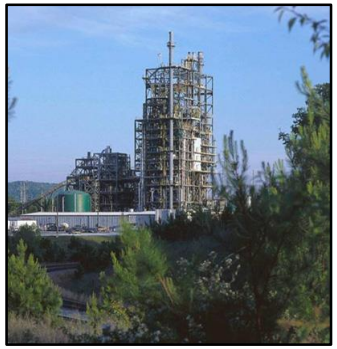

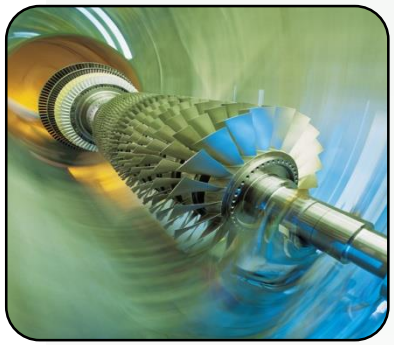

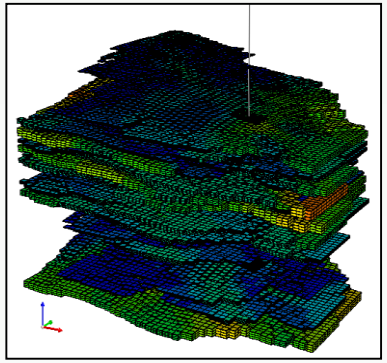

Fossil Forward with Policy Parity

David Mohler

Deputy Assistant Secretary

U.S. Department of Energy, Office of Clean Coal and Carbon Management

May 23, 2016

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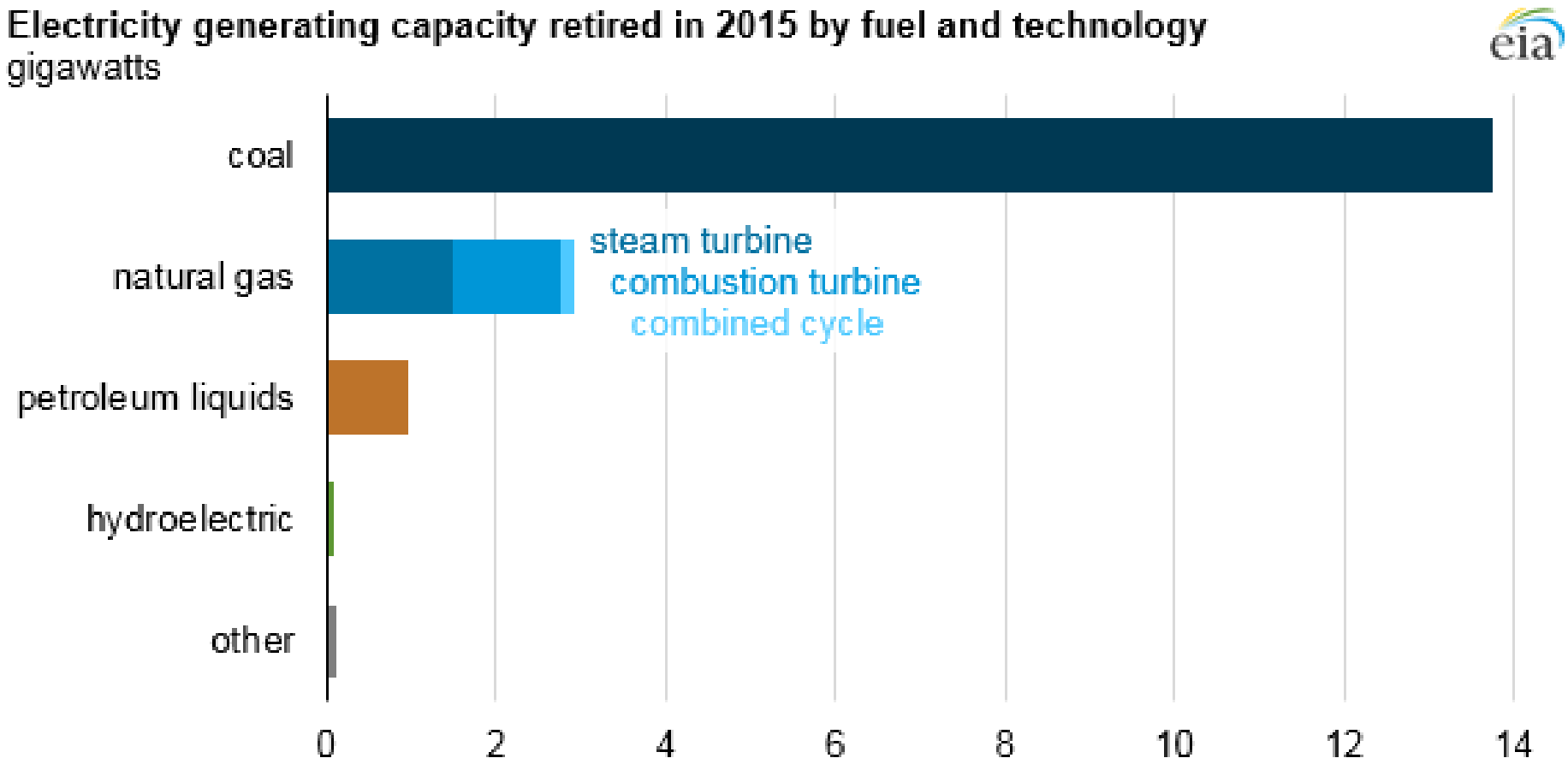
PAST, PRESENT

Coal: 80% of retired capacity in 2015



Source: U.S. Energy Information Administration, *Preliminary Monthly Electric Generator Inventory*

