DOE-FE Comments on 111(b): Preamble, RIA and TSDs

General Comments:

Use of NETL report:

The 111(b) rule and multiple supporting documents rely heavily upon costs developed by DOE's National Energy Technology Laboratory (NETL). The cost information relied on NETL costs but were adjusted by the EPA to derive costs for new, modified, and reconstructed fossil fuel units. In the time allotted, and given the volume of documentation, NETL cannot fully evaluate the appropriateness of the changes to the NETL costs. Page 34 of the Preamble states: "In this final rule, the EPA is relying on updated cost and performance information available largely from the revised NETL report, 'Cost and Performance Baseline for Fossil Energy Plants Supplement: Sensitivity to CO2 Capture Rate in Coal-Fired Power Plants,' NETL-PUB-22695 (October 10, 2019) (2019 NETL Baseline Report)."

Upon review of this EPA proposal and its reliance on the underlying NETL study, a significant costing error in the underlying NETL study has been identified. Unfortunately, the erroneous data point appears pivotal to EPA's regulatory approach as referenced numerous times throughout the draft regulation and technical support documents. DOE is working to correct this error which may have major ramifications on the economic analysis for this regulation. DOE requests time to correct the underlying study and discuss the corrections with EPA staff.

Technical feasibility of CCS:

DOE has serious concerns with EPA's portrayal of the status of carbon capture and storage (CCS) technologies. For decades, DOE has conducted research, development, and demonstration of these technologies with a proven track record of improving their technical viability and cost effectiveness.

Even though EPA has determined that CCS cannot be the basis of their best system of emissions reduction (BSER), CCS technology has improved over the past 5 years, and DOE continues to make forward progress on improvements to performance and reducing the cost of CCS technologies. Specifically, in FY 2021, the Carbon Capture activity for early-stage pre- and post-combustion capture R&D on transformational gas separation technologies (at least 90% of the CO_2 at 95% purity) aims to significantly reduce the cost of CO_2 capture. The program will also leverage these efforts to reduce the cost of technologies that remove CO_2 directly from the atmosphere, i.e., direct air capture systems. Transformational capture systems are a set of disruptive technologies that can significantly reduce the cost of capture, targeting a cost of electricity (COE) at least 30% less than state of the art (~$30/tonne).

In the economic analysis, the EPA states that Enhanced Oil Recovery (EOR) revenues and 45Q tax credits cannot be taken into consideration as mechanisms for setting national technology standards, due to volatility in oil prices and uncertainties regarding tax credit timing. However, public information shows that approximately 30 projects are currently under consideration[1,2] in the U.S. driven by 45Q incentives

[1] https://www.catf.us/2020/07/ccus-interactive-map/

and EOR revenues. Technology costs have continued to decrease, and a business case can be made for CCS in certain markets and regions of the United States.

Recent public-facing DOE studies have shown this to be the case. The National Petroleum Council recently completed a study on CCS development at the request of the Secretary of Energy.[3] The report states, "The United States has made significant strides in the development of CCUS technologies during the last two decades, which has been aided by public-private partnerships that have driven cost reductions and performance improvements. A DOE funded study found that one plant in Wyoming "would not require an increase in the cost of electricity", and that the CO_2 sales revenue from EOR would adequately cover the capital cost of the project.[4] A similar study for power plants in Colorado[5] show that the addition of CCS can create more jobs, increase tax revenue, and reduce GHGs faster than an alternative proposal of retiring the power plants.

EPA had solicited information concerning their determination that CCS is a feasible technology and presents a number of commenters that cast doubt upon the feasibility of CCS, ultimately determining that no new information was available to change their determination from the 2015 rulemaking and affirmed that CCS is technically feasible. However, over the past 5 years, additional data and many studies have been released which show CCS has evolved and gained a wider acceptance as a cost-effective GHG mitigation strategy.

Recently the International Energy Agency (IEA) published an Energy Technology Perspectives Report on CCS[6] which relies on international experts and peer reviewed literature. The study succinctly outlines the maturity of CCS technologies:

- The maturity of CCS varies considerably by technology type and application: several technologies are already mature and could be scaled up rapidly in applications such as coal-fired power generation and hydrogen production, while others require further development.
- Transport and storage of CO_2 has been demonstrated for several decades.
- CCS technologies are at varying levels of maturity today. Several technologies in CO_2 capture, transport, utilization and storage are already deployed at large scale, but other technologies, including those that hold out the promise of better performance and lower unit costs, require further development.
- A number of other applications have been demonstrated at scale over the last decades, but are still at the early adoption stage, such as chemical absorption from coal-fired power generation and hydrogen production from natural gas, compression of CO_2 from bioethanol production and coal-to-chemicals plants, and CO_2 storage in saline aquifers.
- There are no technical barriers to increase capture rates well beyond 90% for most mature capture technologies.

