DEPARTMENT OF ENERGY OVERSIGHT: OFFICE OF FOSSIL ENERGY

HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

HOUSE OF REPRESENTATIVES

ONE HUNDRED FOURTEENTH CONGRESS

SECOND SESSION

May 11, 2016

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May 11, 2016

DEPARTMENT OF ENERGY OVERSIGHT:

ENERGY

WEDNESDAY, MAY 11, 2016

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENERGY,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, D.C.

The Subcommittee met, pursuant to call, at 10:07 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Randy Weber [Chairman of the Subcommittee] presiding.

LAMAR S. SMITH, Texas
CHAIRMAN

EDDIE BERNICE JOHNSON, Texas
RANKING MEMBER

Congress of the United States
House of Representatives
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Subcommittee on Energy

Department of Energy Oversight: Office of Fossil Energy

Wednesday, May 11, 2016
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

Witness

The Honorable Chris Smith, Assistant Secretary for Fossil Energy, U.S. Department of Energy

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

HEARING CHARTER

Thursday, May 5, 2016

TO: Members, Subcommittee on Energy

FROM: Majority Staff, Committee on Science, Space, and Technology

SUBJECT: Subcommittee hearing: "Department of Energy Oversight: Office of Fossil Energy"

The Subcommittee on Energy will hold a hearing titled *Department of Energy Oversight: Office of Fossil Energy* on Wednesday, May 11, 2016, at 10:00 a.m. in Room 2318 of the Rayburn House Office Building.

Hearing Purpose:

The purpose of this hearing is to examine the research, development, demonstration, and commercialization activities conducted in the Department of Energy's Office of Fossil Energy (FE). This hearing will also address key management, structure, and policy changes proposed in the FY 2017 Department of Energy budget request.

The FY 2017 overall budget request for Fossil Energy R&D (FER&D) activities is $600 million, a decrease of $32 million or 5.1 percent from FY 2016 enacted levels.[1] However, the Department only requests $360 million in the FY 2017 appropriations, funding the rest of their budget proposal by de-obligating $240 million from Clean Coal Power Initiative (CCPI) projects that have not reached financial close.[2]

Witness List

- **The Honorable Chris Smith**, *Assistant Secretary, Office of Fossil Energy, U.S. Department of Energy*

Staff Contact

For questions related to the hearing, please contact Emily Domenech of the Majority Staff at 202-226-2179.

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[1] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Budget in Brief," February 2016. Available at http://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetinBrief_0.pdf

[2] U.S. Department of Energy, "FY 2017 Congressional Budget Request: Volume 3," February 2016. Available at http://energy.gov/sites/prod/files/2016/02/f29/FY2017BudgetVolume3_2.pdf

Chairman WEBER. The Subcommittee on Energy will come to order.

Without objection, the Chair is authorized to declare recesses of this Subcommittee at any time.

I want to welcome you to today's hearing titled "Department of Energy Oversight: the Office of Fossil Energy."

I recognize myself for five minutes for an opening statement.

Again, welcome to today's Energy Subcommittee hearing examining the Department of Energy's Office of Fossil Energy. Today, we will hear from the Department on the research, development, demonstration and commercialization activities in the Office of Fossil Energy, and the impact DOE's fossil energy programs have on the energy market and the U.S. economy.

Fossil fuels are America's dominant energy source, and provide over 80 percent of energy around the world. The International Energy Agency estimates that even if the aggressive regulations required to meet the Paris Climate Agreement are implemented, fossil fuels will still account for over 40 percent of global energy use in the year 2050.

With those statistics in mind, DOE should prioritize the type of early stage research in fossil energy that will lead to next generation technology to access our natural resources, move fossil fuels safely to consumers, and then use those fuels more efficiently in our cars and in our power plants. Through the national labs, the Department should take the lead on fossil energy technology innovation, conducting the foundational research that allows the private sector to commercialize groundbreaking technology.

Unfortunately, that is not the type of budget proposal we're discussing today. In the DOE fiscal year 2017 budget request, it is clear that fossil energy innovation is not the priority for the Obama Administration. While the DOE budget proposal regularly offers aspirational goals backed by significant spending in renewable energy research and development, the budget for fossil energy is cut year after year.

This year is no exception, with a $32 million cut to fossil energy R&D. When compared to the proposed $2.1 billion—with-a-B increase to renewable energy, there's no question about where this Administration wants to innovate. And what's worse, instead of research designed to increase fossil energy production through innovation or cut the cost of electricity from fossil fuels with new technology, the budget proposal for fossil energy is singularly focused on emissions management, or "impact mitigation" as the budget describes it.

Simply put, the vast majority of DOE fossil energy research and development programs have been reduced to managing emissions to comply with EPA regulations. But over-regulation is not the right way to innovate. And the Department of Energy shouldn't be dedicating limited taxpayer resources to proving commercial-scale technology to back up EPA rules.

DOE's research infrastructure should be used to develop groundbreaking technology, not move that technology to the commercial market.

By focusing on justifying regulations and rushing to scale up today's technology, the Department has repeatedly put taxpayer dol-

lars at risk on large-scale projects that were not ready for prime time. Even the few successful projects that make it into operation, one in my district, the Air Product and Chemicals carbon capture sequestration storage demonstration project, are often completed at a great cost to the American taxpayer. DOE does not have adequate expertise or capacity to successfully manage commercial-scale projects. So instead, the Department should focus limited federal dollars on the fundamental research to lay the foundation for the next technological breakthrough.

The Department of Energy has made significant contributions to fossil energy production by funding early-stage research, and allowing the private sector to then make that technology work in the energy market.

DOE research conducted by the national labs helped develop the technology of hydraulic fracturing that led to the shale revolution. If the Department refocuses on technology research and development, I believe that American industry can then capitalize on that research, and they can revolutionize the energy industry once again. But that won't happen if DOE's limited resources remain stove-piped—pun intended. Did you like that pun? All right—and focused on regulatory compliance.

I want to thank Assistant Secretary Chris Smith for testifying here today, and I look forward to a review of the budget proposal and a discussion about DOE priorities and research goals for fossil energy.

By funding early-stage research and development, the Department of Energy could build a foundation for the private sector to bring innovative new fossil energy technologies to market, and help grow the American economy, and I would even add help with those emissions.

[The prepared statement of Chairman Weber follows:]

COMMITTEE ON
SCIENCE, SPACE, & TECHNOLOGY
Lamar Smith, Chairman

For Immediate Release
May 11, 2016

Media Contacts: Alicia Criscuolo, Thea McDonald
(202) 225-6371

Statement of Energy Subcommittee Chairman Randy Weber (R-Texas)
Department of Energy Oversight: Office of Fossil Energy

Chairman Weber: Good morning and welcome to today's Energy Subcommittee hearing examining the Department of Energy's Office of Fossil Energy.

Today, we will hear from the Department on the research, development, demonstration and commercialization activities in the Office of Fossil Energy, and the impact DOE's fossil energy programs have on the energy market and the U.S. economy.

Fossil fuels are America's dominant energy source, and provide over 80% of energy around the world. The International Energy Agency estimates that even if the aggressive regulations required to meet the Paris Climate agreement are implemented, fossil fuels will still account for over 40% of global energy use in 2050.

With those statistics in mind, DOE should prioritize the type of early stage research in fossil energy that will lead to next generation technology to access our natural resources, move fossil fuels safely to consumers, and use them more efficiently in our cars and power plants. Through the national labs, the Department should take the lead on fossil energy technology innovation, conducting the foundational research that allows the private sector to commercialize ground breaking technology. Unfortunately, that is not the type of budget proposal we're discussing today.

In the DOE fiscal year 2017 budget request, it is clear that fossil energy innovation is not the priority for the Obama Administration.

While the DOE budget proposal regularly offers aspirational goals backed by significant spending in renewable energy research and development, the budget for fossil energy is cut year after year.

This year is no exception, with a $32 million cut to fossil energy R&D. When compared to the proposed $2.1 billion increase to renewable energy, there's no question about where this administration wants to innovate.

And what's worse, instead of research designed to increase fossil energy production through innovation or cut the cost of electricity from fossil fuels with new technology,

the budget proposal for fossil energy is singularly focused on emissions management – or "impact mitigation" as the budget describes it.

Simply put, the vast majority of DOE Fossil Energy Research and Development programs have been reduced to managing emissions to comply with EPA regulations. But over-regulation isn't the right way to innovate. And the Department of Energy shouldn't be dedicating limited taxpayer resources to proving commercial scale technology to back up EPA rules.

DOE's research infrastructure should be used to develop groundbreaking technology, not move that technology to the commercial market. By focusing on justifying regulations and rushing to scale up today's technology, the Department has repeatedly put taxpayer dollars at risk on large scale projects that weren't ready for prime time. Even the few successful projects that make it into operation, like the Air Product and Chemicals CCS demonstration project in my district, are often completed at great cost to the American taxpayer.

DOE does not have adequate expertise or capacity to successfully manage commercial scale projects. Instead, the Department should focus limited federal dollars on the fundamental research to lay the foundation for the next technology breakthrough.

The Department of Energy has made significant contributions to fossil energy production by funding early stage research, and allowing the private sector to make the technology work in the energy market.

DOE research conducted by the national labs helped develop the technology for hydraulic fracturing that led to the shale revolution.

If the Department refocuses on technology research and development, I believe that American industry can capitalize on that research, and revolutionize the energy industry once again.

But that won't happen if DOE's limited resources remain stove-piped and focused on regulatory compliance.

I want to thank Assistant Secretary Smith for testifying to the Committee today, and I look forward to a review of the budget proposal, and a discussion about DOE priorities and research goals for fossil energy.

By funding early stage research and development, the Department of Energy could build a foundation for the private sector to bring innovative new fossil energy technologies to market, and grow the American economy.

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Chairman WEBER. With that, I want to yield to the Ranking Member for his opening statement.

Mr. GRAYSON. Thank you, Chairman Weber, and thank you, Mr. Smith, for testifying today.

Let's be clear about what we are talking about. We are talking about air pollution in the form of carbon dioxide emissions. No company that produces energy in the United States has any incentive to limit its own air pollution unless we create that incentive for it. Now, there are different means to do that. For instance, we could simply order it. That's regulation. My Republican colleagues might decry that as some kind of war on coal, but the fact is, that's one way to actually cut emissions that wouldn't happen otherwise.

The second possibility is for the government to actually do it itself. The government could actually produce large-scale products that would capture carbon as it is being emitted or before it's being edmitted into the atmosphere. That would be another solution to the problem.

But there is no solution that does not involve some kind of government action because the private market will not limit pollution when the cost of pollution is zero. So either we have to create a cost of pollution through a market mechanism or we have to order its limitation one way or another as we did with the cap-and-trade bill from several years ago.

So one way or another we need government involvement. I don't particularly see any benefit in saying that it has to be a particular kind of government involvement. I don't think there's any benefit in saying it has to be small scale or limited to research or anything like that. The ultimate test is, is it effective or not.

Now, with our government being formally committed under the Paris Climate Agreement to limitations on emissions, I think we have to be practical about how we get to those limits, how we achieve those goals. But it's dreaming to think that it's going to happen through the "free market" when the free market has every incentive to continue to pollute as much as it wants.

Now, with regard to coal versus other sources of energy, we all know that coal has been on the decline in the United States. I think that one of the reasons, to be fair about this, is the rise of natural gas. Another reason is the rise of solar and other renewable forms of energy. That's actually what's happening with or without carbon sequestration. According to the U.S. Energy Information Administration, natural gas is projected to surpass coal as the leading source of energy for U.S. power generation this year. And there's a shift to natural gas in the United States that has resulted in reduced greenhouse gas emissions, reduced pollution by carbon dioxide, if you will.

And I should remind everybody that although natural gas is a cleaner source of fossil energy, it still emits a very large and substantial amount of carbon dioxide into our atmosphere, unlike renewables.

It should be noted that coal and natural gas account for about 65 percent of U.S. electricity generation together, and it's possible that they may continue to be a major part of U.S. energy, particularly depending upon how fast renewables surge into that gap.

Nearly every activity within the Office of Fossil Energy is focused on climate disruption in one form or another and how that has brought about by fossil energy. I commend you for focusing on that, for focusing on matters of environmental mitigation because that's a legitimate government role, and it is true that the Administration is proposing to cut that overall budget.

In order to deliver on the emission targets agreed to in the Paris Climate Agreement and in the future, carbon capture technology likely will be needed in the United States as well as around the world, particularly in developing countries that rely continually, heavily on coal. According to the International Energy Agency, the world's coal consumption is going up, not down, and since the start of the 21st century, coal production has been actually the fastest-growing global energy source, particular in third-world countries. India is entering a period of sustained rapid growth, and its demand for cheap coal power generation is surging. China and Southeast Asia are major consumers of coal and continue to bring on new coal-fired power plants each year. And African countries still count on fossil fuels for 77 percent of their electricity production.

Thus, the development of carbon capture technologies is crucial to the worldwide effort to reduce greenhouse gas emissions and keep our planet safe. The United States can lead this effort to solve this challenging technological problem through your research. We can, and should, capitalize on this unique environmental and economic opportunity.

The Administration's announcement of fossil energy technology innovation gave us all high hopes for transforming our energy economy, including the advancement of innovative carbon capture technologies like the ones they're working on right now. But looking closer at the details, I realize that we may fall short of making any significant progress in reducing the environmental impact of fossil fuels through carbon pollution.

I am hoping that this hearing provides a clearer explanation of the significant cuts within the Office of Fossil Energy's Advanced Energy Systems program budget that have been proposed, among other areas. Also, I'd like to hear how DOE plans to better steward large demonstration and pilot projects going forward since I believe that they may well be necessary to meet our goals of reducing carbon pollution. I hope our conversation today can help to highlight some of these needed improvements, and I thank the chairman and the witness and yield back.

[The prepared statement of Mr. Grayson follows:]

OPENING STATEMENT
Ranking Member Alan Grayson (D-FL)
on the Subcommittee on Energy

House Committee on Science, Space, and Technology
Subcommittee on Energy
"Department of Energy Oversight: Office of Fossil Energy."
May 11, 2016

Thank you Chairman Weber and thank you Mr. Smith for testifying today.

Many of my colleagues believe there is a war being waged on coal. There is a strong belief that government policies are driving the shutdown of coal-fired power plants across the country. Yet, the economic data we have, tell us something different. According to the U.S. Energy Information Administration, natural gas is projected to surpass coal as the leading source of energy for U.S. power generation this year.[1] The so-called "war on coal" has been carried out by the market, not the government.

While this shift to natural gas in the United States has resulted in reduced greenhouse gas emissions, I should remind everyone that although natural gas is a *cleaner* source of fossil energy, it still emits large amounts of carbon dioxide into our atmosphere.

It should be noted that coal and natural gas account for about 65% of U.S. electricity generation, and will likely continue to be a major part of the U.S. energy portfolio, in the decades to come.[2] Nearly every activity within the Office of Fossil Energy is focused on climate, and other forms of environmental mitigation, yet the Administration is proposing to cut its overall budget.

