

- Among drilling oil and gas wells businesses, the number of employer establishments grew by 12.8 percent, including growth of 12.7 percent among establishments with less than 20 workers and 14.1 percent among establishments with less than 500 workers.

- Among oil and gas operations businesses, the number of employer establishments grew by 61.4 percent, including growth of 58 percent among establishments with less than 20 workers and 61 percent among establishments with less than 500 workers.

- Among oil and gas pipeline and related structures construction businesses, the number of employer establishments grew by 2 percent, including growth of 14.3 percent among establishments with less than 20 workers and 2 percent among those with less than 500 workers.

The growth in both jobs and small-midsize employer establishments in the energy sector has been noteworthy, again especially given the abysmal performance of the overall economy.

Finally, it must be noted that the Colorado energy sector in fact is not all about huge enterprises. As noted in Table 9, each energy sector looked at is overwhelmingly populated by small and midsize establishments.

- Among oil and gas extraction businesses, 87.4 percent of employer establishments in 2010 had less than 20 workers, and 99.5 percent had fewer than 500 employees.

- Among drilling oil and gas wells businesses, 73.2 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.

- Among oil and gas operations businesses, 87.4 percent of employer establishments in 2010 had less than 20 workers, and 99.5 percent had fewer than 500 employees.

- Among oil and gas pipeline and related structures construction businesses, 78.4 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.

- Among oil and gas field machinery and equipment manufacturing businesses, 75 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.

Table 9: Establishments – Colorado Total and Energy Industries, 2005-2010

Colorado Total Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	151,070	133,125	150,799	88.1%	99.8%
2010	151,973	134,726	151,695	88.7%	99.8%
CO 05-10	0.6%	1.2%	0.6%		
US 05-10	*-1.4%*	*-3.5%*	*-3.1%*		

Oil/Gas Extraction Employer Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	369	325	369	88.1%	100%
2010	397	347	395	87.4%	99.5%
Chg 05-10	7.6%	6.8%	7.0%		

Drilling Oil and Gas Wells Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	86	63	85	73.3%	98.8%
2010	97	71	97	73.2%	100%
Chg 05-10	12.8%	12.7%	14.1%		

Support for Oil and Gas Operations Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	355	317	354	89.3%	99.7%
2010	573	501	570	87.4%	99.5%
Chg 05-10	61.4%	58.0%	61.0%		

Oil and Gas Pipeline and Related Structures Construction Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	50	35	50	70.0%	100%
2010	51	40	51	78.4%	100%
Chg 05-10	2.0%	14.3%	2.0%		

Oil and Gas Field Machinery and Equipment Manufacturing Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	5	3	5	60%	100%
2010	4	3	4	75%	100%
Chg 05-10	-20%	0%	-20%		

IV. Louisiana

The increase in natural gas production has been sizeable in Louisiana, to say the least. The state's natural gas production, as highlighted in Table 10, expanded by 133.7 percent from 2005 to 2011.

Table 10: Louisiana Natural Gas Marketed Production

2005:	1,296.0 billion cubic feet
2011:	3,029.2 billion cubic feet

Table 11: Louisiana Employment Growth Among Employer Establishments, 2005-2010

Sector	2005	2010	Percent Change
Total	1,617,507	1,599,551	-1.1%
Oil/Gas Extraction	10,280	8,565	-16.7%
Drilling Oil and Gas Wells	6,524	6,765	3.7%
Support for Oil and Gas Operations	26,069	32,247	23.7%
Oil and Gas Pipeline and Related Structures Construction	14,452	28,897	100%
Oil and Gas Field Machinery and Equipment Manufacturing	NA	3,575	NA

Impact on Jobs

Table 11 compares employment growth (again, all employment and business data from Census Bureau "County Business Patterns" unless otherwise noted) among employer establishments in the overall state, and in various energy industry sectors. The difference in the employment story between the energy sector and the overall economy is notable, even with the decline in the oil and gas extraction sector.

While overall employment declined between 2005 and 2010 in Louisiana – though at a much slower rate than the decline in the U.S. overall – jobs grew markedly in the energy sector given the expansion in energy production.

While Louisiana and U.S. total employment *declined*, Louisiana employment *grew* in three of the four energy sectors for which data was available, expanding by the following:

- 3.7 percent in the drilling oil and gas wells sector;
- 23.7 percent in the support sector for oil and gas operations; and
- 100 percent in the oil and gas pipeline and related structures construction industry.

While Louisiana employers overall shed 17,956 jobs over this period, employers in the four energy industries (where data was available) included here added 19,149 jobs. That's an incredible contrast.

Impact on Small Businesses

At the same time, while the number of businesses (in this case, establishments) in the nation declined, in Louisiana, the number of establishments grew, and they expanded strongly in the state's energy sector. It is critical to note the role and growth of smaller businesses as well.

Table 12 makes clear that expanded production in the energy sector has been a boon for small and midsize enterprises in the state. Or, to look at it from a different angle, expanded energy production has been driven by small and midsize businesses.

For all of the U.S., total employer establishments declined by 1.4 percent from 2005 to 2010, including a 3.5 percent decline in firms with less than 20 workers, and a 3.1 percent fall in firms with less than 500 workers.

In Louisiana, total establishments increased by 0.6 percent, including a 0.5 percent increase among establishments with less than 20 workers, and a 0.6 percent rise among those with less than 500 workers.

Again, compare the U.S. decline to the growth in these energy industries in Louisiana:

- Among oil and gas extraction businesses, the number of employer establishments grew by 6.0 percent, including growth of 8.8 percent among establishments with less than 20 workers and 6.6 percent among establishments with less than 500 workers.

- Among oil and gas operations businesses, the number of employer establishments grew by 24.1 percent, including growth of 27.7 percent among establishments with less than 20 workers and 24.6 percent among establishments with less than 500 workers.

- Among oil and gas pipeline and related structures construction businesses, the number of employer establishments grew by 25.7 percent, including growth of 24.3 percent among establishments with less than 500 workers.

- Among field machinery and equipment manufacturing businesses, the number of employer establishments grew by 35.6 percent, including growth of 63 percent among establishments with less than 20 workers and 35.6 percent among establishments with less than 500 workers.

The growth in both jobs and small-midsize employer establishments in the energy sector has been noteworthy in recent years, again especially given the abysmal performance of the overall economy.

Finally, it must be noted that the Louisiana energy sector in fact is not all about huge enterprises. As noted in Table 12, each energy sector looked at is overwhelmingly populated by small and midsize establishments.

- Among oil and gas extraction businesses, 79.6 percent of employer establishments in 2010 had less than 20 workers, and 99.5 percent had fewer than 500 employees.

- Among drilling oil and gas wells businesses, 69.5 percent of employer establishments in 2010 had less than 20 workers, and 99.4 percent had fewer than 500 employees.

- Among oil and gas operations businesses, 74 percent of employer establishments in 2010 had less than 20 workers, and 98.9 percent had fewer than 500 employees.

- Among oil and gas pipeline and related structures construction businesses, 43.9 percent of employer establishments in 2010 had less than 20 workers, and 97 percent had fewer than 500 employees.

- Among oil and gas field machinery and equipment manufacturing businesses, 55 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.

Table 12: Establishments – Louisiana Total and Energy Industries, 2005-2010

Louisiana Total Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	102,790	87,638	102,526	85.3%	99.7%
2010	103,365	88,081	103,130	85.2%	99.8%
LA 05-10	0.6%	0.5%	0.6%		
US 05-10	*-1.4%*	*-3.5%*	*-3.1%*		

Oil/Gas Extraction Employer Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	397	308	393	77.6%	99.0%
2010	421	335	419	79.6%	99.5%
Chg 05-10	6.0%	8.8%	6.6%		

Drilling Oil and Gas Wells Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	179	127	177	70.9%	98.9%
2010	177	123	176	69.5%	99.4%
Chg 05-10	-1.1%	-3.1%	-0.6%		

Support for Oil and Gas Operations Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	738	531	727	72.0%	98.5%
2010	916	678	906	74.0%	98.9%
Chg 05-10	24.1%	27.7%	24.6%		

Oil and Gas Pipeline and Related Structures Construction Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	105	58	103	55.2%	98.1%
2010	132	58	128	43.9%	97.0%
Chg 05-10	25.7%	0%	24.3%		

Oil and Gas Field Machinery and Equipment Manufacturing Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	59	27	59	45.8%	100%
2010	80	44	80	55.0%	100%
Chg 05-10	35.6%	63.0%	35.6%		

V. North Dakota

The big energy story in North Dakota in recent years has been the increase in oil production, pushing the state to ranking second among the states in oil output. At the same time, though, the increase in natural gas production has been sizeable as well. The state's natural gas production, as highlighted in Table 13, expanded by 84.8 percent from 2005 to 2011.

