Event Transcript

Fueling Up: The Economic Implications of America’s Oil and Gas Boom

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Adam Posen: Good afternoon ladies and gentlemen. Welcome to the second public event of the New Year at the Peterson Institute for International Economics. I’m Adam Posen, President of the Institute, and it is really a pleasure today to have not only a full house, but a full house for this particular study and topic.

Today we will be talking about releasing the new volume Fueling Up, The Economic Implications of American Oil and Gas Boom, by our long time visiting fellow Trevor Houser and his colleague from Rhodium Group and of course Trevor is also at the Rhodium Group as a partner, Shashank Mohan.

And it’s been an ongoing process keeping up with events, which has been a challenge for the authors and getting input from a wide variety of sources and I think that’s been important because as you’ll see, this is a book that looks at a wide variety of the issue, a wide range of thoughts about it.

It takes on fundamentally, the basic macroeconomic and trade impact of America’s oil and gas boom, but then it does it in, I think, a very realistic, sober, and sound way but also goes on to consider some of the ways of financing and dealing with the environmental effects of this, things about the trade issues, where of course Gary Hufbauer and others in this building have written and they independently, Trevor and Shashank—forgive my pronunciation—come out in favor of natural gas exports from the U.S., which of course is in keeping with our pro-globalization stance, but also thinking much more creatively about the specific impact on various sectors and industries.

This is not a book that’s going to fuel people running around saying the world is saved by fracking, the U.S. economy is saved or even U.S. manufacturing is saved and I think that’s a good thing. It’s a book that’s going to give a solid basis to cause real discussion about where the benefits are, how long they’re likely to last and how best to manage and use them.

A number of our corporate supporters obviously did not determine the book but did make contributions and I’m glad to say intellectual as well as financial. BP in particular, gave us some data that’s now publicly available that fed into the modeling and we received a lot of input from Cheniere Energy and we’re delighted to have Michael with us today to discuss the volume. I’ll introduce him
after Trevor’s initial pronunciation. But now, I will turn to Trevor and remember, the book is *Fueling Up*. All of you in this room are getting a free copy. Tell your friends. Tell them to buy a copy. All of you watching on the web, there’s an easy button on our webpage. Click on it. It’s well worth your reading. Thank you.

Trevor Houser:

Thanks very much and thanks to all of you for turning out on such a chilly January day. One of the pleasures as an energy walk, being a fellow at the Peterson Institute, is the ability to benefit from the tremendous unique collection of economic thinkers on issues ranging from trade policy to monetary policy and that has been particularly useful in putting together this study, trying to assess the macroeconomic implications of the oil and gas boom that is transforming both U.S. and global energy markets.

For those of you who don’t have the pleasure of spending all of your days waist-deep in energy data, let me provide a little bit of context before we dig into the results of this study. Between 2000 and 2008, we saw a run up in natural gas and crude oil prices to the highest levels adjusted for inflation since we began keeping track and for oil that’s a long time. We started keeping track in 1860. The outlook for U.S. production growth was pretty grim. The outlook for the cost of supply elsewhere in the world was equally grim, so grim in fact that it led a Texas oil man turned president to pronounce in 2006 that the U.S. had no option but to end our addiction to oil and move away from a petroleum-based economy.

As he was giving that speech in his home state of Texas, companies were combining two innovations, hydraulic fracturing and horizontal drilling, to produce natural gas from shale formations. Those processes had been around for decades and they had been combined to produce commercial quantities of gas since the 90s, but it was really the growth in natural gas prices that poured fuel on that fire that attracted the capital and really brought those technologies to scale and we saw a dramatic increase in natural gas drilling activity as gas prices went up in 2006, 2007, and 2008.

The result of that expansion of shale production has been dramatic from an energy market standpoint. U.S. natural gas production is up 30% relative to when President Bush gave his State of the Union Address in 2006. And the outlook for future natural gas production growth has been dramatically revised as well. Every year, the Energy Information Administration puts together an outlook that projects current trends into the future and the forecast for future U.S. natural gas production and it has been significantly revised over the past six years. This production has grown and our understanding of the resource base has changed.

This compares that most recent EIA projection, which actually that says 2013, this is actually their 2014 projection which was just released a few weeks ago. Two recent private sector forecasts and a most recent forecast from the International Energy Agency and there’s some variation but most groups now
expect the growth in natural gas production to continue for another couple of decades.

That dramatic growth in natural gas output has led to a sharp decline in natural gas prices and a historically large disconnect between the price of natural gas and the price of crude oil measured on a common energy unit basis and that’s created a pretty strong commercial incentive to try to drill for oil whenever you can drill for oil, rather than drill for natural gas. It turns out that that same combination of hydraulic fracturing and horizontal drilling that can access natural gas trapped in shale formations can access tight oil in places like the Bakken in North Dakota or the Eagle Ford Shale in Texas.

And so as natural gas prices fell, we saw a significant reallocation of drilling activity to oil and as a result, dramatic growth in U.S. oil production between 2008 and 2012, U.S. oil production, crude production grew by 1.5 million barrels a day. Natural gas liquids production, which is a crude-like product, grew by another 600,000 barrels a day for 2.1 million barrels a day of oil growth. Year-to-date, crude production is up by another 800,000 barrels a day and in its most recent forecast, the EIA projects another 2 million barrels a day of liquids growth over the next three years; a really dramatic change in the oil side.

The current or recent forecast for future oil production, there’s much more divergence than there is for crude. There’s much more uncertainty about the oil production future than there is the gas production future. That’s both because the resource is newer. We’re still getting to know it. But also because the future of U.S. crude production will be determined by what other producers elsewhere in the world do and what happens to global oil prices and there’s far more uncertainty about that than what our main domestic natural gas competitor, Canada, will do in its future production.

So you combine weak demand and growing supply and the share of energy imported in the U.S. has fallen from 30% to 16% over the past few years and the current EIA projection is that goes into the low single digits by 2020.

There’s still a lot of uncertainty about the forecast. Those revision slides should give anyone in my line of work a decent dose of humility when pontificating about what the future is going to look like. Anyway, I’m not a geologist, neither is Shashank and our point of view on how U.S. crude oil production will evolve is not going to add anything valuable to the debate. So what we did instead is we modeled the economic implications of a conservative scenario and an optimistic scenario that bookend the range of current forecasts and we compare that to a pre-shale scenario, which is where we keep all of the same assumptions in the modeling framework but we changed the shale gas and the tight oil resource base back to 2007 levels to just control for what’s happened on the resource side. Let me turn it over to Shashank to kind of walk through how we address that in the modeling and then I’ll give the headline results.
Shashank Mohan: Thanks, Trevor. The good part of being a coauthor is that you have to explain less, but the bad part is you have to explain the boring part. So I’ll try to be as quick as possible.

So our results are based on the national energy modeling system, NEMS, which is our energy economy modeling system of the U.S. energy markets. This modeling framework is being used by the Energy Information Administration to produce its annual energy outlook which Trevor mentioned. It’s being regularly updated and maintained by the folks at EIA, which makes it a great tool for us to use. So it has all the recent market developments and technological updates incorporated into it.