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[2] https://www.globalccsinstitute.com/resources/co2re/
[3] https://dualchallenge.npc.org/
[4] https://governor.wyo.gov/media/news-releases/2020-news-releases/us-department-of-energy-and-state-of-wyoming-partner-on-study-showing-poten
[5] http://lti-global.com/download/colorado-co2-resource-study-phase-ii/
[6] https://www.iea.org/reports/CCS-in-clean-energy-transitions/CCS-technology-innovation#abstract

The EPA regulation includes preamble language that is not reflective of current CCS technology capabilities and is generalized for regulatory purposes without acknowledging the industry trends and acceptance of the technology as a whole. DOE strongly urges EPA to include additional language on page 92, preceding Section VI, to clarify that the determinations made in their rulemaking are for regulatory purposes only. Suggested language below is provided for consideration and addition to the Preamble:

"EPA acknowledges that CCS technology is commercially available, and there is evidence of project development and continued deployment. Several studies commissioned by the US Department of Energy have shown instances where the local economics, supported by 45Q tax credits and CO_2 sales revenue from Enhanced Oil Recovery, can improve the project economics and, in some cases, offset the cost of CCS. Local conditions may be amenable and even favorable to consider CCS on future systems.

Although there have been no new CCS projects built in the preceding 5 years, technological progress continues to be made in multiple areas of CCS. Reports from Petra Nova and Boundary Dam point to cost decreases for the next offering of their technologies. Several Front End, Engineering, and Design (FEED) studies are underway on emerging CCS projects, which are likely to provide further assurances on the design, construction, operation and maintenance of such projects, and the EPA is aware of multiple projects under consideration that seek to monetize 45Q tax credits. Additionally, the International Energy Agency recently published their Energy Technology Perspective, which shows continued deployment and progress of CCS technologies, including deployments of Direct Air Capture and applications for CCS in the industrial sector.

The EPA continues to find that CCS is technically feasible, however it cannot be recognized as the Best System of Emissions Reduction in this rulemaking. This rulemaking is focused on requirements for new, modified, and reconstructed fossil fueled power plants, and must also consider whether the cost of CCS as a CO_2 abatement strategy is reasonable."

Use of 45Q Tax Credits:

On Page 89, EPA states that: "In addition, the EPA noted that while both these projects are currently operating, both received significant government support to mitigate the financial risks associated with the CCS technology. Because no independent commercial CCS projects are in operation, the EPA solicited comment on whether the fact that Boundary Dam and Petra Nova were dependent on government support casts doubt on the technical feasibility of CCS, e.g., whether it raises concerns as to the extent to which developers are willing to accept the risks associated with the operation and long-term reliability of CCS technology."

While this is strictly speaking true for purposes of this rulemaking, EPA should acknowledge that 45Q is encouraging additional project development, with between 20 and 30 projects having been announced at this time. Although they have not begun construction, a significant effort on the part of DOE, EPA, and IRS to develop guidelines and criteria for these projects has improved financial certainty for additional projects. DOE-FE understands that the tax credits and EOR revenue are not being considered as cost offsets, however it would be prudent to acknowledge these efforts and the number of emerging projects in the absence of a national requirement for CCS.

DOE-FE suggests the following language to be added immediately following the cited paragraph on page 89, preceding the discussion in Section VI:

"EPA acknowledges that the recent draft regulations providing additional information on implementation of the 45Q tax credit has led developers to consider additional CCS projects, in the absence of a national CCS standard. These projects are evidence that there is a commercial market for CCS and industry is investing in the new technology. Many of these systems are likely to be retrofits of existing facilities, however the technical knowledge is likely to carry over to new systems."

Startup, Shutdowns, and Power Plant Considerations

EPA selected as a basis of comparison a bituminous power plant with 16% capture and a sub-bituminous power plant with 26% capture. Per the "NETL Cost and Performance Baseline for Fossil Energy Plants Supplement: Sensitivity to CO2 Capture Rate in Coal-Fired Power Plants" the 16% capture plant corresponds to target operational emissions of 1,400 lb-CO2/MWh-gross. The selected power plant by EPA will in all likelihood not be compliant with the 1,400 lb-CO2/MWh-gross limit in the previous regulation. A plant with a higher level of compliance will be needed to account for partial operation and startup/shutdown cycles which will affect the CO2 emission performance for the power plant. Sensitivities as to startups/shutdowns and partial plant operation will need to be considered by EPA as part of the technical analysis.

Specific comments

Preamble:

General Comment: The preamble only refers to capture costs and availability in CONUS; it is recommended that a statement about the no-availability of storage in OCONUS be included as well.

Page 35/36: *"…*that T&S costs are based on the actual amount of captured CO_2, that capacity factors are impacted by incremental generating costs, and that potential tax credits and revenue from sale of captured CO_2 for EOR should not be considered."

Comment: T&S costs in the Baseline Report are from the Quality Guidelines for Energy System Studies (QGESS) Carbon Dioxide Transport and Storage Costs. The basic plant parameters are 90% capture, 3.2 million tonnes of CO_2 captured annually and a capacity factor of 85%. Tax credits were not considered, sales for CO_2 to EOR were beyond the scope of the CO_2 saline storage cost model.