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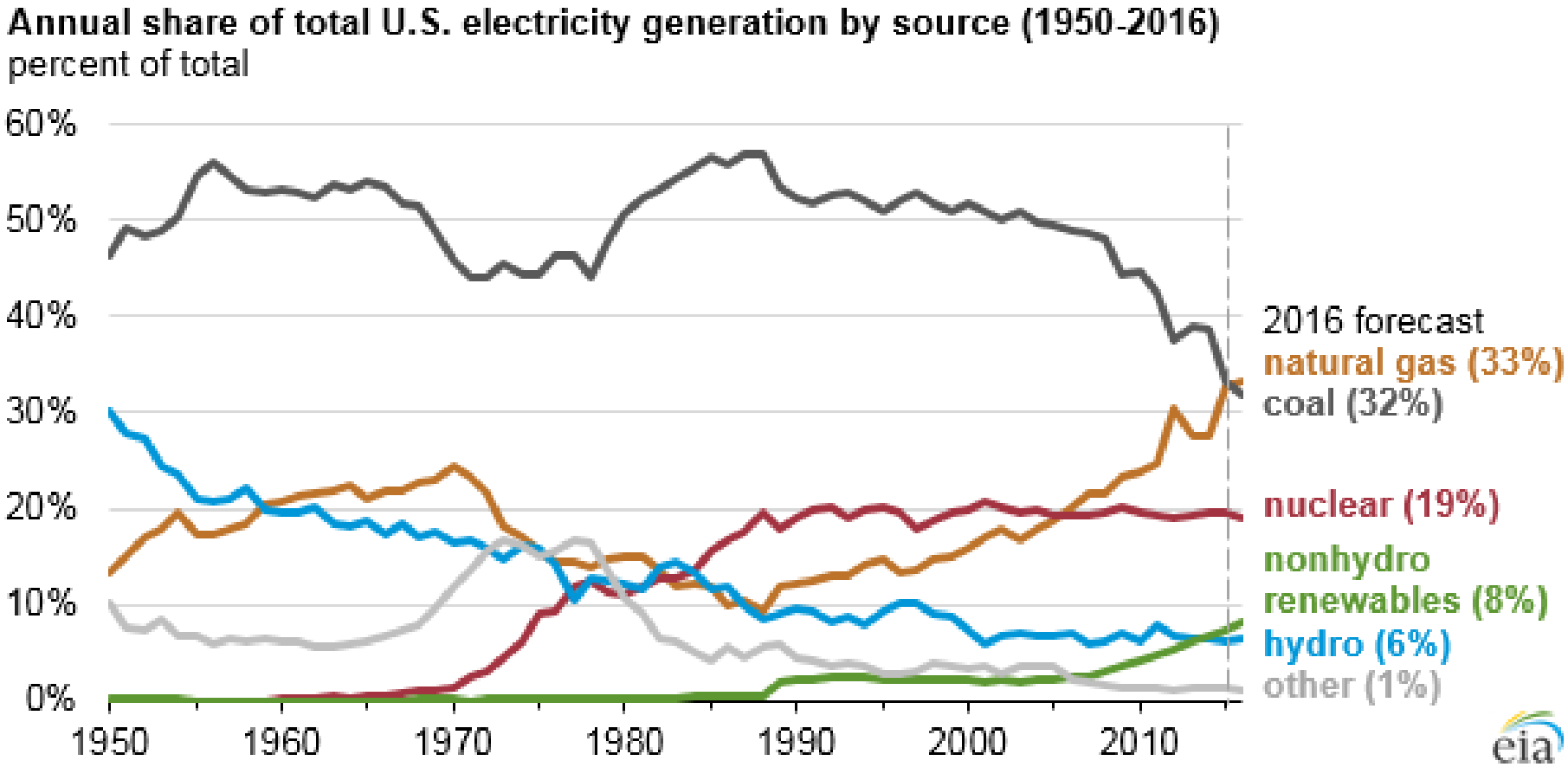
Natural Gas Generation will Exceed Coal Generation in 2016



Source: U.S. Energy Information Administration, Monthly Energy Review, and Short-Term Energy Outlook (March 2016)

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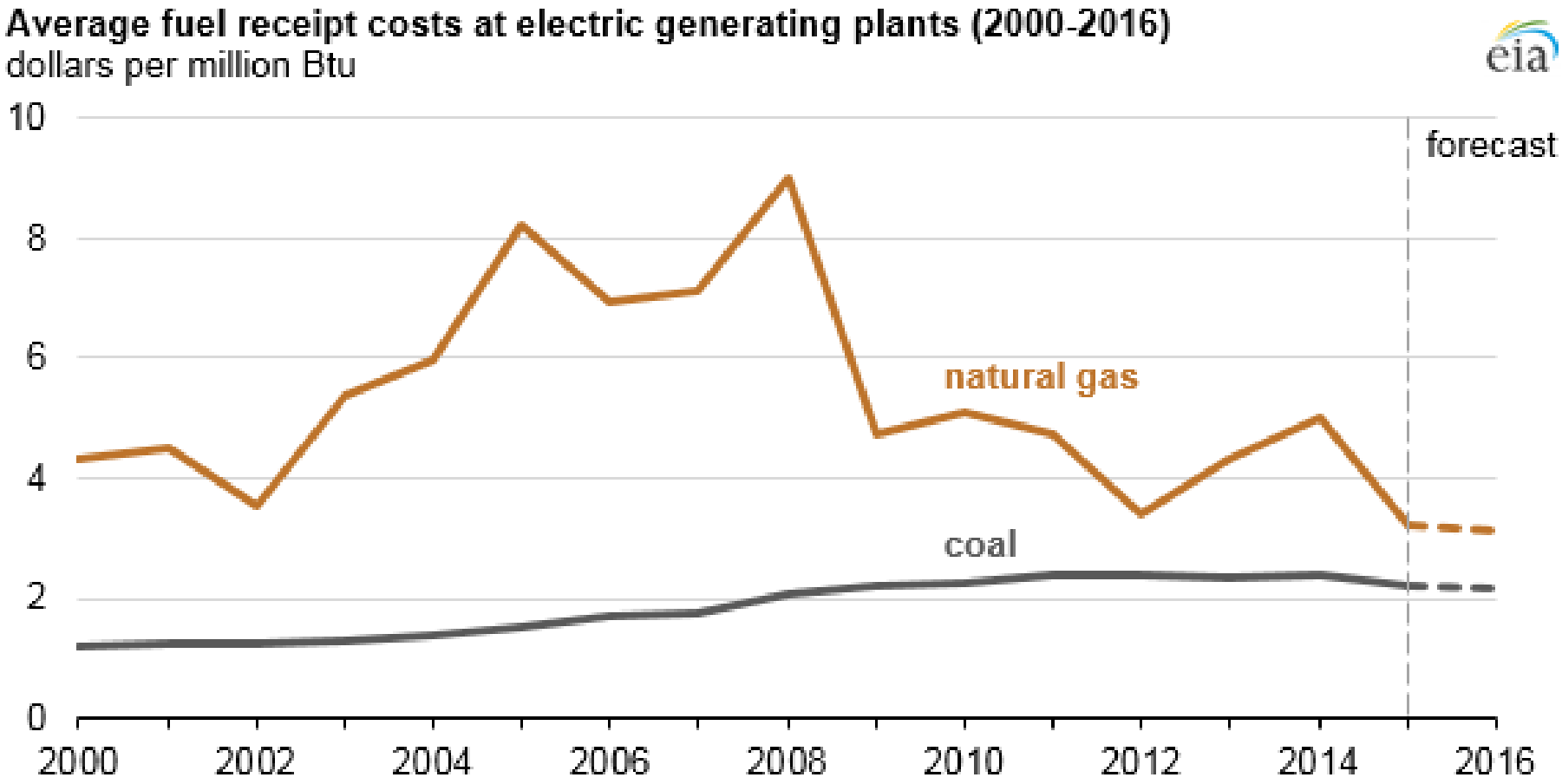
Decline driven 1st by market forces



