



## Quadrennial Energy Review 1.2 Comments

Through its examination of the changes underway in the U.S. electric power sector, the second installment of the Quadrennial Energy Review (QER 1.2) provides critical information to aid decision makers in establishing and executing national energy policies. The National Coal Council (NCC) welcomes the opportunity to submit its recommendations for QER 1.2 in support of the valuable role of coal in ensuring reliable, safe, secure, affordable and environmentally sound energy for our nation's citizens and businesses.

The NCC is an advisory group to the U.S. Secretary of Energy, chartered under the Federal Advisory Committee Act (FACA). The NCC provides advice and recommendations to the Secretary of Energy on general policy matters relating to coal and the coal industry. NCC's mission is purely advisory; NCC is not a lobbying organization.

NCC's members represent a broad cross-section of stakeholders with an extensive breadth and depth of knowledge about coal production, coal use, coal transportation and coal technology. This level of expertise and diversity allows NCC to provide the Secretary with a well-balanced perspective on critical energy issues. A list of current NCC members is available on the NCC website at [www.nationalcoalcouncil.org](http://www.nationalcoalcouncil.org).

In February 2016, the NCC submitted the following reports for consideration by QER development staff. These reports were prepared by NCC over the past two years in direct response to requests from Secretary Ernest Moniz.

- **Reliable & Resilient: The Value of Our Existing Coal Fleet (May 2014)**  
Executive Summary:  
<http://www.nationalcoalcouncil.org/studies/2014/Executive-Summary-Value-of-Our-Existing-Coal-Fleet-May-2014.pdf>  
Full Report:  
<http://www.nationalcoalcouncil.org/reports/1407/NCCValueExistingCoalFleet.pdf>
- **Fossil Forward: Bringing Scale & Speed to CCS Deployment (January 2015)**  
Executive Summary:  
<http://www.nationalcoalcouncil.org/studies/2015/NCC-Fossil-Forward-Executive-Summary-February-2015.pdf>  
Full Report:  
<http://www.nationalcoalcouncil.org/studies/2015/Fossil-Forward-Revitalizing-CCS-NCC-Approved-Study.pdf>
- **Leveling the Playing Field: Policy Parity for Carbon Capture & Storage Technologies (Nov. 2015)**  
Executive Summary:  
<http://www.nationalcoalcouncil.org/studies/2015/Leveling-the-Playing-Field-Executive-Summary.pdf>  
Full Report:  
<http://www.nationalcoalcouncil.org/studies/2015/Leveling-the-Playing-Field-for-Low-Carbon-Coal-Fall-2015.pdf>

Findings and recommendations from these reports have implications for issues outlined in the QER 1.2 stakeholder briefing memo and framing questions. In particular, NCC wishes to highlight recommendations that apply to input sought on:

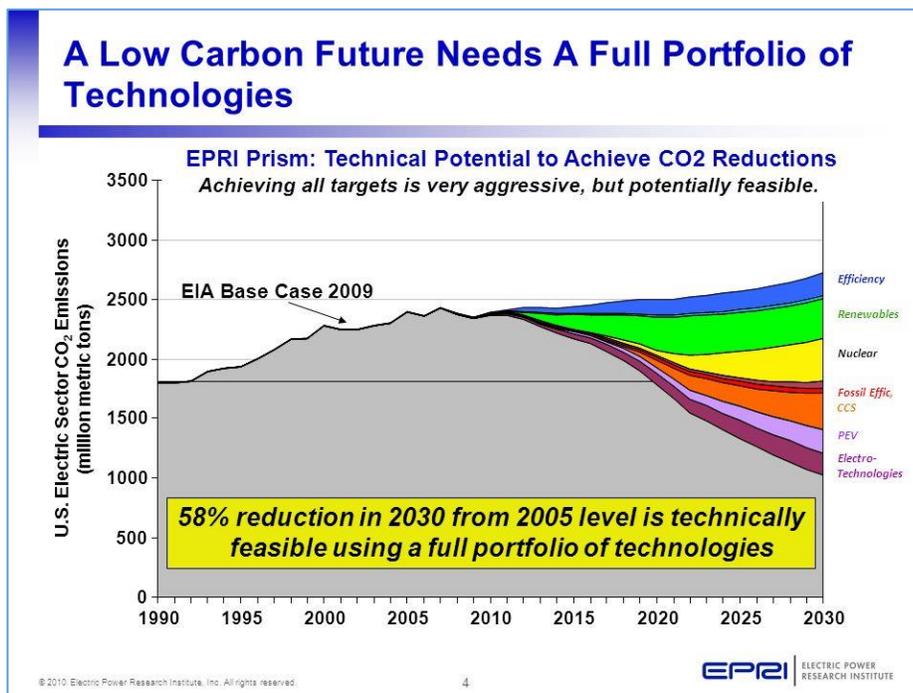
- Generation Portfolio & Reliability
- Grid Operations
- Electricity Markets
- Electricity Valuation
- Innovation & Technology
- Environment
- Resilience

As many of the NCC recommendations overlap in these areas, we have organized our recommendations based on the following critical needs:

- Technological Innovation
- Advancing Environmental Objectives
- A Diverse Energy Portfolio

### **National Coal Council Recommendations Summary**

Many sources have applied detailed techno-economic models to assess the criticality of various energy resources required to meet “least cost” compliance with reduced greenhouse gas emissions. EPRI’s assessment is one such example.