It is a comprehensive bottom up model of the energy systems, which not only projects production, consumption and prices of energy, but even the efficiency of a light bulb that you’ll be using in New England in 2040. So it’s a very detailed model and it makes it a great tool for analyzing different policy—for policy in the United States and energy market developments.

As you can see from this schematic, the presentation of the model, it is modular in nature and each module represents a particular aspect of the energy market. So there is demand modules from different sectors, there are supply modules for different fuel types and these models interact with each other in a cyclical way to produce a general equilibrium solution for any given year depending on what the policy in the market technology looks like in that year.

So now, let’s take a closer look at one of the models of our interest, which is the oil and gas supply module. This module projects the production of oil and gas in the future on a regional basis. I think Alaska should also be here. So for each region, what this module does is it first of all, looks at the set of feasible projects that can be developed in this particular region and then it calculates the net present value of actually implementing that project. So for a shale oil project, it will look at the production cost and calculate the investment cost and look at the future cash flow coming in from selling oil and gas and it calculates the net present value of each of the feasible projects and it then ranks all the projects from the highest NPV to the lowest NPV and selects the most profitable projects to come online to meet the current and the future demand.

And so as Trevor mentioned, we developed a couple of scenarios which tried to model a particular pathway of production for oil and gas. And the main variable which we changed in our modeling to do that is a resource base of shale oil and tight oil.

So in our pre-shale scenario, as Trevor mentioned, we put the resource level back to 2007-2008 level when these technologies were not in the limelight. The conservative scenario is what EIA currently thinks the estimate of the resource base is for both tight oil and shale gas. In our optimistic scenario, we allow the resource base to expand to produce the amount of shale gas and tight oil being projected by some of the forecasters. So the main thing to note here is that we
do not model the effect of a particular resource base but rather we tweaked or
fine-tuned the resource base to meet a particular production pathway.

One more thing that I will mention before proceeding on, as I mentioned before
it is an energy—NEMS is an energy economy modeling system which basically
means that any change in an energy system is—the effect of the change an
energy systems is—on the economy is captured endogenously. So if the energy
prices change, what is the effect on the economy? It’s captured endogenously
using this macroeconomic model. So of all the other things, that macroeconomic
module does is it—given the energy prices, it estimates the investment demand
in a particular sector.

So for example, it uses a combination of natural gas and crude oil prices to
calculate the investment in oil and gas extraction. Then methodology is that the
investment depends only on prices. So if you have lower prices in a particular
scenario, the investment demand will be lower. But it was in most of the
scenarios that lower prices usually signal lower supply and that means lower
investment, but in our scenarios when we changed the resource base, that
relationship breaks down. So for an optimistic scenario, where we have lower
prices of gas but much higher supply we have a lot more investment than the
model would predict. So what we did was we calculated an investment demand
in those sectors exogenously and then put it as an input into the
macroeconomic module. Back to Trevor.

Trevor Houser: Thanks, Shashank. Right, so in looking at the economic impact, we analyzed the
short and medium term impact, which we define as 2013 to 2020, the longer
term economic impact. And then we also look at what it means for particular
regions of the country and sectors of the economy.

In the short-term, in our view, the most significant economic impact of the oil
and gas boom is the oil market, the alternative oil market future that it helped
us avoid. Traditionally, oil prices have fallen during U.S. economic recoveries,
which has helped provide tailwinds to those recoveries. The past recovery was
different. Oil prices rose at the beginning of that recovery due to political
instability in oil producing regions, resilient demand in emerging economies,
which created headwinds to what was already a relatively fragile economic
recovery.

Oil prices would have been considerably higher had the U.S. not added three
million barrels a day of liquid supply to the market between 2008 and 2013,
which more than offset the decline in European production and in Iranian
exports during that period of time.

It’s difficult to calculate exactly how much higher prices would have been
because had the U.S. not produced 3 million barrels a day more of oil, other
producers would have changed their behavior, but suffice it to say, it would
have been considerably higher at a point in time where the global economy
would have had a difficult time adjusting to those prices.
Going forward, the change in energy prices between our optimistic and our pre-shale scenario is the most significant economic benefit in the modeling. On an annual average, we find $180 billion reduction in energy costs for business, households and government as a result of the oil and gas boom and as U.S. production is growing and displacing imports, even though overall U.S. energy expenditures are falling, U.S. producer revenue is increasing by $60 billion a year on average between 2013 and 2035.

Interestingly though, while U.S. oil producers do a lot better, natural gas producers actually do a lot worse as a result of the shale boom because the increase in volume is not enough to offset the sharp decline in prices. So the U.S. natural gas industry is making less money today than they did before shale gas was developed.

The second most important economic impact is the increase in investment and that’s particularly important. In the very short-term, oil and gas is a very capital intensive industry, this is the league tables of U.S. fixed asset investment. In 2011, we find an average annual increase of roughly $95 billion of fixed asset investment as a result of the shale boom going forward.

You combine lower energy prices and increased upstream investment and you get a pretty powerful stimulus package at a point in which the economy is operating below full employment. So between now and 2020, we find that in the optimistic scenario, GDP could be as much as 2% higher cumulatively during that period relative to the pre-shale scenario. Employment could be 1.7% higher. That is on par with the impact of the Recovery Act between 2009 and 2013 though over a longer period of time.

In terms of annual economic growth, that translates in the optimistic scenario into an additional 20 basis points of U.S. economic growth on average between 2013 and 2020, and we’re happy for any 20 basis points we can get right now. That’s front-loaded so the benefit is greater in the early years and diminishes as the economy returns to full employment. Our model makes the maybe optimistic assumption, that at least by 2020 we’re back near full employment.

A year ago in some of the reviews on this work, one of the criticisms was that we were too pessimistic about when the economy would return to full employment and I don’t know what folks think about that timing now.

As the economy returns to full employment however, less of that investment in oil and gas is additional to the economy. Generally equilibrium effects take hold and the oil and gas industry is competing for investment with other sectors of the economy.

So over the long-term, we actually don’t find much of an increase in the average rate of growth of the U.S. economy. There’s an increase in growth over the next seven years. We hold on to that increase in level of GDP going forward, but if
you look at the rate of economic growth post 2020, it’s not that much higher in an optimistic scenario than in a pre-shale scenario.

The oil and gas boom is not—it’s often compared to the IT boom in terms of its transformative impact on the economy. The IT boom increased long-term economic growth, not because of greater sales of hardware and software, but because of the broader productivity improvements that that enabled throughout the economy. Energy has done that in the past. When we went from wood to coal in the late 1800s, coal is a more useful form of energy. The Industrial Revolution would not have been possible with wood. Likewise when we went from coal to electricity, you can do things with electricity that you can’t do with coal. It’s a more useful type of energy.

What we’re talking about here is not a newer more useful type of energy; it’s the same energy. It’s just cheaper. Now that’s a benefit. Cheaper energy is an economic benefit, but unless you think energy prices are going to decline forever, which in our modeling they don’t, we have an adjustment in natural gas prices and oil prices but it’s not a permanent rate of decline, then you book those benefits in the near term and it doesn’t fundamentally alter the rate of long-term economic growth.