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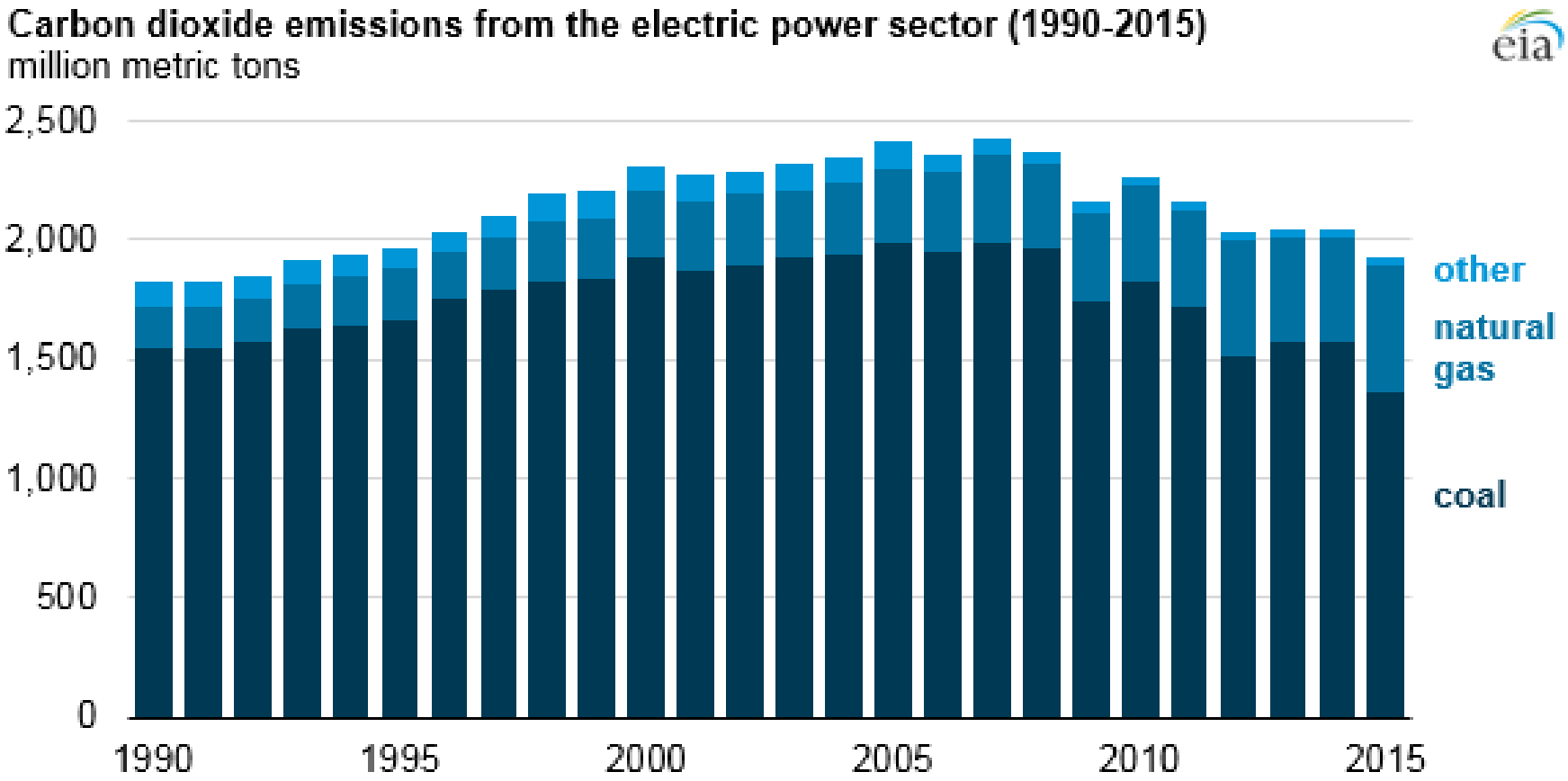
Source: U.S. Energy Information Administration, *Electric Power Monthly*, and *Short-Term Energy Outlook* (March 2016

Changes in Generation mix are driving CO_2 emissions reductions



Source: U.S. Energy Information Administration, Monthly Energy Review

FUTURE

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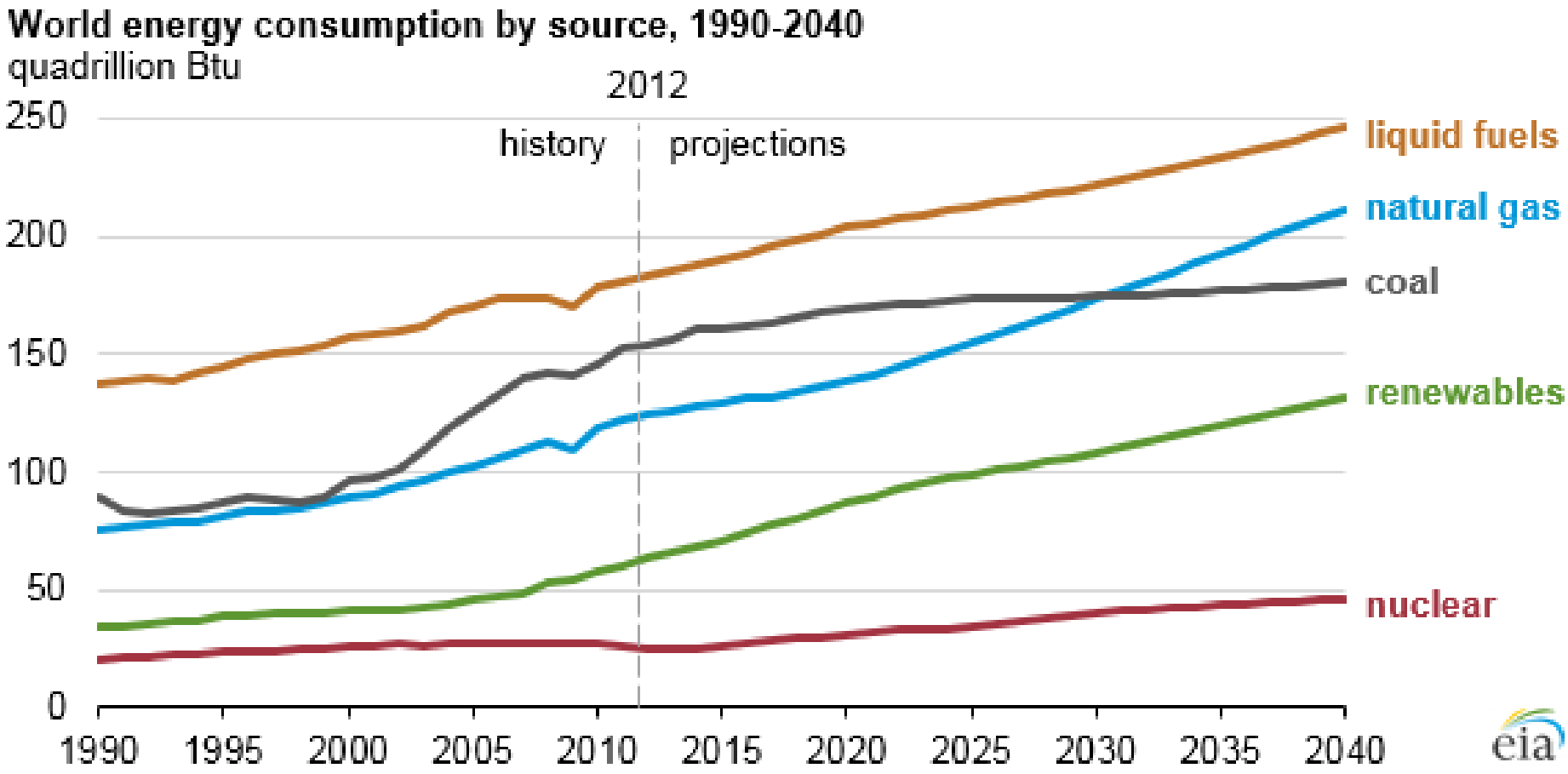
48% increase in world energy consumption by 2040, coal still needed