Table 13: North Dakota Natural Gas Marketed Production

2005:	52.557 billion cubic feet
2011:	97.102 billion cubic feet

Table 14: North Dakota Employment Growth Among Employer Establishments, 2005-2010

Sector	2005	2010	Percent Change
Total	270,479	294,907	9.0%
Oil/Gas Extraction	1,130	1,607	42.2%
Drilling Oil and Gas Wells	554	1,442	160.3%
Support for Oil and Gas Operations	1,036	3,604	247.9%
Oil and Gas Pipeline and Related Structures Construction	NA	75	NA
Oil and Gas Field Machinery and Equipment Manufacturing	NA	NA	NA

Impact on Jobs

Table 14 compares employment growth (again, all employment and business data from Census Bureau "County Business Patterns" unless otherwise noted) among employer establishments in the overall state, and in various energy industry sectors. The difference in the employment story between North Dakota, including its energy sector, and the overall U.S. economy is striking.

While overall employment increased between 2005 and 2010 in North Dakota, jobs grew even faster in the energy sector given the expansion in energy production.

While U.S. total employment *declined,* North Dakota employment *grew* overall, including in each energy sector for which data was available, expanding by the following:

- 42.2 percent in the oil and gas extraction sector;
- 160.3 percent in the drilling oil and gas wells sector; and
- 247.9 percent in the support sector for oil and gas operations.

North Dakota employers overall added 24,428 jobs over this period, with employers in the three energy industries (where data was available) included here adding 3,933.

Impact on Small Businesses

At the same time, while the number of businesses (in this case, establishments) in the nation declined, in North Dakota, the number of establishments grew, and they expanded strongly in the state's energy sector. It is critical to note the role and growth of smaller businesses as well.

Table 15 makes clear that expanded production in the energy sector has been a boon for small and midsize enterprises in the state. Or, to look at it from a different angle, expanded energy production has been driven by small and midsize businesses.

For all of the U.S., total employer establishments declined by 1.4 percent from 2005 to 2010, including a 3.5 percent decline in establishments with less than 20 workers, and a 3.1 percent fall in establishments with less than 500 workers.

In North Dakota, total establishments increased by 3.7 percent, including a 1.0 percent increase among establishments with less than 20 workers, and a 2.5 percent rise among those with less than 500 workers.

Again, compare the U.S. decline to the growth in these energy industries in North Dakota:

- Among oil and gas extraction businesses, the number of employer establishments grew by 28.1 percent, including growth of 44 percent among establishments with less than 20 workers and 32.3 percent among establishments with less than 500 workers.

- Among drilling oil and gas wells businesses, the number of employer establishments grew by 20 percent, including growth of 18.2 percent among establishments with less than 20 workers and 20 percent among establishments with less than 500 workers.

- Among oil and gas operations businesses, the number of employer establishments grew by 74.5 percent, including growth of 46.1 percent among establishments with less than 20 workers and 74.5 percent among establishments with less than 500 workers.

The growth in both jobs and small-midsize employer establishments in the energy sector has been noteworthy in recent years, especially given the abysmal performance of the overall economy.

Finally, it must be noted that the North Dakota energy sector in fact is not all about huge enterprises. As noted in Table 15, each energy sector looked at is overwhelmingly populated by small and midsize establishments.

- Among oil and gas extraction businesses, 87.8 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.

- Among drilling oil and gas wells businesses, 54.2 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.

- Among oil and gas operations businesses, 73 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.

- Among oil and gas pipeline and related structures construction businesses, 85.7 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.

- Among oil and gas field machinery and equipment manufacturing businesses, 33 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.

Table 15: Establishments – North Dakota Total and Energy Industries, 2005-2010

North Dakota Total Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	21,061	15,268	18,768	72.5%	89.1%
2010	21,832	15,427	19,236	70.7%	88.1%
ND 05-10	3.7%	1.0%	2.5%		
US 05-10	*-1.4%*	*-3.5%*	*-3.1%*		

Oil/Gas Extraction Employer Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	32	25	31	78.1%	96.9%
2010	41	36	41	87.8%	100%
Chg 05-10	28.1%	44.0%	32.3%		

Drilling Oil and Gas Wells Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	20	11	20	55.0%	100%
2010	24	13	24	54.2%	100%
Chg 05-10	20.0%	18.2%	20.0%		

Support for Oil and Gas Operations Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	102	89	102	87.3%	100%
2010	178	130	178	73.0%	100%
Chg 05-10	74.5%	46.1%	74.5%		

Oil and Gas Pipeline and Related Structures Construction Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	7	6	7	85.7%	100%
2010	7	6	7	85.7%	100%
Chg 05-10	0%	0%	0%		

Oil and Gas Field Machinery and Equipment Manufacturing Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	2	2	2	100%	100%
2010	3	1	3	33.0%	100%
Chg 05-10	50.0%	-50.0%	50.0%		

VI. Ohio

The opportunity for increased shale natural gas production exists in Ohio, but is only beginning to move forward. The state's natural gas production, as noted in Table 16, actually contracted between 2005 and 2011, falling by 7.8 percent.

Again, though, the opportunities for expanded production certainly exist with both the Utica and Marcellus Shale plays reaching into the state. In fact, it is worth noting that a December 2012 IHS study projected that jobs tied to unconventional oil and gas production in Ohio could rise from 38,830 in 2012 to 143,595 in 2020 and 266,624 in 2035.[11]

Table 16: Ohio Natural Gas Marketed Production

2005:	85.523 billion cubic feet
2011:	78.858 billion cubic feet

Table 17: Ohio Employment Growth Among Employer Establishments, 2005-2010

Sector	2005	2010	Percent Change
Total	4,762,618	4,352,481	-8.6%
Oil/Gas Extraction	1,355	1,340	-1.1%
Drilling Oil and Gas Wells	515	542	5.7%
Support for Oil and Gas Operations	1,206	1,023	-15.2%
Oil and Gas Pipeline and Related Structures Construction	2,281	2,411	5.7%
Oil and Gas Field Machinery and Equipment Manufacturing	NA	NA	NA

For good measure, a recent *New York Times* story noted how investment in the state is stepping up.[12] It was noted in the report that "natural gas buried in shale thousands of feet below the surface is attracting more than $1 billion in private investment and rapidly reviving the area as an energy producer. To prepare, market and transport the natural gas, companies are building an expansive network of regional field offices, processing plants and other infrastructure… In public statements, though, energy industry executives have said drilling and production are being impeded by a shortage of processing plants and pipelines. Chesapeake and other leading production and processing companies are attacking that problem with an infrastructure development program never seen here, said Thomas E. Stewart, executive vice president of the Ohio Oil and Gas Association… With all this energy-related construction, industry executives believe that Ohio will produce two billion to three billion cubic feet of processed gas daily within the decade."

Impact on Jobs

Table 17 compares employment growth (again, all employ-

ment and business data from Census Bureau "County Business Patterns" unless otherwise noted) among employer establishments in the overall state, and in various energy industry sectors. Unfortunately, given the limited activity on the energy front, Ohio has suffered along with the rest of the nation during these tough economic times.

While U.S. total employment *declined* from 2005 to 2010, it fell even more in Ohio. And the jobs story in the energy sector was mixed, with employment:

- declining by 1.1 percent in the oil and gas extraction sector;
- increasing by 5.7 percent in the drilling oil and gas wells sector;
- declining by 15.2 percent in the support sector for oil and gas operations; and
- increasing by 5.7 percent in the oil and gas pipeline and related structures construction.

Impact on Small Businesses

And while the number of businesses (in this case, establishments) in the nation declined, in Ohio, the decline was even larger.

As noted in Table 18, for all of the U.S., total employer establishments declined by 1.4 percent from 2005 to 2010, including a 3.5 percent decline in firms with less than 20 workers, and a 3.1 percent fall in firms with less than 500 workers.

In Ohio, total establishments decreased by 6.4 percent, including a 9.5 percent drop among establishments with less than 20 workers, and a 8.6 percent fall off among those with less than 500 workers.

Again, compared with the U.S. in general and other states that have moved ahead aggressively on energy production, Ohio's numbers in the energy sector regarding establishment growth have been very mixed:

- Among oil and gas extraction businesses, the number of employer establishments fell by 5.7 percent, including a fall of 6.2 percent among establishments with less than 20 workers and 5.7 percent among establishments with less than 500 workers.
- Among drilling oil and gas wells businesses, the number of employer establishments declined by 1.4 percent, including growth of 5 percent among establishments with less than 20 workers and a decline of 1.4 percent among establishments with less than 500 workers.
- Among oil and gas operations businesses, the number of employer establishments actually grew by 9.4 percent, including growth of 9.4 percent among establishments with less than 20 workers and 9.4 percent among establishments with less than 500 workers.
- Among oil and gas pipeline and related structures construction businesses, the number of employer establishments grew by 16.9 percent, including growth of 13.2 percent among establishments with less than 20 workers and 19 percent among those with less than 500.
- Among oil and gas field machinery and equipment manufacturing businesses, the number of employer establishments fell by 33.3 percent, including a decline of 50 percent among establishments with less than 20 workers and 33.3 percent among establishments with less than 500 workers.