It does change the composition of the economy in very important ways and there are regional winners as well as losers in this story. The most profound change in economic composition is maybe on the international trade side, where in our optimistic scenario the energy trade deficit as a share of GDP, falls from a high of over 3% in 2008 down to 0.4, 0.3% of GDP by 2030.

That doesn’t necessarily mean the overall U.S. trade deficit is going to fall as folks in this building will routinely tell me. Your trade balance is a function of your savings and investment balance, not necessarily what you’re exporting or not exporting in any particular good. In other economies that have experienced resource booms, you’ve actually seen a decline in their manufacturing trade balance alongside an increase in their energy trade surplus. So if you look at Australia over the past decade or Canada over the last decade, as their natural resource trade surplus grew, their manufacturing good trade deficit also grew because the resource sector attracts capital, it attracts labor at the expense of the manufacturing sector. It results in a higher exchange rate.

If you go to Brazil and you talk to the guys in the manufacturing unions, their public enemy number one is Vale, the iron ore company, because it just drives up the price of the real and makes Brazilian manufacturing goods less competitive. Likewise, if you’re going to go to Williston, North Dakota today and try to setup a manufacturing operation you would have to pay $140,000 a year for a secretary, $400 a night for a hotel room. You would not be the most competitive Barbie manufacturer around if you’re in Williston because it just makes more sense to spend those resources producing oil and gas.
Now, there are reasons to think that the U.S. would have a different experience. First, the scale of the boom relative to the size of the U.S. economy, it’s much more modest in the U.S. than Australia or Brazil or Canada. Also, there’s this disconnect that has emerged between U.S. energy prices and energy prices for our leading trade partners. These are delivered natural gas prices to industrial consumers, which is pretty close between the U.S., Europe, Japan and China in 2005 and now industrial natural gas prices in the U.S. are half Chinese rates and a third of Japanese rates.

And indeed, for certain energy-intensive industries, that means a substantial reduction in production costs. Chemicals industry in particular, you can make chemicals, petrochemicals with naphtha, which is a crude product or you can make it with ethane, which is a natural gas product and as you can see, the gap between ethane and naphtha prices has mirrored the gap between crude oil and natural gas prices and the result, U.S. petrochemical producers have become considerably more profitable.

So the question then is for which industries does a potential reduction in their energy costs measured as a share of shipment value offset the potential increase in the exchange rate as a result of a declining energy trade deficit, right? So the EIA puts out this very useful survey called MECS, the Manufacturing Energy Consumption Survey, which allows you to look at the change we see in energy prices, how would that affect the cost of production of 440 different manufacturing industries in the U.S.? So we did that.

And what you see is that for a handful of industries, fertilizer, chemicals, flat glass, some types of steel manufacturing, you could see a greater than 10% reduction in overall production costs as a result of the shale boom. If you look at it in terms of employment, those industries only account for 1.3% of total U.S. manufacturing employment. Right? They’re very capital intensive manufacturing industries but they don’t employ a lot of people. The vast majority of U.S. manufacturing is in sectors where energy, total energy, is maybe 2% of production cost, 1% of production cost.

So if I was to go to Boeing and give away energy for free, I think they would still be reluctant to take that if the other side of that deal was a 5% appreciation in the dollar versus the euro and what that would mean for their competitiveness vis-à-vis Airbus. So if you kind of map this all out, on the X axis here, we have potential reduction in energy cost as a share of shipment value. So that’s the benefit different manufacturing industries would get from the shale boom, versus on the Y axis a concept called Net Export Orientation, which the Fed uses to assess vulnerability to exchange rate appreciation. It’s the share of intermediate inputs that are imported versus the share of production that’s exported. The bottom line is the higher you are in this scale, the more vulnerable you are to exchange rate appreciation. Right?

And as you can see, chemicals, clear winner. Right? The reduction in energy costs far outweighs the potential impact of a higher exchange rate. But if you’re
in computers and electronics or machinery or transportation equipment, you potentially have more to lose from exchange rate appreciation than you do to gain from lower energy costs.

Let me make a couple comments on the environmental effects and I’ll make a couple comments on trade effects and then we’ll close up.

I had the dubious pleasure of serving as a Climate Change Negotiator in 2009 and if you had told me at the time that U.S. carbon dioxide emissions in 2012 would be 12% below 2005 levels when our commitment in Copenhagen was 17% below 2005 levels, I would have danced a jig. The projection for business as usual U.S. CO2 emissions that the EIA made in 2006 was kind of steady rate of growth, as you can see on the chart here. Instead, emissions are now 12% below 2005 levels. They have declined more rapidly over the past few years than emissions in the EU, even though the EU has an emissions trading system and a binding 2020 domestic emission reduction commitment.

So what’s responsible for that change? If you compare the actual emissions in 2012 versus projected emissions and you do a little bit of a decomposition analysis, the main factor was the recession. Economic growth was projected to be 3.1% by the EIA between 2005 and 2012. It came in at 1.1%. That’s a big gap and indeed, that’s why the shape of the curve, U.S. and Europe, looks the same because we are part of the same global economy and so we both had a recession, but a significant share was a reduction in the carbon intensity of energy supply and that was due primarily in the past few years, to a shift from coal to natural gas as a result of cheaper natural gas prices.

We’ve seen about as much of that switch to occur as the result of cheap prices alone as we’re going to see. Right? Indeed, as natural gas prices have increased a little bit, particularly now with frigid polar vortex weather gripping the country, we’ve seen coal’s share of power generation rebound a little bit from a low of 33% back to 40%. Right? And when you model it going forward, even in our optimistic scenario which has pretty low natural gas prices, the total absolute coal generation holds flat at current levels.

Now the difference is that in the optimistic case, the load growth is all made up for with natural gas. So anything incremental comes from gas, but the base of coal generation doesn’t decline that much further. And indeed, when you look at the net effect of the oil and gas boom on U.S. CO2 emissions, emissions are lower but only modestly lower. Right? And that’s because while there’s a significant reduction in emissions from coal to gas, that’s power sector fuel switching in this bar here.

This compares average annual CO2 emissions between 2013 and 2035 between the optimistic and the pre-shale case, you get a 363 million ton reduction in emissions from fuel switching, but lower cost energy and faster economic growth means more energy demand. Right? There’s a rebound effect that people discuss in the context of energy efficiency, appliances and policy, that if
you reduce the cost of energy people will consume more of it. That holds true in the consumption of oil and natural gas as well. If it’s lower priced people will consume more of it and we see that rebound effect as eroding half to two-thirds of the emissions reductions you get from power sector fuel switching.

What’s interesting to me is not so much what the oil and gas boom does to CO2 emissions on its own but how it changes the economics and potentially the politics of policies aimed at reducing CO2 emissions. Right? So when we were debating cap and trade legislation in this town in 2007/2008, the primary technology solution to a price on carbon was projected to be some combination of nuclear and renewables and CCS on coal. Right? That’s what you see in the left hand chart here, a pre-shale scenario with some price on carbon.