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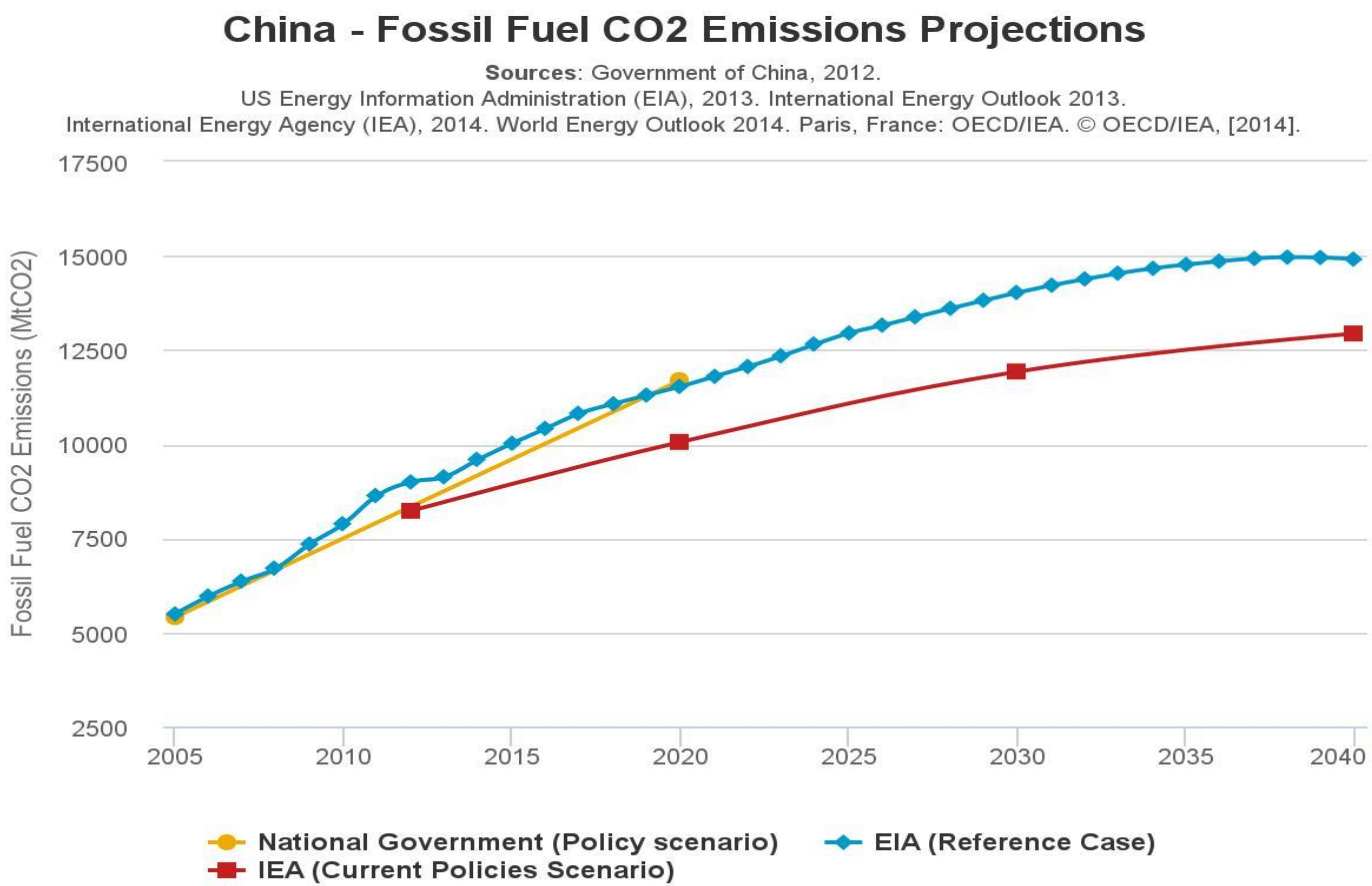
Source: U.S. Energy Information Administration, *International Energy Outlook 2016*

China taking steps to reduce emissions



http://goo.gl/KWObOn
Source: CAIT 2.0, http://cait2.wri.org/projections

WORLD RESOURCES INSTITUTE

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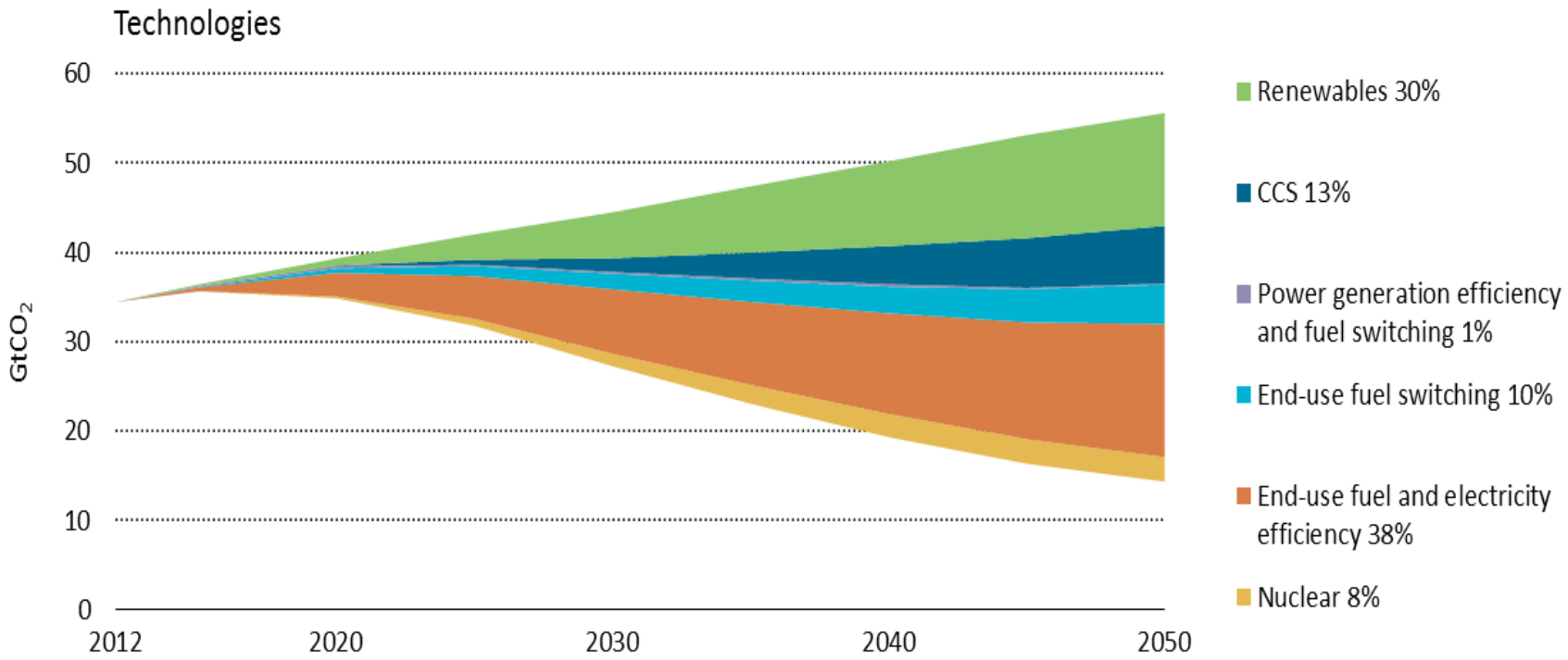
CCS Will Be Required To Meet Our Global Carbon Emission Reduction Goals