Nonetheless, it must be noted that the Ohio energy sector still in fact is not about huge enterprises. As noted in Table 18, each energy sector looked at is overwhelmingly populated by small and midsize establishments.

- Among oil and gas extraction businesses, 92.9 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.
- Among drilling oil and gas wells businesses, 91.3 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.
- Among oil and gas operations businesses, 92.1 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.
- Among oil and gas pipeline and related structures construction businesses, 62.3 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.
- Among oil and gas field machinery and equipment manufacturing businesses, 66.7 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.

In the end, the change in Ohio employment and small business growth will increase like other states with significant shale-based energy resources once the state starts moving ahead aggressively with production. And that will only be fed further via LNG exports.

Table 18: Establishments – Ohio Total and Energy Industries, 2005-2010

Ohio Total Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	270,968	181,984	223,825	67.2%	82.6%
2010	253,491	164,646	204,503	65.0%	80.7%
OH 05-10	-6.4%	-9.5%	-8.6%		
US 05-10	*-1.4%*	*-3.5%*	*-3.1%*		

Oil/Gas Extraction Employer Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	209	195	209	93.3%	100%
2010	197	183	197	92.9%	100%
Chg 05-10	-5.7%	-6.2%	-5.7%		

Drilling Oil and Gas Wells Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	70	60	70	85.7%	100%
2010	69	63	69	91.3%	100%
Chg 05-10	-1.4%	5.0%	-1.4%		

Support for Oil and Gas Operations Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	138	127	138	92.0%	100%
2010	151	139	151	92.1%	100%
Chg 05-10	9.4%	9.4%	9.4%		

Oil and Gas Pipeline and Related Structures Construction Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	59	38	58	64.4%	98.3%
2010	69	43	69	62.3%	100%
Chg 05-10	16.9%	13.2%	19.0%		

Oil and Gas Field Machinery and Equipment Manufacturing Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	9	8	9	88.9%	100%
2010	6	4	6	66.7%	100%
Chg 05-10	-33.3%	-50.0%	-33.3%		

VII. Oklahoma

Natural gas production in Oklahoma, as highlighted in Table 19, expanded by 15.2 percent from 2005 to 2011.

Table 19: Oklahoma Natural Gas Marketed Production

2005:	1,639.3 billion cubic feet
2011:	1,888.9 billion cubic feet

Table 20: Oklahoma Employment Growth Among Employer Establishments, 2005-2010

Sector	2005	2010	Percent Change
Total	1,220,285	1,241,168	1.7%
Oil/Gas Extraction	9,878	14,685	48.7%
Drilling Oil and Gas Wells	6,460	7,317	13.3%
Support for Oil and Gas Operations	12,705	16,520	30.0%
Oil and Gas Pipeline and Related Structures Construction	2,956	3,825	29.4%
Oil and Gas Field Machinery and Equipment Manufacturing	3,746	3,744	-0.05%

Impact on Jobs

Table 20 compares employment growth (again, all employment and business data from Census Bureau "County Business Patterns" unless otherwise noted) among employer establishments in the overall state, and in various energy industry sectors. The difference in the employment story between Oklahoma, including its energy sector, and the overall U.S. economy is striking.

While overall employment increased between 2005 and 2010 in Oklahoma, jobs grew robustly in the energy sector given the expansion in energy production.

While U.S. total employment *declined*, Oklahoma employment *grew* overall, including in the energy sector, expanding by the following:

- 48.7 percent in the oil and gas extraction sector;
- 13.3 percent in the drilling oil and gas wells sector;
- 30 percent in the support sector for oil and gas operations; and
- 29.4 percent in the oil and gas pipeline and related structures construction sector.

Oklahoma employers overall added 20,833 jobs over this period, with employers in the energy industries included here adding 10,346, or half the jobs added.

Impact on Small Businesses

At the same time, while the number of businesses (in this case, establishments) in the nation declined, in Oklahoma, the number of establishments grew, and they expanded strongly in the state's energy sector. It is critical to note the role and growth of smaller businesses as well.

Table 21 makes clear that expanded production in the energy sector has been a boon for small and midsize enterprises in the state. Or, to look at it from a different angle, expanded energy production has been driven by small and midsize businesses.

For all of the U.S., total employer establishments declined by 1.4 percent from 2005 to 2010, including a 3.5 percent decline in firms with less than 20 workers, and a 3.1 percent fall in firms with less than 500 workers.

In Oklahoma, total establishments increased by 1.7 percent, including a 1.4 percent increase among establishments with less than 20 workers, and a 1.7 percent rise among those with less than 500 workers.

Again, compare the U.S. decline to the growth in these energy industries in Oklahoma:

- Among oil and gas extraction businesses, the number of employer establishments grew by 11.8 percent, including growth of 10.2 percent among establishments with less than 20 workers and 11.8 percent among establishments with less than 500 workers.

- Among oil and gas operations businesses, the number of employer establishments grew by 37.3 percent, including growth of 35.7 percent among establishments with less than 20 workers and 37.3 percent among establishments with less than 500 workers.

- Among oil and gas pipeline and related structures construction businesses, the number of employer establishments grew by 14.3 percent, including growth of 9.0 percent among those with less than 20 workers and 13.3 percent among establishments with less than 500 workers.

- Among oil and gas field machinery and equipment manufacturing businesses, the number of employer establishments grew by 28.4 percent, including growth of 36.1 percent among those with less than 20 workers and 28.8 percent among those with less than 500 workers.

The growth in both jobs and small-midsize employer establishments in Oklahoma's energy sector has been strong in recent years, again especially given the abysmal performance of the overall U.S. economy.

Finally, it must be noted that the Oklahoma energy sector in fact is not the domain of huge enterprises. As noted in Table 21, each energy sector looked at is overwhelmingly populated by small and midsize establishments.

- Among oil and gas extraction businesses, 90.6 percent of employer establishments in 2010 had less than 20 workers, and 99.9 percent had fewer than 500 employees.

- Among drilling oil and gas wells businesses, 79.7 percent of employer establishments in 2010 had less than 20 workers, and 98.3 percent had fewer than 500 employees.

- Among oil and gas operations businesses, 86.9 percent of employer establishments in 2010 had less than 20 workers, and 99.8 percent had fewer than 500 employees.

- Among oil and gas pipeline and related structures construction businesses, 64.3 percent of employer establishments in 2010 had less than 20 workers, and 99.1 percent had fewer than 500 employees.

- Among oil and gas field machinery and equipment manufacturing businesses, 57 percent of employer establishments in 2010 had less than 20 workers, and 98.8 percent had fewer than 500 employees.

Table 21: Establishments – Oklahoma Total and Energy Industries, 2005-2010

Oklahoma Total Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	88,548	76,986	88,369	86.9%	99.8%
2010	90,050	78,044	89,885	86.7%	99.8%
OK 05-10	1.7%	1.4%	1.7%		
US 05-10	*-1.4%*	*-3.5%*	*-3.1%*		

Oil/Gas Extraction Employer Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	1,076	989	1,075	91.9%	99.9%
2010	1,203	1,090	1,202	90.6%	99.9%
Chg 05-10	11.8%	10.2%	11.8%		

Drilling Oil and Gas Wells Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	235	195	233	83.0%	99.1%
2010	237	189	233	79.7%	98.3%
Chg 05-10	0.9%	-3.0%	0%		

Support for Oil and Gas Operations Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	914	804	912	88.0%	99.8%
2010	1,255	1,091	1,252	86.9%	99.8%
Chg 05-10	37.3%	35.7%	37.3%		

Oil and Gas Pipeline and Related Structures Construction Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	98	66	98	67.3%	100%
2010	112	72	111	64.3%	99.1%
Chg 05-10	14.3%	9.0%	13.3%		

Oil and Gas Field Machinery and Equipment Manufacturing Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	67	36	66	53.7%	98.5%
2010	86	49	85	57.0%	98.8%
Chg 05-10	28.4%	36.1%	28.8%		

VIII. Pennsylvania

The increase in natural gas production has been dramatic in Pennsylvania via the Marcellus Shale area. The state's natural gas production, as highlighted in Table 22, expanded by 677.8 percent from 2005 to 2011.

Table 22: Pennsylvania Natural Gas Marketed Production

2005:	168.5 billion cubic feet
2011:	1,310.6 billion cubic feet

Table 23: Pennsylvania Employment Growth Among Employer Establishments, 2005-2010

Sector	2005	2010	Percent Change
Total	5,082,630	4,976,193	-2.1%
Oil/Gas Extraction	1,809	3,270	80.8%
Drilling Oil and Gas Wells	846	2,696	218.7%
Support for Oil and Gas Operations	1,640	3,620	120.7%
Oil and Gas Pipeline and Related Structures Construction	1,025	2,566	150.3%
Oil and Gas Field Machinery and Equipment Manufacturing	347	301	-13.3%

Impact on Jobs

Table 23 compares employment growth (again, all employment and business data from Census Bureau "County Business Patterns" unless otherwise noted) among employer establishments in the overall state, and in various energy industry sectors. The difference in the employment story between the energy sector and the overall economy is striking.