If you run the same policy through the model now with current natural gas production assumptions, the story is very different. The technology solution is almost entirely a switch from coal to natural gas. There is a lot of coal dispatch in this country that is sitting on a razor’s edge right now and very small increases in the price of emissions or in the cost of coal could switch that generation over to natural gas.

That means that it’s cheaper to abate emissions than it was previously. The abatement costs are lower, but it also means that the politics could be different because the winners of a climate policy in a post-shale world look very different than the winners of a climate policy in a pre-shale world. The EPA is in the process of developing regulations for existing power plants. They will probably be the largest single wealth transfer to the natural gas industry that we’ve seen in a long time.

All right, a couple words on trade policy implications. We go through LNG, crude and coal in the book. I’m going to leave LNG to Michael. I want to make a couple comments on crude because of Senator Murkowski’s speech yesterday at Brookings and kind of press buzz around that. A little bit of background, it turns out we have a ban on crude oil exports. It’s been on the books for a long time that nobody paid attention to because it didn’t really matter until recently.

That has gotten some attention because there is a sharp disconnect in the price of crude that folks in the Bakken or in the Eagle Ford are able to get, versus the price for similar qualities of crude on the international market. Until very recently that disconnect was the result of a pipeline constraint. It was a transportation bottleneck. You just couldn’t get that oil from Cushing where WTI is priced to the coast.

Over the past few months the bottleneck has moved to the refinery side where there is insufficient demand at Gulf Coast refineries for the type of crude oil that is being produced in the U.S. mid-continent. So even though we still import about 7, 8 million barrels a day of oil, of crude oil, on that, the type of crude we’re producing is not well suited to the type of refineries we have in the Gulf Coast which were built to take Middle East heavier, more sour imports. And so
you’re seeing a dislocation in prices now because of the crude oil export ban, really for the first time over the past couple of months and that’s why that’s become a hot topic just in the past few months.

This will be, I think, one of the primary energy policy debates of 2014. It’s complex. There are a lot of issues to analyze. What does it mean for producers? What does it mean for consumers? What does it mean for emissions? What does it mean for national security?

The experience of the past couple of years gives us a little insight, at least into one of those questions. Who’s benefiting right now from a disconnect between mid-continent crude prices and international crude prices and who would benefit from it being removed? So you can see here, this is the price of crude oil by different regions of the country. We’ve divided the country up into PADs, petroleum something defense districts. I don’t know. It’s a World War II artifact. Dave would know.

Anyway, so PAD2 is the Midwest, PAD4 is the Rocky Mountains. So those are the ones to concentrate on. Those are the kind of stranded mid-continent parts of the country. And indeed, refiners in those parts of the country are paying 15 to 20% less for every barrel they buy today than their competitors on the East Coast or the West Coast and you can see that reflected in the profitability of mid-continent refiners. That’s been one of the big bowl investment themes over the past few years is mid-continent refiners.

It turns out that very little of that price gap is being passed through to consumers. So these are retail gasoline prices excluding taxes, which vary state to state, by the same PAD districts and there’s a 1 to 2% variation in gasoline prices between PAD2, let’s say and PAD1, but not the 20% difference that they’re facing in crude prices. That would suggest that the primary loser of removing the export ban is going to be refiners, not consumers. The net long-term impact on consumer prices is complex and warrants a lot of analysis, but at least the experience to date shows that most of the rent that that policy has created is going to refinery profit margins.

Let me stop there so we’ll have lots of time for discussion and I look forward to hearing from Michael.

Adam Posen: That was terrific, Trevor, and also Shashank, to get models and data and colorful graphs and still make it all come out the way it should for an audience that isn’t, as you say, waist-deep in energy data on a daily basis.

Just to emphasize, I think for many of the economists in the room, a lot of what the authors are saying is think about things in general equilibrium and that of course is always the caution. What are the feedback effects? But what I think is commendable is the way that our authors have put meat on that basic principle and really seen it through in the sectoral level as well.
I’d now like to call upon Michael Wortley, Vice President of Strategy and Risk from Cheniere Energy. As I mentioned, Cheniere has been one of the supporters of this work, as was Dow Chemical, as was BP, as was Chevron. And for those of you who’ve been following this issue, you can well imagine that not all those companies agree with all the statements made in this book, which is a perfect example of the Peterson Institute’s desire to learn from our corporate friends and listen but not always say exactly the same thing.

But in this respect, we do respect and have interest in expertise. And Michael Wortley certainly has that. Prior to joining Cheniere Energy in February, 2005, he spent five years with Anadarko Petroleum Corporation doing oil and gas corporate development, mergers, divestitures. He started off his career working with Union Pacific Resources Corporation and then was later acquired by Anadarko and he’s going to give us a real market and exploration perspective on these issues. Thank you, Michael, for joining us.

Michael Wortley: Thank you, Dr. Posen. On behalf of Cheniere Energy and my colleagues who are in the room today, [inaudible 00:36:12] and Raquel and [inaudible 00:36:14] Washington office and Andrew Ware, who helps us out of Denver. We want to congratulate Trevor and Shashank for their excellent work and insightful analysis. We greatly appreciate their diligent work and the breadth of research that they’ve put into this book. Andrew has been working with these guys offering his suggestions on the manuscript and things like that, not always accepted as Dr. Posen says, over the past year and it’s been a real honor for us to be a part of it.

For us, we think it’s important, critical really, for industry and policymakers to have the best information at their fingertips, particularly on this issue, as they make decisions going forward and understand the implications of this energy revolution that’s happened in this country and understand the implications for our economy and sort of our standing in the world.

And certainly for us, we’re pleased to rely on folks like Trevor and others who are a lot smarter than us on these issues. We’re trying to run a business and deal with suppliers and customers and investors and all of this and we don’t have the time to step back, nor the expertise a lot of times, to step back and try and understand really what all of this means for both the U.S. economy and its place in the world. So it’s just so helpful for companies like ourselves. We believe that Fueling Up will stand as the preeminent analysis of the impacts that the tight oil and gas revolution will have on this country and we congratulate them on their exceptional work.

So we ran into Trevor, I think it was 2010 or 2011 at an Aspen Institute Forum or something, and knew immediately that we wanted to follow the work that he was doing. It was clear that when he spoke a lot of thought and rigorous analysis had gone into what he said and so when the opportunity presented itself to participate and help support this project, of course we jumped at it and waited
with great anticipation to see the findings that the guys would come up with and really many of the findings from *Fueling Up* are truly incredible. You heard a lot of them. We came up with three that we thought were pretty interesting and you saw them but I think they bear repeating.

The first one is since the depths of the recession in 2009, the tight oil and gas revolution in this country has had an economic impact equivalent to the 2009 Recovery and Reinvestment Act. So that’s almost a trillion dollars of stimulus that came from the private sector during that time. It’s just amazing to us.

Number two, and Andrew and I were debating the exact numbers, you can verify them in the book, but they are large regardless, and that is that unconventional energy development has boosted economic growth by up to 2% in the short-term and reduced unemployment by almost 2% during that time. So it’s just had a profound impact on the economy as we’ve come out of this deep recession.