In order to deliver on emission reduction targets agreed to at COP21 (the Conference of Parties in Paris)and in the future, carbon capture technology may well be needed in the U.S. as well as around the world, particularly in developing countries that rely heavily on their cheapest and most easily attainable source of energy –coal.

In fact, according to the International Energy Agency, the world's coal consumption is going up, not down. Since the start of the 21st century, coal production has been the fastest-growing global energy source.[3]

As India enters a period of sustained rapid growth, their demand for cheap coal power generation is surging.[4] China and Southeast Asia are major consumers of coal and continue to bring on new coal-fired power plants each year.[5] And African countries still count on fossil fuels for 77% of

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[1] http://www.eia.gov/todayinenergy/detail.cfm?id=25392
[2] Id.
[3] http://www.iea.org/aboutus/faqs/coal/
[4] http://www.iea.org/publications/freepublications/publication/WEB_WorldEnergyOutlook2015ExecutiveSummaryEnglishFinal.pdf
[5] http://www.iea.org/publications/freepublications/publication/WEO2015_SouthEastAsia.pdf

their electricity production.[6]

Thus the development of carbon capture technologies is crucial to the worldwide effort to reduce greenhouse gas emissions. The United States can lead this effort to solve this challenging technological problem. We can, and should, capitalize on this unique environmental and economic opportunity.

The Administration's announcement of Mission Innovation gave me high hopes for transforming our energy economy, including the advancement of innovative carbon capture technologies. But looking closer at the details, I believe we fall short of making any significant progress in reducing the environmental impact of fossil fuels. I am hoping that this hearing provides a clearer explanation of the significant cuts within the Office of Fossil Energy's Advanced Energy Systems budget, among other areas. Additionally, I would like to hear how DOE plans to better steward large demonstration and pilot projects going forward. DOE does not have an acceptable track record in this area, and I hope our conversation today can help highlight some of the needed improvements.

Thank you Mr. Chairman. I yield back.

[6] http://www.tsp-data-portal.org/Breakdown-of-Electricity-Generation-by-Energy-Source#tspQvChart

Chairman WEBER. I thank the gentleman.

The Chair now recognizes the Chairman of the full Committee, Chairman Smith.

Chairman SMITH. Thank you, Mr. Chairman.

Today we will examine the Department of Energy Office of Fossil Energy's research and development budget for coal, oil, and natural gas.

The fossil energy research and development programs should advance technologies for the "reliable, efficient, affordable, and environmentally sound use of fossil fuels that are important to our nation's security and economic prosperity" as is their stated mission. Like many of my colleagues, I share this commitment to the long-term use of our nation's most abundant and affordable fuel source.

Unfortunately, the Administration's proposed budget for fossil energy research and development appears to be at odds with America's energy resources and needs. As in past budget requests, the Obama Administration proposes to cut fossil energy R&D this time by $32 million.

DOE apparently counts on Congress to increase funding for fossil energy every year, and I'm glad to see the House Appropriations Committee has proposed to restore funding for fossil energy R&D again this year. However, this lack of consistency is no way to manage a robust research and development program.

While the Administration pays lip service to the important role of fossil fuels in a clean energy future, there are fundamental concerns with DOE's approach to fossil energy R&D. DOE refuses to prioritize early-stage research and development for innovative fossil energy exploration and production technologies or research to develop and integrate technology to make coal-fired power plants more efficient. Instead, the Fossil Energy R&D program has become singularly focused on carbon dioxide management.

DOE should expand access to America's oil and gas resources, not use limited research dollars to help the EPA measure emissions. Unfortunately, fossil energy innovation does not appear to be a priority for this Administration.

The fiscal year 2017 budget proposal also lacks transparency. The Administration proposes to eliminate funding by fuel type in the fossil R&D budget. It argues that this can streamline research for carbon capture and sequestration by coordinating coal and natural gas programs. While CCS for coal and natural gas power plants face similar technology challenges, the proposed restructuring masks how federal dollars are being spent. Congress appropriates funding by fuel type to avoid this problem. Coordination of research when appropriate can be cost-effective and save limited resources for research and development. But coordination cannot come at the expense of transparency.

The budget proposal also lacks transparency regarding the Administration's Mission Innovation initiative. This is the commitment made during the Paris climate change negotiations to double federal investment in clean energy research and development. According to the budget request, $564 million of the $600 million request for fossil energy R&D is for programs that support Mission Innovation. However, nowhere in the budget does DOE explain the purpose of Mission Innovation or the goals for fossil energy re-

search and development conducted in support of the initiative. It should be clear to stakeholders, researchers, and Congress what the Department hopes to accomplish in fossil energy and across DOE.

Finally, the Office of Fossil Energy has significant management challenges. Large demonstration projects have been poorly managed by the Department, with little transparency on project decisions until a public announcement of pooled funds.

The Office of Fossil Energy should fairly enforce deadlines and work with companies to ensure projects can be successful. Instead, it appears the Office systematically ignores time and cost limits. This type of sloppy management doesn't help companies that work with DOE to develop groundbreaking technology, and it certainly doesn't benefit the taxpayer.

Mr. Chairman, I want to thank our witness, Assistant Secretary Smith, for testifying today, and I look forward to a discussion about the direction and purpose of the fossil energy research programs at DOE.

Finally, let me say that regrettably I have another committee that is starting a markup or started a markup 20 minutes ago, so I'm going to have to leave, but I hope to return.

Thank you, Mr. Chairman, and I yield back.

[The prepared statement of Chairman Smith follows:]

COMMITTEE ON
SCIENCE, SPACE, & TECHNOLOGY
Lamar Smith, Chairman

For Immediate Release
May 11, 2016

Media Contacts: Alicia Criscuolo, Thea McDonald
(202) 225-6371

Statement of Chairman Lamar Smith (R-Texas)
Department of Energy Oversight: Office of Fossil Energy

Chairman Smith: Thank you, Mr. Chairman. Today, we will examine the Department of Energy (DOE) Office of Fossil Energy's research and development budget for coal, oil, and natural gas.

The Fossil Energy research and development programs should advance technologies for the "reliable, efficient, affordable, and environmentally sound use of fossil fuels that are important to our nation's security and economic prosperity."

Like many of my colleagues, I share this commitment to the long term use of our nation's most abundant and affordable fuel source.

Unfortunately, the administration's proposed budget for fossil energy research and development appears to be at odds with America's energy resources and needs. As in past budget requests, the Obama administration proposes to cut fossil energy R&D by $32 million.

DOE apparently counts on Congress to increase funding for fossil energy every year. I'm glad to see the House Appropriations Committee proposed to restore funding for fossil energy R&D again this fiscal year. However, this lack of consistency is no way to manage a robust research and development program.

While the administration pays lip service to the important role of fossil fuels in a clean energy future, there are fundamental concerns with DOE's approach to fossil energy R&D.

DOE refuses to prioritize early stage research and development for innovative fossil energy exploration and production technologies or research to develop and integrate technology to make coal-fired power plants more efficient. Instead, the Fossil Energy R&D program has become singularly focused on carbon dioxide management.

DOE should expand access to America's oil and gas resources, not use limited federal research dollars to help the EPA measure emissions. Unfortunately, fossil energy innovation does not appear to be a priority for this administration.

The FY 2017 budget proposal also lacks transparency. The administration proposes to eliminate funding by fuel type in the fossil R&D budget. It argues that this can streamline research for carbon capture and sequestration (or CCS) by coordinating coal and natural gas programs.

While CCS for coal and natural gas power plants face similar technology challenges, the proposed restructuring masks how federal dollars are being spent.

Congress appropriates funding by fuel type to avoid this problem. Coordination of research when appropriate can be cost-effective and save limited resources for research and development. But coordination cannot come at the expense of transparency.

The budget proposal also lacks transparency regarding the administration's "Mission Innovation" initiative. This is the commitment made during the Paris climate change negotiations to double federal investment in clean energy research and development. According to the budget request, $564 million of the $600 million request for fossil energy R&D is for programs that support Mission Innovation.

However, nowhere in the budget does DOE explain the purpose of Mission Innovation or the goals for fossil energy research and development conducted in support of the initiative. It should be clear to stakeholders, researchers and Congress what the Department hopes to accomplish in fossil energy and across DOE.

Finally, the Office of Fossil Energy has significant management challenges. Large demonstration projects have been poorly managed by the Department, with little transparency on project decisions until a public announcement of pulled funds. The Office of Fossil Energy should fairly enforce deadlines and work with companies to ensure projects can be successful. Instead, it appears the Office systematically ignores time and cost limits.

This type of sloppy management doesn't help companies that work with DOE to develop groundbreaking technology – and it certainly doesn't benefit the taxpayer.

I want to thank our witness, Assistant Secretary Smith, for testifying today. I look forward to a discussion about the direction and purpose of the fossil energy research programs at DOE.

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Chairman WEBER. Thank you, Mr. Chairman.

The Chair now recognizes the Ranking Member of the full Committee, the gentlelady from Texas.

Ms. JOHNSON. Thank you very much, Mr. Chairman, and let me express my appreciation to you and to the Ranking Member for holding this hearing. And I'd also like to thank Assistant Secretary Smith for being here today.

The Department of Energy's Office of Fossil Energy plays a critical role in developing technologies and best practices that minimize the environmental impact that we, and indeed the world, cause when we extract and use fossil fuel resources.

While I'm also strongly in support of the Department's efforts to advance renewables, energy efficiency, nuclear power, and other clean energy sources as quickly as possible, I recognize that we and our international partners are likely going to continue to use significant amounts of coal, natural gas, and oil to heat our homes and fuel our vehicles for decades to come.

However, we can't bury our heads in the sand if we are serious about tackling climate change. We can't just focus on developing one set of energy sources, as promising as they are. We need to do all of them.

This is why I was so excited about the announcement of Mission Innovation, a commitment that the President and leaders from 19 other nations made to double their government-supported clean energy R&D investments over the next five years. This is exactly the kind of commitment we need to cover the full range of research and technology development activities required to sufficiently address the climate crisis.

And yet, just a few months after Mission Innovation was announced, the Department proposed large cuts to or the outright elimination of a number of worthwhile programs carried out by Assistant Secretary Smith's Office, with little justification for those cuts provided in the budget request. Examples include the elimination of the Carbon Use and Reuse program, a 78 percent cut to Gasification Systems, a 73 percent cut to fuel cell research, and a 33 percent cut to the Advanced Turbines subprogram.

All of these programs aim to make fossil energy systems cleaner and more efficient, which is consistent with the goals of Mission Innovation. So, Mr. Smith, I hope you can help us better understand the rationale behind these drastic cuts that have been made, despite an effort to double overall funding for clean energy R&D in the next five years.

In addition, and we have discussed before, I would like you to provide this Committee with a clear explanation for the Department's rather abrupt shift from support of the Texas Clean Energy Project through the end of the year to your proposal to reprogram the remaining, previously appropriated funds for it. Your timely response to the letter from the Texas delegation on this issue was helpful, as was my recent conversation with the Secretary. And the Inspector General report released two weeks ago on the project provided further context. However, questions remain regarding the process that the Administration followed to come to its decision.

I certainly understand that sometimes new research projects are unsuccessful in meeting their initial goals, and difficult decisions

must be made to ensure that taxpayer dollars are used wisely. But this needs to be done in a clear and transparent fashion, with mutually understood milestones and clearly stated potential consequences for not achieving them.

I look forward to working with you, Mr. Smith, and my colleagues on the Committee, to address these concerns and to ensure that you have the direction, tools, and resources you need to help ensure that we are using our abundant fossil energy resources as wisely and responsibly as possible.

Thank you, and I yield back the balance of my time.

[The prepared statement of Ms. Johnson follows:]

OPENING STATEMENT
Ranking Member Eddie Bernice Johnson (D-TX)

House Committee on Science, Space, and Technology
Subcommittee on Energy
"Department of Energy Oversight: Office of Fossil Energy."
May 11, 2016

Good morning, and thank you Chairman Weber for holding this hearing. I would also like to thank Assistant Secretary Smith for being here today.

The Department of Energy's Office of Fossil Energy plays a critical role in developing technologies and best practices that minimize the environmental impact that we – and indeed the world – cause when we extract and use fossil fuel resources.
While I also strongly support the Department's efforts to advance renewables, energy efficiency, nuclear power, and other clean energy sources as quickly as possible, I recognize that we and our international partners are likely going to continue to use significant amounts of coal, natural gas, and oil to heat our homes and fuel our vehicles for decades to come.

So we can't bury our heads in the sand if we're serious about tackling climate change. We can't just focus on developing one set of energy sources, as promising as they are. We need to do it all.

This is why I was so excited about the announcement of Mission Innovation, a commitment that the President and leaders from 19 other nations made to double their government-supported clean energy R&D investments over the next five years. This is exactly the kind of commitment we need to cover the full range of research and technology development activities required to sufficiently address the climate crisis.

And yet, just a few months after Mission Innovation was announced, the Department proposed large cuts to or the outright elimination of a number of worthwhile programs carried out by Assistant Secretary Smith's Office, with little justification for those cuts provided in the budget request. Examples include the elimination of the Carbon Use and Reuse program, a 78 percent cut to Gasification Systems, a 73 percent cut to fuel cell research, and a 33 percent cut to the Advanced Turbines subprogram.

All of these programs aim to make fossil energy systems cleaner and more efficient, which is consistent with the goals of Mission Innovation. So, Mr. Smith, I hope you can help us better understand the rationale behind these drastic cuts that have been made, despite an effort to double overall funding for clean energy R&D in the next five years.

In addition, as we have discussed before, I would like you to provide this Committee with a clear explanation for the Department's rather abrupt shift from support of the Texas Clean Energy Project through the end of last year to your proposal to reprogram the remaining, previously appropriated funds for it. Your timely response to the letter from the Texas delegation on this issue was helpful, as was my recent conversation with the Secretary. And the Inspector

General report released two weeks ago on the project provided further context. However, questions remain regarding the process that the Administration followed to come to its decision.

I certainly understand that sometimes new research projects are unsuccessful in meeting their initial goals, and difficult decisions must be made to ensure that taxpayer dollars are used wisely. But this needs to be done in a clear and transparent fashion, with mutually understood milestones and clearly stated potential consequences for not achieving them.

I look forward to working with you, Mr. Smith, and my colleagues on the Committee, to address these concerns and to ensure that you have the direction, tools, and resources you need to help ensure that we are using our abundant fossil energy resources as wisely and responsibly as possible.

Thank you, and I yield back the balance of my time.

Chairman WEBER. I thank the gentlelady.

Let me introduce our witness today. Our witness today is the Honorable Chris Smith, Assistant Secretary for Fossil Energy at the U.S. Department of Energy. Prior to his confirmation in 2014, Assistant Secretary Smith served as Principal Deputy Assistant Secretary for Fossil Energy, and as Deputy Assistant Secretary for Oil and Natural Gas. Assistant Secretary Smith received his bachelor's degree in engineering management from West Point and his MBA from Cambridge.

I now recognize Assistant Secretary Smith for five minutes to present his testimony. Welcome, Chris.