While overall employment fell between 2005 and 2010, jobs grew markedly in the energy sector given the expansion in energy production.

While both U.S. and Pennsylvania total employment *declined* from 2005 to 2010, Pennsylvania jobs *grew* by the following:

- 80.8 percent in the oil and gas extraction sector;
- 218.7 percent in the drilling oil and gas wells sector;
- 120.7 percent in the support sector for oil and gas operations; and
- 150.3 percent in the oil and gas pipeline and related structures construction sector.

While Pennsylvania employers overall shed 106,437 jobs over this period, employers in the four energy industries (where data was available) included here added more than 5,823 jobs.

Impact on Small Businesses

At the same time, while the number of businesses (in this case, establishments) declined in the nation and in Pennsylvania, the number of establishments grew strongly among Pennsylvania's energy sector. And it is critical to note the role and growth of smaller businesses.

Table 24 makes clear that expanded production in the energy sector has been a boon for small and midsize enterprises in the state. Or, to look at it from a different angle, expanded energy production has been driven by small and midsize businesses.

For all of the U.S., total employer establishments declined by 1.4 percent from 2005 to 2010, including a 3.5 percent decline in firms with less than 20 workers, and a 3.1 percent fall in firms with less than 500 workers.

In Pennsylvania, total establishments declined by 2.1 percent, including a 2.2 percent fall among establishments with less than 20 workers, and a 2.1 percent decline among those with less than 500 workers.

Compare those declines to the growth in these energy industries in Pennsylvania:

- Among oil and gas extraction businesses, the number of employer establishments grew by 40.7 percent, including growth of 36.3 percent among establishments with less than 20 workers and 40.7 percent among establishments with less than 500 workers.
- Among drilling oil and gas wells businesses, the number of employer establishments grew by 104.2 percent, including growth of 121.6 percent among establishments with less than 20 workers and 102.1 percent among establishments with less than 500 workers.
- Among supporting oil and gas operations businesses, the number of employer establishments grew by 119.5 percent, including growth of 111.7 percent among those with less than 20 workers and 119.5 percent among establishments with less than 500 workers.
- Among oil and gas pipeline and related structures construction businesses, the number of employer establishments grew by 14.8 percent, including growth of 13 percent among establishments with less than 500 workers.

The growth in both jobs and small-midsize employer establishments in the energy sector has been striking in recent years, especially given the abysmal performance of the overall economy.

Finally, it must be noted that the Pennsylvania energy sector is not all about huge enterprises. As noted in Table 24, each energy sector looked at is overwhelmingly populated by small and midsize establishments.

- Among oil and gas extraction businesses, 80.1 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.
- Among drilling oil and gas wells businesses, 83.7 percent of employer establishments in 2010 had less than 20 workers, and 99 percent had fewer than 500 employees.
- Among oil and gas operations businesses, 75.1 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.
- Among oil and gas pipeline and related structures construction businesses, 74.2 percent of employer establishments in 2010 had less than 20 workers, and 98.4 percent had fewer than 500 employees.
- Among oil and gas field machinery and equipment manufacturing establishments, 50 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.

Table 24: Establishments – Pennsylvania Total and Energy Industries, 2005-2010

Pennsylvania Total Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	303,333	258,823	302,449	85.3%	99.7%
2010	297,023	253,251	296,208	85.3%	99.7%
PA 05-10	-2.1%	-2.2%	-2.1%		
US 05-10	*-1.4%*	*-3.5%*	*-3.1%*		

Oil/Gas Extraction Employer Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	150	124	150	82.7%	100%
2010	211	169	211	80.1%	100%
Chg 05-10	40.7%	36.3%	40.7%		

Drilling Oil and Gas Wells Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	48	37	48	77.1%	100%
2010	98	82	97	83.7%	99.0%
Chg 05-10	104.2%	121.6%	102.1%		

Support for Oil and Gas Operations Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	77	60	77	77.9%	100%
2010	169	127	169	75.1%	100%
Chg 05-10	119.5%	111.7%	119.5%		

Oil and Gas Pipeline and Related Structures Construction Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	54	46	54	85.2%	100%
2010	62	46	61	74.2%	98.4%
Chg 05-10	14.8%	0%	13.0%		

Oil and Gas Field Machinery and Equipment Manufacturing Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	11	5	11	45.5%	100%
2010	10	5	10	50.0%	100%
Chg 05-10	-9.1%	0%	-9.1%		

IX. Texas

The increase in natural gas production has been considerable in Texas. The state's natural gas production, as highlighted in Table 25, expanded by 34.8 percent from 2005 to 2011.

Table 25: Texas Natural Gas Marketed Production

2005:	5,276.4 billion cubic feet
2011:	7,112.9 billion cubic feet

Table 26: Texas Employment Growth Among Employer Establishments, 2005-2010

Sector	2005	2010	Percent Change
Total	8,305,102	8,785,238	5.8%
Oil/Gas Extraction	34,124	42,889	25.7%
Drilling Oil and Gas Wells	31,310	32,485	3.8%
Support for Oil and Gas Operations	53,064	78,505	47.9%
Oil and Gas Pipeline and Related Structures Construction	29,299	41,699	42.3%
Oil and Gas Field Machinery and Equipment Manufacturing	20,544	26,455	28.8%

Impact on Jobs

Table 26 compares employment growth (all employment and business data from Census Bureau "County Business Patterns" unless otherwise noted) among employer establishments in the overall state, and in various energy industry sectors.

The difference in the employment story in Texas versus the U.S. at large is breathtaking, including the growth in the Texas energy sector.

While Texas total employment increased by 5.8% percent from 2005 to 2010, jobs *grew* by the following:

- 25.7 percent in the oil and gas extraction sector;
- 3.8 percent in the drilling oil and gas wells sector;
- 47.9 percent in the support sector for oil and gas operations;
- 42.3 percent in the oil and gas pipeline and related structures construction sector; and
- 28.8 percent in the oil and gas field machinery and equipment manufacturing sector.

Texas employers overall added 480,136 jobs over this period, including employers in the energy industries included here adding 53,692 jobs.

Impact on Small Businesses

At the same time, while the number of businesses (in this case, establishments) declined in the nation, the number of establishments grew strongly in Texas, including in the energy sector. And it is critical to note the role and growth of smaller businesses.

Table 27 makes clear that expanded production in the energy sector has been a boon for small and midsize enterprises in the state. Or, to look at it from a different angle, expanded energy production has been driven by small and midsize businesses.

For all of the U.S., total employer establishments declined by 1.4 percent from 2005 to 2010, including a 3.5 percent decline in firms with less than 20 workers, and a 3.1 percent fall in firms with less than 500 workers.

In Texas, total establishments increased by 4.9 percent, including a 4.7 percent increase among establishments with less than 20 workers, and a 4.9 percent increase among those with less than 500 workers. The growth in energy industries in Texas were:

- Among oil and gas extraction businesses, the number of employer establishments grew by 9 percent, including growth of 6.7 percent among establishments with less than 20 workers and 9.1 percent among establishments with less than 500 workers.
- Among drilling oil and gas wells businesses, the number of employer establishments grew by 19.1 percent, including growth of 12 percent among establishments with less than 20 workers and 20.7 percent among establishments with less than 500 workers.
- Among supporting oil and gas operations businesses, the number of employer establishments grew by 34.2 percent, including growth of 29.4 percent among establishments with less than 20 workers and 34.4 percent among establishments with less than 500 workers.
- Among oil and gas pipeline and related structures construction businesses, the number of employer establishments grew by 37.8 percent, including growth of 36 percent among establishments with less than 20 workers and 38.2 percent among establishments with less than 500 workers.
- Among oil and gas field machinery and equipment manufacturing businesses, the number of employer establishments grew by 11.4 percent, including growth of 14.8 percent among establishments with less than 20 workers and 11.4 percent among those with less than 500.

The growth in both jobs and small-midsize employer establishments in the energy sector has been striking in recent years, especially given the abysmal performance of the overall economy.

Finally, it must be noted that the Texas energy sector in fact is not all about so-called "Big Oil." As noted in Table 27, each energy sector looked at is overwhelmingly populated by small and midsize establishments.

- Among oil and gas extraction businesses, 88.7 percent of employer establishments in 2010 had less than 20 workers, and 99.9 percent had fewer than 500 employees.
- Among drilling oil and gas wells businesses, 72 percent of employer establishments in 2010 had less than 20 workers, and 98.6 percent had fewer than 500 employees.
- Among oil and gas operations businesses, 78.3 percent of employer establishments in 2010 had less than 20 workers, and 99.6 percent had fewer than 500 employees.
- Among oil and gas pipeline and related structures construction businesses, 53.3 percent of employer establishments in 2010 had less than 20 workers, and 97 percent had fewer than 500 employees.
- Among oil and gas field machinery and equipment manufacturing establishments, 54.4 percent of employer establishments in 2010 had less than 20 workers, and 96.8 percent had fewer than 500 employees.

