

Advanced Energy



21st Century Coal: An Essential Role in Our Energy Future

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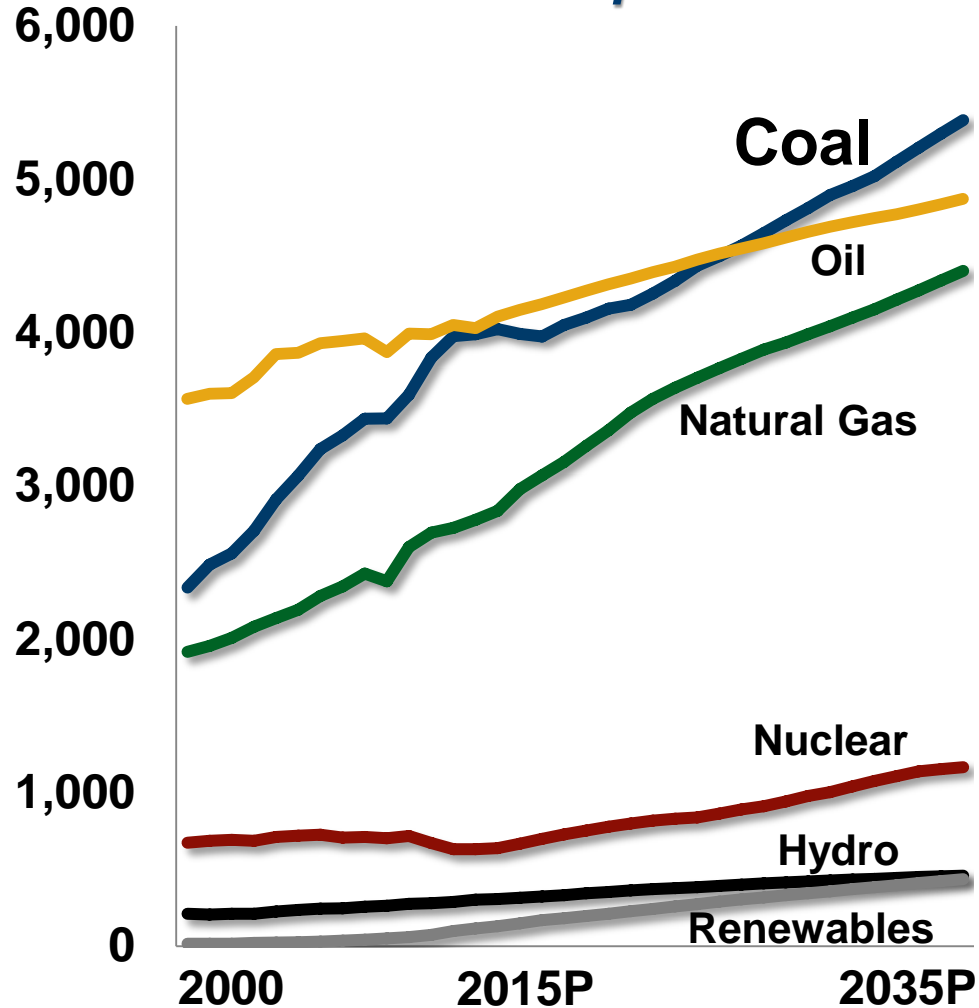
Key Themes

- Coal is the world's fastest-growing fuel and will continue to be vital to our energy future
- A technology path is the solution to achieve the world's ambitious environmental goals
- U.S., China and other nations must accelerate advancement of clean coal technologies



