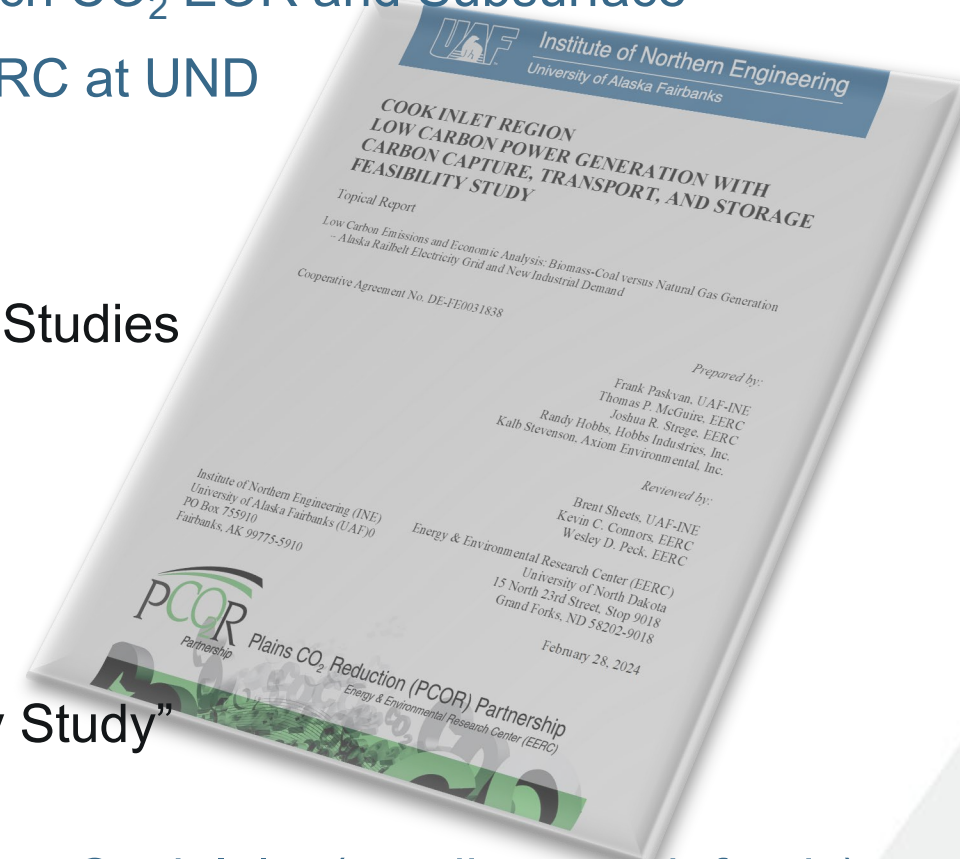




- 1980: UAF started Petroleum Engineering program
- 1984: UAF-INE started Petroleum Development Lab. Research CO<sub>2</sub> EOR and Subsurface
- 2019: UAF-INE began CCUS work—joined PCOR led by EERC at UND
- 2022: started Alaska CCUS Workgroup
  - Build CCUS Network, Support Carbon Storage Laws and Regulations, Host Technical Discussions, Perform CCUS Studies
  - <http://INE.UAF.EDU/Carbon> documents outcomes
    - #6: SPE 213051: “Alaska CCUS Workgroup and a Roadmap to Commercial Deployment”
    - #9: “Cook Inlet Region Low Carbon Power Generation with Carbon Capture, Transport, and Storage Feasibility Study”
- 2024:
  - initiate ARCCS Project, Carbon Storage Assessment northern Cook Inlet (pending match funds),
  - apply for DOE DE-FOA-3014 RITAP to fund ACORN to continue CCUS efforts (for next 3 years)



## Affordable and Reliable Energy through Carbon Capture Use and Sequestration

Petroleum Development Laboratory  
Alaska CCUS Workgroup  
[ine.uaf.edu/carbon](http://ine.uaf.edu/carbon)



Carbon Capture Use and Sequestration (CCUS)  
has the potential to:

- ✓ reduce the cost of energy.
- ✓ meet future voluntary or required emission reductions.
- ✓ make oil-, gas-, and coal-fired heat and power plants nearly carbon-neutral.
- ✓ remove both CO<sub>2</sub> and pollutants.