Table 27: Establishments – Texas Total and Energy Industries, 2005-2010

Texas Total Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	497,758	423,838	496,364	85.1%	99.7%
2010	522,146	443,599	520,718	85.0%	99.7%
TX 05-10	4.9%	4.7%	4.9%		
US 05-10	*-1.4%*	*-3.5%*	*-3.1%*		

Oil/Gas Extraction Employer Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	2,958	2,681	2,952	90.6%	99.8%
2010	3,225	2,860	3,222	88.7%	99.9%
Chg 05-10	9.0%	6.7%	9.1%		

Drilling Oil and Gas Wells Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	587	449	571	76.5%	97.3%
2010	699	503	689	72.0%	98.6%
Chg 05-10	19.1%	12.0%	20.7%		

Support for Oil and Gas Operations Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	2,377	1,930	2,365	81.2%	99.5%
2010	3,191	2,497	3,179	78.3%	99.6%
Chg 05-10	34.2%	29.4%	34.4%		

Oil and Gas Pipeline and Related Structures Construction Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	365	197	353	54.0%	96.7%
2010	503	268	488	53.3%	97.0%
Chg 05-10	37.8%	36.0%	38.2%		

Oil and Gas Field Machinery and Equipment Manufacturing Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	307	162	297	52.8%	96.7%
2010	342	186	331	54.4%	96.8%
Chg 05-10	11.4%	14.8%	11.4%		

X. Utah

The increase in natural gas production has been sizeable in Utah. The state's natural gas production, as highlighted in Table 28, expanded by 51.9 percent from 2005 to 2011.

Table 28: Utah Natural Gas Marketed Production

2005:	301.2 billion cubic feet
2011:	457.5 billion cubic feet

Table 29: Utah Employment Growth Among Employer Establishments, 2005-2010

Sector	2005	2010	Percent Change
Total	974,686	1,021,143	4.8%
Oil/Gas Extraction	1,027	1,262	22.9%
Drilling Oil and Gas Wells	610	716	17.4%
Support for Oil and Gas Operations	1,582	2,374	50.1%
Oil and Gas Pipeline and Related Structures Construction	547	452	-17.4%
Oil and Gas Field Machinery and Equipment Manufacturing	NA	NA	NA

Impact on Jobs

Table 29 compares employment growth (again, all employment and business data from Census Bureau "County Business Patterns" unless otherwise noted) among employer establishments in the overall state, and in various energy industry sectors.

The difference in the employment story in Utah versus the U.S. at large is striking, including the growth in the Utah energy sector.

While Utah total employment increased by 4.8% percent from 2005 to 2010, jobs *grew* by the following:

- 22.9 percent in the oil and gas extraction sector;
- 17.4 percent in the drilling oil and gas wells sector; and
- 50.1 percent in the support sector for oil and gas operations.

Utah employers overall added 46,457 jobs over this period, including employers in the energy industries included here adding 1,038 jobs.

Impact on Small Businesses

At the same time, while the number of businesses (in this case, establishments) declined in the nation, the number of establishments grew strongly in Utah, including in the energy sector. And it is critical to note the role and growth of smaller businesses.

Table 30 makes clear that expanded production in the energy sector has been a boon for small and midsize enterprises in the state. Or, to look at it from a different angle, expanded energy production has been driven by small and midsize businesses.

For all of the U.S., total employer establishments declined by 1.4 percent from 2005 to 2010, including a 3.5 percent decline in firms with less than 20 workers, and a 3.1 percent fall in firms with less than 500 workers.

In Utah, though, total establishments increased by 5.0 percent, including a 5.3 percent rise among establishments with less than 20 workers, and a 5.0 percent increase among those with less than 500 workers. The growth in energy industries in Utah were:

- Among oil and gas extraction businesses, the number of employer establishments grew by 3.6 percent, including growth of 10 percent among establishments with less than 20 workers and 3.6 percent among establishments with less than 500 workers.
- Among drilling oil and gas wells businesses, the number of employer establishments grew by 56.8 percent, including growth of 33.3 percent among establishments with less than 20 workers and 56.8 percent among establishments with less than 500 workers.
- Among supporting oil and gas operations businesses, the number of employer establishments grew by 41.2 percent, including growth of 39.9 percent among establishments with less than 20 workers and 41.2 percent among establishments with less than 500 workers.
- Among oil and gas pipeline and related structures construction businesses, the number of employer establishments grew by 4.2 percent, including growth of 4.2 percent among establishments with less than 500 workers.
- Among oil and gas field machinery and equipment manufacturing businesses, the number of employer establishments grew by 33.3 percent, including growth of 33.3 percent among establishments with less than 500 workers.

The growth in both jobs and small-midsize employer establishments in the energy sector has been striking in recent years, especially given the abysmal performance of the overall economy.

Finally, it must be noted that the Utah energy sector in fact is not all about large companies. As noted in Table 30, each energy sector looked at is overwhelmingly populated by small and midsize establishments.

- Among oil and gas extraction businesses, 75.9 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.
- Among drilling oil and gas wells businesses, 75.9 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.
- Among oil and gas operations businesses, 89.2 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.
- Among oil and gas pipeline and related structures construction businesses, 64 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.
- Among oil and gas field machinery and equipment manufacturing establishments, 75 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.

Table 30: Establishments – Utah Total and Energy Industries, 2005-2010

Utah Total Establishments

		Number of Employees		As Percent of Total Firms	
	Total	**Less 20**	**Less 500**	**Less 20**	**Less 500**
2005	65,549	57,040	65,399	87.0%	99.8%
2010	68,820	60,074	68,656	87.3%	99.8%
UT 05-10	5.0%	5.3%	5.0%		
US 05-10	*-1.4%*	*-3.5%*	*-3.1%*		

Oil/Gas Extraction Employer Establishments

		Number of Employees		As Percent of Total Firms	
	Total	**Less 20**	**Less 500**	**Less 20**	**Less 500**
2005	56	40	56	71.4%	100%
2010	58	44	58	75.9%	100%
Chg 05-10	3.6%	10.0%	3.6%		

Drilling Oil and Gas Wells Establishments

		Number of Employees		As Percent of Total Firms	
	Total	**Less 20**	**Less 500**	**Less 20**	**Less 500**
2005	37	33	37	89.2%	100%
2010	58	44	58	75.9%	100%
Chg 05-10	56.8%	33.3%	56.8%		

Support for Oil and Gas Operations Establishments

		Number of Employees		As Percent of Total Firms	
	Total	**Less 20**	**Less 500**	**Less 20**	**Less 500**
2005	170	153	170	90.0%	100%
2010	240	214	240	89.2%	100%
Chg 05-10	41.2%	39.9%	41.2%		

Oil and Gas Pipeline and Related Structures Construction Establishments

		Number of Employees		As Percent of Total Firms	
	Total	**Less 20**	**Less 500**	**Less 20**	**Less 500**
2005	24	18	24	75.0%	100%
2010	25	16	25	64.0%	100%
Chg 05-10	4.2%	-11.1%	4.2%		

Oil and Gas Field Machinery and Equipment Manufacturing Establishments

		Number of Employees		As Percent of Total Firms	
	Total	**Less 20**	**Less 500**	**Less 20**	**Less 500**
2005	3	3	3	100%	100%
2010	4	3	4	75%	100%
Chg 05-10	33.3%	0%	33.3%		

XI. West Virginia

The increase in natural gas production has been sizeable in West Virginia. The state's natural gas production, as highlighted in Table 31, expanded by 78.2 percent from 2005 to 2011.

Table 31: West Virginia Natural Gas Marketed Production

2005:	221.1 billion cubic feet
2011:	394.1 billion cubic feet

Table 32: West Virginia Employment Growth Among Employer Establishments, 2005-2010

Sector	2005	2010	Percent Change
Total	565,499	560,450	-0.9%
Oil/Gas Extraction	1,806	2,605	44.2%
Drilling Oil and Gas Wells	929	1,016	9.4%
Support for Oil and Gas Operations	1,154	2,296	99.0%
Oil and Gas Pipeline and Related Structures Construction	868	1,000-2,499	NA
Oil and Gas Field Machinery and Equipment Manufacturing	NA	NA	NA

Impact on Jobs

Table 32 compares employment growth (all employment and business data from Census Bureau "County Business Patterns" unless otherwise noted) among employer establishments in the overall state, and in various energy industry sectors. The key point in the employment story in West Virginia has to do with the energy sector.

While West Virginia total employment *decreased* by 0.9% percent from 2005 to 2010, jobs *grew* by the following:

- 44.2 percent in the oil and gas extraction sector;
- 9.4 percent in the drilling oil and gas wells sector; and
- 99 percent in the support sector for oil and gas operations.