Source: International Energy Agency, ETP 2015

We must strengthen our commitment to deployment of CCS

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CSLF Energy Ministers Agree on CCS

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CCS Deployment: Urgent and Important

Not just about cost

- Costs are higher than plants without CCS
- Costs are lower than many clean energy alternatives

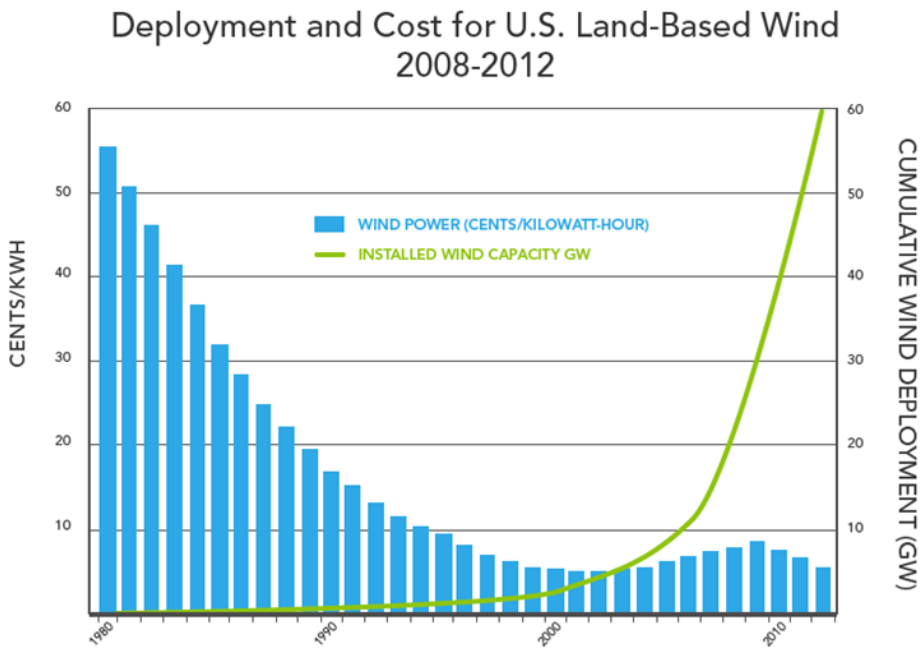
Not just about technology

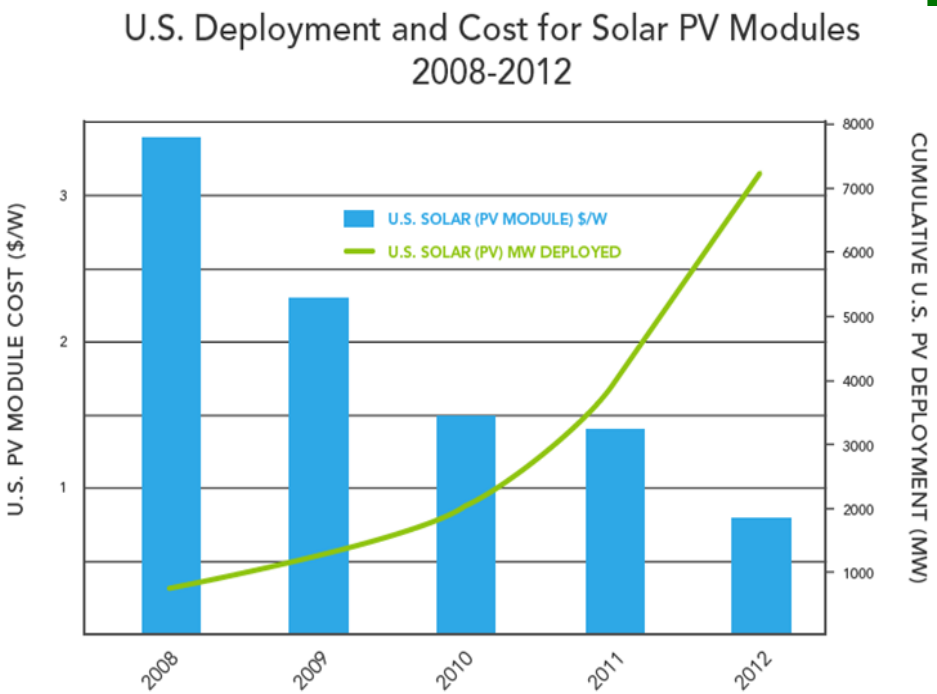
- Many technologies are well demonstrated
- Improvement potential is very large

Policy Issue: Could finance many ways

- Rate recovery; feed-in tariffs; direct grants
- Clean energy portfolios; tax-free debt financing; others

With increases in capacity installed, costs decrease (examples from wind and solar)





Source: US DOE, 2013 "Revolution Now"

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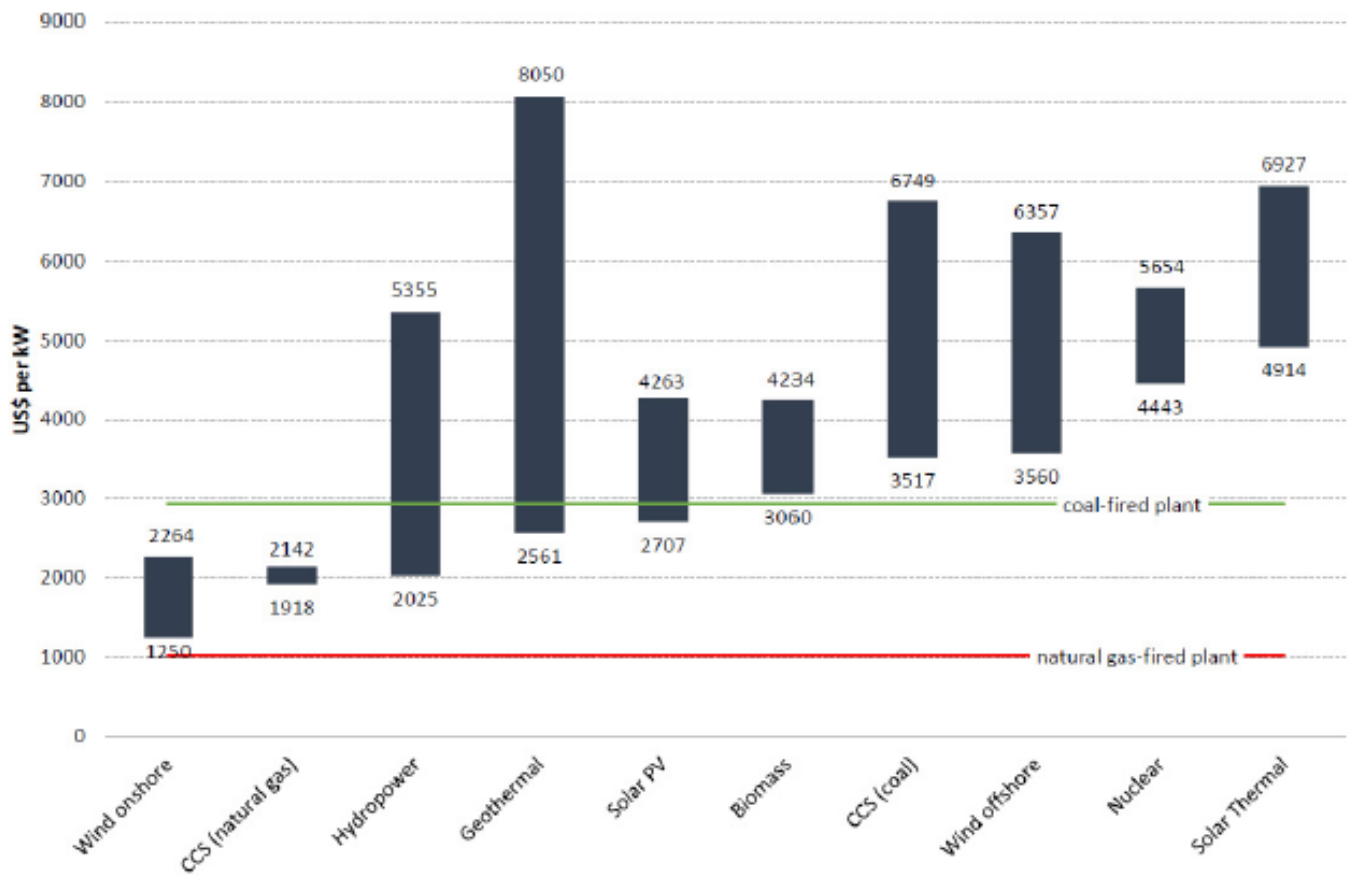
14

