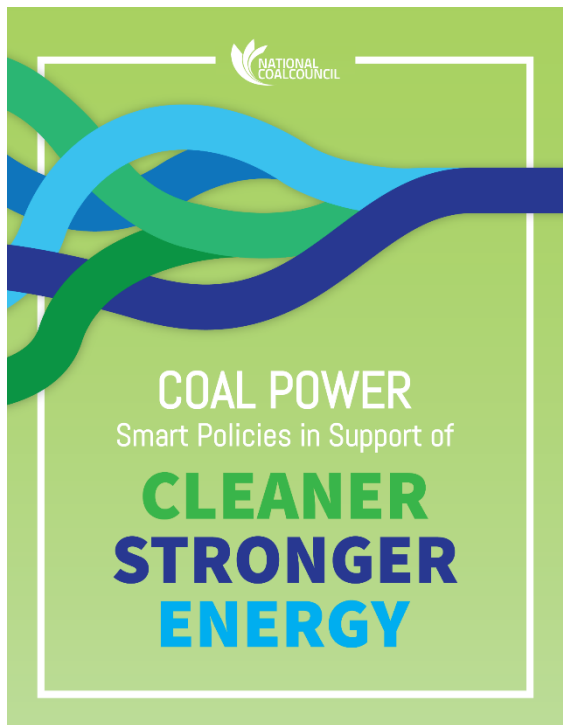




Secretary of Energy’s Request

“... develop a white paper assessing smart policies in support of advanced coal-fired power generation technologies ... provide an industry perspective on the future of advanced coal technologies in the power sector ...”



Key Questions Addressed

- ~ What regulatory and legislative initiatives could be advanced to help accelerate the deployment of coal generation technologies?
- ~ What coal generation technologies would benefit from regulatory and legislative reforms?
- ~ What energy infrastructure initiatives would support the deployment of advanced coal generation technologies?

Principal Challenges

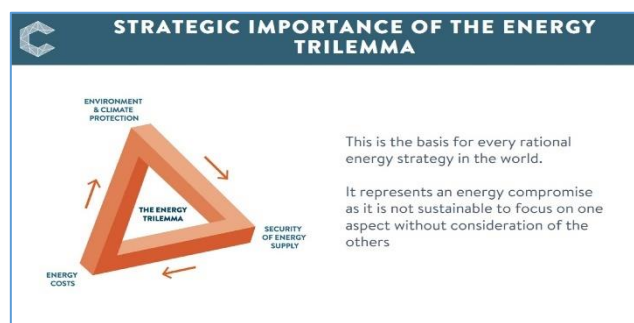
The U.S. strives to achieve an energy trilemma balance between security of energy supply, energy cost containment and environmental protection.

A growing number of states and utilities have established low-carbon or carbon reduction requirements to be met by mid-century or sooner.

Existing energy policies are insufficient to incentivize deployment of advanced coal generation technologies at scale and in a timely manner.

The Value of Advanced Coal Generation Technologies

The deployment of advanced coal generation technologies holds tremendous promise for reducing greenhouse gas emissions. Other nations have made strides in deploying cost-effective low-carbon technologies. To-date, however, there has been limited deployment of these technologies in the U.S.



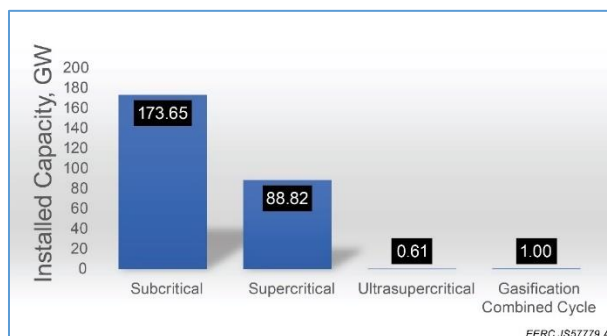
Source: International Energy Agency

Ultra-Supercritical Coal Capacity Worldwide

REGION	IN OPERATION
	2018
Asia	224203
Europe	19208
Middle East	0
Eurasia	300
North America	665

Source: International Energy Agency

Installed Generation Capacity U.S./EIA





Advanced Coal Generation Technologies in Support of Coal FIRST

The U.S. Department of Energy’s Coal FIRST initiative supports development of technologies that would have a minimal environmental footprint, reduce up-front costs and be more responsive and flexible. NCC’s COAL POWER report assesses the current status of advanced technologies, their ability to meet DOE’s Coal FIRST objectives for **Flexibility**, **Innovation**, **Resilience**, **Small-scale** and **Transformation**, and their potential for retrofit or new plant applications.