And finally, the one that we like the most frankly, and think is the most compelling about what’s going on, is that U.S. consumers are realizing the equivalent of about $180 billion of tax cuts from lower energy prices. And if that weren’t good enough, that 180 billion immediately gets rolled back into other sectors of the economy and just has a snowball effect.

So those are three impacts at home, but also impacts have been felt abroad as well and certainly we felt that at our company. And one of the themes detailed, we think, well in *Fueling Up* is that this energy boom in this country has had a ripple effect beyond our shores and as Trevor noted, the economic stimulus that’s resulted from growing oil and gas production is impacting, first America’s trade imbalance. We’re not buying as much gas from Canada today as we were four years ago. We’re obviously not importing as much oil as we were four years ago and so we’re already feeling that effects and then companies like ours and others in a few years will start exporting large quantities of LNG and that’s just going to exacerbate the effect. And that’s having knock-on effects as Trevor mentioned, to the value of the U.S. dollar.

And importantly for us, as a company, it’s really changed the expectations for trade among our international peers. So many of our allies who once expected to be competing with us on the world stage for energy supplies are now expecting us to be their supplier and it’s not just for natural gas. Right? It’s for coal, it’s for petrochemicals and other things.

And for those of you who don’t know the history of our company, we started 15 years ago. We were these brilliant guys who thought it would be a good idea to build import facilities. And so we spent a couple billion dollars building LNG import facilities, almost went broke in the process, but we were running around the world talking to suppliers: the Nigerians, the Qataris and all of these guys, trying to buy LNG to bring to the U.S. and of course, we would in the waiting room, run into the Japanese, the Koreans and other representatives from other
European countries who were trying to do the same thing. And interestingly enough, now we as a company and we as a country, are going to be a supplier to those same guys, whether it’s the Japanese—we won’t be supplying the Japanese ourselves but the Koreans and European countries. So it’s been an amazing thing to see.

So we live in an interconnected world and there’s no way to withdraw from it. We should continue to support free trade which helps really create this incredible opportunity.

In addition to the impacts noted, we’d mention a lesson learned that the book highlights and that is that the lesson has to do with how rapid and unexpected this turnabout in the U.S. energy outlook occurred. Technology breakthroughs were a surprise to everyone.

Trevor mentioned the confluence of horizontal drilling and fracking coming together to produce this great resource. But that was a rational response to a price signal that the market was giving at the time and it’s really been a market and technology driven turnabout and as I said, our company has been a beneficiary of that turnaround. We had no choice really but to look at exports and obviously, that has come to pass. So change can be a messy process but as Fueling Up demonstrates, there are real benefits for the economy, for consumers and the country as a whole in allowing free markets to work.

So I guess, afterwards we can take questions if there are any on the LNG business specifically. But we want to thank the Peterson Institute for today for allowing us to speak here. And you guys, both Trevor and many in the room, serve an important role in Washington in publishing balanced and rigorous work on economics and international trade and we really do thank you. So again, congrats to Trevor and Shashank and thanks for letting us be a part of today’s events.

Adam Posen: Wow. Well, I’m very grateful to Michael. Of course, I agree with everything he said completely, including most particularly, about the study. But we have a lot of other expertise in the room from the policy sector, the academic sector, markets, corporates and we do want to give you a chance to engage and hear your views, your questions, your challenges. As usual, I’m going to ask that my colleagues from the Institute hold off and let our outside guests ask the first two or three questions. We have, thanks to Jessica, a roving mic up at the front of the room, a standing mic at the back of the room. Who would be interested or should I just pluck somebody and …? Great, Prakash, could you go to the mic? Even though you’re known to everybody, please identify yourself.

Prakash Loungani: Prakash Loungani, from the IMF. I hope I’m adding to the credibility of the study by saying that the IMF agrees with it. We did a recent study of our own on the economic impacts of the shale boom and came to very similar conclusions which can be summarized basically as saying, “Don’t get carried away by the shale gale.” We find impacts but sort of modest impacts. I mean, these are welcome
impacts given the state of the economy but we find impacts of about 1%, 1.5% on GDP sort of bracketed by the two scenarios that were presented here. We find modest impacts on employment just as they do and we very much like the emphasis they’ve put on the fact that even though the energy component of the trade deficit will of course improve the overall trade deficit again, will have modest impacts and the impact could go either way because as people get richer they will import goods from other countries.

One other thing about the IMF’s study is that it shows you the impacts on other countries. Sometimes we’ve seen that people think this is us versus them and the U.S. will get better and the others worse, but the IMF study shows that other than a few energy producers, the rest of the world actually also gets richer as a result of the boom. So this is not a question. This is a shameless self-promotion but I do want to point out that the IMF has done some work on this.

If you’re wondering why you haven’t seen this study, it was presented to the U.S. authorities as part of our Article IV Consultations with them and of course, they give it the same attention that they have in the past.

Trevor Houser: I welcome any shameless self-promotions that agree with our study.

Adam Posen: Trevor is a pro. But just in all seriousness, please if you want to go to the mic, the IMF work, which I actually have seen thanks to Prakash, is another independent way with a different group, different motivations and say it’s coming to much the same result. And it is important because as I think Prakash said, and as I think Michael articulated very well, increases in supply, whatever the short-term disruptions through market signals are a good thing for the world and it’s nice that when we all work through it and we say, "Yes, that genuinely is true." And so I’m very glad to have people echoing that as well as promotion. Please.

Jeff Hopkins: Thank you. Jeff Hopkins with the Center for Climate and Energy Solutions. Trevor and Shashank, great work as always, love to see this study come out. I was wondering if you had any—I like the attention to general equilibrium, but I’m always kind of drawn to the supply side and I’m wondering if you have any thoughts either modeled or elsewhere, just related if we have a change in the cost curve and is the U.S. oil production, is it marginal or inframarginal and just any thoughts on that?

Trevor Houser: You mean the ...?

Jeff Hopkins: Whether the production that has come in, has it displaced? I mean, you talked about-?

Trevor Houser: Other producers?

Jeff Hopkins: Yeah. Who was displaced and where does it sit on the cost curve?
Trevor Houser: Great question. And that of course, is one of the main variables in trying to think about what future production growth will be and what the impact is on prices. We have more confidence in the modeling of the impact on natural gas prices, of the increasing gas production, because it’s a relatively isolated North American market and you have a decent sense of supply elasticities and demand elasticities. The oil side is much tougher. It’s a global market. It’s very volatile. You have OPEC in that market.

There are academic estimates on oil supply and demand elasticities globally in the past and our estimates are consistent with that which would suggest that an increase in U.S. production, maybe a quarter of that is net additional over the long-term supply to the market. In the short-term, supply elasticity in the oil market is very low, so much more of the increase in production in the short-term was probably additional in the long-term maybe, something in the range of 25%, but that’s a really uncertain number.