Cost, policy, and parity

FIGURE 5.1: Capital cost for plant in the US, exclusive of interest during construction (2014 US$)



Source: Global CCS Institute analysis

http://hub.globalccsinstitute.com/sites/default/files/publications/195008/costs-ccs-other-low-carbon-technologies-united-states-2015-update.pdf

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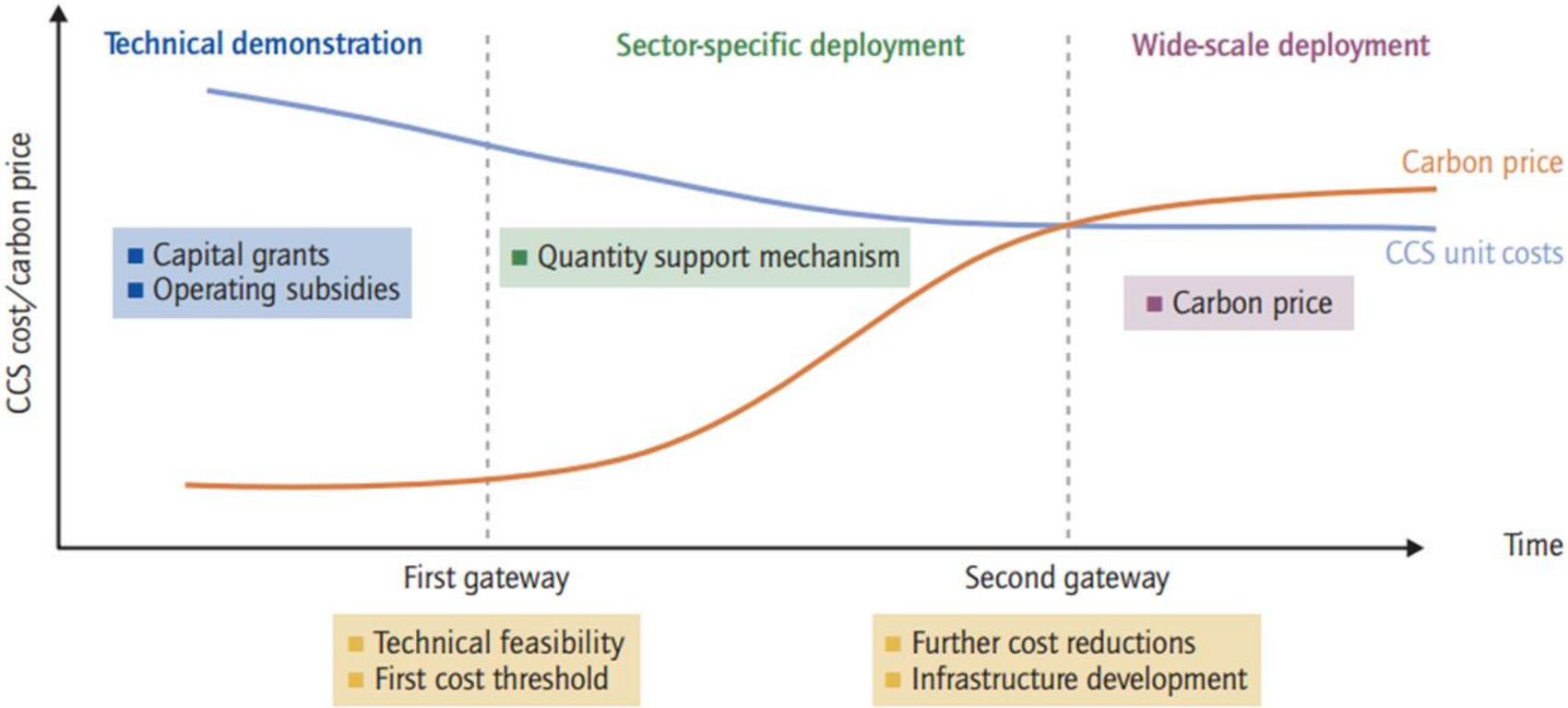
CCS deployment is contingent on policy action



Source: IEA, 2012f.

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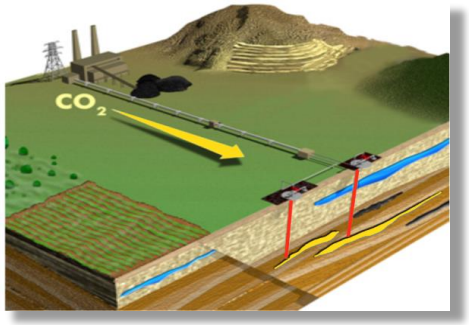
National Coal Council Report: Leveling the Playing Field, Policy Parity for CCS

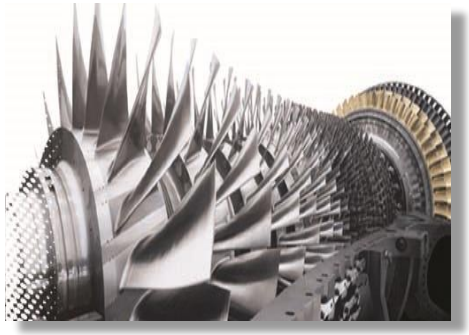
- Recommended a menu of approaches:
  - Contracts for differences (CFD)
  - Limited guaranteed power purchase agreements
  - Market set aside
  - Clean energy credits
  - Tax credits and price interventions
    - Production tax credit, CO2 price stabilization, electricity price stabilization, and 45Q revisions
  - Tax preferred bonds
  - Master Limited Partnerships (MLPs)
  - Loan Guarantees