CCUS research at UAF's Institute of Northern Engineering focuses on:

- building knowledge and establishing a legal and regulatory framework for Alaska.
- conducting feasibility studies to improve the use and sustainability of local energy resources.
- innovating new energy industries in Alaska (e.g. direct air capture of CO<sub>2</sub>; hydrogen or ammonia-based fuel from natural gas).
- developing Alaska's workforce through the Energy Resources Engineering program at the University of Alaska Fairbanks starting in the fall of 2024.

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[www.alaska.edu/nondiscrimination](http://www.alaska.edu/nondiscrimination).  
All images by UAF/INE

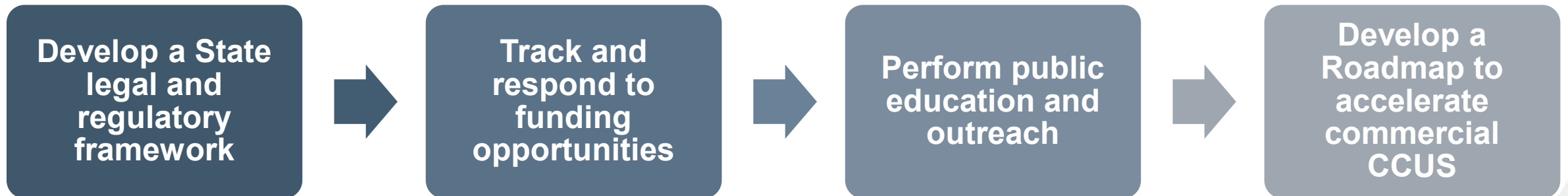




The CCUS workgroup mission is to accelerate commercial carbon capture projects in Alaska.

## Why?

- To attract new investments and
- To create options to decarbonize activities vital to the State's economy including power generation, refineries, and oil and gas production.