Given this premise, it is critical that the viability and value of coal is appropriately addressed in the context of both a current generation source, as well as a future generation source. A clear imperative exists to continue to shape R&D investments toward commercial proof of carbon capture utilization and storage (CCUS) and high efficiency-low emissions (HELE) technologies to enable coal to be classified as a truly clean fuel alternative – equal in status to today’s renewables. The value of existing coal units to serve current energy needs cannot be underestimated and positive action is required to tailor coal plant roles and economic value toward these ends.

QER 1.2 recommendations must reflect the continuing value coal will provide in meeting the energy needs of U.S. citizens and businesses, as well as the international community. U.S. and global policymakers must firmly understand that fossil fuels – including coal, natural gas and oil – will be used in coming decades to a greater extent than today and that there is a resulting need for carbon capture, utilization and storage (CCUS) and other low carbon coal technologies to be developed and deployed at large scale on an accelerated, priority basis.

The National Coal Council recommends:

- The U.S. Department of Energy (DOE) fund coal technology RD&D programs at levels that are realistically sufficient to achieve the aggressive goals for CO<sub>2</sub> mitigation established by the Administration.
- DOE fully engage in legislative, regulatory and financial initiatives that advance policy parity for CCUS with other low-carbon technologies.
- DOE work with EPA to eliminate New Source Review barriers that disincentivize coal consumers to pursue efficiency improvements and finance innovative technologies.
- DOE support efforts to assess and promote the value of a diverse portfolio of energy resources.

Additionally, the NCC is currently preparing a white paper for Secretary Moniz assessing market opportunities for CO<sub>2</sub> utilization and the extent to which these opportunities might work to advance the deployment of carbon mitigation technologies. This report will be presented to the Secretary in late summer 2016. Recommendations from this report will likely have implications for issues being addressed in the QER 1.2. NCC welcomes the opportunity to submit a summary of these recommendations for QER 1.2 consideration at the end of August 2016.

## The Need for Technological Innovation

Secretary Moniz’s call to “... invest in tomorrow’s energy breakthroughs today” highlights the defining role RD&D must play in driving innovation, lowering costs and accelerating deployment of critical energy technologies.

In its recent reports, the National Coal Council has found that:

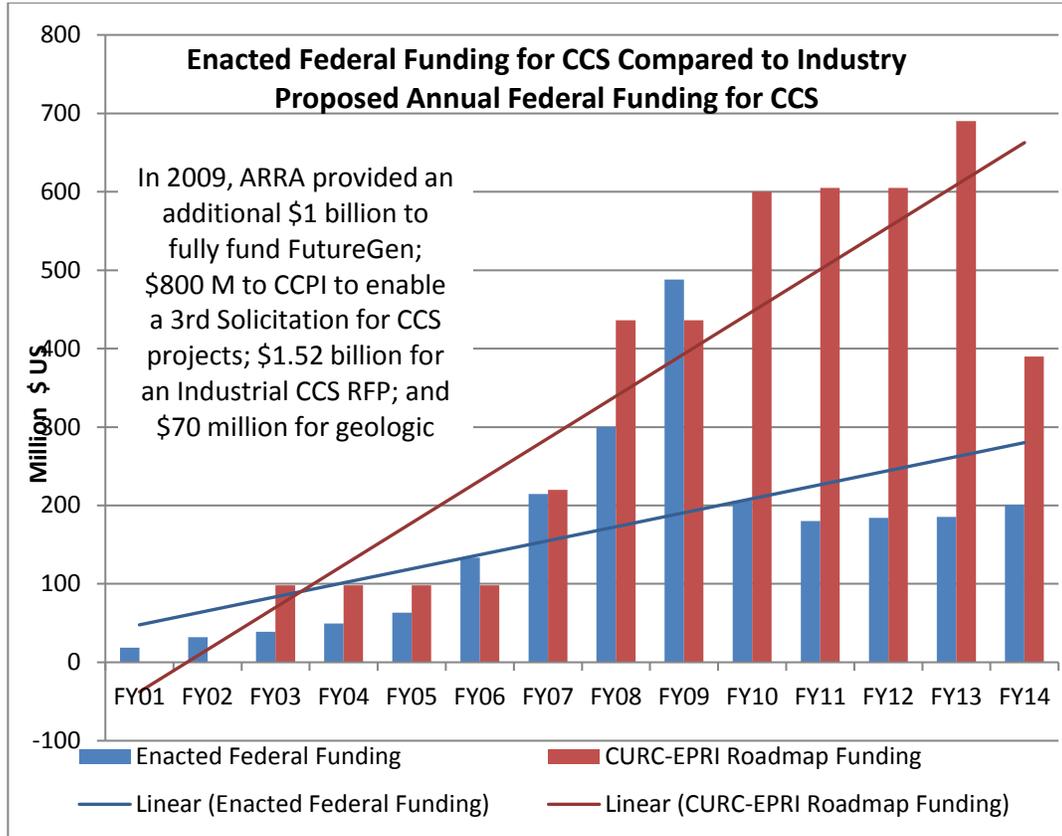
- CCUS is the only large-scale technology that can mitigate CO2 emissions from fossil fuels (coal, natural gas and oil) used for electric generation and key industrial sectors, including cement production, iron and steel making, oil refining and chemical manufacturing.
- Not including CCUS as a key mitigation technology is projected to increase overall costs of meeting CO2 emissions goals by 70-138%.
- Significantly more CCUS pilot and demonstration projects are needed in order to commercially deploy the technology. Without adequate demonstration, there can be no commercialization of CCUS.
- CCS technology is not commercially available at large power plant scale.