Recent Legislative Action Towards Parity

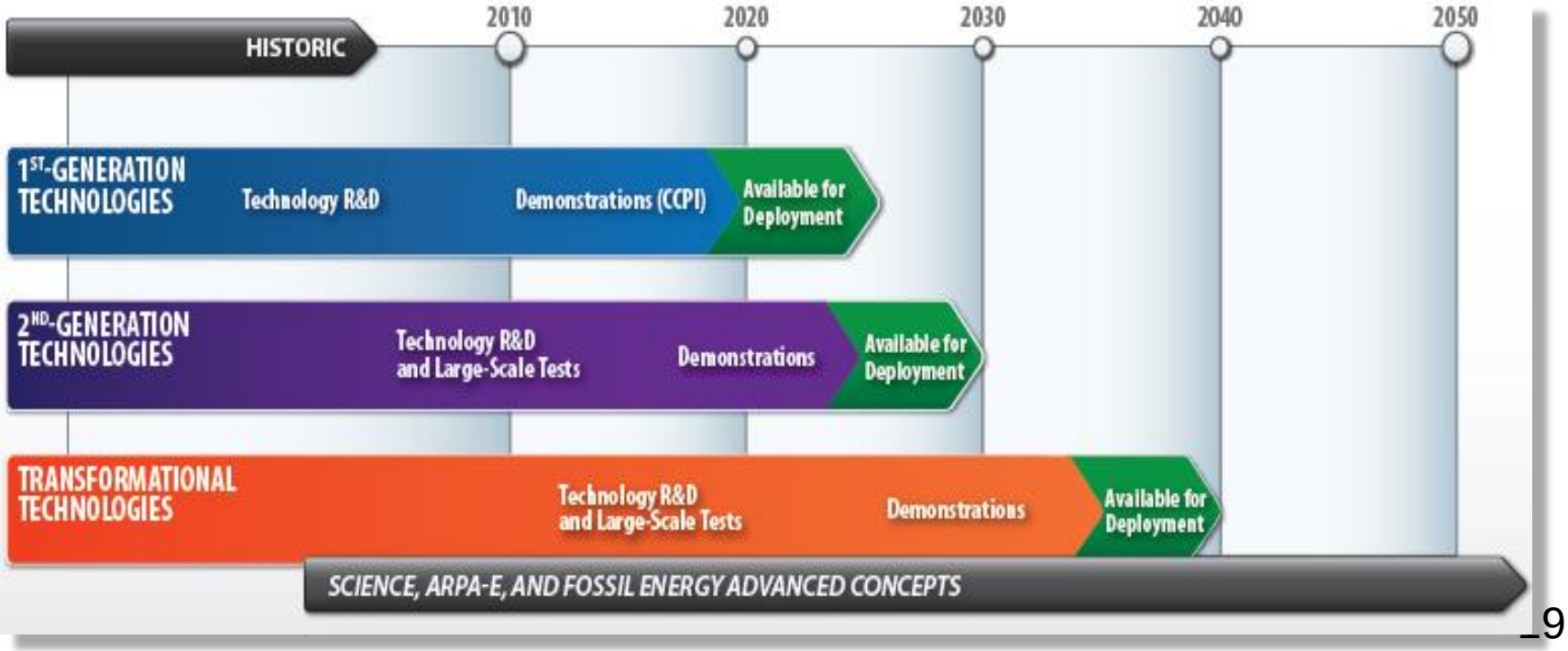
- HR 4622
  - Amends the IRS code of 1986 to improve and make permanent the credit for carbon dioxide sequestration.
- S.1285
  - Authorizes the Secretary of energy to enter into contracts to provide price stabilization support for EGUs that use coal and CCUS.

A technology pipeline for CCS innovations





CO_2 Capture	CO_2 Storage	Advanced Energy Systems	Crosscutting Research
Cost-effective capture for new and existing plants	Safe, permanent storage of CO_2 from power and industry	Gasification, advanced turbines, advanced combustion, and fuel cells	Crosscutting technology development



CCS is a Domestic and Global Necessity

- Limiting global warming to 2 degrees C will require unprecedented expansion of low-carbon energy sources.
  - 60% of primary energy must be low carbon by 2050; >90% by 2100.

- Without CCS, a 2 degree scenario is highly unlikely, and extremely costly.
  - CCS is the <u>only</u> technology option for deep decarbonization of some industries such as cement and steel.
  - According to the IPCC 5th Assessment, the cost to reach a 2 degree scenario would be as much as 138% higher

OBJECTIVE: Rapidly advance CCS development and deployment in the US

1. Enable widespread industrial CCS deployments by catalyzing pipeline and storage infrastructure needed to capture 30 million tonnes of CO_2 from opportune industrial point sources, below $30/tonne, by 2025.
   - Regional deployment approach will help the states meet domestic CO_2 emission reductions targets.

2. Reduce capture costs for power sector sources to $30/tonne by 2025, enabling ~ 400,000,000 tonnes / yr CO_2 capture to deploy between 2025 and 2050.
   - Aggressive R&D program will help ensure continued US technology leadership; good for US companies and business.

3. Develop and Implement supporting policies and financial incentives, to support widespread deployment of CCS.
   - DOE to support broader executive branch actions

iNNOVATION CCS
Status: Transformational Technologies

FY 2015 Funding Opportunity Announcement:

- 14 Transformational Technologies Awarded
- Disruptive technologies
  - Hybrid processes (Encapsulated Ionic Liquids, Non-Aqueous Solvents, etc.)
  - Electrochemical
  - Advanced materials (hollow fiber membranes, Combined Sorbents, etc.)
- >$25M invested in new lab and bench scale technologies
  - 11 Post Combustion, 3 Pre Combustion
- Integration of algae into power plants (2 Projects)
- Small Pilot of Electrochemical Membrane (Fuel Cell Energy)

iNNOVATION CCS
CCS and Clean Energy Messaging:

A more inclusive working definition of "clean energy" within climate mitigation discussions could be very beneficial.