West Virginia employers overall shed 5,049 jobs over this period, yet employers in the energy industries included here (three for which there are data) added 2,028 jobs.

Impact on Small Businesses

At the same time, while the number of businesses (in this case, establishments) declined in the nation and in West Virginia overall, the number of establishments grew strongly in West Virginia's energy sector. And it is critical to note the role and growth of smaller businesses.

Table 33 makes clear that expanded production in the energy sector has been a boon for small and midsize enterprises in the state. Or, to look at it from a different angle, expanded energy production has been driven by small and midsize businesses.

For all of the U.S., total employer establishments declined by 1.4 percent from 2005 to 2010, including a 3.5 percent decline in firms with less than 20 workers, and a 3.1 percent fall in firms with less than 500 workers.

In West Virginia, total establishments declined by 5.0 percent, including a 5.5 percent fall among establishments with less than 20 workers, and a 5.0 percent decline among those with less than 500 workers. However, the growth in energy industries in West Virginia were:

- Among oil and gas extraction businesses, the number of employer establishments grew by 9.6 percent, including growth of 5.3 percent among establishments with less than 20 workers and 9.6 percent among establishments with less than 500 workers.
- Among drilling oil and gas wells businesses, the number of employer establishments grew by 12.5 percent, including growth of 36.6 percent among establishments with less than 20 workers and 12.5 percent among establishments with less than 500 workers.
- Among supporting oil and gas operations businesses, the number of employer establishments grew by 48.3 percent, including growth of 45.2 percent among establishments with less than 20 workers and 48.3 percent among establishments with less than 500 workers.
- Among oil and gas pipeline and related structures construction businesses, the number of employer establishments grew by 14.3 percent, including growth of 30.2 percent among establishments with less than 20 workers, and 14.3 percent among establishments with less than 500 workers.

The growth in both jobs and small-midsize employer establishments in the energy sector has been striking in recent years, especially given the abysmal performance of the overall economy.

Finally, it must be noted that the West Virginia energy sector in fact is not all about huge enterprises. As noted in Table 33, each energy sector looked at is overwhelmingly populated by small and midsize establishments.

- Among oil and gas extraction businesses, 86.9 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.
- Among drilling oil and gas wells businesses, 77.8 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.
- Among oil and gas operations businesses, 82.2 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.
- Among oil and gas pipeline and related structures construction businesses, 75 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.
- Among oil and gas field machinery and equipment manufacturing establishments, 50 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.

Table 33: Establishments – West Virginia Total and Energy Industries, 2005-2010

West Virginia Total Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	40,735	35,419	40,656	86.9%	99.8%
2010	38,676	33,463	38,604	86.5%	99.8%
WV 05-10	-5.0%	-5.5%	-5.0%		
US 05-10	*-1.4%*	*-3.5%*	*-3.1%*		

Oil/Gas Extraction Employer Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	188	170	188	90.4%	100%
2010	206	179	206	86.9%	100%
Chg 05-10	9.6%	5.3%	9.6%		

Drilling Oil and Gas Wells Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	40	26	40	65.0%	100%
2010	45	35	45	77.8%	100%
Chg 05-10	12.5%	36.6%	12.5%		

Support for Oil and Gas Operations Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	87	73	87	83.9%	100%
2010	129	106	129	82.2%	100%
Chg 05-10	48.3%	45.2%	48.3%		

Oil and Gas Pipeline and Related Structures Construction Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	35	23	35	65.7%	100%
2010	40	30	40	75.0%	100%
Chg 05-10	14.3%	30.4%	14.3%		

Oil and Gas Field Machinery and Equipment Manufacturing Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	4	2	4	50.0%	100%
2010	2	1	2	50.0%	100%
Chg 05-10	-50.0%	-50.0%	-50.0%		

XII. Wyoming

The increase in natural gas production has been notable in Wyoming. The state's natural gas production, as highlighted in Table 34, expanded by 31.7 percent from 2005 to 2011.

Table 34: Wyoming Natural Gas Marketed Production

2005:	1,639.3 billion cubic feet
2011:	2,159.4 billion cubic feet

Table 35: Wyoming Employment Growth Among Employer Establishments, 2005-2010

Sector	2005	2010	Percent Change
Total	191,934	205,046	6.8%
Oil/Gas Extraction	2,663	3,592	34.9%
Drilling Oil and Gas Wells	3,041	3,604	35.3%
Support for Oil and Gas Operations	7,342	7,506	2.2%
Oil and Gas Pipeline and Related Structures Construction	892	2,987	234.9%
Oil and Gas Field Machinery and Equipment Manufacturing	NA	364	NA

Impact on Jobs

Table 35 compares employment growth (again, all employment and business data from Census Bureau "County Business Patterns" unless otherwise noted) among employer establishments in the overall state, and in various energy industry sectors.

Employment growth in Wyoming was positive over the period of 2005 to 2010, compared to a decline nationally, with Wyoming's energy sector showing particularly solid expansion.

While Wyoming total employment increased by 6.8% percent from 2005 to 2010, jobs *grew* by the following:

- 34.9 percent in the oil and gas extraction sector;
- 35.3 percent in the drilling oil and gas wells sector;
- 2.2 percent in the support sector for oil and gas operations; and
- 234.9 percent in the oil and gas pipeline and related structures construction sector.

Wyoming employers overall added 13,112 jobs over this period, yet employers in the energy industries included here (four for which there are data) added 3,751 jobs.

Impact on Small Businesses

At the same time, while the number of businesses (in this case, establishments) declined in the nation, the number of establishments grew in Wyoming, including in the energy sector. And it is critical to note the role and growth of smaller businesses.

Table 36 makes clear that expanded production in the energy sector has been a boon for small and midsize enterprises in the state. Or, to look at it from a different angle, expanded energy production has been driven by small and midsize businesses.

For all of the U.S., total employer establishments declined by 1.4 percent from 2005 to 2010, including a 3.5 percent decline in firms with less than 20 workers, and a 3.1 percent fall in firms with less than 500 workers.

In Wyoming, total establishments increased by 2.5 percent, including a 2.6 percent rose among establishments with less than 20 workers, and a 2.5 percent increased among those with less than 500 workers.

The growth in energy industries in Wyoming was:

- Among drilling oil and gas wells businesses, the number of employer establishments grew by 20.6 percent, including growth of 19.6 percent among establishments with less than 20 workers and 20.6 percent among establishments with less than 500 workers.

- Among supporting oil and gas operations businesses, the number of employer establishments grew by 13.6 percent, including growth of 13.3 percent among establishments with less than 20 workers and 13.9 percent among establishments with less than 500 workers.

- Among oil and gas pipeline and related structures construction businesses, the number of employer establishments grew by 40.7 percent, including growth of 51.3 percent among establishments with less than 20 workers, and 38.9 percent among establishments with less than 500 workers.

The growth in both jobs and small-midsize employer establishments in the energy sector has been striking in recent years, especially given the abysmal performance of the overall economy.

Finally, it must be noted that the Wyoming energy sector in fact is not all about big businesses. As noted in Table 36, each energy sector looked at is overwhelmingly populated by small and midsize firms.

- Among oil and gas extraction businesses, 75.6 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.

- Among drilling oil and gas wells businesses, 75.8 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.

- Among oil and gas operations businesses, 83.5 percent of employer establishments in 2010 had less than 20 workers, and 99.6 percent had fewer than 500 employees.

- Among oil and gas pipeline and related structures construction businesses, 73.7 percent of employer establishments in 2010 had less than 20 workers, and 98.7 percent had fewer than 500 employees.

- Among oil and gas field machinery and equipment manufacturing establishments, 45.5 percent of employer establishments in 2010 had less than 20 workers, and 100 percent had fewer than 500 employees.

Table 36: Establishments – Wyoming Total and Energy Industries, 2005-2010

Wyoming Virginia Total Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	19,736	17,804	19,715	90.2%	99.9%
2010	20,231	18,270	20,213	90.3%	99.9%
WY 05-10	2.5%	2.6%	2.5%		
US 05-10	*-1.4%*	*-3.5%*	*-3.1%*		

Oil/Gas Extraction Employer Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	205	159	205	77.6%	100%
2010	180	136	180	75.6%	100%
Chg 05-10	-12.2%	-14.5%	-12.2%		

Drilling Oil and Gas Wells Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	98	81	98	82.7%	100%
2010	128	97	128	75.8%	100%
Chg 05-10	20.6%	19.6%	20.6%		

Support for Oil and Gas Operations Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	412	345	409	83.7%	99.3%
2010	468	391	466	83.5%	99.6%
Chg 05-10	13.6%	13.3%	13.9%		

Oil and Gas Pipeline and Related Structures Construction Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	54	37	54	68.5%	100%
2010	76	56	75	73.7%	98.7%
Chg 05-10	40.7%	51.3%	38.9%		

Oil and Gas Field Machinery and Equipment Manufacturing Establishments

		Number of Employees		As Percent of Total Firms	
	Total	Less 20	Less 500	Less 20	Less 500
2005	11	8	11	72.7	100%
2010	11	5	11	45.5%	100%
Chg 05-10	0%	-37.5%	0%		

XIII. LNG Exports: Expand or Limit Opportunities?

As is clear from the trends noted throughout this analysis, advancements in technology have opened up vast resources of natural gas (as well as oil) in shale rock that were previously not accessible. As a result, natural gas prices have plummeted in the U.S. However, prices remain high in other parts of the world, and therefore, the potential exists for economic benefits to be derived from exporting LNG.