Program Area	Key Technology	Number of R&D Projects					Total
		TRL 1	TRL 2	TRL 3-4	TRL 5-6	TRL 7	
<b>Post-Combustion Capture</b>	<i>Solvents</i>		3	9	5	-	17
	<i>Sorbents</i>		3	9	2	-	14
	<i>Membranes</i>		4	5	1	-	10
	<i>Hybrid/Novel</i>		5	3	1	1	10
<b>Pre-Combustion Capture</b>	<i>Solvents</i>		2	1	→	-	3
	<i>Sorbents</i>		2	1	1	-	4
	<i>Membranes</i>		2	5	-	-	7
	<i>Hybrid/Novel</i>		3	-	-	-	3
<b>Compression</b>	<i>Compression</i>		-	-	2	-	2
<b>TRL Totals</b>			24	33	12	1	70
<p><b>Need for fresh, transformational ideas</b>  <b>“Wave” of bench scale projects approaching graduation (1/2 of portfolio)</b>  <b>Up to 12 candidate ≤1MW pilots progressing toward large pilot scale</b></p>							



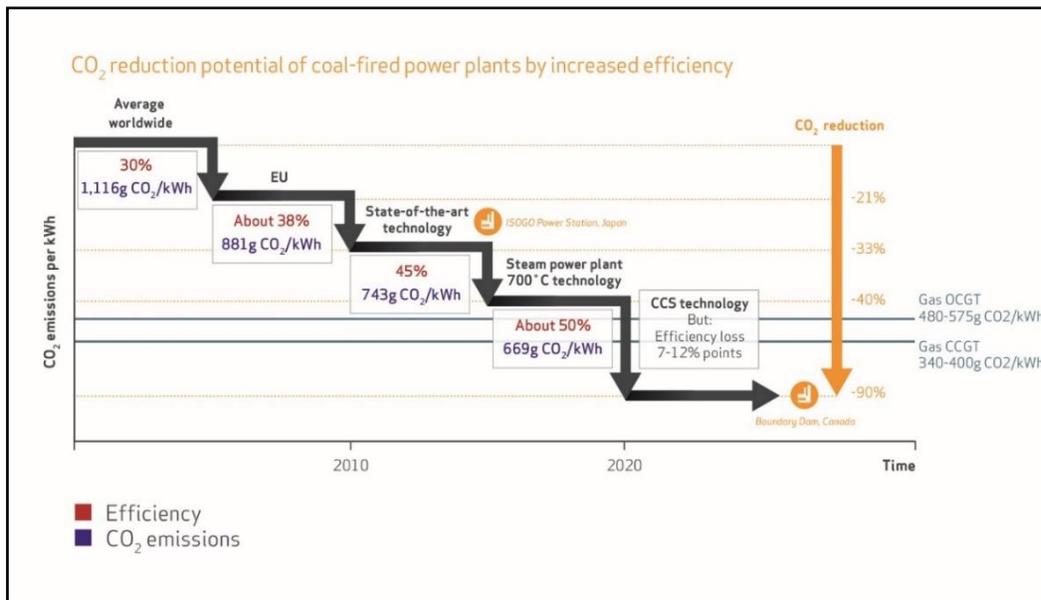
Technology Readiness Levels (TRL) Levels of Carbon Capture R&D Portfolio, DOE/NETL

- Funding for U.S. Department of Energy (DOE) programs for deploying CCS have consistently been inadequately funded and is insufficient to achieve the aggressive goals of the program.



**Federal Funding vs Industry Recommended Funding**

- The infrastructure for transportation and storage of massive quantities of captured CO<sub>2</sub> does not exist. Without this infrastructure, it is difficult to imagine that CCUS can be commercialized.
- Variable end-use demand and integration of renewable energy require increasing flexibility of power plant operations. Enhancing the cycling capability of coal generation will require the development of advanced materials and restructuring of power plant operations.
- The commercial deployment of high efficiency-low emissions (HELE) and carbon capture, utilization and storage (CCUS) technologies will help maintain electric reliability by providing baseload generation. Baseload power is the “always on” power that enables the grid to maintain voltage, frequency and other attributes essential to reliable power supply.