Coal Expected to Overtake Oil as Largest Energy Source by 2025

Primary Energy Demand per Million Tonnes of Oil Equivalent

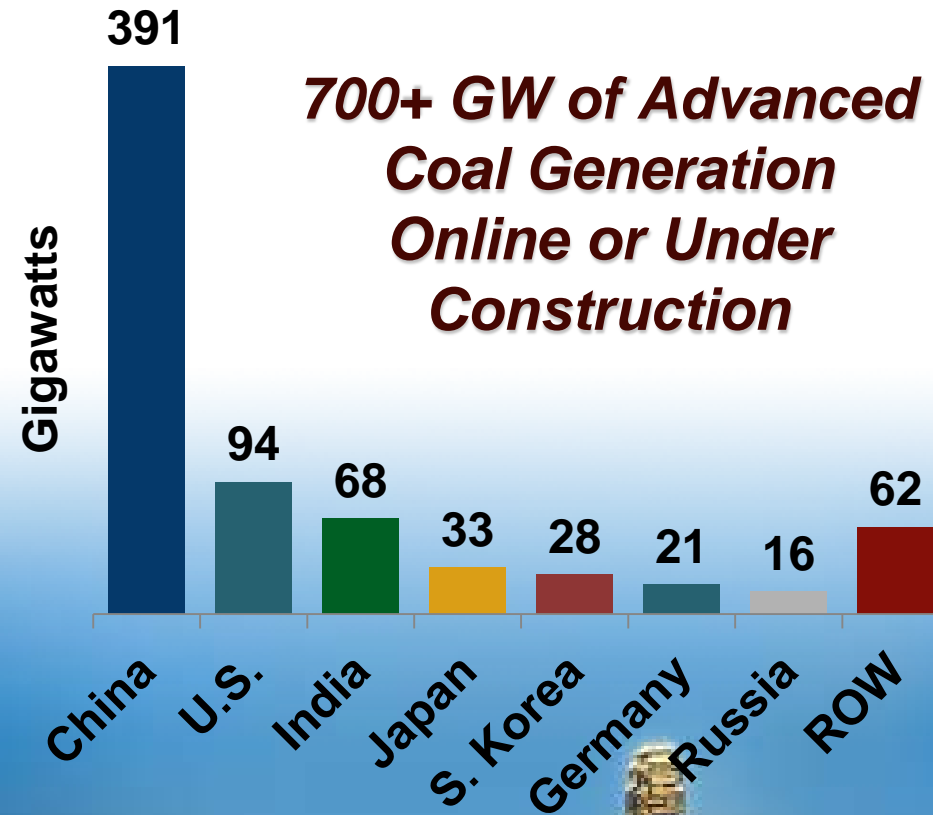


- Coal is the world's fastest growing major fuel this century
- Coal fuels ~ 40% of U.S. and global electricity
- Coal is highly reliable and the least expensive form of electricity generation to meet rising demand

China Leads the World in Build Out of Super and Ultra-Supercritical Coal Plants

Advanced Coal With Controls Drives Major Emission Reductions

High-efficiency plants achieve a 25% lower CO₂ profile than the oldest U.S. plants



China Achieving Air Quality Measures in 4-6 Years That Took U.S. Several Decades



Can-Do Approach Leads to 55% of World's High-Efficiency Coal Fleet

- Coal provides approximately 70 percent of China's power
- China credits coal with lifting 650 million people from poverty in the past 25 years; Use of coal-fueled power increased eight-fold during this period
- China leads the world in deploying high-efficiency coal plants
- Effort to deploy emission controls for nitrogen oxides and particulates on a scale equivalent to equipping half the U.S. coal fleet



The World's Leadership Needed to Bring CCS to Commercial Scale

“Excluding CCS from a mitigation-technology portfolio would more than double the cost of achieving climate-stabilization goals through 2100.”

– Intergovernmental Panel on Climate Change

“With coal and other fossil fuels remaining dominant in the fuel mix, there is no climate friendly scenario in the long-run without CCS.”

– Maria van der Hoeven

Executive Director, International Energy Agency

“Excluding CCUS as a technology option for the power sector alone would increase mitigation costs by \$2 trillion over 40 years, representing a 40 percent increase if CCUS is not available.”

– International Energy Agency

“Rapid commercial development and deployment of clean coal technologies, particularly carbon capture and storage, will help position the United States as a leader in the global clean energy race.”

– The Honorable Barack Obama

President of the United States

U.S. Can Learn from Canada, China in Developing Low-Carbon Energy

Canada

- Boundary Dam first carbon capture and storage project for power sector
- Captures CO₂ for enhanced oil recovery
- Sask Power believes it can achieve 25-30% cost reduction on next project
- Early success makes it a world model

China

- GreenGen conceived, permitted, built and brought online while FutureGen was being contemplated
- CCS for EOR in later stages
- Project would be among world's largest near-zero emissions coal plants at full build
- China a leader advancing high-efficiency coal plants

United States

- U.S. should expand leadership role in the research and development required to commercialize technology
- EPA's climate plan widely opposed; would raise electricity costs and force caps for no notable benefit under climate theory

22 Large-Scale CCUS Projects in Operation or Under Construction

Substantial Increase Needed in Development of Large CCUS Projects



Source: Global Carbon Capture and Storage Institute, "The Global Status of CCS: 2014."

A Policy Path Toward a Low-Carbon Energy Future

1. Recognize the importance of providing all citizens with energy access and keeping energy available, reliable and affordable.
2. Recognize the important role of HELE (high-efficiency, low-emissions) technologies in a true “all of the above” energy strategy and the immediate benefits for carbon reduction.
3. Provide policy support and investment in clean coal technologies; especially in U.S. and China – the two largest consumers of energy in the world
4. Encourage funding by public financial institutions and international development funds to expand clean electricity access in emerging markets.
5. Accelerate development of next generation carbon capture utilization and storage technologies by bringing CCUS to scale.





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