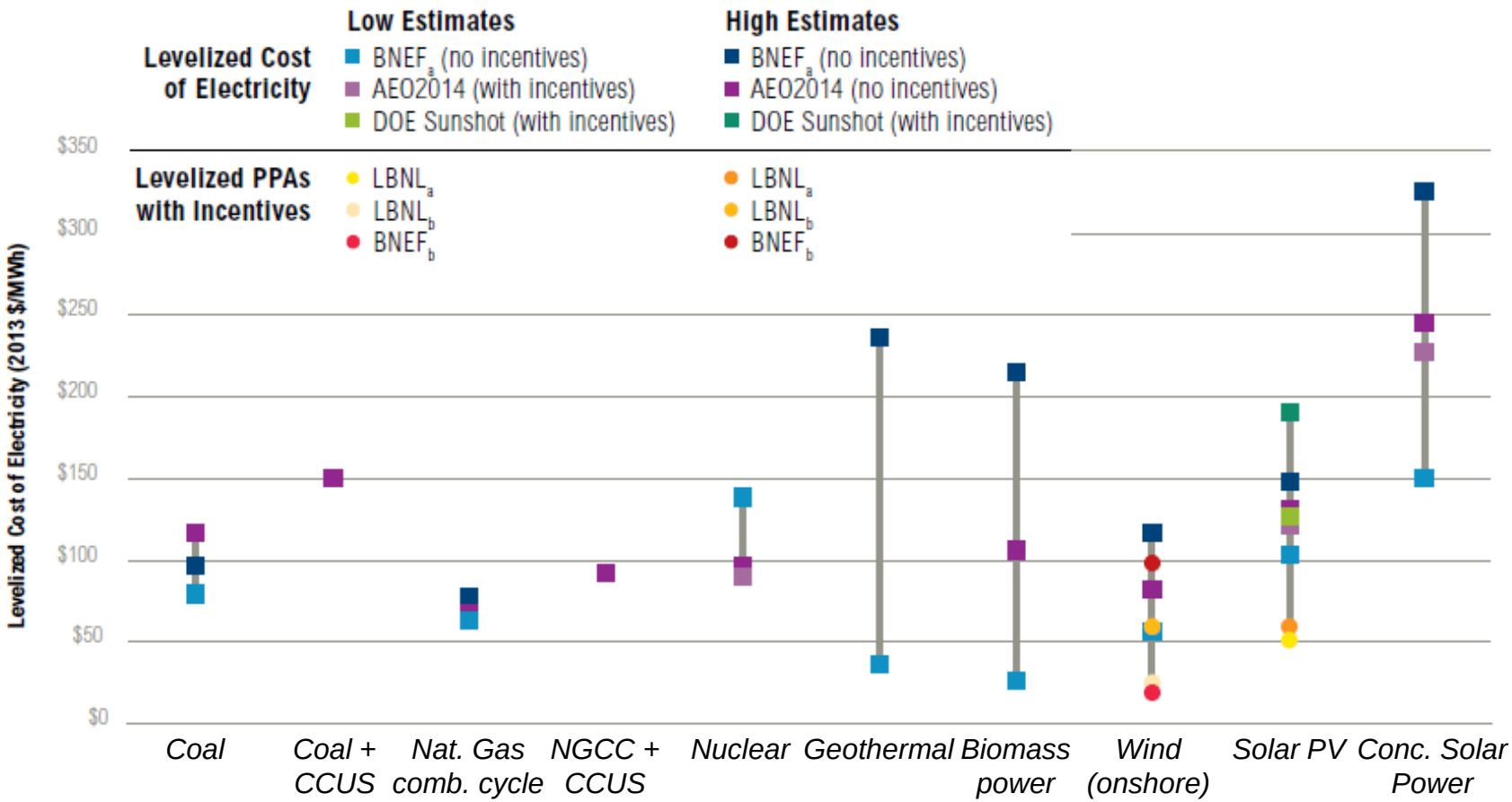
Within a climate-change mitigation context, clean-energy analysis and messaging should emphasize CCS as integral to a global sustainable energy economy.

A dramatic shift in the way in which we use fossil fuels will be critical to meeting global climate change goals.

BACKGROUND

Cost, policy, and parity

Levelized cost of electricity ($/MWh) for new generation sources and levelized power purchase agreement prices for recent wind and solar projects



WRI, Oct. 2014

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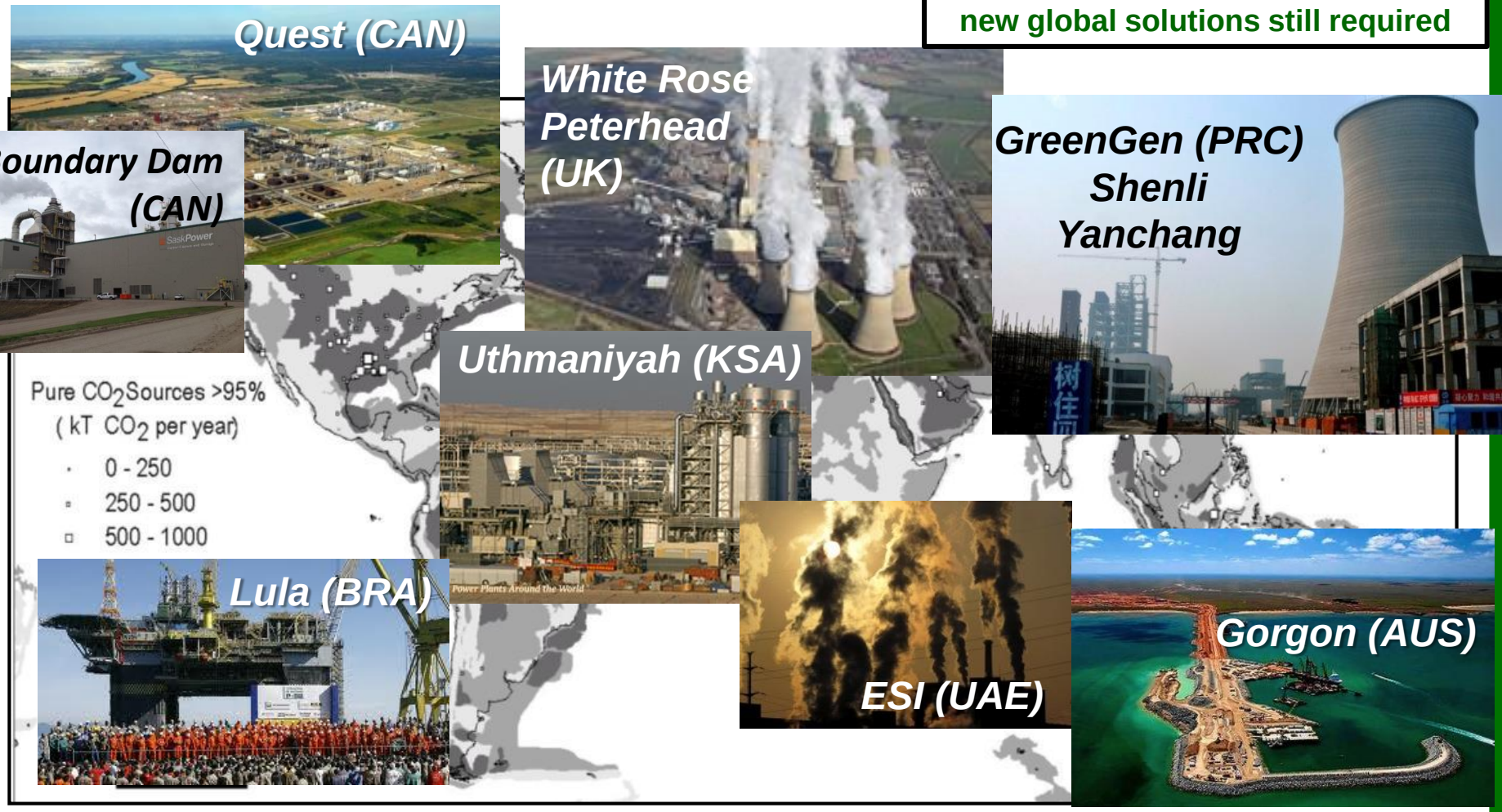
Global challenge ➡ global progress

new global solutions still required



We need more projects and more information

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CO_2 Capture from Industrial Sources

- Globally, industry accounts for 40% of energy-related CO_2 emissions -- mostly in developing countries
- Many industrial facilities are large point sources
- In some plants, CO_2 is already being captured in order to produce the desired product (e.g., H_2/Ammonia), and additional capture cost is minimal
- CO_2 concentration in treated stream may be high or nearly pure
- Often located near potential storage sites
- ICCS technology is applicable to coal-fired power generation

Hanson Permanente Cement Kiln, Los Altos, CA, 2008