**Increasing Efficiency of Coal Plants by 1% Reduces CO<sub>2</sub> 2-3%**  
 Source: VGB PowerTech 2013, World Coal Association

- Past federal RD&D initiatives to improve the performance and reduce emissions from coal-based power plants has yielded \$13 of benefits for every dollar of federal investment.

### Recommendations on the Need for Technology Innovation

To advance technology innovation, the National Coal Council recommends:

- The U.S. Department of Energy (DOE) align Research, Development, & Demonstration (RD&D) funding with other fuels. DOE needs to substantially increase the budget for RD&D funding for CCS. The CURC-EPRI Roadmap is the industry's best-supported estimate of the funding needed for CCS RD&D. The NCC recommends fully funding CCS RD&D at a minimum as recommended in the CURC-EPRI Roadmap. That would include funding an 80% Federal cost share for early stage RD&D, 100% Federal cost share for large-scale pilots, and a fully funded 50% cost share for commercial demonstrations.<sup>i</sup>
- DOE develop a plan to have a total of 5-10 GW of CCUS demonstration projects in operation in the U.S. by 2025.
- That while DOE continues its strategy of fostering a portfolio of technologies for implementing CCS, in recognition of budgetary constraints and the need to move more quickly in getting larger scale CCS projects operating, DOE cull its support for technologies after they reach TRL Level 4, supporting only those technologies that show a clear promise of meeting or exceeding DOE's CCUS performance goals.
- DOE develop a plan for demonstrating 2<sup>nd</sup> generation and transformational CCS technologies on the scale of 25-50 MW by 2020 and make subsequent budget requests to Congress to carry out the plan.

## The Need to Advance Environmental Objectives

To advance U.S. economy-wide emission reduction goals and U.S. contributions toward international climate objectives, carbon mitigation technologies need to be deployed at an accelerated pace and scale. A more concerted effort is needed, globally, to deploy carbon capture, utilization and storage (CCUS) technologies. As part of a modular approach to mitigating CO<sub>2</sub>, efficiency enhancements need to be pursued through technology retrofits at existing power plants and through the deployment of new, higher efficiency power plants.

In its recent reports, the National Coal Council has found that:

- Federal energy and environmental policies have severely tilted the energy playing field so as to disadvantage the development and deployment of low carbon coal technologies.

### Incentives for Renewable Electricity Generation Compared with Electricity Generation with CCS

<u>INCENTIVE</u>	<u>RENEWABLES</u>	<u>CCS</u>
<b><u>DOE Budget (2012-2016)<sup>ii</sup></u></b>		
<b>FY 2016 (Requested)</b>	\$645 Million	\$224 Million
<b>FY 2015</b>	\$456 Million	\$188 Million
<b>FY 2014</b>	\$450 Million	\$200 Million
<b>FY 2013</b>	\$480 Million	\$186 Million
<b>FY 2012</b>	\$480 Million	\$182 Million
<b>Total DOE Budgets:</b>	<b>\$2.5 Billion</b>	<b>\$980 Million (CCS Demonstration: \$0)</b>
<b><u>Tax Credits (2010-2014)<sup>iii</sup></u></b>		
<b>Investment Tax Credit</b>	\$2.1 Billion	\$1 Billion
<b>Production Tax Credit</b>	\$7.6 Billion	\$0 <sup>iv</sup>
<b>ARRA §1603 Grants in Lieu of Credit</b>	\$24 Billion	\$0
<b>Investment in Advanced Energy Property</b>	\$2.1 Billion	\$0
<b>Accelerated Depreciation for Energy Property</b>	\$1.5 Billion	\$0
<b>Total Revenue Cost:</b>	<b>\$37.3 Billion</b>	<b>\$1 Billion</b>
<b><u>Other Federal Programs</u></b>		
<b>Loan Guarantees (EPA Act '05 §1703)</b>	Yes (\$13.9 billion)	Yes (\$0)
<b>Mandatory Purchase Requirement (PURPA § 210)</b>	Yes	No
<b>Siting and Interconnection Preferences (e.g., FERC Order 792)</b>	Yes	No
<b>Clean Energy Credits (EPA, 111(d) Existing Power Plant Rule)</b>	Yes	No
<b><u>State Programs</u></b>		
<b>Net Metering</b>	44 States	0 States
<b>Renewable Energy Standards</b>	29 States	5 States (CCS applied to standard: 0)

NOTE: DOE issued a solicitation for up to \$8 billion in loan guarantees for advanced fossil energy projects on December 12, 2013. To date, no loan guarantees have been made for an advanced fossil energy project. It is unclear whether any applications have been submitted.

The principal recommendation from the NCC's Fossil Forward report is that in order to achieve CCUS deployment at commercial scale, **policy parity** for CCUS with other low carbon technologies and options is required. In direct response to this recommendation, Secretary Moniz requested that NCC prepare a white paper detailing specific financial and policy measures that could be employed to achieve policy parity for CCUS.