Technology	Retrofit	New Plants	Flexible	Innovative	Resilient	Small	Trans-formational
Currently Deployed Technology							
USC	X	X	X	X	X	X	X
IGCC	X	X	X	X	X	X	X
Post-combustion CCUS	X	X	X	X	X	X	X
Technologies Under Development							
AUSC	X	X	X	X	X	X	X
sCO ₂	X	X	X	X	X	X	X
Post-combustion CCUS	X	X	X	X	X	X	X
Oxy-Combustion	X	X	X	X	X	X	X
Pressurized Oxy-Combustion	X	X	X	X	X	X	X
PFBC	X	X	X	X	X	X	X
Chemical Looping	X	X	X	X	X	X	X

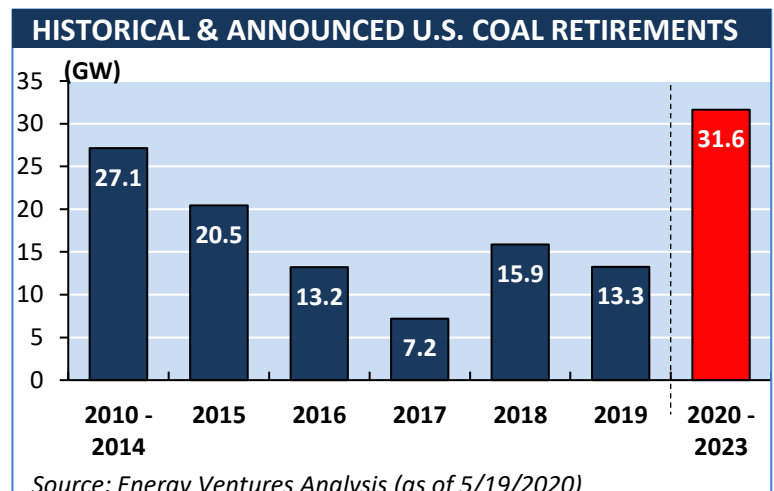
Red = not likely applicable, yellow = potentially applicable, green = highly applicable.

Existing Coal Fleet

Since 2010, approximately 40% of the coal fleet has been or is planned to be retired. Nearly 32 GW of coal generation is expected to retire between 2020 and 2023. Opportunities exist to retain these valuable assets, enhancing their efficiency and environmental profiles with the adoption of newer technologies and features with modest cost and a reasonable cost/benefit ratio.

Efficiency improvements can significantly lower CO₂ emissions. A 1% improvement in efficiency of a standard coal plant results in a 2%-3% reduction in CO₂ emissions.

The inhibiting impacts of New Source Review (NSR) regulations on coal power plant efficiency improvements have been addressed by the NCC since 2001. NCC supports regulatory initiatives at EPA and legislative proposals in Congress to eliminate NSR-related barriers to efforts to enhance coal plant efficiency.



New Coal Generation

All of the advanced technologies currently deployed and under development would enhance the environmental profile of new coal plants. In order to realize a low-carbon future derived from reliable generation sources, a greater level of investment in these technologies is needed along with enhanced support for demonstration and large-scale pilot projects.

Principal Findings & Recommendations

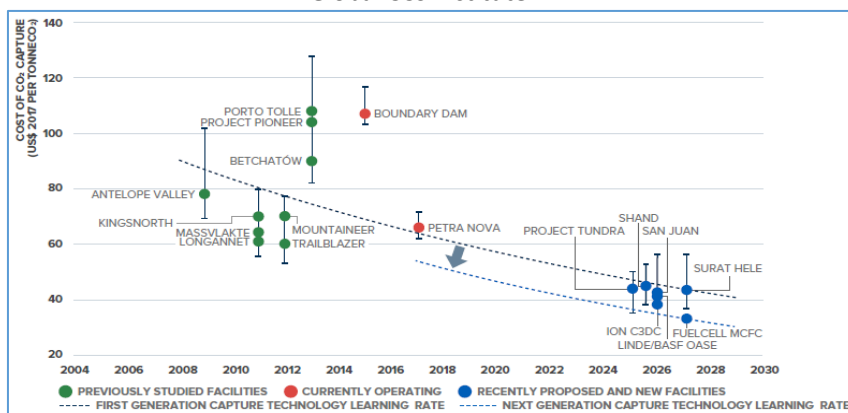
A growing number of states and utilities have established low-carbon or carbon reduction requirements to be met by mid-century or sooner. Meeting these goals with affordable, reliable energy will require deployment of low-carbon or decarbonized power systems. There is an urgent need to undertake technology research, development, demonstration and deployment (RDD&D) initiatives that:

- Lower the cost of carbon capture, utilization and storage (CCUS) and high efficiency-low emissions (HELE) technologies through learning by doing at demonstration and commercial projects.
- Eliminate deployment bottlenecks due to lack of carbon dioxide (CO₂) pipelines and storage sites.
- Foster commercialization of next generation, near-zero emissions coal power plants that can compete on cost and environmental performance with other low-carbon energy resources.