If you think about OPEC as a cartel, the most effective thing to do—I’ll pause it on this and then I’ll turn it over to the two people who actually have insight on this question. Dan [inaudible 00:48:50] in the front who’s the dean on whose shoulder we all stand and then Carlos Pascual from—Ambassador Pascual, from the State Department here as well. But when we think through this from a research standpoint you’ve got a cartel whose, as a collective incentive economically, would be to curtail production to try to offset as much of the increase in U.S. supply as possible to keep prices high. Right? That’s why OPEC exists. That’s their collective incentive.

Their individual incentives are different and in the past when we’ve seen rising non-OPEC supply and weak global demand, OPECs had a hard time holding together, like in the 80s, and there’s fairly strong incentives for individual countries to produce above their quotas if we get into a world where demand for OPEC crude is below production capacity for people other than just Saudi Arabia. So that makes it really hard.

To give you a ballpark estimate in our modeling, in the optimistic scenario, crude prices on average are about 16% lower than in the pre-shale case. So it’s a much more modest reduction than the reduction for gas prices. But there’s a pretty wide confidence margin around that price reduction number.

Adam Posen: I don’t know since he called about if either Pascual or Dan would like to comment on this issue?

Dan: Well first also, congratulations on a great study and the rigor of the study is really impressive in the way that you’ve captured the feedbacks on this. So this is a real contribution. I think on the question of the impact on the oil exporters, I think they kind of went through a process of denial and now it’s more recognition that this is significant and what’s balanced it out is of course, it’s the big disruptions in some of the producers, which has taken supplies off the market, which is without giving the other producers’ more room.
I think the point you made and I can’t remember if it’s among the three top points you had, but it would be probably talking about an oil disruption now had this not developed. We’d be having high oil prices and we’d be having Congressional hearings about why gasoline prices are so high and we’ve not seen this happen.

I think the thing is that it’s really country-by-country and the West African producers are the ones in particular who are reeling from this because they have lost their markets along the East Coast and are really scrambling to try and find new markets in the Far East and event Kazakh oil has been rerouted to the Far East because this really has displaced a big market for them, but I think they’re in a process of trying to adjust.

Adam Posen: Thank you. Pascual?

Carlos Pascual: The difficult thing of letting Dan comment first is he said the same thing I would have said, but I’ll just give you numbers. Usually one would predict about somewhere between 400, 500,000 barrels a day in disruptions in global markets at any given time. In the past few months, the disruptions have been at about 2.2 to 2.3, 2.5 million barrels a day. By the time you take into account impact on Iran, obviously what’s happening now and continues to happen in Sudan, Nigeria, and the decreases in production there and a whole range of other places around the world.

And so the key issue here is that if you hadn’t seen these massive increases in oil production out of the United States indeed, the impact on global oil prices would have been quite stunning. Brent crude has been consistently between $105 to $111 a barrel. Some would say why is it so high, given that there had been these massive increases. But if you just take for comparison Libya, where in 2011 the disruption of 1.5 million barrels a day essentially took oil prices from about $85 a barrel to $130 a barrel in a period of two weeks. We lost at one point 1.5 million barrels a day in production out of Libya and had virtually absolutely no impact on global oil prices. So it’s indicative of how U.S. supplies have been playing into that overall equation.

On the gas side, I think one of the things that is quite fascinating is how you put U.S. supplies and production into an overall gas market, a growing gas market and supplies coming from other countries. And so we’re at a point right now where the United States has been approving new export licenses and we’re seeing increased supplies potentially coming online from other countries 2017, 2018, 2019 and I don’t know if in your modeling you had an opportunity to look at how the U.S. production is going to play into that broader global market and what the expectation of the impact of prices on United States. I imagine Michael, you’ve been doing a little bit of this work given that it’s the bread and butter of your future existence. And so if you guys could talk about the U.S. gas market in the context of evolution and change in the global market, I’d love to hear your thoughts.
Adam Posen: Yeah, if we can get that without paying for an entirely new study, that would be great.

Dan: One footnote also to what Carlos said in terms of this disruption, it’s very hard to see how the Iranian sanctions would have worked without this increase in U.S. oil production.

Adam Posen: Another general equilibrium point in a sense. Do any of the three panelists want to comment on the [inaudible 00:54:25].

Trevor Houser: So that’s phase two, what you outlined right there Carlos, the international impacts, not just for LNG but crude oil and coal exports which are a consequence of the U.S. oil and gas boom as well. So that’s a topic that we’re digging into. I would say anecdotally in conversations with the Chinese and the Japanese and the Australians and others, even before the first cargo has hit the water, obviously avoiding the counter factual scenario which was the future that Michael was preparing for a few years ago of a large growth in U.S. LNG imports has changed the balances, right, because these are capital intensive projects, long lead times. So the LNG market would have certainly been a lot tighter right now had U.S. demand for import showed up in the way that it was projected to.

But now as we go into a new round of contract negotiations as there’s a possibility of European utilities renegotiating contracts with Russia, just the prospect of U.S. gas gives consumers considerably more negotiating leverage and helps transfer some of those rents from producers on the LNG side who have been in the catbird seat for the past few years to consumers, whether they be Japanese or European utilities.

The thing that I’m interested in is if you look forward and you think about new projects; what gets pushed offline as U.S. LNG comes online? And I think there’s some interesting potential impacts in East Africa and other areas where they seem to be emergent LNG suppliers and while that’s not terribly important from a global economic perspective, it’s really important from a development perspective. I mean, you had developing countries in Africa and in Southeast Asia for whom LNG exports were potentially going to be a major source of revenue. And so thinking about what the viability of those projects is going forward in light of U.S. exports is an interesting question as well.

Adam Posen: I’m just going to pause it here for a moment first to do advertising. As many of you know, our Anders Aslund has been tracking the political game of particularly, the rent-seeking by Russia and the negotiations with Europe and that political economy and his work is available. Also, our Director of Studies, Marcus Noland, joined with the Political Scientist Cullen Hendrix, has been doing some work on the transformative effects of these resource finds in Africa and in other countries making the leap from developing to emerging as Trevor spoke about and we have a new study on that that will be coming out in the next few months.
Before I turn back to questions, I just want to pick up one thing. Amidst all the self-congratulation and self-promotion, which I take full responsibility for fueling, we have been implicitly a little placid on the issue of externalities and climate change in this discussion. When I say, "Okay, we have the market outcome, isn’t that great?" Well of course, as you know better than any of us, that’s not a great outcome if it doesn’t price in the spillover effects of overuse of carbon.

In *Fueling Up*, you do discuss some of these issues and specifically having to do with the new extraction technologies and the environmental impact and how you balance those. I was wondering if you could just give the audience and the people online a bit more about what you say in *Fueling Up* on that topic?

**Trevor Houser:** Sure. I think there’s two categories in environmental questions. One is the local environmental impacts of natural gas production and then there’s the global climate impacts of a change in energy consumption in the U.S. On the local environmental impacts, which range from potential water impacts to—I grew up in Wyoming and there’s air pollution from diesel trucks. That’s an issue that has to be dealt with.