# ARCCS Project

Determine CO<sub>2</sub> storage volume Northern Cook Inlet

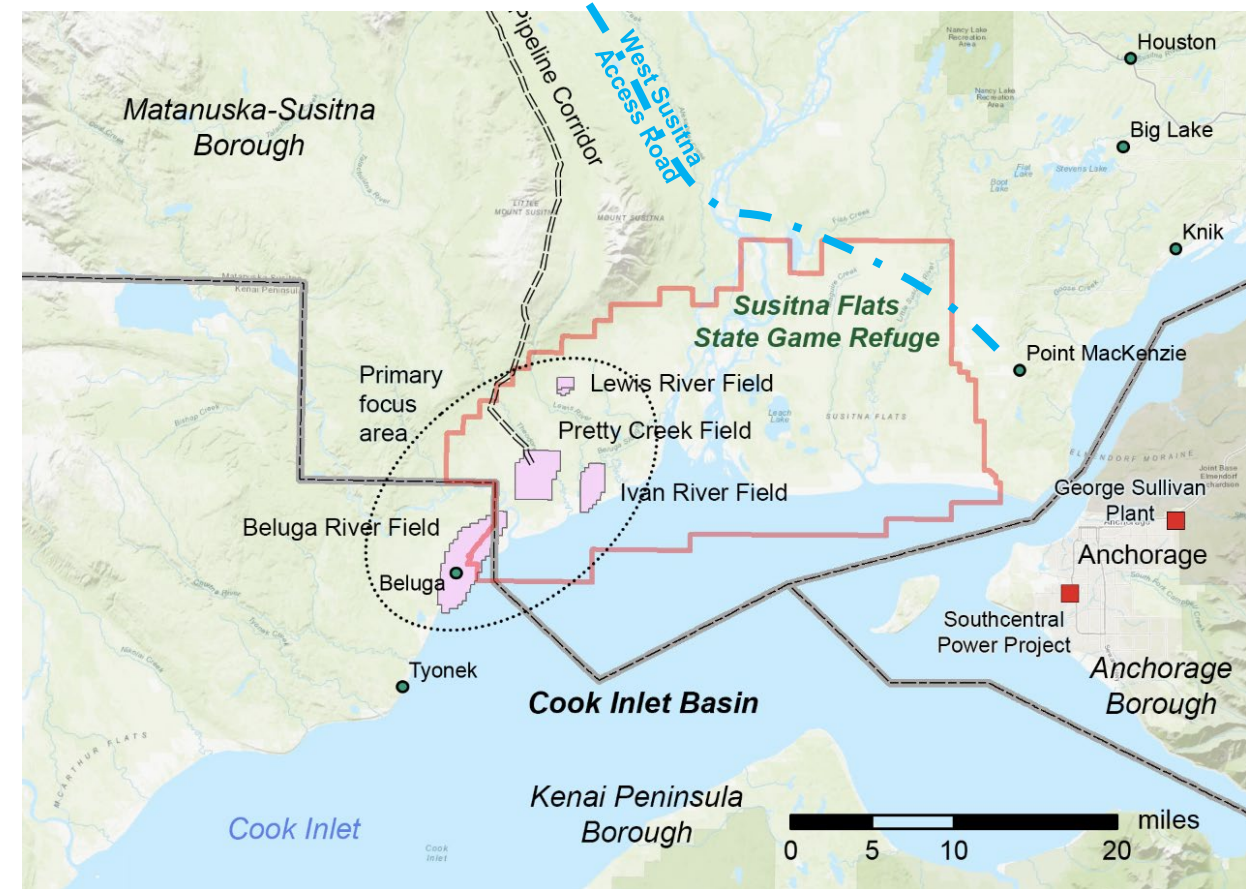


Institute of Northern Engineering  
University of Alaska Fairbanks

- Carbon Storage capacity, proved through engineering and geoscience, is key requirement for any CCS Project
- Beluga River Field has estimated 60+ years storage for 300 MW net biomass-coal power plant with CCS
- Project evaluates aggregating CO<sub>2</sub> from Chugach Electric's two Anchorage natural gas power plants
- DOE awarded \$9 million to UAF November 2023. Cannot be accepted until matching funds secured.
  - \$2.2 million matching funds request included in UA Budget, pending with AK Legislature

ALSO NEED Carbon Storage Volume Assessments for 1) Interior AK, 2) Cook Inlet Total Storage Capacity

## Alaska Railbelt Carbon Capture and Storage (ARCCS) Project



# Alaska CO<sub>2</sub> Reduction Network (ACORN), UAF-INE's proposal for RITAP funding



- **UAF-INE applied for Regional Initiative for Technical Assistance Partnerships (RITAP) funding from DOE DE-FOA-3014 to:**
  - Continues CCUS Workgroup
  - Expands CCUS technical support in Alaska via UAF B.S. Energy Resources Engineering (formerly Petroleum)
  - Funds for three years, if awarded
- **Builds Alaska capability to perform feasibility studies and geotechnical evaluation of secure CO<sub>2</sub> storage**
- **Supports Energy Industry Training for the Next Generation**

**Project Title:** Alaska CO<sub>2</sub> Reduction Network (ACORN) Project  
**Applicant Name:** University of Alaska Fairbanks (UAF)  
**Principal Investigator:** Dr. Abhijit Dandekar  
**Associated Organization:** DNR Division of Geological & Geophysical Surveys, Marwan Wartes  
**Project Objectives:**