TESTIMONY OF HON. CHRISTOPHER SMITH,
ASSISTANT SECRETARY FOR FOSSIL ENERGY,
U.S. DEPARTMENT OF ENERGY

Mr. SMITH. Thank you very much, Mr. Chairman, and it's a pleasure to appear again before this Committee, so thank you very much for having me here today.

Today we're seeing new opportunities and challenges for our fossil energy resources. This was highlighted in the recent climate agreement in Paris. With the United States' leadership, 190 countries submitted plans to reduce their carbon emissions to address climate change. COP–21 was an important first step but it was only a first step. The mandate coming out of Paris is that we must continue to innovate.

That's the idea behind Mission Innovation, a landmark international effort to double clean energy research and development over the next 5 years.

Mr. Chairman, in the clean energy economy of the future, there will be those who build the technologies and there will be those who buy them. The United States must be a builder and a leader in this new economy.

We have a leg up in this race. Innovation is something that we do well here in America and at the Department of Energy.

The Department is primarily a research organization focused on developing clean energy technologies from wind to solar, from geothermal to nuclear, but one of the most important things that we are doing in our work is to enable the sustainable use of our coal and natural gas resources. That's what we do through my Office of Research and Development program, and that's the core of our contribution to Mission Innovation

The President's final budget emphasized the importance of this work with a $31 million increase in those core activities consistent with Mission Innovation, and through your funding, Congress also recognizes the importance of fossil energy research and development.

This R&D includes in-house research at NETL, the National Energy Technology Laboratory, the only government-owned and government-operated laboratory in DOE where we are working with our partners to advance innovative technologies like CCS, advanced power systems to ensure the sustainable use of natural gas and coal. And just today we announced the selection of Penn State to establish and lead a new university coalition for fossil energy re-

search, which will focus on the challenges to fossil energy-based technologies.

I'd like to add that we're also working with those communities that have been impacted by market pressures on coal including exploring commercial opportunities for extracting rare earth elements from coal. This is important to those communities and to the Nation since China is currently the dominant source for those materials.

We also sponsor a portfolio of major demonstration projects which are critical to commercializing carbon capture utilization and storage. These projects along with our regional partnerships have stored nearly 12 million metric tons of CO_2.

As you know, however, the developments of any complicated innovative technology will face difficulties. Some projects won't reach completion, and I have had the opportunity to talk with some of you about the Texas Clean Energy Project, but we're also seeing real progress.

For example, NRG's Petra Nova 240-megawatt post-combustion project will begin full capacity operation next January. Southern Company's Kemper project is preparing gas fires for the first lignite feed and syngas production and is scheduled for commercial startup by third quarter of this year.

ADM's industrial CCS project will achieve full CO_2 injection rate by early 2017, and the Air Products project is expected to capture and store 3 million metric tons of CO_2 by the summer.

Going forward, we will soon select a 10-megawatt pilot project to test the next generation of carbon capture technologies. We also have the opportunity to strengthen our contribution to Mission Innovation. Our fiscal year 2017 budget proposes that an initiative that would build on FER&D advances to bring to market revolutionary methods and technologies that capture, use and store CO_2 for power plants as well as from industrial sources.

Fossil Energy research and development is also pursuing innovative ways to safely and sustainably develop our gas resources including gas hydrates. R&D includes well design and engineering-induced seismicity and technologies to treat and produce waste for reuse.

We're also working to reduce methane leaks from our natural gas infrastructure. That's why in the wake of Aliso Canyon we've partnered with the Department of Transportation on a new interagency task force on natural gas storage safety, the safety of integrity of the Nation's natural gas infrastructure.

We're also collaborating with transportation to better understand and mitigate risks associated with the transportation of conventional and tight crude oils.

Mr. Chairman, innovation is critical to meeting the challenges of climate change and the demands of a low-carbon future. The Department of Energy is committed to developing innovative fossil energy technologies to meet those challenges and secure U.S. leadership in the global clean energy economy.

With that, I'd be happy to answer any questions that the Committee might have, and again, thank you for giving me the opportunity to appear here today.

[The prepared statement of Mr. Smith follows:]

Summary of Statement by Christopher Smith, Assistant Secretary for Fossil Energy
U.S. Department of Energy
Subcommittee on Energy, Committee on Science, Space and Technology
U.S. House of Representatives
May 11, 2016

Our fossil fuel resources are essential to the Nation's security and economic prosperity. At the same time, a dramatic shift in the way we use fossil fuels will be critical to meeting our national and global climate goals.

Through the Fossil Energy Research and Development (FER&D) program, FE is working to develop and demonstrate technologies such as carbon capture, utilization, and storage (CCUS) that will enable the continued use of our fossil fuel resources for clean, affordable, and reliable energy. To this end, FE plays an important role in DOE's effort to support Mission Innovation, a landmark initiative launched by the U.S. and 19 other countries to double public clean energy research and development (R&D). This is in addition to commitments for private investments led by a coalition of 28 private investors from ten countries.

The FER&D program is administered by FE and implemented by the National Energy Technology Laboratory (NETL). The program advances technologies related to the reliable, efficient, affordable, and environmentally sound use of fossil fuels that are important to our Nation's security and economic prosperity. The CCS and Advanced Power Systems program is focused on reducing carbon emissions by advancing the environmental performance and efficiency of fossil energy systems integrated with CCUS technologies.

The FER&D portfolio includes several major integrated CCUS demonstration projects encompassing different innovative technological approaches and applications of CCUS. To date, DOE's major demonstration projects and Regional Carbon Sequestration Partnerships have stored 11.8 million metric tons of CO_2.

The Fuel Supply Impact Mitigation portfolio under FER&D is focused on environmentally prudent and efficient development, as well as responsible stewardship, of the Nation's natural gas resources. The program continues to implement priority collaborative R&D, together with Department of the Interior and the EPA, to ensure that resource development is conducted in a manner that is environmentally sound and protects human health and safety.

Finally, NETL is carrying out congressionally-mandated research on the feasibility of extracting rare earth elements (REE) from coal and coal byproducts.

The Department of Energy is committed to working with industry, our National Labs, and other stakeholders to develop the science and innovative technologies that will allow the Nation to use its abundant fossil energy resources in a way that meets our energy needs, ensures environmental responsibility, and secures U.S. leadership in the global clean energy economy. Technology innovation is critical to this effort. Our programs have made substantial progress toward meeting these goals, and we believe these continued advances will help ensure that the U.S. will continue to lead the world in clean energy technology innovation.

Statement of Christopher Smith
Assistant Secretary for Fossil Energy
U.S. Department of Energy

Fossil Energy Research and Development

Subcommittee on Energy
Committee on Science, Space and Technology
U.S. House of Representatives

May 11, 2016

Thank you Chairman Weber, Ranking Member Grayson, and members of the Committee. I appreciate the opportunity to discuss the programs and activities within the Department of Energy's (DOE) Office of Fossil Energy (FE).

Our fossil fuel resources are essential to the Nation's security and economic prosperity. At the same time, a dramatic shift in the way we use fossil fuels will be critical to meeting our national and global climate goals. According to the International Energy Agency (IEA), fossil fuels are projected to remain a major feature of the energy mix even as the world acts to limit temperature increases to 2 degrees Celsius. In the IEA 2 Degree Celsius Scenario (2DS), fossil fuels account for approximately 40 percent of primary energy use in 2050. As we transition to a low carbon energy future, FE will continue working to develop innovative and cost-effective technologies for the environmentally sound use of fossil fuels that will be essential for economic growth, energy security, and U.S. competitiveness going forward.

MISSION INNOVATION

Through the Fossil Energy Research and Development (FER&D) program, FE is working to develop and demonstrate technologies such as carbon capture, utilization, and storage (CCUS) that will enable the continued use of our fossil fuel resources for clean, affordable, and reliable energy. To this end, FE plays an important role in DOE's effort to support Mission Innovation, a landmark initiative launched by the U.S. and 19 other countries to double public clean energy research and development (R&D). This is in addition to commitments for private investments led by a coalition of 28 private investors from ten countries.

Going forward, FE has the opportunity to strengthen the Department's tangible contribution to Mission Innovation. As proposed in the FY2017 Budget, this initiative would build on FER&D advances and accomplishments to bring to market revolutionary methods and technologies that capture, use, and store CO_2 from power plants, as well as from industrial sources.

FOSSIL ENERGY RESEARCH AND DEVELOPMENT

The FER&D program is administered by FE and implemented by the National Energy Technology Laboratory (NETL). Through this program, FE is working with partners in industry and academia to develop new innovative technologies that will enable the environmentally sound and more efficient use of fossil energy resources in the face of climate change.

CCS and Advanced Power Systems

The Fossil Energy Research and Development (FER&D) program advances technologies related to the reliable, efficient, affordable, and environmentally sound use of fossil fuels that are important to our Nation's security and economic prosperity. The CCS and Advanced Power Systems program is focused on reducing carbon emissions by advancing the environmental performance and efficiency of fossil energy systems integrated with CCUS technologies. This program is concentrated on the following research areas:

Carbon Capture

Carbon Capture R&D is focused on developing post-combustion and pre-combustion carbon dioxide (CO_2) capture, as well as advanced combustion technologies, such as oxy-combustion and chemical looping. This research is targeted at 2nd generation and transformational technologies that can reduce the cost and increase the efficiency of CO_2 capture in fossil-fueled power plants. In addition to existing research, the President's Fiscal Year (FY) 2017 Budget request includes $31 million to support a Front End Engineering Design (FEED) study and initial construction of a large pilot facility to capture CO_2 from a natural gas power system. Funding would also be used to test existing post-combustion capture systems on natural gas that are currently field testing technologies from the bench to small slipstream pilot-scale.

Research partners from national labs, universities, and the private sector are developing these new carbon capture technologies. The technologies are evaluated first in a laboratory environment, and then tested at the DOE-sponsored National Carbon Capture Center (NCCC) in Wilsonville, Alabama. The NCCC has tested more than 30 advanced carbon capture technologies, totaling more than 78,000 hours of combined testing. The NCCC recently assumed leadership of the International Carbon Capture Test Center Network, which was established under the Carbon Sequestration Leadership Forum. The purpose of the network is to share best practices and learning from the carbon capture test facilities throughout the world to advance the development and deployment of 2nd generation and transformational carbon capture technologies.

In FY 2015, DOE selected six projects as part of a Phase 1 effort under the Post-Combustion Capture Systems R&D to develop advanced, 2nd generation post-combustion carbon capture technologies. In FY 2016, up to two of these projects will be selected to move on to Phase 2, in which a 10 – 25 megawatt (MW) unit will be built and tested. These projects will accelerate development of next-generation CO_2 capture technologies by validating the potential of advanced solvents, advanced

sorbents and novel process configurations to reduce the energy penalty and cost associated with capturing carbon dioxide.

Carbon Storage

Carbon Storage R&D is focused on developing and validating technologies to ensure safe and permanent geologic storage of captured CO_2 from fossil fuel systems. The Carbon Storage subprogram significantly contributes to DOE's cross-functional Subsurface Science, Technology and Engineering RD&D (SubTER) Technical Team activities related to subsurface technologies. Therefore, much of the work being conducted by FE under the Carbon Storage subprogram is being coordinated with other DOE offices through the SubTER Technical Team to maximize the value of this research across the Department.

Recent accomplishments under the Carbon Storage subprogram include the release of the fifth edition of Carbon Storage Atlas (Atlas V), which identifies prospective CO_2 storage resources of at least 2,600 billion metric tons across the U.S. and other portions of North America. The Atlas contains updated information on DOE's carbon storage activities and field projects, including large-scale field projects conducted by the Department's Regional Carbon Sequestration Partnerships. Additionally, the National Risk Assessment Partnership, led by NETL, has developed simulation tools designed to help evaluate environmental risks of carbon storage.

The Carbon Storage subprogram is also exploring the potential of producing fresh water from produced brines at CO_2 storage sites, which could prove highly beneficial for regions that face water shortages. In FY 2015, DOE selected five Phase 1 projects to evaluate the potential benefits of brine extraction associated with carbon storage as a pressure management and enhanced water recovery operation. These projects were included in the November 2014 joint announcement between President Obama and President Xi Jinping of China. They serve as counter-facing projects with China under the US-China Climate Change Working Group.

Using prior appropriations, the Carbon Storage program is funding R&D on technologies that have the potential to reduce CO_2 emissions and the near-term cost of CCUS by developing beneficial uses for captured CO_2 other than enhanced oil and gas recovery. These beneficial uses include the conversion of CO_2 to chemicals, plastics, building materials, curing for cement, and the integration of carbon utilization technologies with fossil fuel power plants, including biological conversion systems.

In FY 2016, DOE selected two projects that will focus on biological CO_2 use/conversion. One project will integrate microalgal production systems into a coal-fired power plant to study the ability to use and mitigate CO_2 emissions from flue gas. The other project will study microalgae-based CO_2 capture with conversion of the resulting algal biomass to fuels and bioplastics. The FY2017 Budget requests no funding for CO_2 use and reuse.

Advanced Energy Systems

Advanced Energy Systems (AES) R&D includes gasification, turbines, and fuel cell energy conversion systems. The AES subprogram's mission is to increase the availability and efficiency of fossil energy systems integrated with CO2 capture, while maintaining the highest environmental standards at the lowest cost. Many of these technologies require new approaches to electricity generation, and simultaneously achieve higher efficiencies while capturing CO_2 as part of the conversion process. The research is targeted at improving overall system efficiency, reducing capital and operating costs, and enabling affordable carbon capture.

FE is currently exploring a number of innovation pathways to improve power generation efficiency and optimize the operation and utilization of the plant itself. More efficient turbines that incorporate pressure gain combustion technology can be employed in both coal and natural gas systems. In addition, the use of supercritical CO_2 (in place of steam) as a primary working fluid can enhance the performance of fossil fuel plants with the potential for application in other thermoelectric power cycles (e.g., nuclear, geothermal, and concentrated solar power). Activities in this subprogram support the Supercritical Transformational Electric Power (STEP) initiative, which is a central component of DOE's Supercritical CO_2 crosscut effort targeted at technology development for supercritical CO_2-based power conversion cycles.

Crosscutting Research and Analysis

Crosscutting Research and Analysis fosters the development of innovative systems for improving availability, efficiency, and environmental performance of advanced energy systems integrated with carbon capture and storage (CCS). The subprogram targets research gaps identified in the rest of the CCS and Advanced Power Systems portfolio that have potential to be solved through computational means or by examination through university research programs. It also includes technologies that can apply to a variety of different power systems. For example, the Carbon Capture Simulation Initiative, led by NETL, has developed simulation tools designed to accelerate the development of 2nd generation and transformational carbon capture technologies.

Research areas include: sensors and controls critical to the implementation and optimization of advanced fossil fuel-based power generation systems; materials that can be applied to the full range of fossil fuel power generation technologies; simulation-based engineering design tools that reduce the risk and time required to deploy advanced technologies; and water management improvements in thermoelectric systems, which contributes to DOE's Energy-Water Nexus Crosscut R&D.