Recommend that EPA update response to include specific T&S capture rates, volumes, and capacities based on the NETL T&S report to improve accuracy.

Page 36: *"*Specifically, in the 2015 NETL Baseline Report, which, as noted above, served as the basis for the 2015 Rule's cost calculations, the cost of T&S (representative of storage cost for the Midwest and Texas regions and not accounting for any revenues from the sale of CO_2) equaled $11 per tonne of CO_2." Comment: This is not accurate, "Midwest" should be changed to "Illinois Basin" and Texas should be changed to "East Texas".

Page 39: “The T&S costs in this final rule are $28/tonne for the supercritical bituminous EGU and $19/tonne for the supercritical subbituminous EGU.”

Comment: In the 2018 QGESS Carbon Dioxide Transport and Storage Costs in NETL Studies report, T&S cost of $19/tonne CO2 were estimated for the Williston Basin, and $28/tonne CO2 for the Powder River Basin, however these are only two representative storage costs provided in the report. Other formations such as the Inyan Kara, Red River, Mission Canyon, and Cambrian Sandstone formations can provide transport & storage at costs of $19/tonne or less.

Recommend that EPA update text to include specific cost figures per NETL analysis and an explanation that these are not representative of all T&S costs in this section. EPA goes to great lengths to explain the variation in geographical differences, and it would be prudent to expand upon those differences specifically regarding geologic storage costs.

Page 42: The text is missing a number in the text, it should be $1/MWh.

Page 46: "This demonstrates the value of efficient generation in reducing LCOE of new generation without CCS."

This comment is not necessary. Recommendation is to remove this sentence.

Page 50: “In order to implement CCS and be able to rely on the section 45Q tax credit, a developer would have to complete all planning, including arrange all financing and preconstruction permitting, and commence construction by January 1, 2024.”

The quote above is factually incorrect. IRS Notice 2020-12 provides guidance on the determination of when construction has begun on a qualified facility or on carbon capture equipment that may be eligible for the section 45Q credit. It does not require that all planning, financing, and permitting be completed or that construction commence (there is a financial test that can also be met).

Recommendation is that EPA adjust the language to be consistent with IRS 45Q guidelines as follows: “In order to implement CCS and be able to rely on the section 45Q tax credit, a developer would have to [delete: ~~complete all planning, including arrange all financing and preconstruction permitting, and~~] commence construction by January 1, 2024 [insert: as outlined in IRS Notice 2020-12].

Page 55: The data as presented shows a higher O&M cost for Nuclear power projects. A coal power plant can run with 20 people, nuclear needs at least 900. It is recommended that EPA review EIA’s cost figures for O&M.

Page 56-63: Increase cost of LCOE:
In general, the numbers adjusted from NETL studies appear to be within the error margin and/or scaled properly given explanations in earlier text and footnotes.

Page 65: Increase in capital costs / Review of costs: EPA presents the costs as-is within the document; however, NETL is careful to provide the appropriate context of their cost estimates, which is not acknowledged in the document. As NETL States in Section 2.7 of the NETL Baseline Study: “Systems with CO2 capture are Emerging Technologies and Designs that are not fully mature but use the same cost estimating methodology as for mature plant designs, which may not fully account for the unique cost

premiums associated with the initial, complex integrations of emerging technologies in a commercial application. **It is anticipated that early deployments of PC plants with CO2 capture may incur costs higher than those in the baseline report**. Other project and site-specific considerations may also make construction more costly. These considerations are not considered by the capital cost uncertainty." NETL provides costs as a "next commercial offering" or "N-th of a kind" cost estimation, and that new plant costs are likely to be higher than the cost estimations provided by NETL. That is, these costs do not reflect the anticipated cost of building a new CCS plant, and do not include early development costs or large contingencies, which is correctly stated by EPA in the above section. The NETL baseline reports are developed by NETL using a consistent methodology to compare system costs. It would be prudent for EPA to include the following text in the document to acknowledge the above caveats from NETL's cost estimation. The quote referenced below is provided as-is from the NETL baseline report:

"The NETL costs as presented are engineering analysis of emerging technologies and designs which are not fully mature, but use the same cost estimation methodology for mature plant designs. NETL states that early deployment of PC plants with CO2 capture may incur costs higher than those in the baseline report. Other project and site specific considerations may also make construction more costly, and are not considered by the capital cost uncertainty as presented in the NETL Baseline Report."

Page 70: "However, the emission rates listed in the NETL Baseline Reports are more representative of the overall average than the maximum 12-operating month emissions rate."

Comment: The NETL value is not an overall average, instead it is CO2 emissions at the full-rated load only. The overall average of a deployed unit, including starts/stops and part-load operation, would be inevitably higher on a per-MW basis. The main purpose of the NETL baseline study is to provide a basis for the analysis/comparison of technological advancements and not the basis emissions rate determinations. The EPA representation and assertion that it is an "overall average" is incorrect. Recommend that the text be changed to the following quote:

"However, the emission rates listed in the NETL Baseline Reports are more representative of a CO2 emissions rate at full-rated load only and do not represent a 12-month average operating rate."