### **Recommendations to Advance Environmental Compliance through Policy Parity for Low Carbon Coal**

The NCC recommends the following financial incentives and regulatory improvements be advanced to ensure achievement of our environmental objectives:

- **Financial Incentives** – for CCS must be substantially increased and broadened to include incentives available to other clean energy sources. Financial incentives fall into two primary categories: (1) those that provide up-front financial support for projects and (2) those that assure guaranteed revenue over the life of the projects. Financial incentives recommended by NCC include:
  - **Contracts for Differences** – The U.S. Department of Energy (DOE) should provide for a CFD structure under which a limited number of projects – at a minimum the first 5-10 GW of output from facilities with CCS – can receive a combination of the incentives described below.
  - **Limited Guaranteed Purchase Agreements** – In order to obtain financing, a limited number of pioneering facilities with CCS should receive a guarantee that their output will be purchased. This is key to the development of an immature technology with a yet uncertain risk profile and a potential for significantly lower cost. It also is a key element in parity, as renewables have benefited from PURPA mandatory purchase requirements. This incentive should be limited in scope to cover at least the first 10 GW of output from facilities with CCS, be designed to encourage geographically diverse projects, and minimize impacts on electricity markets.
  - **Market Set Aside** – True parity would entail a mandatory market set-aside, akin to state renewable energy requirements. The vast majority of renewables construction has occurred in states with an active or impending Renewable Energy Standard (RES). One mechanism to provide a market set aside is a “baseload allowance.” Fossil technologies that deploy CCS or other immature carbon reducing technologies and meet a defined carbon emissions rate while providing baseload power would be eligible for the credit. Given the importance of CCS to meeting climate goals, we recommend a Federal mechanism be explored to authorize a portion of any state-mandated RES to be met through use of qualifying low-carbon fossil baseload, similar to those in Utah, Michigan, Ohio, West Virginia, and Massachusetts.
  - **Clean Energy Credits** – Fossil projects with CCS should receive credit under applicable programs for 100% of CO<sub>2</sub> emissions avoided by deployment of CCS. Programs that currently allocate extra clean energy credits for renewables either should make the same credit available to fossil with CCS, or the extra crediting should be removed to assure parity.

- **Tax Credits and Price Interventions** – Guaranteed purchase agreements, and the ability to attract financing that accompanies it, is only part of the equation. Facilities will not be built by entities subject to traditional utility regulation if state utility commissions determine the cost is too high. In areas with Enhanced Oil Recovery (EOR) opportunity, incentives could involve price support for CO<sub>2</sub> sales. Below are specific proposals:
- **Production Tax Credit** – Policy makers should provide a tax credit for production of electricity with CCS equivalent to that for renewables in Section 45. Options for structuring the credit could include (a) applying the credit consistent with the lower available inflation-indexed rate in Section 45 (i.e., 1.2¢/kWh) for capture at a new facility that brings the rate of emissions to 1,400 lbs./MWh, increasing proportionately to 2.3¢/kWh as the capture and storage rate increases toward 100%; or (b) applying the full 2.3¢/kWh credit to the number of kWh dispatched, multiplied by the capture percentage.
  - **CO<sub>2</sub> Price Stabilization** – Establish a “variable price support” program for CO<sub>2</sub> sequestration under which applicants would bid to DOE for financial support payments for CO<sub>2</sub>, tied to the market price for oil (where EOR opportunities are available). This variable price support would be used under CFD agreements.
  - **Electricity Price Stabilization** – Establish a price support program for electricity under which applicants would bid to DOE for financial support for a limited number of projects. The support would be based on the delta between the amount needed to achieve a commercial rate of return and the amount that can be earned, in the case of regulated markets, at just and reasonable rates, or in the case of deregulated markets, at projected market rates. This variable price support would be used under CFD agreements.
  - **Revise CO<sub>2</sub> Injection Credit** – The Section 45Q tax credit should be revised as follows:
    - Eliminate the requirement that the recipient both capture and inject the CO<sub>2</sub> (which may not be the case, for example, with a power plant selling CO<sub>2</sub> to the oil field);
    - Assure that injection that qualifies under existing verification mechanisms as sequestration is satisfactory to obtain the credit;
    - Provide for transferability of the credit between parties in the capture and injection chain of custody; and
    - Increase the credit to \$40/ton for beneficial reuse (*e.g.*, EOR storage) and \$60/ton for other geologic storage.
- **Tax-Preferred Bonds** – A variety of activities can be funded by tax-preferred and tax-exempt bonds. Renewable projects funded by local governments and electric cooperatives may issue Clean Renewable Energy Bonds under Section 54 of the Internal Revenue Code to finance clean energy projects (those which also are covered by the Section 45 tax credit). Approaches could include extending the Section 54 approach to CCS, or qualifying CCS projects for use of exempt facility bonds issued under Section 142.