Major Demonstrations

Scale-up of innovative technologies is inherently risky and investors in large-scale, capital-intensive projects are inherently risk-averse. To enable widespread commercial CCS deployment and realize the emissions reduction potential, commercial-scale demonstration projects are important to validate that CCUS technologies can be deployed while maintaining reliable, predictable, and safe operations. Therefore, the FER&D portfolio includes several major integrated CCUS demonstration projects

encompassing different innovative technological approaches and applications of CCUS. To date, DOE's major demonstration projects and Regional Carbon Sequestration Partnerships have stored 11.8 million metric tons of CO_2.

Advances through this R&D include demonstrating the business case for carbon capture utilization and storage at commercial-scale using an existing coal-fired generating facility, which is being done by NRG's Petra Nova project. The project is expected to capture 1.4 million tons of CO_2 annually. The CO_2 will then be used to extract additional, hard-to-access oil from a previously depleted oil field 80 miles away, safely storing the carbon underground in the process. NRG scaled up the Petra Nova project from the original 60MW to the 240MW currently being built to improve project economics and support more economically viable CO_2 flooding of the candidate oil field for enhanced oil recovery.

At the same time, Southern Company's Kemper project is building a new, first-of-its-kind, low-carbon power plant using very low-cost and abundant local lignite coal. The successful completion and operation of the project will fully assess the ability of this kind of low-carbon power system to provide reliable baseload electricity generation. The Kemper project is designed to capture and store around 3 million metric tons of CO_2 annually. In addition to selling electricity to power the grid, Kemper will sell products that are co-produced by their technology. These products include ammonia, sulfuric acid, and CO_2 for EOR.

In addition to projects in the power sector, DOE-funded projects are also deploying CCUS technologies in industrial operations. As part of the Illinois Industrial Carbon Capture and Storage (Illinois ICCS) project, the Archer Daniels Midland Company (ADM) has been testing large-scale industrial carbon capture technologies, gathering crucial scientific and engineering data related to large-scale carbon dioxide storage in saline formations in the Southern Illinois Basin. The Illinois ICCS project will demonstrate an integrated system for collecting CO_2 from an ethanol production plant and geologically sequestering it deep underground in a sandstone reservoir. ADM is awaiting final Environmental Protection Agency (EPA) authorization to begin CO_2 injection operations.

The Air Products and Chemicals hydrogen facility in Port Arthur, Texas has been in operation since December of 2012 and achieved full production in March of 2013. The company is using a technology called vacuum swing adsorption, allowing for the capture of over 90 percent of the CO_2 contained in the product streams from the two steam methane reformers at the site. The project has already successfully captured over 2.8 million metric tons of CO_2 and is well on its way to capture 3 million metric tons of CO_2 by July 2016.

The development of any innovative technology is a difficult endeavor. Businesses face significant challenges as they work to introduce innovative, early-stage energy technologies to markets. Consequently, some major demonstration projects in the FER&D portfolio have failed to reach critical milestones. One of those projects, which has a great deal of support from members of this Committee, is Summit Power Group's Texas Clean Energy Project (TCEP).

Over the past six years, FE has worked closely with TCEP to help enable the success of their project. Unfortunately, while Summit Power has made some recent progress in negotiating engineering,

procurement, and construction agreements with the private sector, many major milestones remain unmet, including, most critically, obtaining financing for the project.

Consequently, after an extensive and careful review, FE determined that advancing additional Federal funding at this time would not substantively increase the likelihood of the project's success, and that no additional taxpayer funds should be put towards the project. We have issued a no-cost time extension through May 13, 2016, to allow additional opportunity for the project to make progress, and are continuing to monitor the project closely.

Despite the fact that some projects have faced difficulties, DOE has acquired valuable information and tangible benefits from the work accomplished to date. The Department remains committed to advancing CCUS through deployment at commercial-scale and the development of next generation technologies that help to increase efficiency and continue to further drive down cost.

Fuel Supply Impact Mitigation

In addition to R&D on CCUS and advanced power systems, FER&D also develops technological solutions for the prudent and sustainable development of the Nation's natural gas resources. The Fuel Supply Impact Mitigation portfolio under FER&D is focused on environmentally prudent and efficient development, as well as responsible stewardship, of the Nation's natural gas resources. The program continues to implement priority collaborative R&D, together with Department of the Interior and the EPA, to ensure that resource development is conducted in a manner that is environmentally sound and protects human health and safety.

Environmentally Prudent Development

FE is pursuing research to continually narrow the bounds of uncertainty and risk in resource development. Areas of research include well design and engineering, induced seismicity, and water quality and availability, where innovative technologies have been developed to treat produced water for reuse, rather than disposal.

Research on induced seismicity has determined that the causes are specific to regions and need to be studied individually. To that end, DOE-funded research is assessing the risks in different oil and gas producing regions; establishing seismic monitoring networks; developing tools for assessing seismic risk; and providing access to wastewater disposal volumes.

Subsurface science research has resulted in improved design, monitoring, and control of fractures and stimulations. It has advanced our understanding of the properties and behavior of the reservoir rock, the well, and the fluids. At the same time, DOE-funded research has assessed the nature and scale of unconventional resource plays in an effort to minimize the footprint of development. The Department and its partners have developed tools and technologies to assist with well pad siting and density decisions, to identify location-specific subsurface geologic and wellbore (oil, gas, and underground injection) risks to the surface, and to minimize environmental impacts of well pad access roads.

Emissions Mitigation and Quantification

FE is currently focused on quantifying and mitigating methane emissions from natural gas infrastructure. This includes the development of technologies and methods for identifying and mitigating leaks and improving the operational efficiencies of pipelines, storage facilities, and compressor stations.

The methane emissions quantification research is targeted at improving emissions estimates published in the national Greenhouse Gas Inventory. In FY2016, these efforts will be supported by competitively awarded grants issued through a Funding Opportunity Announcement that was recently posted on Grants.gov.

In addition, NETL has developed a natural gas life cycle model to calculate the emissions from the natural gas sector, identify key supply chain dependencies, and prioritize methane emission reduction opportunities. FE has collaborated with the Environmental Defense Fund, using the NETL model as a framework for integrating new methane emission measurements. This analysis identified emissions sources that were previously overlooked, analyzed emission sources with skewed emission distributions, and helped to prioritize methane emission reduction opportunities. Methods and findings of this work have been published in reports and peer-reviewed publications. Working in collaboration with academic researchers, NETL also has related projects located in Colorado's Denver-Julesburg Basin, Utah's Uintah basin, and the Marcellus region in Pennsylvania.

The recent natural gas leak at the Aliso Canyon site in California underscored the importance of ensuring the safety and integrity of the nation's natural gas infrastructure. Therefore, in addition to our ongoing research, DOE has partnered with the U.S. Department of Transportation's (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA) to launch a new Interagency Task Force on Natural Gas Storage Safety. In addition to DOE and PHMSA, the Task Force will include technical experts from the EPA, the Department of Health and Human Services, the Department of Interior, the Federal Energy Regulatory Commission, and the National Oceanic and Atmospheric Administration.

The Task Force will work with state and local governments, as well as industry, to avoid future incidents and ensure the safe storage of natural gas. Specifically, FE will hold workshops with industry, state and local leaders, and other interested stakeholders to support them in the development of best practices for ensuring well integrity and proper response plans, safe operations of storage facilities, and assess the potential vulnerabilities to energy reliability posed by the loss of use of storage facilities.

Gas Hydrates

DOE is conducting resource characterization investigations, in coordination with the U.S. Geological Survey, to confirm the nature and regional context of gas hydrate deposits in the Gulf of Mexico, and the physical properties and characteristics of gas hydrate-bearing sediments. DOE will also provide technical leadership and contribute to the initial phases of the primarily Japanese–funded Alaska North Slope test. DOE recently issued a Funding Opportunity Announcement for fundamental Gas Hydrate

research to include laboratory and numerical studies of reservoir response to depressurization and climate effects.

Crude Oil Characterization Study

FE and PHMSA are collaborating to better understand and mitigate risks associated with the transportation of conventional and tight crude oil. Sandia National Laboratories was commissioned to conduct a study of available crude oil chemical and physical property data and literature related to crude oil potential for ignition, combustion, and explosion.

That study identified gaps in important crude oil characterization data; sampling, testing and analysis methods; and deficiencies in the understanding of the relationships between crude oil properties and the potential for accidental ignition, combustion, and explosion. At DOE and DOT's request, Sandia prepared a comprehensive Crude Oil Characteristics Research Sampling, Analysis and Experiment Plan, which contained recommendations on research needed to improve the understanding of transport-critical crude oil, especially tight crude oil properties. Historically, crude oil characterization has been done by industry organizations such as the American Petroleum Institute. However, the data on certain properties believed to be related to safety was not included in their standard classification systems.

Activities include evaluating up to five different sampling methods for application to crude oils containing higher concentrations of volatile hydrocarbons and conducting pool fire and fireball experiments to compare tight and conventional crude oils. This work, funded by congress in FY 2016 will be completed in 2017 with FY 2016 funds.

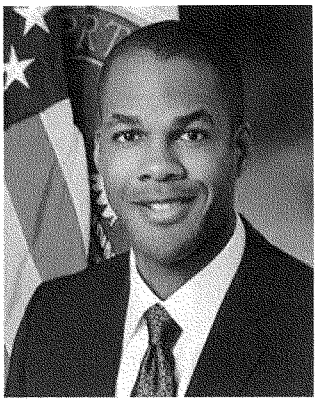
Rare Earth Elements

Finally, NETL is carrying out congressionally-mandated research on the feasibility of extracting rare earth elements (REE) from coal and coal byproducts. In March 2016, nine projects were selected to conduct research as directed by Congress on Recovery of Rare Earth Elements from Coal and Coal By-Products. This research is focused on the development of bench-scale and pilot-scale technology to determine if it is possible to economically separate, extract, and concentrate mixed REEs from coal and coal byproducts, including solids and liquids from coal-related operations.

Conclusion

The Department of Energy is committed to working with industry, our National Labs, and other stakeholders to develop the science and innovative technologies that will allow the Nation to use its abundant fossil energy resources in a way that meets our energy needs, ensures environmental responsibility, and secures U.S. leadership in the global clean energy economy. Technology innovation is critical to this effort. Our programs have made substantial progress toward meeting these goals, and we believe these continued advances will help ensure that the U.S. will continue to lead the world in clean energy technology innovation.

Christopher A. Smith



Christopher Smith serves as Assistant Secretary for Fossil Energy at the U. S. Department of Energy. President Obama nominated Smith for the position in November 2013. He was confirmed by the U. S. Senate and sworn into office in December 2014.

As Assistant Secretary, Smith leads the Department of Energy's Office of Fossil Energy, including scientists and engineers working at eleven sites across the United States. In this capacity, he oversees the Department's fossil energy's research and development program (coal, oil and natural gas) and the National Energy Technology Laboratory. He is also responsible for the U.S. Petroleum Reserves, the largest strategic petroleum stockpile in the world.

Prior to his Senate confirmation, Smith served as Principal Deputy Assistant Secretary for Fossil Energy and as Deputy Assistant Secretary for Oil and Natural Gas. During that tenure, he served as the Designated Federal Official for the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, established by President Obama to investigate the root causes of the Gulf oil spill.

Before his appointment in October 2009, Smith served in managerial and analytical positions of increasing responsibility in the private sector. Most recently he spent eleven years with two major international oil companies focused primarily on upstream business development and LNG trading, including three years negotiating production and transportation agreements in Bogotá, Colombia.

Smith began his career as an officer in the U. S. Army and served tours in Korea and Hawaii. He subsequently worked for Citibank and JPMorgan in New York City and London in the area of emerging markets and currency derivatives. Smith holds a bachelor's degree in Engineering Management from the United States Military Academy at West Point and an MBA from Cambridge University.

Chairman WEBER. Thank you, Mr. Smith.

The Chair now recognizes himself for five minutes.

In your opinion, Mr. Smith, what is the appropriate role of government in fossil energy research and development, and let me be specific. In other words, what is the right balance of investments between applied energy research versus the demonstration and commercialization of energy technologies for fossil energy? That is kind of a two-part question. Let me restate it.

In your opinion, what is the appropriate role of government in fossil energy research and development? I'll let you take that one first.

Mr. SMITH. Okay. Well, thank you, Mr. Chairman, and that's a big question. I mean, that's the basis of our entire budget.

So the role of my program is developing those clean energy technologies that are going to ensure that all forms of domestic energy are relevant in the economy of the future. The Department of Energy is a technological organization. It's what we do. We develop technologies from wind to solar to enhanced geothermal to biofuels to nuclear. An important part of all of our goals be it innovation, job creation, energy securing, reducing greenhouse gas emissions, is to ensure that all forms of domestic energy remain relevant, and so the core of our program is carbon capture and sequestration technologies, ensuring that those technologies move forward so that all forms of energy are reliable and part of the future for us.

Chairman WEBER. Well, let me say this. When you're focusing on—and as you know, in my district, Port Arthur, Texas, with Air Products, the project that you and I were able to be there for the groundbreaking on a very good project, a lot of carbon sequestration captured and, you know, just the success of the project, do you remember, was that $460 million?

Mr. SMITH. Of that order.

Chairman WEBER. So something in that area. And they've captured, I think according to your statement, up to three million tons now of CO_2?

Mr. SMITH. Three million tons for that project.

Chairman WEBER. What does that cost per ton if you divide that out?

Mr. SMITH. We'd have to do the math on that, Mr. Chairman.

Chairman WEBER. Four hundred and sixty million divided by three million tons. That's a lot of millions of dollars per ton.

It seems to me like what's happening is, when you go focusing on carbon—CO_2 capture, that it's kind of like closing the barn door once the cow gets out because that's on the back end of the energy chain, so to speak. You know, you're using fossil fuel energy, which as we noted earlier, is 80 percent of the world's energy consumption, or energy usage, rather, and I think they're saying probably still as much as 40 percent by 2050. So when you focus on the back end of fossil fuel energy, doesn't that take your focus away from innovation and technology on the front end?

Mr. SMITH. Well, I'm not sure I agree with that characterization, Mr. Chairman. The important thing that we have to work on—and I agree with some of the statements you made in your opening statement about the importance of innovating, the importance of early-stage technology, the importance of pushing the envelope in

that way, and also agree very strongly with some things that the Ranking Member mentioned in his technology that the challenge of these projects is not the technology per se but it's some of the commercial issues around pushing forward and improving these technologies and doing the demonstrations, an environment in which it's free for companies to emit as much CO_2 as they want to in the environment. You don't have to pay for that. So there's not a way for companies to capture the very strong positive externalities that you get from capturing that CO_2.

Therefore, we have to work with industry to make sure that we're doing demonstrations like the one we've done in your district that you and I got to do the groundbreaking on. It's important to show and demonstrate that those technologies are available, that they work, that you get real projects built so that coal and natural gas can continue to be part of our energy mix.

Chairman WEBER. But in all fairness, Mr. Smith, when you look at that project, $460 million, 60 percent of it was paid for by the American Reinvestment and Recovery Act, if I remember, so I don't know what that math is, but—and it was a great project and a great plan in our district and it led to a lot of jobs, but realistically speaking, DOE, in my opinion, their—your focus needs to be on improving that energy efficiency, not on capturing what's considered by some to be on the back end, you know, undesirable energy, a fuel, and so when you focus on capturing the emissions, if you will, on the back side, you're reducing your ability to actually focus on innovating on the front end, and no project—I mean, I don't think any project can be built with 100 percent free market business money because when the government provided 60 percent of that money to that project, of course it could be built, but I don't think you can duplicate that.