My overall view is that those environmental consequences are not intrinsic to the process in the same way that horrible air in Pittsburgh from steel production was not necessarily intrinsic to steel production. There are technology solutions to address those pollution side effects and I think they are affordable and implementable in natural gas and tight oil production.

On the climate side, there’s a CO2 question and there’s a methane question. So in the CO2 side, what our modeling shows is that an increase in production of tight oil and natural gas leads to a modest net reduction in CO2 emissions, right, which puts us right about in the middle of the spectrum between folks who claim that natural gas has delivered all of the 12% reduction in U.S. CO2 emissions and we don’t need climate policy because cheap gas is going to do it and folks on the other end who say that fracking is a game over for the climate. So we’re kind of nicely positioned in the middle there.

On the methane question and for those who again, aren’t steeped in this, natural gases methane, methane is a greenhouse gas. It’s considerably more potent than carbon dioxide if it’s released and not combusted. It’s not great for the climate. There is still a decent amount of uncertainty about what the leakage rates of methane are. Available studies suggest that it is relatively low and that it is low enough not to undercut the emissions benefit of switching from coal to natural gas. But again, there’s more assessment work that needs to be done.

What I’d say is like the local environmental impacts, methane leakage is not necessarily an intrinsic problem with natural gas production to the extent that
we find problematic rates of methane leakage that can be addressed through technology and policy.

The broader point I would make from a climate standpoint, is that natural gas provides an opportunity for very cost effective climate policy to deliver significant emission reductions. It doesn’t do it on its own but it makes it pretty affordable to do it. We could meet our 17% target by 2020 and deliver meaningful reductions after that in the 2025 and 2030 range with tiny rate impacts to consumers thanks to the ability to switch dispatch from coal to natural gas and that was an opportunity we didn’t have five years ago or ten years ago.

Adam Posen: Awesome. I didn’t want that to get lost. Barry at the back and then Jessica here up front.

Barry Wood: Barry Wood, RTHK. How important is the Keystone XL pipeline and what would be the likely effect of its completion on price?

Trevor Houser: On the price of what?

Barry Wood: Oil.

Trevor Houser: Global oil prices, U.S. oil prices ...?

Barry Wood: The distortions you were speaking about in terms of the differences in prices between Midwest and coast for example, and on gas prices. What overall effect on energy prices you have?

Trevor Houser: We don’t analyze that topic. I’m usually perfectly happy to pontificate on something I haven’t done analysis on. Given how controversial this particular topic is, I think I’m going to pass on it.

Adam Posen: Actually when you’re under this banner, we prefer you pass on pontification, but thank you. Jessica, if you could give her the mic.

Jessica: Thanks, Adam. I was intrigued by your carbon price results that you showed near the end of the presentation, specifically that carbon price had no benefit for nuclear, indeed a rather significant negative effect. Can you take us through why the model produces that outcome?

Trevor Houser: It’s just that in—I mean, it’s similar for renewables too, that at least in the next decade and a half, it is hard to compete with natural gases and abatement option. Now, when you get out to post 2030 land, if you assume a kind of gradually increasing carbon price that would mirror what you would get with a cap and trade program, then you need to either retrofit your natural gas combined cycle plants with CCS or you need to replace them with nuclear renewable. So that’s where you see the big growth in nuclear, but even with a
modest carbon price in place, it’s not enough to close the gap for nuclear, in our
analysis, for the next decade and a half, two decades.

Jessica: So how big a price were you modeling?

Trevor Houser: It was $20 a ton that grows at 5% a year. If you put in place a bigger carbon price
than that and deep reductions, you get some more nuclear deployment.

Adam Posen: Very good. Okay, we unfortunately have to brilliant people waiting to speak in
the no man’s land between the microphones. Could I ask you guys, the two of
you gentlemen, to head to the microphone there? Is that possible? But you’re in
the middle so you’re mobile, that’s what counts.

Will: Will [inaudible 01:03:15], temporarily with the Federal Reserve Board. I was just
curious if the authors could speak a little bit about the possibility or maybe the
lack thereof, of other countries cracking the code, if you will, on tight oil and the
shale gas.

Trevor Houser: Sure. So the resource exists in many places. Early estimates suggest that, at least
on the shale gas side, China potentially has more technically recoverable
resources in place than the U.S. does. I’m pessimistic about the rate at which
that will be developed in other countries, particularly countries large enough to
make a difference for markets like China. That’s both because from what we see
so far, the quality of the resource is not nearly as good in China as it is in the U.S.
It takes time to learn.

To me the most important limiting factor in the Chinese market anyway will be
the above ground constraints, primarily the market structure. So what made the
shale boom possible in the U.S. was hundreds of companies scrambling around
competing with each other to lease up acreage and produce and that’s what’s
driven prices down so low. As I showed before, that trend has not been—it’s
been great for consumers, it hasn’t been good for natural gas producers.

If Chevron and Exxon controlled 90% of the shale acreage in the U.S., production
would not have grown nearly as fast as it did because there would have been
economically optimal from their standpoint, rate of production considerably
lower than the rate of production that delivers $3 dollar.

In China, 90% of the qualified shale acreage is held by Sinopec and CMPC, two
companies. And they’re not in a terrible hurry to develop that resource. They’re
drilling exploration wells, they’re partnering with international oil companies.
They’re trying to learn, but you don’t have that same Wild West competitive
environment that we had here that leads to really rapid growth in production.

Adam Posen: Competition, good. Gentleman at the back.

Peter Fox-Penner: Yes. Peter Fox-Penner from the Brattle Group in Georgetown University and
congratulations, Trevor and Shashank. Great study.
First of all, one quick comment on this, the climate question and what replaces coal. We do a lot of that modeling. I've done some and lately our numbers show that under many scenarios we get the same results as you which is gas takes all of coal's share, but we find that that's quite sensitive to tax policies towards renewables. The rate of increase in renewables getting cheaper, which they have gotten dramatically cheaper. Those assumptions drive the numbers dramatically and our central scenarios are actually renewables coming in and taking gases' share starting in the 20s, not in the 30s. That's up on the web and you can see it. But generally, gas is going to take a lot. Under all scenarios, gas takes a lot of coal's share and that's exactly what we want towards our climate goals.

The question I have for the authors is how to think about the optimistic and pessimistic scenarios, and it goes to some of the questions we've had here. What little I know about the shale revolution includes some observations and I think you made it, that some shale production is actually being done at almost below competitive rates of return and that can't last and also that we're going to have environmental rules come into shale production. And so that drives the price path of gas and I don't know how to think about that in the context of your pessimistic and optimistic scenarios. Which ones do you feel are the more realistic future price paths?

Trevor Houser: Great question. So I think what we've seen, so we started this modeling using a 2012 vintage of the annual energy outlook. Both the data and the projection sense are moving in the optimistic scenario path, both for gas and for oil. We're still within the bounds of our two scenarios. I think in the near term, it's the optimistic production pathway and price pathway that's the most likely.

Over the long-term, I think there is tremendous uncertainty on the tight oil side in particular. If you look, we assume that the U.S. in the optimistic case, grows to 14 million barrels a day of liquids so that's NGLs and crude and then hangs out there until 2035. Right?