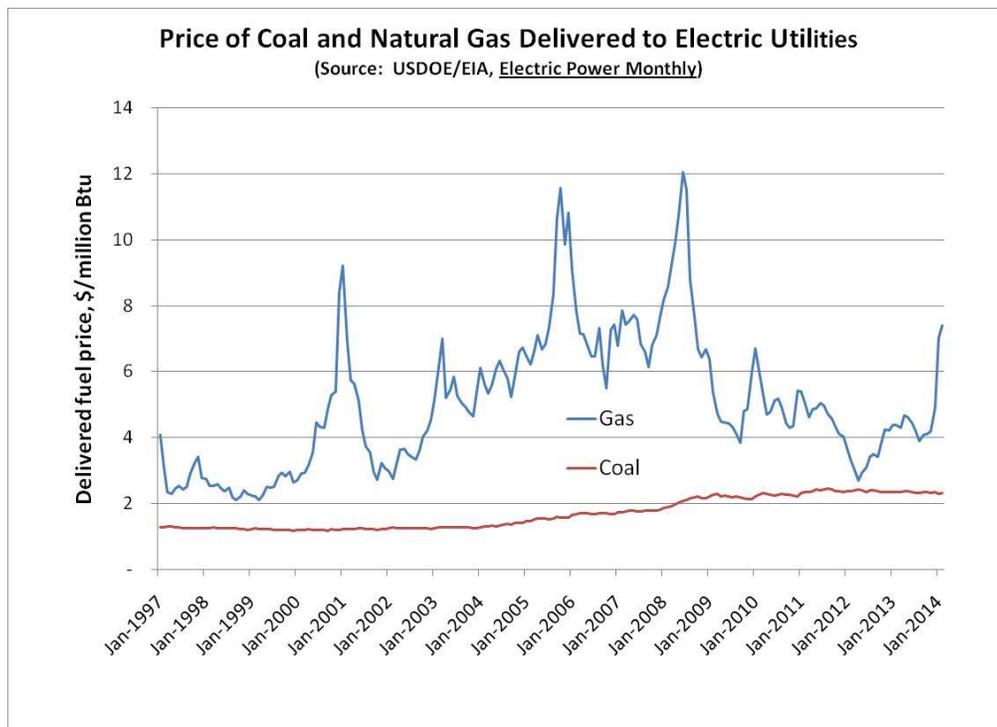
- **Master Limited Partnerships (MLPs)** – Section 7704 of the Internal Revenue Code provides that business structures receiving at least 90% of their income from “qualifying income” can be treated as master limited partnerships for tax purposes; therefore, their income will be taxed only at the individual level, rather than both the corporate and individual level. Currently neither renewables nor low-carbon fossil technologies such as CCS qualify for this treatment. If renewables are made eligible for such treatment, parity requires that CCS also qualify.<sup>v</sup>
- **Loan Guarantees** – DOE’s loan guarantee program has helped renewables, but not CCS. Congress enacted a special \$6 billion program to pay for the credit subsidy cost of renewables, another disparity with fossil deploying CCS. The loan guarantee program should be revised to provide opportunity for the same credit subsidy relief for fossil projects as has been provided to renewable projects under the Section 1705 program.
- **Regulatory Improvements** – The U.S. Department of Energy (DOE) must take the lead in developing a regulatory blueprint which removes barriers to the construction and development of projects with CCS. This blueprint would be applicable to facilities for carbon capture (*e.g.*, industrial facilities such as power stations), transportation and injection. Given its charter and expertise, DOE is central to the development of this blueprint with sister agencies, which would include such elements as addressing the specific regulatory barriers below.
  - **Remove Injection Barriers** – EPA’s 111(d) existing power plant and 111(b) new power plant rules both provide that CO<sub>2</sub> from power plants regulated by the rule that is injected at oil and gas wells be reported under more stringent reporting rules than is currently required. Some CO<sub>2</sub> users have said this will discourage rather than encourage their use of CO<sub>2</sub> from these sources in the oilfield, and that associated regulatory obligations may conflict with state natural resource law. Federal policy should encourage and facilitate reuse of CO<sub>2</sub> from CCS operations, not discriminate against it.
  - **New Source Review** – Power plant efficiency improvements represent a low-cost, low-risk opportunity for coal generators to reduce CO<sub>2</sub> and criteria emissions. The New Source Review (NSR) permitting program unintentionally limits investments in efficiency. Concerns have been raised that retrofits of existing power plants to install carbon capture could trigger NSR requirements of the Clean Air Act. Such retrofits would constitute a “physical change” at the facility, and some may argue this could result in a significant net emissions increase. If we are to reduce CO<sub>2</sub> emissions from existing facilities in the U.S., government policy must eliminate this uncertainty in order to encourage rather than discourage installation of CO<sub>2</sub> emission control equipment. NCC recommends that DOE work with the Environmental Protection Agency (EPA) to eliminate NSR-related barriers that disincentivize generators to pursue efficiency improvements and innovative technologies that would otherwise reduce emissions, increase capacity and enhance plant operations.
  - **Infrastructure Siting** – Federal policy makers should consider Federal eminent domain authority for the siting and construction of CO<sub>2</sub> pipelines, like the authority provided under the Natural Gas Act for natural gas pipelines. If a state does not have authority to provide for siting of a pipeline, or fails to act within a reasonable period, FERC should be available as a backstop siting and permitting authority.
  - **Storage Siting** – The NCC recommends that DOE identify and certify at least one reservoir which is capable of storing a minimum of 100 million tons of CO<sub>2</sub> at a cost of less than \$10/ton in each of the seven regions covered by DOE’s Regional Carbon Sequestration Partnership program.