Cost of CO₂ Capture - Coal Power Plant with Post-combustion Capture
Global CCS Institute

The deployment of more advanced coal technology demonstration and large-scale pilot projects will aid in significantly reducing the cost of CO₂ emission reductions.

There is an abundance of Federal legislative and regulatory opportunities currently available to support these objectives, as detailed in the accompanying Technology-Policy Matrix. States are also employing various legislative and regulatory tools to support coal and the deployment of advanced coal technologies, providing financial incentives and R&D support, streamlining permitting, and addressing concerns associated with regulatory certainty and the reliability/resilience of the power system.



NCC supports policies that provide:

- Enhanced support for U.S. Department of Energy R&D for technology projects that extend beyond basic R&D and development of niche market applications for small-scale modular coal power units.
- Enhanced Federal support to minimize investor cost and risk, reduce regulatory burdens and reform energy markets.
- Enhanced state, regional and tribal support expanding eligibility for and incentivizing deployment of low-carbon energy technologies in compliance with state emissions reduction goals.
- Enhanced support for energy infrastructure projects that enable deployment of advanced coal generation technologies, including demonstration and commercial-scale projects, characterization of geologic storage and CO₂ pipeline capacity.

In order to meet mid-century carbon reduction targets, three critical objectives will need to be met over the next 20 years.

- By 2030, retrofit a critical mass of existing coal power plants with carbon capture and efficiency enhancing technologies, more fully demonstrating the viability and maturity of these technologies and their availability through competitive bid from multiple vendors.
- By 2035, establish a growing network of CO₂ storage sites and pipelines approximately five times larger than what exists today. The network will need to expand over time to meet 2050 needs of the power and industrial sectors.
- By 2040, a variety of new coal plant technologies will need to be commercially available, cost competitive and have a near-zero emissions profile to meet power sector commitments to reduce or eliminate their CO₂ emissions by 2050.

These objectives are achievable if we are willing to pursue an aggressive agenda that acknowledges the urgency of the need and the economic-environmental implications of not meeting these goals, both in the U.S. and globally.

Summary Matrix of Technologies-Policies

Technology	CCUS	HELE	USC/AUSC	Allam Cycle	Oxy-Combustion	Other Transformational	Small Modular	Energy Infrastructure	Other	Coal Conversion & Utilization	Exports Coal & Coal Technology
Policy											
Initiatives to Advance R&D											
Coal FIRST	X	X	X	X	X	X	X				X
EFFECT Act	X	X	X	X	X	X	X			X	X
Fossil Energy R&D	X		X	X	X	X	X				
Technology Transitions Act	X	X	X	X	X	X	X				
Initiatives to Minimize Cost & Risk											
45Q	X										
Master Limited Partnerships	X								X		
Private Activity Bonds	X										
BEAT Tax Relief	X										
48A	X	X	X								
Technology Neutral Tax Credit	X	X	X	X	X	X	X				
USDA RUS Leg.	X									X	
Contracts for Differences	X	X	X	X	X	X					
LPO Reforms	X	X	X	X	X	X					
Development Finance Corp	X	X	X	X	X	X	X	X	X		X
Initiatives to Bolster Emissions Abatement											
Clean Energy Standard	X	X	X	X	X	X	X				
Affordable Clean Energy	X				X						
Initiatives to Address Regulatory Risk & Burden											
USE IT Act	X							X			
NSR/Gain Act	X	X									
Coal Combustion Residuals								X	X	X	X
Effluent Limitation Guidelines									X		
Initiatives to Reform Energy Markets											
PURPA	X	X	X	X	X	X					
Capacity Market Reforms	X	X	X	X	X	X					
Initiatives in Support of Energy Infrastructure											
LIFT America Act								X			
INVEST CO ₂ Act								X			
FAST Act								X			

COAL POWER: Smart Policies in Support of Cleaner, Stronger Energy

<https://www.nationalcoalcouncil.org/page-NCC-Studies.html>

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