As you saw in many of the other projections, including the EIA’s, there’s a big spike up and then a fairly sharp drop down. Right? Now, that’s subject to evolving understanding of decline rates, evolving assumptions about how other producers will respond and what the price to producers in the Bakken and the Eagle Ford will be. But that’s where I think the most risk is is on the tight oil in the out years. We could see price declines much more modest than what we’re projecting for crude. We could see price declines considerably larger than what we’re projecting for crude. So if there’s an asterisk that I’d put anywhere in this study, it’s around that.

Adam Posen: Interesting. Bill?

William Cline: Bill Cline here at the Institute. Trevor, I just want to underscore that this study basically is pessimistic for the scope of the natural gas fraking to do much
about the climate change problem. If you look at page 112, it makes a very small difference to the baseline emissions and if you look at page 118, it does a little bit better in terms of having bigger bite for carbon tax but not an awful lot. So I find that kind of a pessimistic conclusion because I think there is a certain sense out there that the natural gas breakthrough is a tremendous contradiction on the climate front. I hope that you’re on the pessimistic side in that one could tell plausible stories where there is more impact. I see that a lot of what’s happening on the carbon tax is that you thwart the development of other non-carbon energies when you put the tax on and you shift it to natural gas. But I just want to flag that and also would invite you to correct me if I’m taking away the wrong conclusion.

Trevor Houser: Right. So I guess I would frame it this way, that without any policy, fracking alone doesn’t do much for the climate good or bad. It kind of keeps us about on trend. And other people who would argue that fracking is catastrophic for the climate and there are people who are arguing that it would save the climate and our finding is absent policy, it’s about wash. What I think is interesting is not so much what it does to the climate absent policy but how it changes the cost, the regional distribution and thus the politics of climate policy.

If you’re in Texas and you’re considering what type of state implementation plan to develop for forthcoming EPA regulations on existing power plants let’s say, as an example, the impact of those regulations to the extent that they create an effective price on carbon for the power sector, is to switch you and your utilities from coal purchased from my home state of Wyoming to natural gas produced in your own backyard. Right?

That means there are potential advocates and constituents for that type of policy, particularly given the fact that much of this production and most of this production is happening on private lands where a significant share of the revenue goes to the landlord that there is a different political landscape now when you think about the impact of environmental policy than there was in 2007, 2008 when we were thinking about cap and trade.

But your core point, Bill, is right and I’m glad that you raised it, that absent that policy action, we can’t count on cheap gas alone to solve our climate challenges.

Adam Posen: Very good. Jeff.

Jeff Schott: Jeff Schott with the Peterson Institute. I’d like to ask Michael a question and get him into the action here. It concerns LNG exports. There are two constraints on U.S. exports, policy and infrastructure and so we’re looking over the horizon over the next five or ten years, assuming we can alleviate some of the policy constraints, which is a big assumption, but putting that to the side, what are the infrastructure constraints to substantial increase in U.S. exports?

Michael Wortley: Well, I think on policy constraints, we’ve not seen that. A lot of people have stood at podiums and complained about not getting a license or that or this, but
it’s our view that none of that has held up a project at this stage. Okay? And so we haven’t felt a policy constraint at all and I don’t believe that any of our competitors have either. Now, they may say other things, so we’re happy with—as we said, it’s messy. It’s been hard. People have had to figure out how to deal with something that they didn’t expect and it’s taken some time, but it also takes time to put these projects together. The FRP process is long and laborious and well put together, frankly. And so it takes time to get through that. So we haven’t seen the policy constraint.

The infrastructure side, every plant is $10 billion and so not many people can write those kind of checks and you have to go out and find very large customers for these projects and I think that to the extent there aren’t customers, there won’t be the infrastructure. You can’t go out and speculatively build one of these facilities. You just can’t do it. You have to sign long-term deals and raise your money on the backs of those contracts.

So the infrastructure constraint will eventually be due to a lack of customers. We’ve satisfied the world’s demand for this time-frame and we’re done. So I guess that will be my comments on those two issues.

Adam Posen: That’s helpful and thank you.

Jeff Schott: The projection of the possible volume-

Michael Wortley: For how long?

Adam Posen: The next five years.

Michael Wortley: The next five years?

Trevor Houser: That’s easier than ten years.

Michael Wortley: It takes four or five years to build one of these projects so I think we’ll be the only guys online at that time. We’ll be exporting in the neighborhood of 2 Bcf a day and there will be some projects behind us and I couldn’t tell you when. You’d have to ask them, but no other project has broken ground, right, and it’s under construction. So five years is easy. I’d say we’ll be at 2, 2.5 Bcf a day in five years so …

Adam Posen: Physical laws do bind more than policy even, sometimes and some of us in Washington tend to forget that. I appreciate Jeff dragging Michael in to speak. You’ve been quiet, Shashank. Is there any point-

Shashank Mohan: I’m happy to be quiet.

Adam Posen: You’re happy to be quiet. You really don’t belong in Washington. Ted.
Ted Truman: Ted Truman from the Peterson Institute. In the interest of—this has been fascinating and I always like the energy talk because it’s real economics that actually works. Right? So I think some of the comments that Adam has made is emphasize that point and I is nice to find out that incentives work in the way you predict incentives to work and you can see it working through both in your modeling, but more importantly in what’s based on the modeling in the past.

And one of the more intriguing things that you’ve said about three times, Trevor, without quantifying and it may be quantified in the book, is that in terms of the climate change, notwithstanding Bill’s comment that it doesn’t in and of itself oil and gas, this revolution doesn’t do very much for us, thus lower the base for the moment, I think that’s important but it doesn’t do anything else in terms of the long-term trajectory, but it does change at least potentially, the cost of switching going forward. I mean, you said that about three times. So that the cost of meeting any given target for us and I guess implicitly for the world, if you think about the world cost of dealing with the climate change CO2 and methane emissions. Could you give us a little bit more about sort of to what orders of magnitude in a sense how those costs are lower today than they would have as viewed in 2006 or 2007?

Trevor Houser: Yeah, great question. We do have those numbers in the book. So it’s mostly a short and medium term story and it’s a U.S. story, but if you look at abatement costs in the U.S. between now and 2020, they’re about a third lower now thanks to the shale boom, than they would have been with the same policy previously. Not much of that translates to outside of the U.S. yet because this is still mostly a U.S. story, but about a third lower. And I think politically what’s more interesting than the overall cost reduction is the regional implications on the supply side that the transfer in rents between coal producers and gas producers as a result of any climate policy has some interesting regional implications.

Adam Posen: The North Carolina renaissance may not last forever, I mean, not North Carolina, North Dakota, sorry. Yeah, I’m showing my biases. Anyone else care to quiz our guests? All right. Well, again, a sincere thanks to Michael for joining us and adding his expertise, to Cheniere and also BP, Chevron and Dow for helping us make this possible. But especially, thank you to Shashank and Trevor for doing such serious work and such relevant work and we’re very proud to be publishing it here at the Peterson Institute. The meeting is adjourned.