That is, the trends in terms of expanded investment, entrepreneurship, economic growth and employment that have been highlighted given the expansion of domestic energy production – with our emphasis primarily on natural gas via hydraulic fracturing and horizontal drilling – can be expanded further through global markets for LNG.

Of course, this is how markets work. Prices send signals to producers to expand investment and production. Expanded foreign demand can boost the incomes of U.S. energy entrepreneurs, businesses and workers, with added benefits rippling out through the larger economy. Naturally, businesses must consider costs relative to the potential revenues, and assess the state of current and future competitors to get a full picture of the opportunity. The opportunity and evaluation process that businesses undertake was noted in a recent analysis of the LNG export issue published by the Peterson Institute for International Economics:

> "US natural gas producers are eager to take advantage of tremendous price differentials between the United States and foreign markets. US prices are around $3 per million metric British thermal units (mmBtu), while prices in Europe are $11 to $13 per mmBtu and as high as $18 per mmBtu in Southeast Asia. Even considering the cost of liquefaction and ocean transportation at $3.50 to $9.00 per mmBtu, producers can export LNG and earn a significant profit over domestic sales."[13]

Unfortunately, though, there is a movement afoot to actually have government limit LNG exports. Various chemical firms are seeking such limits. As the *Houston Chronicle* reported on January 10, 2013: "Some of the nation's largest chemical makers and manufacturers on Thursday united as a new coalition to lobby against a wholesale rush to export America's new natural gas bounty, which they say threatens some $80 billion in planned investments in new U.S. plants and assembly lines." They are concerned about higher natural gas prices due to increased exports.

Given the benefits that the chemicals industry has reaped in the international marketplace, these firms effectively are arguing that exports are fine for us, but not for others, in particular, the firms that produce our inputs. Consider the increases in U.S. chemical exports (in millions of dollars) from 2000 to 2011 in Table 37.

Based on their own arguments, might it follow then that these chemical firms should have their own exports limited, so as to keep their own products' prices in check for U.S. consumers of such chemicals? Of course not.

As noted in the Peterson Institute for International Economics analysis: "Fears of a significant increase in average domestic natural gas prices over a 20-year horizon are no more justified as a reason for limiting US exports of LNG than they would be as a reason for limiting exports of soybeans, corn, coal, or other natural resources. Historically, domestic price stabilization has not been an objective of US export policy. Rather, the overarching philosophy of a market economy is that prices for individual commodities should be allowed to fluctuate and thereby guide rational production and consumption decisions, both at home and abroad."[14]

Therefore, expanded demand for U.S. natural gas in international markets will result in greater U.S. natural gas production, increased investment, enhanced GDP growth, rising incomes, and more jobs – just as is the case with increasing exports in chemical industries.

Table 37: Chemical Industry: Export Growth, 2000-2011

Category	2000 Exports	2011 Exports	Percent Change
Chemicals – Cosmetics	5,292	13,244	150%
Chemicals – Dyeing	4,089	8,542	109%
Chemicals – Fertilizers	2,249	5,133	128%
Chemicals – Inorganic	5,359	13,345	149%
Chemicals – Medicinal	12,893	40,011	210%
Chemicals – n.e.s.	12,264	27,127	121%
Chemicals – Organic	17,990	43,571	142%
Chemicals – Plastics	19,519	46,195	137%

Economics 101 reminds us that the economy is not a zero-sum game. Therefore, expanded demand for U.S. natural gas in international markets will result in greater U.S. natural gas production, increased investment, enhanced GDP growth, rising incomes, and more jobs – just as is the case with increasing exports in chemical industries.

If one understands that international trade is mutually beneficial (otherwise, why would the parties participate in the transaction?), and that trade expands opportunity, enhances incentives for investment and expanded production, boosts competition, and increases income and employment, then the idea that government should place barriers on either exports or imports is glaringly absurd. Again, Economics 101 offers the lesson of comparative advantage, taught by the 19th-century economist David Ricardo, showing how trade is an economic positive as businesses, entrepreneurs and workers focus on the endeavors at which they rank as most efficient, and then trade with others for other goods and services. That's how the domestic and global economies work.

Unsurprisingly, study after study shows how these basic economic principles apply to energy markets. Consider the following examples.

- In "Macroeconomic Impacts of LNG Exports from the United States," researched and written by NERA Economic Consulting for the Energy Information Administration (December 2012), it was found: "Across all these scenarios, the U.S. was projected to gain net economic benefits from allowing LNG exports. Moreover, for every one of the market scenarios examined, net economic benefits increased as the level of LNG exports increased. In particular, scenarios with unlimited exports always had higher net economic benefits than corresponding cases with limited exports. In all of these cases, benefits that come from export expansion more than outweigh the losses from reduced capital and wage income to U.S. consumers, and hence LNG exports have net economic benefits in spite of higher domestic natural gas prices. This is exactly the outcome that economic theory describes when barriers to trade are removed. Net benefits to the U.S. would be highest if the U.S. becomes able to produce large quantities of gas from shale at low cost, if world demand for natural gas increases rapidly, and if LNG supplies from other regions are limited."

- In "Made in America: The economic impact of LNG exports from the United States," from Deloitte Center for Energy Solutions and Deloitte MarketPoint LLC (2011), it was reported: "Given the model's assumptions, the WGM projects a weighted-average price impact of $0.12 per million British thermal units (MMBtu) on U.S. prices from 2016 to 2035 as a result of the 6 Bcfd of LNG exports. The $0.12/MMBtu increase represents a 1.7% increase in the projected average U.S. citygate gas price of $7.09/MMBtu over this time period."

Given this small projected price rise, a follow-up captured the nature of how the market works: "The results show that the North American gas market is dynamic. If exports can be anticipated, and clearly they can with the public application process and long lead time required to construct a LNG liquefaction plant, then producers, midstream players, and consumers can act to mitigate the price impact. Producers will bring more supplies online, flows will be adjusted, and consumers will react to price change resulting from LNG exports."

- That point about the dynamism of the market was emphasized in a study titled "Liquid Markets: Assessing

the Case for U.S. Exports of Liquefied Natural Gas," written by Charles Ebinger, Kevin Massy, and Govinda Avasarala, for the Brookings Institution in May 2012. The authors observed: "Shale gas technologies and production processes have been developing rapidly in recent years, improving the economics of extraction. Companies now are drilling longer laterals and are increasing the number of frack stages—the number of different fracking sections in each lateral section—per well, leading to an increase in available reserves and well productivity. An analysis of well-specific-data illustrates that both initial production rates and ultimate well recovery have been growing across all production regions (or 'plays'), thereby driving down per unit costs of production."

Ebinger, Massy and Avasarala summed up a critical point when it comes to how increased demand via new exports markets would be met: "In their analyses, both Deloitte and EIA found that the majority—63 percent, according to both studies—of the exported natural gas will come from new production as opposed to displaced consumption from other sectors."

For good measure, the study from the Peterson Institute made an important counterpoint to one pessimistic point put forth by the NERA study.

Any politically driven efforts to limit exports, therefore, would limit the creation, growth and job-creating abilities of those small and midsize businesses that populate the energy industry.

It was stated in the NERA study, "LNG exports are not likely to affect the overall level of employment in the U.S. There will be some shifts in the number of workers across industries, with those industries associated with natural gas production and exports attracting workers away from other industries. In no scenario is the shift in employment out of any industry projected to be larger than normal rates of turnover of employees in those industries." However, it is countered in the Peterson Institute study: "The NERA model assumes that the economy operates at full employment. In reality, the American economy has not been operating at full employment for four years and this condition is expected to last at least through 2015. For this reason, the potential employment benefits from larger natural gas production may be understated in the NERA report. By the same token, if lower gas prices spurred new investment in chemical or power plants, that too would reduce the unemployment rolls."

In the end, the expectation that nearly two-thirds of LNG exports would be met via new production – and within the context of recent and expected growth in natural gas production – speaks to further strong growth for small and midsize businesses, and for employment. At the same time, the minimal price impact that expanded exports might have on domestic prices would have small effects on domestic consumers of natural gas – especially given the enormous declines we've already experienced in natural gas prices. And even those small, potential price increases must be further offset against the effect of the overall positive for economic growth coming via generally lower natural gas prices and expanded natural gas production.

Recall the tremendous growth in energy sector employment due to expanded domestic natural gas and oil production, as cited earlier in this report, versus the decline in overall U.S. jobs. Also, consider that growth state by state in energy sectors, again versus the dismal overall job market.