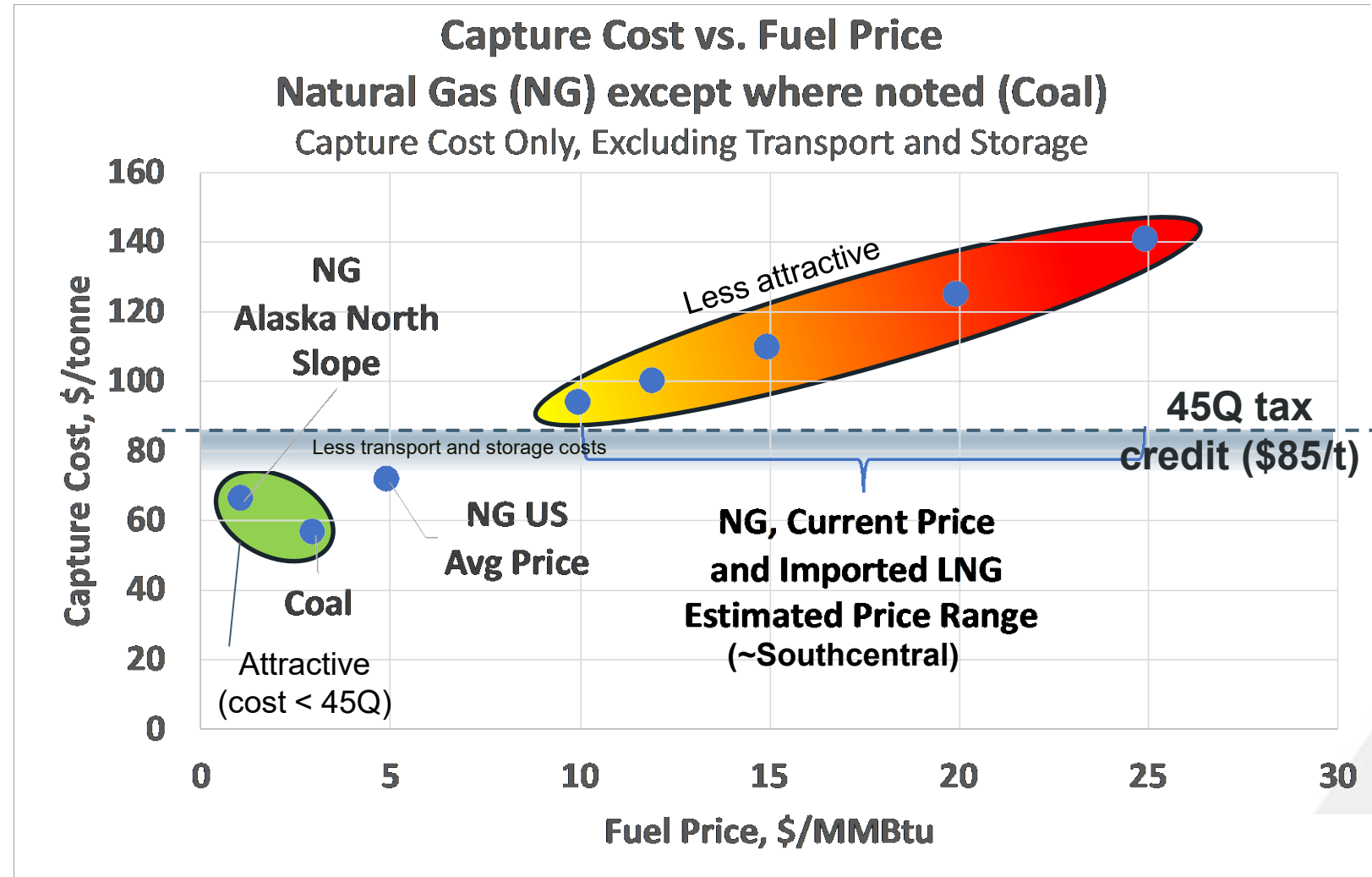
Carbon capture use and sequestration (CCUS) in Alaska can attract new investments and create decarbonization options for power generation, industrial processes, and oil and gas operations that are vital to the State's economy. Decarbonizing in a safe, reliable, and cost-effective manner can enable continued clean operation of equipment, improve community health and welfare, and mitigate carbon risks. Building on UAF's momentum and past successes, the Alaska CO<sub>2</sub> Reduction Network (ACORN) Project will expand collaboration between industry, regulators, educators, technology providers, and investors. ACORN assists commercial CCUS deployment in the following ways:

- Supports transitioning UAF's successful, ABET-accredited B.S. Petroleum Engineering (PETE) program into Energy Resource Engineering (ERE). ACORN supports Faculty hiring (engineering, geosciences, and energy focused) for curriculum development and delivery. These Faculty will develop Alaska and America's future energy industry workforce, graduating versatile, robust professionals prepared for the energy challenges facing society.
- Supports ERE Faculty who will provide expert carbon capture and sequestration (CCS) technical assistance to industry projects and prepare CCS studies and feasibility reports. Reports and data will be publicly available via the new CCS database constructed by the Alaska Dept. of Natural Resources (DNR), and Alaska Oil and Gas Conservation Commission (AOGCC).
- Provides support from the DNR Division of Geological and Geophysical Surveys (DGGS), from the U. of North Dakota's Energy and Environmental Research Center (EERC), and from Petrotek. Their staff, among others, will serve on ACORN's Industry Advisory Board and be available to answer questions and support the ERE Faculty.
- Creates a stronger network and positive environment for CCS development in Alaska by continuing the Alaska CCUS Workgroup. The CCUS Workgroup has been meeting since 2021. ACORN will enable continuation of this Workgroup whose funding would otherwise expire September 2024.
- Creates Forums to promote interchange of ideas and sharing of experiences. Forums will employ the philosophy and guidelines of Society of Petroleum Engineers (SPE) Forums, designed to be collaborative, idea-generating meetings that stimulate new ideas and innovation to meet upcoming challenges to the industry. They bring together top technologists, innovators, and stakeholders to address specific industry challenges.
  - Technical Forums will be established by sub-basin and technical topic, inviting key individuals to collaborate across projects, interchange ideas, and share experiences.
  - A Community Benefits Forum will be established where Alaska's multiple CCS project teams can discuss and align on best practices, public engagement, and community benefits plans.
- Supports the DNR DGGS expansion of CCS data and report compilation for sedimentary basins around the state into the DNR and AOGCC's Alaska CCS database.



Based on SPE paper 213051 Table 1, Paskvan et. al. <sup>1</sup>

- **Alaska Capture Screening**
  - Using typical Lower 48 costs
  - Fuel price a key cost driver
  - Capture cost only, excluding transport & storage costs
- **With Lower 48 costs and 45Q**
  - Natural gas capture attractive on North Slope
  - Natural gas capture less attractive for Southcentral
  - Coal capture looks attractive Statewide
- **Further work should be done for attractive projects**



<sup>1</sup> Cost methodology benchmarked against NETL, U.S. Department of Energy National Energy Technology Laboratory, 2015, "Cost and performance baseline for fossil energy plants volume 1a: Bituminous coal (PC) and natural gas to electricity" revision 3. July 6, 2015, DOE/NETL-2015/1723.



- **CCS Technology is Proven and Cost Effective**

- per EPA, CCS adequately demonstrated technology for certain natural gas- and coal-fired power generation
- 90% capture CCS required for long-term coal-fired boilers by Jan. 1, 2032 to run after 2039
  - See 4/25/2024 EPA Fact Sheet on GHG Standards for Fossil Fuel-Fired Power Plant Rule

- **Use of Alaska's abundant Coal, Oil, and Natural Gas resources may require CCS**

- With CCS, coal and natural gas power plants across Alaska can provide clean, reliable, decarbonized power



Coal is the most abundant fossil fuel in the U.S.

27% of the world's coal is in the U.S.  
and half of all U.S. coal resources are found in Alaska