Mr. SMITH. Well, again, Mr. Chairman, in this current market, that's necessary because it's free to emit as much carbon pollution to the environment as you want to. I mean, the optimal thing for a company to do is to run their plant and just put that pollution into the environment because it doesn't cost anything.

Chairman WEBER. Well, I want to respectfully disagree, and I'm running over here because, you know, we live in our districts. I represent the Gulf Coast of Texas, five ports, more than any other Member of Congress. Sixty percent of the nation's jet fuel is produced in our district. It's almost 20 percent of the nation's gasoline east of the Rockies, so a lot of energy production, and those of us who live and work there, we want clean air for our kids and clean air and clean water. We just do. And those industries do too and the communities do too, and they strive to be as clean as possible.

But we could go on for a long time here, and I appreciate you being here, and I'm way over my time, so I'm going to yield now for questions to the Ranking Member of the whole Committee, Mrs. Johnson.

Ms. JOHNSON. Well, thank you. I didn't realize I'd be called out of order.

Mr. Smith, roughly how much of the Fossil Fuel Energy R&D budget would you consider to be relevant to climate mitigation, both domestically and if we can export these technologies around the world? And in the context of Mission Innovation, how does it

make sense for so many of these programs to receive such significant cuts or be eliminated entirely?

Mr. SMITH. Thank you very much for the question. So if you look at our entire $600 million budget request, I'd characterize the vast majority of those projects being relevant to reducing greenhouse gas emissions and promoting cleaner energy. The core of our program is the carbon capture and sequestration efforts, capturing CO_2 out of power systems, out of industrial sources, capturing that CO_2 and storing it over—permanently so that CO_2 does not go into the environment.

In the Oil and Gas program, we're focused on environmental sustainability and safety, so I'd say overall if you look at our budget, the overwhelmingly vast majority of the work that we do is very much relevant to the challenge of the clean energy economy of the future.

In terms of our budget, our budget is consistent with the idea of Mission Innovation, which is doubling of clean energy R&D over the next five years, and in fact, we've got a core of our program that is directly relevant to the challenge of Mission Innovation. That core has been increased from $533 million to $564 million, so that's a $31 million increase. At the same time, we've had some successes in our program and we're rolling off of certain efforts which allow us to gain some efficiencies.

For example, in our carbon storage program, we're moving from the injection phase in some of our major regional partnerships to long-term monitoring and verification. That is a less costly phase of that research. It's just as important but less costly, and what it allows us to do is, you know, in an environment of very challenging budgets for us to reduce funding in some areas as we make some advances or as some of the technologies become less relevant and focus those funds on areas that we think are going to be particularly relevant for the types of topics that are going to be important for Mission Innovation early TRL-level research and development that is going to be truly transformational in reducing the costs for capturing CO_2.

Ms. JOHNSON. Hypothetically, if the Department's request for $1.6 billion of additional so-called mandatory spending for clean energy research is authorized during this Congress, would it make sense for Fossil R&D to receive some of the additional funding?

Mr. SMITH. Well, indeed, Congresswoman, again, the core of our program, we actually are increasing and that's something that we'd like to—you know, we'd be happy to detail in more granularity but we've added additional $31 million to those core programs that are relevant to Mission Innovation, and over time since—you know, I came into this role back in 2013 so the 2014 budget was the budget that I—you know, my first budget I got to work on, which was an R&D budget of about $430 million, and that has increased by 40 percent, you know, since the fiscal year 2014 request to this year of $600 million.

So again, in an environment of tremendously challenging budget pressures, I think our recognition of the importance of this challenge has increased as has our budget request and the successes that we are having in some of our programs.

Ms. JOHNSON. Well, considering that fossil fuel energy generates over 60 percent of our electricity, don't you think it would be wise to at least a fraction of that proposed increase and put it toward technology development and demonstration efforts to reduce environmental impacts of coal and natural gas, or even mission-driven basic research that could be handed off to industry when applicable?

Mr. SMITH. So our materials programs are and remain very important, everything from advanced computational efforts through our major demonstrations. We've got a very wide range of programs that are doing the early phase research and development on the transformational technologies like chemical looping and pressurized oxy-combustion all the way through the major demonstrations, which we are working very intently with our collaborators to move forward and be successful with. So again, I concur with your observation that these technologies are important, and indeed, I think that we're putting the right effort into them.

Ms. JOHNSON. Thank you. I yield back. Time has expired.

Chairman WEBER. I thank the gentlelady.

The gentleman from California is recognized for five minutes.

Mr. ROHRABACHER. Thank you very much, Mr. Chairman.

Let me just note that I think that the premise that we're operating on in this hearing is just wrong. I think it started right with Mr. Grayson, whose opinions I deeply respect but disagree with, when he said that this is all about air pollution, and CO_2—it's about CO_2. It's not about air pollution. Pollution by the definition of most—not most but many very prominent scientists is something that endangers human life, endangers the health of human beings. What we have here and the hundreds of millions of dollars if not billions of dollars that we are talking about is all based on the idea that CO_2 is heating our planet, and this theory, which we have to understand, pushing this theory, this Administration is basically by doing—putting such an emphasis on it, being willing to sign agreements that put enormous power in the hands of global decision makers instead of just American decision makers as well as have tremendous impact on jobs, especially in the coal industry where we're talking about tens of thousands of jobs that are being lost, and I'm very happy to hear we're trying to do something to help them come through a crisis when men and women who have earned a living and supported their families are now just being thrown out because of a theory, and I say the "theory" because there are hundreds of scientists who do not believe that the global warming theory based on CO_2 that is heating our planet is correct, whether it's Dr. Freeman Dyson of Cornell or William Happer of Princeton, those are just two of hundreds of scientists who just disagree, and it seems to me what we've got here when we're talking about the money that's being spent and the shift—forcibly shifting a reliance from coal to natural gas and to wind and solar, et cetera, is running roughshod basically over the livelihood and the well-being of many American working people, and I—can you—I guess you're not the one to explain global warming, the global warming theory, but when we're talking about CO_2 reduction, what are the other benefits that you can see that justify this enormous ex-

pense—how do you say—dislocation of our economy in order to accomplish these goals?

Is there anything else but—somebody says air pollution. I don't accept the fact that CO_2 in any way causes human health problems. Air pollution to me is worth trying to do some things to try to protect health. There's no doubt about that, but trying to basically fulfill this—base our operations on the CO_2 theory of global warming I don't believe is justified. Maybe you could tell us what else besides global warming is being benefited by these expensive and dramatic changes that you're involved in.

Mr. SMITH. Well, thank you very much, Congressman, for the question. So there's a lot there in that question.

So maybe I'll refer back to COP–21, the global climate event late last year. I went into COP–21 with the expectation that maybe 60, maybe 70, maybe 50 countries would put forth INDCs, their Initial National Determined Contributions, real steps that countries are going to take in order to reduce greenhouse gas emissions. With U.S. leadership we ended up with 190 countries, 190 countries, essentially all the participating countries, made specific commitments to address climate change, to address anthropogenic CO_2, a remarkable outcome. I mean, it's remarkable to get 190 countries to agree to anything, much less something as difficult to address as this, as fundamental as it is to our ideas around energy security, and indeed, something that you actually have to take steps to address. You know, 190 countries led by the United States. And so in terms of an emerging consensus, I mean, there's an emerged scientific consensus around this existential need to address carbon pollution——

Mr. ROHRABACHER. So it's all based on the CO_2 theory then? There's other things, and you're talking about CO_2. Let me ask, does CO_2—is there an indication—I was—I just visited some hothouses where they're growing different vegetables and plants, and I noted that they were pumping CO_2 into these hothouses to grow plants that would have a greater production of food. Even here in our own country we do that. If we are reducing the CO_2 in the atmosphere, is that also going to result in a lower production of food?

Mr. SMITH. So——

Mr. ROHRABACHER. I mean, all these people have a consensus about air pollution. Is there a side impact as well beside the dislocation of people's jobs that there'd be less food produced in the world?

Mr. SMITH. We actually—we're looking at beneficial uses of CO_2 that include taking CO_2 for algae production, so there are useful things that you can do with CO_2, and that has been part of our program. It's been part of the EERE's program that looks at renewable energy. So there certainly are beneficial uses of anthropogenic CO_2, but overall, there is an enormous challenging of reducing greenhouse gas emissions so that we can get the climate to sustainable levels. That's the core of our program. That's the reason why we are working on——

Mr. ROHRABACHER. Honest people can disagree with that, so thank you.

Mr. SMITH. And I did want to address this idea of forcibly shifting from coal, and I've spent—you know, I've spent a lot of time

in coal-producing countries. I've spent some time with the governor in West Virginia. We had a laboratory that's based in Morgantown, West Virginia, a National Energy Technology Laboratory. Coal country is under tremendous pressures but they are market forces which are impacting coal. You have trillions and trillions of cubic feet of natural gas that are available and at commercial quantities that were not available years ago, and that reduction in the price of natural gas has put a tremendous pressure on coal that along with the need to greenhouse gas emissions, so I'd say that the program—you know, our efforts within the Office of Natural Gas within the Office of Fossil Energy are to ensure that all forms of energy remain relevant.

Chairman WEBER. We do need to move on. I appreciate that.

The Chair now recognizes the Ranking Member for five minutes.

Mr. GRAYSON. Thank you.

Regarding my friend from California and what he just said, if he thinks that carbon dioxide doesn't cause any human health problems, I'd invite him to put a plastic bag over his head, tie it tightly around his neck, and see what happens next. He says they're always trying to do that to him anyway.

Mr. Smith, tell me your sense of what the term "corporate welfare" means.

Mr. SMITH. I would demur from offering a definition, Mr. Chairman. Is that a question—or Mr. Ranking Member, is that a question in reference to our program or——

Mr. GRAYSON. I'd like to know—well, it's a question. I'd like to know whether you think that anything that could be conceived of as corporate welfare is properly a function of your office.

Mr. SMITH. So the function of our office is to make sure that we are moving forward and deploying technologies that will be necessary for the clean energy economy of the future, and that's what we do, and in order to do that we have to work together with industry, work together with academia, work together with our network of national laboratories. It's important for us to have corporate partners because that's the way that you push innovation to the marketplace, and that's what we do.

Mr. GRAYSON. Well, would you want to see in your office, for instance, $100 million effort to try to improve fracking technology? And if not, why not?

Mr. SMITH. Well, early on we did have a major effort for hydraulic fracturing. I mean, the very first horizontal——

Mr. GRAYSON. I'm talking about today.

Mr. SMITH. Well, the nature of our program is, for us, a success is something where you have an early-stage investment where the government innovates. We create—we put out data and results and outcomes that companies can then subsequently come in and invest in, and so we're certainly way down the path in terms of hydraulic fracturing. I mean, I came from Chevron. That's where I was before I came to government. Companies do this very well. I don't see a government role in helping companies do things that there's already a commercial motivation to move forward on.

Mr. GRAYSON. Do you happen to know what Exxon's annual research and development budget is?

Mr. SMITH. I don't know off the top of my head.

Mr. GRAYSON. It's actually bigger than yours. It's a billion dollars a year, and it's been a billion dollars every year for the past 5 years.

So do you think there's some need to try to make sure that your office is not doing in a duplicative way at the expense of the taxpayers the same work that a company like Exxon would be doing?

Mr. SMITH. We very specifically do exactly that.

Mr. GRAYSON. All right. Explain to me how you do that.

Mr. SMITH. Well, so we're constantly in conversation with the market, with market players. They're our partners in a lot of these efforts. We know where they are in terms of be it extractive technologies for natural gas or technologies to commercialize carbon capture, for example. So, you know, we're in touch with the market. We see where the market's going. We monitor market forces. We understand what investment is being put in place, and we have to identify those scientific challenges that absent an active government role would not be filled and which have an important impact on the public good. That's basically our annual budget process.

Mr. GRAYSON. And by "important impact on the public good," you mean what you and I were both referring to earlier, this idea that pollution is an externality, that companies have no incentives to deal with it unless we create an incentive, and if we don't create an incentive, then it's incumbent upon the government to promote research and sometimes even regulate in order to take care of the effects of that externality? In fact, you used the phrase earlier "positive externalities that you get from capturing CO_2." That was your phrase, not mine. What did you mean by that?

Mr. SMITH. So if you capture that CO_2 and you store it instead of pumping it into the environment, that—you know, that avoided emissions has a definite benefit, and right now the market doesn't pay companies for that. If you're an emitter, you can emit as much CO_2 as you want to and you don't get charged for doing that.

So there is a positive benefit to reducing emissions. In fact, our program is approaching 12 million tons of CO_2 that we've stored through our R&D efforts and through our major demonstrations. That's an enormous benefit. I mean, that is a positive thing. Right now companies can't reap that benefit and therefore you have to find other creative ways to make sure that these projects get built that technologies continue to advance. Otherwise companies aren't going to work on these things, and we think that they're important.

Mr. GRAYSON. You're developing ways to sequester CO_2, the actual know-how, how to do that, that's what you're doing in your office. What's the next step after that? Once you're successful, what's the next step after that?

Mr. SMITH. Well, I mean, the challenge that we have is continuing to advance new systems that lower cost, that fundamentally change the way that we combust hydrocarbons, the way we capture CO_2. So, you know, two other projects that we're looking at kind of going forward for new pilots would be pressurized oxy-combustion using oxygen to combust the coal and therefore you get a very concentrated stream of water vapor and then CO_2 in the back end so you don't have to capture the CO_2. That's kind of precaptured.

The second thing we're working on is chemical looping, which is another novel way of combusting CO_2 that you end up with a very pure stream of—combusting carbon so you get a very pure stream of CO_2.

Those are systems that, you know, need further research. They need further development. They need to be investigated at the pilot scale but could take an enormous stride toward reducing the cost of capture and ensuring that all forms including coal remain relevant in the economy of the future.

Mr. GRAYSON. But here's my point. You're not just doing this for the sake of advancing scientific knowledge; you're doing this so that we can actually sequester carbon on a large scale and reduce pollution, correct?

Mr. SMITH. That is correct.

Mr. GRAYSON. Thank you. I yield back.

Mr. KNIGHT. [Presiding] Thank you very much.

And I will take the next set of questions. First I want to thank the Secretary for coming out to Southern California and to Aliso Canyon, not that it's hard to come out to Southern California, but I appreciate him coming out and having the hearing, and it was one of the biggest incidents of the year without a doubt, and so my first—all of my questions will be around Aliso Canyon and around the gas leak that plagued our district for 118 days and continues to have serious issues.

Can you tell me what the connection is to the states? In certain states we have—like in California, we have the CPUC. We obviously have the Governor's Office that does an awful lot of these types of regulations and issues and then we have CARB and I could go on and on, and I'm sure everyone's state could go on and on, so can you tell me from the DOE what their connection is, what their stance is on connecting with the states in reducing and the regulations that come out of the states?