## The Need for a Diverse Energy Portfolio

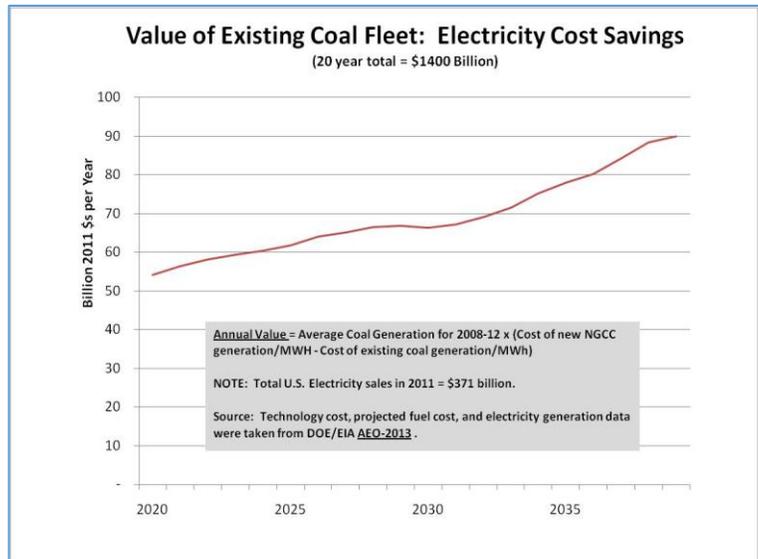
A balanced portfolio of energy resources protects against energy price volatility, promotes economic vitality and enhances national energy security. Diversity of energy resources, as well as a combination of always-on baseload and variable sources, ensures affordable, reliable electric power.

In its recent reports, the National Coal Council has found that:

- A balanced energy portfolio that includes coal, natural gas, oil, nuclear and renewable energy is crucial for the U.S. to reliably and affordably meet its energy needs. Maintaining a diverse energy portfolio includes maximizing the economic and environmental value of the existing coal fleet, as well as ensuring deployment of new high-efficiency, low-emissions coal plants in the future.
- Coal benefits include the direct and macroeconomic advantages of low-cost electricity, the portfolio value of having a diverse mix of fuels and technologies for power generation, and the energy security value of a power generation option that is not dependent upon real-time fuel delivery/transport and is relatively immune to purposeful attack (terrorism).
- Coal has traditionally provided a buffer against higher electricity prices, most notably those resulting from volatile natural gas prices.



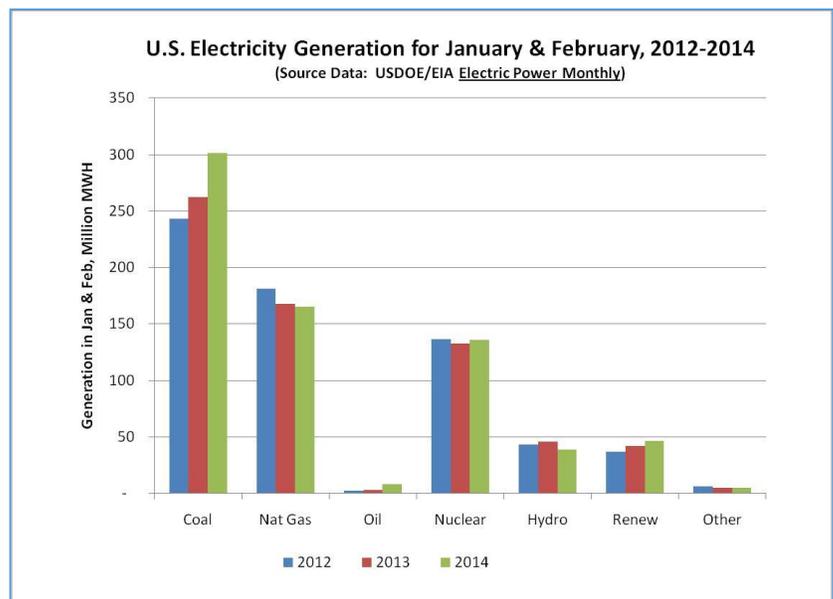
- Coal-based power underpins economic prosperity in the U.S. One way of estimating the value of the existing coal fleet is to calculate the cost of replacing it. If the existing fleet were replaced with the next cheapest alternative generating source, natural gas combined cycle power plants, a conservative estimate of the impact on the U.S. economy would be a 1.5% drop in Gross Domestic Product (GDP) and a loss of 2 million jobs/yr.



- The U.S. existing coal fleet continues to play a vital role in meeting our nation’s electric power needs. The extreme cold weather events of the winter of 2013-2014 highlight the need to maintain a diverse portfolio of generation options in order to ensure the availability of affordable, reliable power for residential and industrial uses.