### BSER At-A-Glance

FINAL CARBON POLLUTION STANDARDS FOR NEW AND EXISTING FOSSIL-FUEL FIRED ELECTRICITY GENERATORS			
Existing 111(d) Steam Generators		New Source and Reconstructed 111(b) Stationary Combustion Turbines	
Coal-Fired Boilers	Natural Gas and Oil-Fired Boilers	Phase I Date of promulgation or initial startup	Phase II Beginning in Jan 1, 2032
<p><b>Long-term subcategory:</b> For units operating on or after January 1, 2039</p> <p><b>BSER:</b> CCS with 90 percent capture of CO<sub>2</sub> (88.4% reduction in emission rate lb/MWh-gross) by January 1, 2032</p>	<p><b>BSER:</b> routine methods of operation and maintenance with associated degree of emission limitation:</p> <p><b>Base load unit standard:</b> (annual capacity factors greater than 45%) 1,400 lb CO<sub>2</sub>/MWh-gross</p>	<b>Low Load Subcategory (Capacity Factor &lt;20%)</b>	
		<p><b>BSER:</b> Use of lower emitting fuels (<i>e.g.</i>, hydrogen, natural gas and distillate oil)</p> <p><b>Standard:</b> less than 160 lb CO<sub>2</sub>/MMBtu</p>	EPA is not finalizing a Phase II BSER for low load units
<p><b>Medium-term subcategory:</b> For units operating on or after Jan. 1, 2032, and demonstrating that they plan to permanently cease operating before January 1, 2039</p> <p><b>BSER:</b> co-firing 40% (by heat input) natural gas with emission limitation of a 16% reduction in emission rate (lb CO<sub>2</sub>/MWh-gross basis) by January 1, 2030</p>	<p><b>Intermediate load unit standard:</b> (annual capacity factors greater than 8% and less than or equal to 45%) 1,600 lb CO<sub>2</sub>/MWh-gross.</p> <p><b>Low load units:</b> (annual capacity factors less than 8%) a uniform fuels BSER and a presumptive input-based standard of 170 lb CO<sub>2</sub>/MMBtu for oil-fired sources and a presumptive standard of 130 lb CO<sub>2</sub>/MMBtu for natural gas-fired sources.</p> <p>Compliance date of January 1, 2030</p>	<b>Intermediate Load Subcategory (Capacity Factor 20% to 40%*)</b> *Source-specific upper bound threshold based on EGU design efficiency	
		<p><b>BSER:</b> Highly efficient simple cycle technology with best operating and maintenance practices</p> <p><b>Standard:</b> 1,170 lb CO<sub>2</sub>/MWh-gross</p>	EPA is not finalizing a Phase II BSER for intermediate load units
<p>For units demonstrating that they plan to permanently cease operating before January 1, 2032</p> <p>Units are exempt from the rule. Cease operations dates finalized in state plans for exemption purposes are federally enforceable.</p>		<b>Base Load Subcategory (Capacity Factor &gt;40%*)</b> *Operation above upper-bound threshold for Intermediate Subcategory	
		<p><b>BSER:</b> Highly efficient combined cycle generation with the best operating and maintenance practices</p> <p><b>Standard:</b> 800 lb CO<sub>2</sub>/MWh-gross (EGUs with a base load rating of 2,000 MMBtu/h or more)</p> <p><b>Standard:</b> 800 to 900 lb CO<sub>2</sub>/MWh-gross (EGUs with a base load rating of less than 2,000 MMBtu/h)</p>	<p><b>BSER:</b> Continued highly efficient combined cycle generation with 90% CCS by Jan 1, 2032</p> <p><b>Standard:</b> 100 lb CO<sub>2</sub>/MWh-gross</p> <p>EPA's standard of performance is technology neutral, affected sources may comply with it by co-firing hydrogen.</p>
For new and existing units installing control technologies, a 1-year extension is available in situations in which implementation delays are due to factors beyond the EGU owner/operator's control. For existing units with cease operations dates, a 1-year extension is available in situations in which the unit is needed for reliability through a reliability assurance mechanism, provided appropriate documentation is submitted.			
<b>Major Modifications 111(b) Coal-fired Steam Generators:</b> Standards of performance for coal-fired units that undertake a large modification ( <i>i.e.</i> , increases hourly emission rate by more than 10%) mirror the emission guidelines for existing coal-fired steam generators.			

Interested parties can download a copy of the final rule from EPA's website at [Greenhouse Gas Standards and Guidelines for Fossil Fuel-Fired Power Plants](https://www.epa.gov/greenhouse-gas-standards-and-guidelines-for-fossil-fuel-fired-power)

<https://www.epa.gov/stationary-sources-air-pollution/greenhouse-gas-standards-and-guidelines-fossil-fuel-fired-power>