Mr. SMITH. Well, thank you for the question. So we're the technical organization. You know, we do research and development. We've got a tremendous resource with the network of national laboratories, you know, thousands and thousands of researchers and scientists and engineers that cover the gamut of scientific knowledge, much of which is relevant to challenges like this. So our primary role at the Department of Energy, we're not the regulators, you know, that's not our job. However, we do have a very deep scientific bench that is really relevant to states, local and federal authorities when it comes to understanding risks, understanding how to mitigate risks, quantifying concerns, helping local and state entities come up with plans for mitigating those risks. We think we're an important resource. And indeed, much of the research and development that we do is geared towards quantifying concerns that the communities have around the long-term safety and sustainability of our fossil energy systems. We think that's an important mission that we have and one that we look for opportunities to work with state authorities.

Mr. KNIGHT. Absolutely. I understand the regulatory issues and who is in charge of what, but can you tell me—in other words, if it wasn't an emergency, would you be reaching out to some of these states to do some of these areas that have these types of issues

that do high-energy output, that do underground piping, that do these types of things that can be dangerous, and we've been doing them for 70 or 80 years, and we've learned an awful lot. Are you reaching out to those groups and giving them your expertise and maybe working on some of those issues so that when they do regulations they're effective regulations and the industry is able to continue on with the regulation?

Mr. SMITH. Indeed, Congressman. I mean, we have numerous interactions with everything from the Southern State Energy Board to the American Association of Petroleum Geologists. We have ongoing conversations with state geologists throughout the United States. I mean, there's myriad entities that we work with to—and that communication goes two ways. I mean, we get great inputs from states in terms of things that they're learning and their processes that would help us shape our research and development program, and then we also look for opportunities to share things that we're learning so that states can be more effective regulators.

States of course—again, we're not the regulators. States are covetous us with their regulatory autonomy, which I think is important. But at the same time, every state—well, states have different concerns but a lot of them are similar, and a lot of things that states are concerned with are the very issues that we are investigating within the Office of Fossil Energy, with the National Energy Technology Laboratory. So indeed, I look for—I look forward to having further opportunities to collaborate with the State of California and with other entities throughout the United States on these important issues.

Mr. KNIGHT. And very quickly, so we've seen the PIPES Act that has moved through for underground piping, and there's been an amendment that has been kind of to put a regulation across the board in the federal government so that states are not doing—one is doing this, one state is doing this, one state is doing this. How would you feel as—is that a good—is that a good line in the sand to say that the federal government should be doing that or should we allow the states to just do whatever you want and there's no federal regulation?

Mr. SMITH. Well, Congressman, I'm not familiar enough with the amendment to speak specifically to that particular amendment or to that piece of proposed legislation, but certainly there is a balance to be drawn, and again, we're not the regulator but, you know, whatever entity is in charge of putting in place rules or promulgating those rules, the Department of Energy would look for opportunities to collaborate to make sure that rules are put in place to represent commonsense regulation that's consistent with science and the quantified risk that we worked on.

Mr. KNIGHT. Very good. Thank you very much.

And I'll recognize the distinguished gentleman from Colorado.

Mr. PERLMUTTER. Thank you, Mr. Chair.

Mr. Secretary, thanks for being here. I've just—you know, listening to this conversation and representing the suburbs of Denver where we have a lot of activity in the environmental community, obviously have substantial production of oil and gas and we have coal in our state, so it's a combination of things, and you know,

there are some in my state that would completely do away with any fossil-fuel production whatsoever because they believe with everything in their soul that that's causing the planet to warm and could, you know, lead to the extinction of all of us. Then there are those that are in the industry saying—some who say well, you know what, we're going to produce, we have a very reliable energy sources here whether it's oil and gas or coal, and we're going to just produce, and I want to compliment you and DOE for trying to find a way that uses innovation, imagination, invention to take a plentiful energy source that we have and yet recognize the environmental problems that it may be causing, and so you know, thank you for that. I'm glad to see you all play a role in trying to take the brains that we have and find a way to make these things work without damaging the planet.

But my questions are on the Strategic Petroleum Reserve, okay? And one of the things that we've seen—and I used to be a bankruptcy lawyer and I cut my teeth on oil and gas bankruptcies, and we watched the Saudis, who can produce at a much lower price than we can, you know, back in the day drop it from 30 bucks a barrel to 7 bucks a barrel. We've watched them now pump into lower demand type of economy, take it from 107 bucks a barrel down to 30, and now we're at around 40, 45. And I know DOE plays some—has some role with respect to the Strategic Petroleum Reserves, which Congress has tapped to help fund a couple of items out there, whether it's some of our transportation, our budget generally. Can you explain to us—and maybe it's not within your jurisdiction of your department within DOE but can you explain to us how DOE analyzes, you know, when we fill up the Strategic Petroleum Reserve, when we draw down on it? I mean, is that a question that you're comfortable with?

Mr. SMITH. Thank you, Congressman. So the—you know, as you know, oil prices are very volatile. In the 1998 time frame, we're looking at $18, $20 prices. Ten years later in 2008, we were up to $140. Oil prices subsequently crashed down to the 20s and are now back up to the 40s, you know, 44, 45. So a remarkably volatile commodity for something upon which our entire economy relies. I mean, the overwhelmingly vast majority of miles that Americans travel are fueled by oil. So we still have a very important strategic link back to oil and our economy has a very high level of vulnerability to spiking oil prices. We are importing fewer barrels than—we import fewer barrels from other countries than we produce domestically for the first time in decades, which I think is—you know, it's a tremendous step forward. It reduces our reliance, helps us balance the trade and job creation. I mean, I think those are all positive things.

But the Strategic Petroleum Reserve remains very relevant. I think we still definitely need this reserve to protect our economy. It's the one thing that we have to protect us against price spikes. The global markets are well supplied now as we see from the lower oil prices but it's still a very uncertain world so the reserve remains important.

We've been instructed to sell barrels, you know, both through the bipartisan Budget Act and the Transportation Act. You know, on the Executive Branch, we execute the law as passed by Congress

so we will operate consistent with the spirit and letter of that law. One positive thing that we get out of that is that about $2 billion that will be go back into the modernization of the Strategic Petroleum Reserve to make sure that that reserve remains ready and that we have facilities to push incremental barrels out to the market in a way that protects our economy. So we're going to execute that mission in a way that's positive for this SPRO.

Mr. PERLMUTTER. And I just hope that you buy low and sell high. Thank you.

With that, I'll yield back to the Chair.

Chairman WEBER. So you were a stock trader as well as a lawyer?

The Chair now recognizes the gentleman from Texas, Mr. Neugebauer.

Mr. NEUGEBAUER. Thank you, Mr. Chairman.

Secretary Smith, thank you for being here. In your prepared testimony, you discussed the DOE's ongoing research and development in the carbon storage focused primarily on the permanent geological storage of captured CO_2 from fossil fuel systems. But in your testimony there's no mention of putting the captured CO_2 to use in enhanced oil recovery.

Similarly, the entire fiscal year 2017 budget proposal mentions enhanced oil recovery only twice in the context of past projects. Given the potential for cost-effective carbon storage, can you explain why facilitating EOR is not included in a major part of the DOE's carbon storage program?

Mr. SMITH. Thank you very much for the question, Congressman, and it's actually a really good one.

So as we look at the necessity to get these projects moved forward and built, enhanced oil recovery is I think as important as it has ever been in terms of incentivizing these projects. If you take that CO_2, you capture it, you put it into a pipeline and use it to produce an incremental barrel that otherwise would have remained in the ground, you can take that value and use it to pay for the project itself. In fact, we've got a major demonstration in the State of Texas just south of Houston, the Petra Nova Project with NRG, that's doing exactly that. It's a 240-megawatt project that's using enhanced oil recovery, and the total in economics of the recovered barrels are important for the overall project economics.

Now, when it comes to research, I don't see a direct R&D role for the Department of Energy in terms of enhanced oil recovery. In fact, that's something that industry has been doing for decades and does very well. Now, as a methodology for taking that CO_2 and putting it to beneficial use, I think that is tremendously important.

One thing that we have proposed are tax credits for sequestration so that there would be a tax credit that you'd receive for oil that goes into EOR. We think that's important to incentivize the activity to push those projects forward. In terms of an R&D role, that has not been in our program simply because there's a very, very strong commercial drive for private industry to put research and development and activities and capital into that area. In fact, industry's gotten a lot better at it.

Mr. NEUGEBAUER. So your focus then for your research is just cost-effective storage and not necessarily looking at alternatives? I

mean, the enhanced oil recovery and use of the CO_2 for enhanced oil recovery has been a very good thing for the oil industry, and according to you is good for the environment as well. So if we're not focusing—if we're focusing on storage, then why are we not focusing more on if it works in the oil industry, it might work in other areas?

Mr. SMITH. Well, I mean, it comes back to a question I had earlier, I believe from Mr. Grayson, about how we think about where we invest. You know, we've got finite dollars, we've got a limited budget, so where do we focus those dollars? We want to focus those dollars on areas that have a benefit to the taxpayer, have a benefit to the Nation in terms of energy security, job creation and the environment, but are areas in which industry will not invest in itself that but for the involvement of the government that this research wouldn't occur. So when we look at saline aquifers, for example, that's certainly an area in which we think that we do have to put a lot of effort. Otherwise companies are lining up to do that research and development right now simply because it's free to emit the carbon dioxide.

Enhanced oil recovery, we think there's an enormous driver to invest in that research and development. In fact, we see companies doing that. So most of the R&D that we do is going to be focused on saline aquifer.

We will say that the major demonstrations, however, are using enhanced oil recovery as their disposal method simply because it's positive for the economics of the project. So we're getting—you know, we're getting some bang for our buck in terms of incentivizing EOR projects but it's not a focus for our research, again, simply because it's something that the private sector is running pretty hard on.

Mr. NEUGEBAUER. Mr. Chairman, I yield back.

Chairman WEBER. I thank the gentleman.

The Chair recognizes Eric Swalwell from California for five minutes.

Mr. SWALWELL. Thank you, Chair, and thank you, Assistant Secretary Smith.

I'm interested in your testimony with respect to rare earth elements. I had a bill last year that received an overwhelming majority of support in the House of Representatives to have the Department of Energy play a critical role in finding mines in this country where we could harvest these elements which, as you know, are used to make jet engines, cell phones, laptops, anti-missile systems and the like. However, because you needed two-thirds under that procedural vote, it did not pass. I'm still hopeful that our Chairman Lamar Smith, who supported the bill, and Majority Leader McCarthy, who also supported this bipartisan bill, will bring it back.

But in your testimony, you referred to the National Energy Laboratory researching the feasibility of extracting rare earth elements from coal and coal byproducts. In March, nine projects were selected to look into this topic. I appreciate that you are working on this, and I wanted to know if you could give us an update on what is the current state of the nine projects selected in March, and what—which rare earth elements do each of these projects hope to harness? When do you expect results?

Mr. SMITH. Thank you very much for the question. So this is—this is a project that we've got some enthusiasm for and that we're pushing forward on. We've already had some really interesting results in terms of increasing our understanding of the occurrence of rare earth elements, not only in geologic settings where you'd have some mining challenges but also in tailings that come out of the coal-mining process and also in coal ash. So we've done some work. The NETL is really publishing some groundbreaking papers. We're increasing our understanding of areas in which we might be able to find rare earth elements in commercial concentrations that as you know might reduce the reliance of the United States on importing some of these important elements from overseas, primarily from China.

Mr. SWALWELL. And would this require burning the coal?

Mr. SMITH. Well, in some cases of it, if you're looking at coal ash, I mean, what you essentially have are some kind of pre-combusted, pre-pulverized mass that then helps you in terms of recovering the rare earth element. We see some promise there. We also see some promise in tailings kind of in the pre—in the mined residue that you get out of the mining process, and we also see some potential in going out and extracting it in mining operations of directly—that are geared towards recovering rare earth elements, and you know, part of our research is going to be exactly how do you extract elements. That's kind of the core, how do you—the core of our research. That's really the heart of the scientific inquiry that we're putting forth presently.

So the—you mentioned I think we have eight or nine solicitations that are in the process of being awarded or they're right at the award stage now, so over the course of this year I think we'll know a lot more about the results from that work but we've already published some work that helps us understand the potential, the commercial potential for rare earth elements, and again, it's something that in coal-producing countries—coal-producing parts of the United States that have been negatively and adversely impacted by reduction in coal use. This is something that has some promise for bringing some economic activity to those areas.

Mr. SWALWELL. Great. Thank you. I yield back.

Chairman WEBER. I thank the gentleman.

Mr. Loudermilk, you are recognized for five minutes.

Mr. LOUDERMILK. Thank you, Mr. Chairman, Mr. Smith, for being here.

Secretary Moniz regularly states that innovation is one of the most important aspects of advancing energy technology. However, it's very clean that the Clean Power Plan will devastate the coal industry. My question is, is this the right way to innovate to actually harm an entire industry so others would prosper, or wouldn't we be better served investing more in fossil energy research and technology development than trying to regulate our way to success?

Mr. SMITH. Well, thank you for the question, Congressman, and this kind of steers us back to a point we've had an opportunity to discuss a couple times in this hearing. It's difficult to push forward with some of these clean energy technologies when it's free to emit as much carbon pollution as you want to. What the Clean Power Plan does is provide some incentives for—you know, some man-

dates and incentives for states to reach certain predetermined levels of CO_2 emissions, and it's an all-of-the-above approach. You can meet those targets using whatever methodology one chooses, be it wind or solar or nuclear, or in the case of the part of the technology that I'm working on, carbon capture and sequestration to reduce greenhouse gas emissions coming out of industrial sources and out of power sources.

So we believe it's very important that, you know, under the Clean Power Plan that states will have the option of continuing to use domestically produced sources of fossil energy including oil and natural gas and that we're developing those technologies to make sure that there are cost-effective ways of capturing CO_2 out of those sources.

Mr. LOUDERMILK. Another question. The Energy Information Administration recently reported that coal dropped to 29 percent of the U.S. utility scale power generation down from almost 38 percent last year. At the current rate of regulatory impact, aren't the coal research and development programs at DOE going to be too little, too late?

Mr. SMITH. Well, I mean, we're seeing natural gas prices down at $2.15, I think, today, so you're seeing very low natural gas prices. They've gone down, you know, beneath $2, and this was, you know, when I was in the industry not too long ago and, you know, we were seeing close to double-digit natural gas prices. That has a big impact on decisions that electricity power generators make in terms of how they dispatch electricity. It's been a real challenge for coal country. It will continue to be a real challenge. But what we have to work on—I mean, that's a market force that we're not going to be able to unwind, and I'm not going to make any predictions about the future of commodity prices. I mean, natural gas prices are also involved, and I don't think we can count on any particular price or any particular position in the dispatch curve of various forms of power generation but what we do have to do is make sure that we're continuing to innovate on technologies to reduce greenhouse gas emissions out of all sources of energy.

So we try not to chase a commodity curve. I mean, we can't say well, a price is a certain place and so therefore we're going to stop research and development program. The challenges remain the same, and so we want to give some certainty to our researchers, and you know, the road is long in this area.