- The “Polar Vortex” weather events of January/February 2014 demonstrated the contribution of the existing coal fleet, including those units currently (in 2014) scheduled for retirement over the next 2 to 3 years, to the reliability of the U.S. electricity grid. American Electric Power (AEP) reported that it deployed 89% of its coal units scheduled for closure; Southern Company reported use of 75% of its coal units scheduled for closure. Use of these units enabled utilities to meet customer demand during a period when already limited natural gas resources were diverted from electricity production to meeting residential heating needs. Nationwide, over 90% of the increase in power generation in January/February 2014 (versus January and February 2013) came from the existing coal fleet.

- The U.S. benefits from having a diverse portfolio of electricity sources. However, the Energy Information Administration (EIA) projects very little new coal capacity will be built in the U.S. through 2040.<sup>vi</sup> EIA projects that coal’s share of total generation will decline from 39% in 2013 to an average of 37% for 2014-2040,<sup>vii</sup> assuming current environmental regulations.<sup>1</sup>



<sup>1</sup> Current regulations do not include, for example, rules now under development for CO<sub>2</sub> limits, restrictions on cooling water intake structures, and coal combustion residuals (ash) management.

- The commercial deployment of new coal plants with high efficiency-low emissions (HELE) and carbon capture, utilization and storage (CCUS) technologies can help preserve the economic value of energy diversity, fossil fuel reserves and associated infrastructure, while undertaking strong actions necessary to mitigate climate change.

### **Recommendations on the Need for a Diverse Energy Portfolio**

To recognize the benefits associated with a diverse portfolio of energy sources, the National Coal Council recommends:

- DOE pursue initiatives to preserve diversity of the U.S. energy portfolio. Retaining the coal option requires a multi-tiered approach that includes capitalizing on baseload benefits, adapting units to accommodate integration of renewable energy, and advancing deployment of HELE and CCUS technologies.
- DOE ensure that basic federal energy policy assessments, such as the Quadrennial Energy Review<sup>viii</sup> and the President's Advanced Manufacturing Initiatives<sup>ix</sup> consider the impact of lower priced electricity facilitated by coal power plants, and include an assessment of the value of diversity of generation sources and how pending coal plant retirements are likely to impact power prices, availability and reliability.
- DOE lead collaborative efforts with industry to evaluate the implications of generation diversity on the President's advanced manufacturing initiatives and efforts to enhance the global competitiveness of U.S. manufacturers.
- DOE lead collaborative efforts with industry to identify technology pathways that will expedite the deployment of CCS and HELE technologies (see The Need for Technology Innovation page 4).
- DOE support the use of financial incentives and policy parity measures to level the playing field for CCS and HELE technologies with other low carbon technologies (see The Need to Advance Environmental Objectives page 7).

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<sup>i</sup> CURC-EPRI ADVANCED COAL TECHNOLOGY ROADMAP.

<sup>ii</sup> Budgets for “Renewables” reflect funds budgeted to the Office of Energy Efficiency and Renewable Energy for the following line items: “Solar Energy,” “Wind Energy,” “Water Energy,” and “Geothermal Technologies.” Budgets for “CCS” reflect funds budgeted to the Office of Fossil Energy for the line items: “Carbon Capture” and “Carbon Storage.” As noted in the chart, no funds were budgeted for CCS demonstration projects (*i.e.* CCPI). The budget for CCS does not reflect funding for technologies not under the CCS budget that have application beyond electric generation, such as oxycombustion and chemical looping. Budgets available at <http://www.energy.gov/budget-performance>.

<sup>iii</sup> Molly Sherlock and Jeffrey Stupak, ENERGY TAX INCENTIVES: MEASURING VALUE ACROSS DIFFERENT TYPES OF ENERGY RESOURCES 7, Tbl. 2, CONG. RESEARCH SERV., R41953 (Mar. 19, 2015) available at: <https://www.fas.org/sgp/crs/misc/R41953.pdf>.

<sup>iv</sup> While approximately \$30 million of this credit has been claimed, we could find no evidence of the credits being claimed by power projects with CCS.

<sup>v</sup> Note that the House and Senate legislation that has been introduced to extend MLP status to renewables and CCS. Master Limited Partnership Parity Act of 2015, H.R. 2883 and S. 1656, 114th Cong. (2015).

<sup>vi</sup> Annual Energy Outlook – 2014er, USDOE/EIA, December 16, 2013.

<sup>vii</sup> *Ibid.*

<sup>viii</sup> Obama Administration Launches Quadrennial Energy Review, The White House, January 9, 2014, <http://www.whitehouse.gov/the-press-office/2014/01/09/obama-administration-launches-quadrennial-energy-review>.

<sup>ix</sup> White House Advanced Manufacturing Initiatives to Drive Innovation and Encourage Companies to Invest in the U.S., The White House, July 17, 2012, <http://www.whitehouse.gov/the-press-office/2012/07/17/fact-sheet-white-house-advanced-manufacturing-initiatives-drive-innovati>.