Recall the growth in the number of small and midsize businesses experienced nationally and in key states due to expanded energy production, and compare those to the overall decline in the U.S. economy. And again, keep in mind that these energy sectors are overwhelmingly populated by those small and midsize firms.

Given these economic realities, allowing for LNG exports to be guided by market forces – as opposed to political preferences and lobbying – means expanding the potential opportunity for small and midsize businesses to be created, to grow, and to create jobs. Any politically driven efforts to limit exports, therefore, would limit the creation, growth and job-creating abilities of those small and midsize businesses that populate the energy industry.

About the Author

Raymond J. Keating is the chief economist for the **Small Business & Entrepreneurship Council**. Keating also serves as an adjunct professor at the Townsend School of Business at Dowling College in New York where he teaches graduate courses on innovation and entrepreneurship, international business, and public sector economics.

In addition, Keating writes a weekly column for Dolan Media Company publications, including *Long Island Business News*. Keating's analysis and commentary pieces also have appeared in such publications as *The New York Times, The Wall Street Journal, The Washington Post, The Washington Times, Boston Globe, Newsday, Los Angeles Daily News*, and many others.

Keating has testified before congressional and state legislative bodies, and has spoken to groups across the nation on a wide range of economic, policy and small business topics. The media taps him regularly for his views, including print, radio and television (for example, NBC, CNBC, Fox News, Fox Business Network, CNN, PBS, etc.) interviews.

Endnotes

1 Liquefied natural gas, as explained here for example from Shell Global's website (http://www.shell.com/global/future-energy/meeting-demand/natural-gas/liquefied-natural-gas/what-is-lng.html), is: "Transporting gas by pipeline can be costly and impractical. We create LNG by cooling the gas to a liquid to -160°C, which we can then ship out, safely and efficiently.

LNG is a clear, colourless, non-toxic liquid that can be transported and stored more easily than natural gas because it occupies up to 600 times less space. When LNG reaches its destination, it is returned to a gas at regasification facilities. It is then piped to homes, businesses and industries."

2 International Energy Administration, "North America leads shift in global energy balance, IEA says in latest World Energy Outlook," November 12, 2012, accessed at http://www.iea.org/newsroomandevents/pressreleases/2012/november/name,33015,en.html.

3 Energy Information Administration, "What is shale gas and why is it important?" *Energy in Brief*, December 5, 2012, accessed at http://www.eia.gov/energy_in_brief/article/about_shale_gas.cfm.

4 Energy Information Administration, "What is shale gas and why is it important?" *Energy in Brief*, December 5, 2012, accessed at http://www.eia.gov/energy_in_brief/article/about_shale_gas.cfm.

5 Census Bureau industry definition: "This industry comprises establishments primarily engaged in operating and/or developing oil and gas field properties and establishments primarily engaged in recovering liquid hydrocarbons from oil and gas field gases. Such activities may include exploration for crude petroleum and natural gas; drilling, completing, and equipping wells; operation of separators, emulsion breakers, desilting equipment, and field gathering lines for crude petroleum; and all other activities in the preparation of oil and gas up to the point of shipment from the producing property. This industry includes the production of crude petroleum, the mining and extraction of oil from oil shale and oil sands, the production of natural gas and the recovery of hydrocarbon liquids from oil and gas field gases. Establishments in this industry operate oil and gas wells on their own account or for others on a contract or fee basis."

6 Census Bureau industry definition: "This U.S. industry comprises establishments primarily engaged in drilling oil and gas wells for others on a contract or fee basis. This industry includes contractors that specialize in spudding in, drilling in, redrilling, and directional drilling."

7 Census Bureau industry definition: "This U.S. industry comprises establishments primarily engaged in performing support activities on a contract or fee basis for oil and gas operations (except site preparation and related construction activities). Services included are exploration (except geophysical surveying and mapping); excavating slush pits and cellars, well surveying; running, cutting, and pulling casings, tubes, and rods; cementing wells, shooting wells; perforating well casings; acidizing and chemically treating wells; and cleaning out, bailing, and swabbing wells."

8 Census Bureau industry definition: "This U.S. industry comprises establishments primarily engaged in the construction of oil and gas lines, mains, refineries, and storage tanks. The work performed may include new work, reconstruction, rehabilitation, and repairs. Specialty trade contractors are included in this group if they are engaged in activities primarily related to oil and gas pipeline and related structures construction. All structures (including buildings) that are integral parts of oil and gas networks (e.g., storage tanks, pumping stations, and refineries) are included in this industry."

9 Census Bureau industry definition: "This U.S. industry comprises establishments primarily engaged in (1) manufacturing oil and gas field machinery and equipment, such as oil and gas field drilling machinery and equipment; oil and gas field production machinery and equipment; and oil and gas field derricks and (2) manufacturing water well drilling machinery."

10 IHS, *America's New Energy Future: The Unconventional Oil and Gas Revolution and the US Economy: Volume 2: State Economic Contributions*, December 2012.

11 IHS, *America's New Energy Future: The Unconventional Oil and Gas Revolution and the US Economy: Volume 2: State Economic Contributions*, December 2012.

12 Keith Schneider, "Ohio's Resurgent Natural Gas Industry Spends Millions to Set Up Shop," *The New York Times*, March 12, 2013, accessed at http://www.nytimes.com/2013/03/13/realestate/commercial/natural-gas-industry-drives-construction-surge-in-ohio.html?pagewanted=all&_r=0.

13 Gary Clyde Hufbauer, Allie E. Bagnall, and Julia Muir, "Liquefied Natural Gas Exports: An Opportunity for America," Peterson Institute for International Economics, February 2013.

14 Gary Clyde Hufbauer, Allie E. Bagnall, and Julia Muir, "Liquefied Natural Gas Exports: An Opportunity for America," Peterson Institute for International Economics, February 2013.

SBE COUNCIL
Small Business & Entrepreneurship Council

www.sbecouncil.org

Small Business & Entrepreneurship Council
301 Maple Ave. West, Suite 690, Vienna, VA 22180
Phone: 703-242-5840 • Fax: 703-242-5841

UF | UNIVERSITY of FLORIDA

COGNITION & CONTROL IN COMPLEX SYSTEMS

College of Engineering
Department of Electrical & Computer Engineering

Sean Meyn
Robert C. Pittman Eminent Scholar Chair
Director Florida Institute for Sustainable Energy
445 New Engineering Bldg. PO Box 116230
Gainesville, FL 32611 352-392-8924

June 20, 2013

Re: Subcommittee on Agriculture, Energy and Trade ***The New Domestic Energy Paradigm: Potential for Small Businesses and the Economy. Regarding sponsored projects at the University of Florida.***

To whom it may concern:

At today's hearing, Representative Luetkemeyer stated on the record that I received millions of dollars last year from the federal government. This statement is incorrect. Below is a record of current funding.

My portion of federal funding is approximately $250,000 per year, which is not unusual for an active research professor. Funds are used to support graduate students in joint research. Funding also supports conference travel, and funds for partial release time from teaching. I could not conduct research without this support.

Sincerely,

Sean P. Meyn
Director Florida Institute for Sustainable Energy
Robert C. Pittman Eminent Scholar Chair
Electrical and Computer Engineering

UF UNIVERSITY of FLORIDA

COGNITION & CONTROL IN COMPLEX SYSTEMS

Grant title: *Information Theoretic Paradigms for Modeling, Inference and Decision Making in Complex Systems*
Source: AFOSR
Amount: $ 1,200K Duration: 2009-2013
Number of investigators: 2

This is a collaborative project with Professor Prashant Mehta at the University of Illinois. The funding is used to support our students – both graduate and undergraduate. Three of them were funded to present their recent work at the American Control Conference here in Washington DC this week. Some of the output of this research is of current interest to Raytheon and Boeing in current target tracking applications. The research has many applications beyond this.

Grant title: *Collaborative Research GOALI: Methods for Network-Enabled Embedded Monitoring and Control for High-Performance Buildings*
Source: NSF
Amount: $ 745K Duration: 2009-2013
Number of investigators: 2

This is collaborative work with United Technologies on building systems – efficiency, modeling, and grid interactions. Research has led to several patent applications at the University of Florida.

Grant title: *Collaborative Research: Smart Power Systems of the Future: Foundations for Understanding Volatility and Improving Operational Reliability*
Source: NSF
Amount: $ 900K Duration: 2011-2015
Number of investigators: 2

Focus is largely renewable integration – both policy and engineering. Many papers, tutorial lectures, and workshop activities may be found on my website.

Grant title: *EAGER: Blackout: An educational experiment in gaming the power grid*
Source: NSF
Amount: $800K Duration: 2012-2015
Number of investigators: 3

This is a unique grant in that it is purely educational. Undergraduate students will collaborate with a professional game designer to create an educational game about power grids; both engineering and markets. All but a small fraction of the funds will support the game designer.