Mr. LOUDERMILK. And you mentioned the inexpensive natural gas production, and since 2010, according to the Sierra Club, we've lost about a third of the country's coal capacity that's been shut down because of the regulations of the EPA. But we've been able to avoid spikes in electricity costs because of the cheap natural gas. Would you agree that the electricity rates would have spiked much higher after those coal shutdowns if it wasn't for fracking and the cheap natural gas?

Mr. SMITH. Well, I mean, first I'd challenge the characterization that coal is being challenged by EPA regulations and that's the cause of the challenges around coal. I just don't think that's correct. I mean, market forces have had an enormous impact on coal and it's been driven by the trillions and trillions of cubic feet of natural

gas that are available now that weren't available ten years ago. But——

Mr. LOUDERMILK. In Georgia, we had three coal plants shut down because of EPA regulations, but you're saying that EPA regulation hasn't had an effect on coal production?

Mr. SMITH. I'm saying that the major effect—the major challenge that coal faces is the fact that natural gas prices are $2 and they're not $10, and that has a big impact on the way that power generators decide to build plants. I mean, but to your question, I think that the advances around hydraulic fracturing, advances around horizontal laterals, our ability to extract shale gas out of shale formations has been tremendously positive for the United States. We're going to be net exporters of liquefied natural gas. When I last saw the Chairman, we were down in Savine passing the very first LNG export terminal that I worked on when it was an import terminal, when it was an industry. So this——

Chairman WEBER. You need to work on some more of those.

Mr. SMITH. Well, we've worked on quite a few of them.

Mr. LOUDERMILK. And so from what I'm hearing it's because of the fracking and the access and the cheap natural gas we have here in the United States has definitely helped offset some of the loss of our coal production and keeping the prices down for the consumers.

Mr. SMITH. Indeed. I mean, 40 percent of our power generation comes from coal, a big percent comes from natural gas, and they're both important.

Mr. LOUDERMILK. Last quick question if I may, Mr. Chairman.

There is a movement to keep it in the ground, which would stop fracking and access to this natural gas. I mean, we actually have some presidential candidates who are campaigning on this, we're going to keep it in the ground and put a lock on accessing these commodities through fracking and natural gas. Would that not cause a spike in electricity production should as we've just been discussing the access to these commodities is what's kept the prices low as we shut down coal. Would that not have the opposite effect?

Mr. SMITH. The increasing production of natural gas has had a very positive impact on our economy. It's had a positive impact on the environment. We understand—I mean, there are concerns about some of the risks but those are things that we've quantified and we believe that this is a process that can be managed safely, so we think that natural gas is an important part of the clean energy economy of the future. In fact, we've been kind of explicit around that view.

Mr. LOUDERMILK. Thank you, sir. I yield back.

Chairman WEBER. I thank the gentleman.

The gentleman from Texas, Mr. Veasey, is recognized.

Mr. VEASEY. Thank you, Mr. Chairman, and Secretary Smith, thank you for being here today. It's always good to see someone else from Fort Worth on Capitol Hill, so welcome here today.

And I wanted to ask if you could touch very briefly on the Texas Clean Energy Project. As you know, that is of huge importance to the state and I wanted to see what you know about it and if you can just briefly get me caught up on that.

Mr. SMITH. Well, thank you very much for the question, Congressman. So the Texas Clean Energy Project is a project that was designed to—it's one of the major demonstrations designed to capture CO_2 coming out of a plant in Texas. It's a project that we've been working on for the last several years along with a company called Summit that's based in Washington State. Along with all of our major demonstrations, it's been kind of an important part of our effort to ensure that technologies move from the desktop to the laboratory out into the real world and get built and developed.

We've recently made—you know, over time we've allowed this project to have additional time to meet some major milestones. Whenever we have a major project like this, we put in place very well thought-out controls to ensure that we're getting the best value for the taxpayer. That project has some milestones that it has not met in terms of getting financing for the project, and so I've recently—just recently sat down with the CEO of that company. We've discussed offering them a no-cost extension that would allow them to continue to try to develop the project at no additional cost to the taxpayer. Again, these are difficult projects. They're tough projects. This is a company that's been dogged in its pursuit of what we think is a really important project for us. And you know, I foresee them, you know, trying to continue to raise additional funding for that project but at this point the U.S. government is not putting additional taxpayer funds towards that project.

Mr. VEASEY. Thank you very much for the update on that.

And I want to shift over to sequestration. It appears that we've solved some key technological hurdles when it comes to sequestering CO_2 in geological formations but we still have a lot of challenges that we have to overcome in that area, and I wanted to ask you what are some of the key hurdles left in DOE's research into carbon sequestration?

Mr. SMITH. Well, thank you for the question. So we've got seven major—seven regional partnerships across the United States that are looking at the challenge of putting CO_2 into geologic formations across the United States, and this is looking at a variety of depositional environments, a variety of geologic settings, so the geology in different parts of the United States is different and therefore you have to do different types of research about the effectiveness of storing CO_2 in formations across the United States.

The challenge of CO_2 storage is that you are storing just enormous, enormous quantities of CO_2, and that's one of the reasons why geologic storage in saline aquifers is what we see as being kind of the future of carbon storage.

We've learned a lot in that process. We've been able to create a lot of data that we're able to provide in terms of the potential of storing CO_2 in different areas so we've put out atlases that show the potential for carbon storage, and we know that we've got a tremendous, tremendous resource in the United States in terms of the storage potential for CO_2. We're continuing to work on issues around monitoring and verification. We've got projects that have cycled out of the phase of injecting CO_2 into the ground and have moved on to that medium-term monitoring and verification, so there's more work for us to but we're working very closely with state and local authorities. The end goal of all this effort is to be

able to scientifically quantify the activity and the opportunity and to provide regulatory authorities with the data they need in order to create a robust permanent environment in the future in which we know that we're going to have to capture all the CO_2 and store it for—store it in these geologic formations.

Mr. VEASEY. Has DOE researched the public relations and education aspect of siting the CO_2 pipelines and commercial storage sites?

Mr. SMITH. Indeed. I mean, part of what we do, I mentioned the atlases and the other publications that the NETL puts out. I think that's an important part of the public outreach so that we're clearly communicating the results of the project. People know, you know, that we've understood the issues around long-term geologic storage, everything from well bores to ability all the way through induced seismic issues. I think it's important that we take any of these risks seriously and that we clearly communicate the scientific research so that we're quantifying the risk.

Additionally, you know, projects like the ADM project that we're doing in Illinois have a component of creating a public outreach centers that we're able to communicate with the public so that they understand our research and the process that one would have to go through in order to accomplish one of these projects.

Mr. VEASEY. Thank you very much, and Mr. Chairman, in closing, I hope that Mr. Smith has a chance to go back to his alma mater of Southwest High School and talk with their program that they actually have a program at the school that trains people on, you know, exploration and the different aspects of energy and being a petroleum engineer specifically, and so hopefully you have a chance to go back to Fort Worth ISD and do that.

And Mr. Chairman, I yield back. Thank you.

Mr. SMITH. Thank you. I'll be back in Fort Worth this Friday actually.

Chairman WEBER. Marc, did they have multiple classes when you were in high school? They weren't all just in one single room with a wood-burning stove?

Mr. VEASEY. No, we had moved past the schoolhouse——

Chairman WEBER. Okay. I was just——

Mr. VEASEY. —into a full school by the time I was there.

Chairman WEBER. —curious. All right. Thank you. The gentleman yields back.

The gentleman, the pride of East Texas, the Big Thicket, is recognized, and you've got a lot of forest out there, Dr. Babin, that uses CO_2, I bet. You're recognized for five minutes.

Mr. BABIN. Those trees needs lots of CO_2, or they give a lot of oxygen back. Thank you, Mr. Chairman.

And thank you, Mr. Secretary. We appreciate you, and you had mentioned a Houston project a while ago, and would you give me the name of that?

Mr. SMITH. That's the Petra Nova project. It's a collaboration with NRG so it's a 240-megawatt post-combustion capture project that's just south of Houston, Texas.

Mr. BABIN. Just south?

Mr. SMITH. Just south of Houston.

Mr. BABIN. All right. Thank you.

And I noticed you're a graduate of West Point as well, right?

Mr. SMITH. I am indeed.

Mr. BABIN. Yeah. That's good. Well, I have a son that went to the Naval Academy. Go Navy, beat Army.

Mr. SMITH. Okay. Beat Navy.

Mr. BABIN. Well, funding for the TCEP, or Texas Clean Energy Project, is a coal gasification project in Texas, which we've talked about a little bit today, was pulled to fund other priorities in the fiscal year 2017 budget. This Committee has been working in a bipartisan manner to get to the bottom of the problems with the project, and we appreciate the letter that you sent in response to some of our questions about this project, and in your response you referenced an internal review that your office conducted of the project before making the decision to rescind the funding. Can you commit to provide that review to this Committee?

Mr. SMITH. I'd be happy to respond to that for the record.

Mr. BABIN. Okay. That'd be great.

The DOE Inspector General released a special report on TCEP just last month, and in this report, the IG was very critical of DOE's management practices, particularly when it came to enforcing deadlines, cost ceilings, and managing risk for the taxpayers. Your office has overseen several large project failures and it's clear that there is a systematic problem in the Office of Fossil management for large commercialization projects. What steps have you taken to address these management issues?

Mr. SMITH. Well, thank you for the question, Congressman, and that's obviously a big issue.

So first, to address the IG report, so the bottom line on the IG report was that they recommended that the Department of Energy continues to not advance funds to the TCEP project. When we have a project like this, we take the overall award, which I think was around $450 million for the TCEP project, and we divide it up into phases, phase I, which is the project development, and then phase II, which is construction and operation, and we have milestones within phase I that allow the applicant to get from phase I to phase II. These projects are difficult. Again, the primary difficulty is commercial, commercially difficult. You have to sell the CO_2. You have to sell the urea offtake. You have to sell the power. You have to get your EBC contract in place. You have to get financing. So there's lots of moving parts, and you're trying to do this in an environmental which again it's free to emit as much CO_2 into the environment as you want to, so they're commercially difficult.

They're important, and we worked with the Summit team, you know, over time to give them more time to accomplish some of the milestones. We worked with them to advance in funding from phase II to phase I. Every time we do that, it's a case-by-case decision. I mean, we don't have our feet set in stone. We have to look at what the market's doing. We have to look at what progress is being made, and we have to look at what the risks are to the taxpayer of making the decision to advance funds from phase II to phase I.

At some point, however, you decide that it's not the prudent thing to do in terms of getting the best outcome for the taxpayer, which is exactly what we did in this case. So we have to make

some hard decisions in some cases. We'd love for all the projects to make it. But the bottom line is that these projects are difficult, and if we knew they were all going to make it, there probably would not be a role for the government to help push these along. So——

Mr. BABIN. Let me follow up with something real quickly here. Looking at this and other failed or struggling projects in the fossil portfolio, the connecting thread seems to be the size and the goal of the project. It seems like when the Office of Fossil undertakes a large commercialization project, there are frequent problems and delays. The Department has considerable expertise in research and development, and a long history of success in fossil energy. Shouldn't DOE get the hint and focus on fossil technology R&D instead of investing in companies looking to commercialize energy technology?

Mr. SMITH. Well, Congressman, we do both. I think that both are important roles for our Department. So we invest in those early-stage technologies from controls to systems to materials to next-generation technologies like pressurized oxy-combustion and chemical looping. We think there's an important role for us there. We think there's also an important role for the major demonstrations. Throughout our seven regional partnerships, we've got a number of very, very successful projects that again have stored almost 12 million tons of CO_2 over time. We spoke about the project that we did in Chairman Weber's district, the Air Products project, the Archer Daniels Midland project in Illinois, the Petra Nova project that you and I just spoke about. These are examples of taking ideas from the laboratory and putting them out into the field so they're actually pouring concrete and bending rebar and erecting steel and getting projects built. They're difficult. If they weren't difficult, we wouldn't be working on them.

But—and we learn something every time we do one of these things but I would characterize our risk management methodology as being robust, as being sound, and again, we think that these are really, really important projects and for the future of fossil energy and making sure that all of our sources of energy remain relevant. They're important for coal.

Mr. BABIN. Okay. Thank you.

Mr. Chairman, thank you, and my time is expired.

Chairman WEBER. I thank the gentleman, and I want to thank Chairman, or Secretary Smith for his valuable testimony, for being here, and the record will remain open for two weeks for additional comments and written questions from members.

I do want to say in closing, however, though, that it's our opinion that I think it would be better that the DOE would focus on innovation rather than commercialization and kind of leave as much of that to the private sector as we can. So we thank you for being here, Secretary Smith, and this hearing is adjourned.

[Whereupon, at 11:38 a.m., the Subcommittee was adjourned.]

Appendix I

Answers to Post-Hearing Questions

ANSWERS TO POST-HEARING QUESTIONS

Responses by The Hon. Chris Smith

QUESTIONS FROM CHAIRMAN LAMAR SMITH

Q1. In your opinion, what is the appropriate role of government in fossil energy research and development? Specifically, what do you think the right balance of investments between applied energy research versus demonstration and commercialization of energy technologies is for fossil energy?

Q1a. Do you think this budget proposal achieves that balance?

A1. The Office of Fossil Energy (FE) advances research, development, and demonstration (RD&D) projects that reduce the risk and cost of advanced carbon technologies and further the sustainable use of the Nation's fossil resources. Our goal is to pursue high-impact RD&D that will have a material benefit to our economy and environment but which industry will not undertake solo due to cost, timescales, and/or other key uncertainties. As such, we evaluate our portfolio regularly and make adjustments, as needed, to ensure this balance.

The technical challenges we focus on span the technology readiness levels from research and development to demonstration, depending on the area of focus—all with the goal of supporting commercial readiness. The Fiscal Year (FY) 2017 Budget Request for the Office of FE balances the completion of several major demonstration projects, the continued development of large-scale pilot projects, and lab and bench-scale research into the next generation of fossil energy technologies. The Fossil Energy Research and Development (FER&D) program includes several major integrated carbon capture, utilization, and storage (CCUS) demonstration projects encompassing different innovative technological approaches and applications of CCUS. To date, Department of Energy's major demonstration projects and Regional Carbon Sequestration Partnerships have stored 11.8 million metric tons of carbon dioxide. The FER&D carbon capture program is focused on developing post-combustion and pre-combustion carbon dioxide capture, as well as advanced combustion technologies, such as chemical looping. The FY 2017 Budget Request also includes funding for a new initiative to support a front end engineering design (FEED) study and initial construction of a large-scale pilot facility to capture carbon dioxide from a natural gas power system. The Budget Request also includes funding to support the Discovery of Carbon Capture Substances and Systems (DOCCSS) initiative. DOCCSS is focused on the use of computational chemistry, rapid

synthesis and testing, and manufacturing to accelerate the discovery of transformational capture technologies. These investments and others in the FER&D program, along with collaboration with industry, the National Labs, and other stakeholders, are contributing to the development of innovative technologies that will allow the Nation to use its abundant fossil energy resources in a way that meets our energy needs, ensures environmental responsibility, and secures U.S. leadership in the global clean energy economy.

Q2. The President proposed a wholesale reorganization of the Fossil Energy program - eliminating the distinction between coal and natural gas programs, and combining funding for coal-based carbon capture activities with natural gas-based carbon capture, activity that has been explicitly separated by Congress. Why does the Department want to muddy the water on this issue, particularly when coal and natural gas power plants face different regulatory burdens?

A2. The Department of Energy (DOE) will add a new and distinct activity focused on carbon capture research and development (R&D) efforts for natural gas fired power systems to the program's current portfolio of efforts to develop similar technologies for coal fired systems, thereby utilizing the expertise that already exists in the Department on flue gas separations. This will leverage the technology innovation and lessons learned and developed from the existing R&D program. Studies and Roadmaps by organization such as the International Energy Agency (IEA) suggest that to reach greenhouse gas emissions reductions targets, carbon capture and storage (CCS) will also need to be successfully applied to natural gas fired facilities.1 Under the proposed reorganization, the Post-Combustion and Pre-Combustion Capture activities will remain focused on coal carbon capture while the new Natural Gas Carbon Capture activity will focus on R&D challenges specific to natural gas carbon capture.

Q2a. In the FY 2017 Budget Request, the Department proposes that the technology similarities negate a need to separate programs. But the concentration of CO2 in the flue gas from coal is much different than in natural gas based systems, which could require different solvents and sorbents as well as different designs for the vessels that are used to capture the CO2. So while there may be some areas of overlap in research, there would still be technology challenges that need to be studied and developed separately. How would the Fossil Energy R&D program successfully address these different challenges if the FY 2017 budget reorganization was adopted?

[1] International Energy Agency, Carbon Capture and Storage Technology Roadmap, 2013 Edition, http://www.iea.org/publications/freepublications/publication/technologyroadmapcarboncaptureandstorage.pdf.

A2a. DOE is requesting funding for the natural gas carbon capture R&D activities to address the specific challenges of capturing carbon dioxide from natural gas power plants by adapting the gas separation technologies (solvent, sorbents, and membrane) and processes that have been and continue to be developed for coal. These R&D efforts will require making some changes to the existing processes and possibly some of the materials which is why the Natural Gas Carbon Capture activity is a separate budget line within the Carbon Capture subprogram. The fundamental gas separation techniques are very similar for coal and natural gas power systems, however, which is why it makes sense to keep these activities within the same subprogram. Efforts will continue in the Post-Combustion and Pre-Combustion Capture budget lines to reduce the cost and increase the efficiency of carbon capture from coal fired power systems. In the Natural Gas Carbon Capture line, DOE looks to focus on FEED studies and adapting the existing suite of coal technologies to natural gas systems and conditions. Many of the technologies in the existing coal program are already of interest to the power industry. DOE seeks to leverage these stakeholders' interests and accelerate the development of pilot scale units for natural gas power systems by supporting both FEED studies and subsequent construction and operation of pilot plants, readying carbon capture technology for commercial applications on natural gas systems.

Q3. The FY 2017 budget recommends renaming the Natural Gas Technologies program the "Fuel Supply Impact Mitigation," and provides $13 million for multi-agency research and development focused on "environmentally sound" unconventional oil and gas development within that program. This research is conducted in partnership with the Department of Interior and the EPA starting in 2012. Can you provide an update on the status and goals of this collaborative research?

A3. The three agencies continue to coordinate their research efforts including facilitating forums for researcher to researcher discussions on the topics of resource characterization, water and air quality, water availability, and induced seismicity.

Q4. The Natural Gas program includes $13 million for a new subprogram on "Environmentally Prudent Development," as well as $11 million for a subprogram on emissions mitigation and quantification from natural gas infrastructure throughout the natural gas supply chain. With these two subprograms, it appears that the majority of the Natural Gas program budget is dedicated to emissions quantification and reduction efforts - is any funding from this program going to research and development for new natural gas production technology?

A4. The subsurface science research conducted by DOE and its partners has resulted in improved design, monitoring, and control of fractures and stimulations. It has advanced our understanding of the properties and behavior of the reservoir rock, the well, and the fluids. The FY 2017 budget request includes research funding for increasing our technical understanding of water quality, water availability, air quality, and induced seismicity tied to natural gas production as well as funding for R&D focused on mitigating the impacts of development such as through maintaining wellbore integrity.

Q4a. The FY 2017 budget includes a decrease of $17 million for the Gas Hydrates Subprogram, which will "continue to evaluate the occurrence, nature, and behavior of naturally occurring gas hydrates and the resulting resource, hazard, and environmental implications." This does not appear to include research for the extraction of methane hydrates, a vast but currently inaccessible energy resource. Why is emissions quantification prioritized over innovative energy research within the fossil energy research and development budget?

A4a. The Department received $19.8 million for gas hydrate research in its FY 2016 appropriation. This funding allows DOE to make a financial contribution to the initial phases of the primarily Japanese–funded Alaska North Slope project and allows for DOE's continued participation in that project through technical leadership in FY 2017. The FY 2017 Gas Hydrates request of $2.5 million will be used to continue resource characterization research in the Gulf of Mexico to confirm the nature and regional context of those gas hydrate deposits. Any future gas hydrate funding needs will be evaluated through future budget processes.

How we effectively mitigate the environmental impacts of natural gas production, transport, and use, particularly with regard to climate, will dictate how North America's abundant natural gas resource base can support economic growth and national security as the global clean energy economy continues to evolve. DOE supports innovative research to develop best practices to ensure environmentally prudent development of oil and natural gas resources and also supports developing technologies to better detect and mitigate fugitive methane emissions during oil and gas production, transport, and storage operations.

In FY 2016 the Office of FE is implementing a $12 million Natural Gas Infrastructure Methane Mitigation Research Program and a Methane Emission Quantification Program. This includes a $7 million program for technology R&D focused on reducing methane leaks from natural gas infrastructure and enhancing operational efficiencies of pipelines, storage facilities, and compressor stations. The objective of this research is to develop a suite of technologies that will enable companies to effectively mitigate leaks e.g., smart in-pipe methane sensing device technologies, advanced in-pipe coatings, and composite liner materials. It also includes a $5 million methane emission quantification program to better quantify methane emissions across the natural gas value chain. DOE is working with EPA to ensure that data produced is compatible with the national Greenhouse Gas Inventory and is targeted in ways that will enable improved emissions estimates. Efforts will focus on understanding regional variation and reducing uncertainty in emissions estimates.

Q5. Can you provide additional information on how DOE's proposed crosscutting initiatives in the FY 2017 budget request will impact the Fossil R&D program? The budget indicates that Office of Fossil programs will contribute to five Department wide cross- cutting initiatives in the budget proposal, including Energy-Water Nexus, Subsurface Technology and Engineering, Supercritical C02, Cybersecurity, and Advanced Materials.

Q5a. How will the Department manage these crosscutting initiatives? Is there a case where funds designated for fossil energy R&D will be directed by other offices in the Department?

A5a. While some crosscutting initiatives have co-leads from other DOE Offices, the Office of FER&D funds designated as supporting any given crosscutting initiative will solely be managed by the respective FER&D program office participating in the crosscut.

Q5b. Couldn't this approach dilute funds for Fossil Energy R&D? Why or why not?

A5b. No. Participation in the crosscutting initiatives ensures there is no duplication of effort within DOE offices; identifies appropriate areas of collaboration with other offices; and reflects a coordinated R&D approach within the Department. There is no dilution of funds as FE identifies its own initial research topic areas submitted to the crosscut and exercises full control of any funds allocated. In fact, collaboration within the context of these crosscutting initiatives adds value by leveraging insights

and expertise from outside of the program to help maximize the FE program's R&D funds.

Q5c. What role does the Office of Fossil play in setting the research goals for the Subsurface Technology and Engineering crosscut?

A5c. The Office of FE co-leads the Subsurface Technology and Engineering crosscut and thus has a leadership role in setting the research goals for the effort. FE's portfolio of subsurface related R&D projects, combined with those from other DOE offices, are crucial for identifying the most effective set of research goals that maximize crosscut applications.

Q6. The FY 2017 budget request outlines DOE's water management R&D program, highlighting research activity in water treatment with captured carbon dioxide and desalination. Can you provide an update on the progress and goals of this subprogram?

A6. The goal is to develop alternatives for, or improvements to, the more expensive currently available methods for high-total dissolved solids (TDS) water treatment processes. Technologies are being sought to economically treat extracted waters, for example from carbon storage projects, keeping these waters above ground for beneficial reuse and thereby reducing reinjection volumes or avoiding reinjection all together. Extracted waters can have TDS that reach levels as high as 300,000 ppm, depending on the specific geologic formations from which they are drawn. Initial studies of technologies focused on the treatment of the high-TDS waters are concluding, and identification of technologies ready for field testing the treatment of brines extracted through CCS is underway.

QUESTIONS FROM RANKING MEMBER EDDIE BERNICE JOHNSON

Q1. Mr. Smith, you have been with DOE's Office of Fossil Energy since 2009. Over that time period you have seen several carbon capture demonstration projects for power plants fail: FutureGen, FutureGen 2.0, HECA, and potentially the Texas Clean Energy Project if things are not sorted out soon. I'm sure you are confident and hopeful that the Kemper County and Petranova projects are successful, but that still does not make for a great track record.

Q1a. Besides saying that these projects are difficult - which is a given for any first-of-a-kind project - what could DOE do differently to better steward large demonstration projects and ensure they are successful?

A1a. As you correctly point out, any first-of-a-kind (FOAK) new technology demonstration project is difficult by its very nature. These large Carbon Capture and Storage (CCS) demonstration projects face technological, financial, and regulatory challenges, as well as the ever changing project economics that correspond to changing oil, natural gas, and commodity market prices. All of these factors combined will influence the potential for success of any particular project. Department of Energy (DOE) partners with industry to help commercialize reality critical new CCS technology, while at the same time ensuring that taxpayer funds are properly invested for the advancement of U.S. technological leadership worldwide and for the fulfillment of important U.S. international commitments. Going forward DOE will leverage the knowledge and information gained from previous projects and apply those insights to future projects that build upon the already accomplished technology breakthroughs. Some of the more successful FOAK projects tested their technological proof of concept as small pilot-scale projects first. Once proven, these new technologies were significantly scaled up for commercialization. At the National Carbon Capture Center, DOE is helping the industry transition from the first pilot-scale testing of new technology through the technology scale up to full-scale demonstration and commercialization. DOE also has significant in-house research and technology repository and capability through the National Energy Technology Laboratories that can assist the industry in facing the challenges of commercializing technologies.

Q1b. Why was there such a high rate of failure or withdrawal after DOE awarded the third round of funding for the Clean Coal Power Initiative?

A1b. Large CCS demonstration projects face technological, financial, and regulatory challenges, as well as the ever changing project economics that correspond to changing oil, natural gas, and commodity market prices. In addition, scale-up of innovative technologies is inherently risky and investors in large-scale, capital-intensive projects are inherently risk-averse. That is where the U.S. DOE steps in providing cooperative agreements and loan guarantees to provide project financing to these FOAK projects. Despite the fact that some projects have faced difficulties, DOE has acquired valuable information and tangible benefits from the work accomplished to date. The Department remains committed to advancing carbon capture, utilization and storage through deployment at commercial-scale and the development of next generation technologies that help to increase efficiency and continue to further drive down cost. Three large CCS demonstration projects are on a solid path to success and are scheduled to reach commercial operation within the next year: the Petra Nova project, the ADM project, and the Kemper project. Another large CCS demonstration project, Air Products, has been in successful commercial operation for over three years, and has already captured and permanently stored over 3 million metric tons of CO2 as part of enhanced oil recovery efforts. Once the three pending demonstration projects become operational, they will join Air Products to capture and permanently store a projected total of approximately 6 million metric tons of CO2 per year. The development of any innovative technology is a difficult endeavor. Businesses face significant challenges as they work to introduce innovative, early-state energy technologies to markers. Consequently, some major demonstration projects have failed to reach critical milestones. This once again shows that any demonstration project can be very difficult simply by its very nature of being a FOAK.

Q1c. What steps has the Office of Fossil Energy taken to assess, record, and apply lessons-learned to future projects attempting to demonstrate carbon capture technologies?

A1c. DOE fully understands the importance of ensuring the maximum amount of information and knowledge is gathered from each of these major demonstration projects, whether they are successful or not, and DOE always strives to assess "lessons learned" and to apply those insights to any future projects. That is why capturing and gathering project lessons learned is such a very important part of the

major CCS demonstration program efforts. These lessons learned are gathered from previous projects through discussion with project participants during the duration of the project, and are being compiled and analyzed and where applicable will be applied to any future projects. These project insights also help identify technology gaps that can improve future project execution. This compilation of lessons learned and the application of those insights to any future projects can contribute to potential time savings and reduction in project costs, and can also contribute to the increased likelihood of success for future projects. Some of the lessons learned include allowing for flexibility in the initial project design, to be able to scale the project accordingly to meet the changing economic viability standards. Another is to carefully consider component modularity to best leverage complex manufacturing and construction considerations specific to a particular FOAK new technology project. It is too soon to list all of these since DOE is currently in the process of gathering project lessons learned and will do so with the three remaining CCS Major Demo projects that are scheduled to reach full commercial production in the next six months (Petra Nova, ADM and Kemper). Once these projects reach commercial operation DOE will meet with the project participants to finalize project lessons learned including but not limited to: technology consideration, quantifying and managing project risk, licensing and permitting, environmental and financing considerations, managing public perception, engineering, design, construction, labor considerations, startup/shakedown, operation and maintenance, etc.

Q2. Capturing C02 at power plants on a commercial scale has proven to be a difficult challenge. The technology is available and the science and engineering appear to work. The problem comes when scaling up to a power plant at the 200 MW level and beyond. Yet the pilot projects that DOE is proposing are no larger than 10 MW. I feel strongly that we need to act immediately on climate change, and it is difficult to see how we achieve the results we want in the near-term without further developing these technologies with some urgency.

Q2a. How does DOE intend to solve the plethora of scaling challenges when funding these small scale pilot projects?

A2a. DOE will address the key challenges through these large scale pilots (10+ MWe) by supporting fully integrated systems for carbon capture that significantly reduce the associated costs when compared to first generation technologies. Previous smaller scale research has validated these concepts at the component level. These large pilots

will integrate these components and validate their performance through a series of parametric and long-term tests that will provide the performance data and confidence that these systems can be scaled to commercial application (200+ MWe). The success of these large pilots will provide the utility industry and financial markets more confidence that the risk profiles are low before making investments in new technologies at the commercial scale.

Q2b. Can these projects accelerate the technology fast enough to have a commercial impact within five years?

A2b. Yes, these large scale pilots will be complete in the next 5 years and these technologies will then be ready for commercial demonstration.

Q2c. What are the key technological challenges that the Department of Energy is not testing at the pilot scale that will remain barriers to commercial deployment and how do you plan to address them?

A2c. The key technical challenge not addressed at the large pilot scale is the integration of the capture system with the main power plant. This is an important step that can be addressed in the commercial design process prior to full scale demonstration. This is a technical challenge with relatively low risk and is specific to each individual plant.