



Greenhouse Gas Regulations for New Power Plants

**Adam Yarina
NDEQ Air Toxics Coordinator**

**NDEQ Environmental Update, Lincoln NE
May 15, 2014**

Overview

GHG Emissions & Regulation

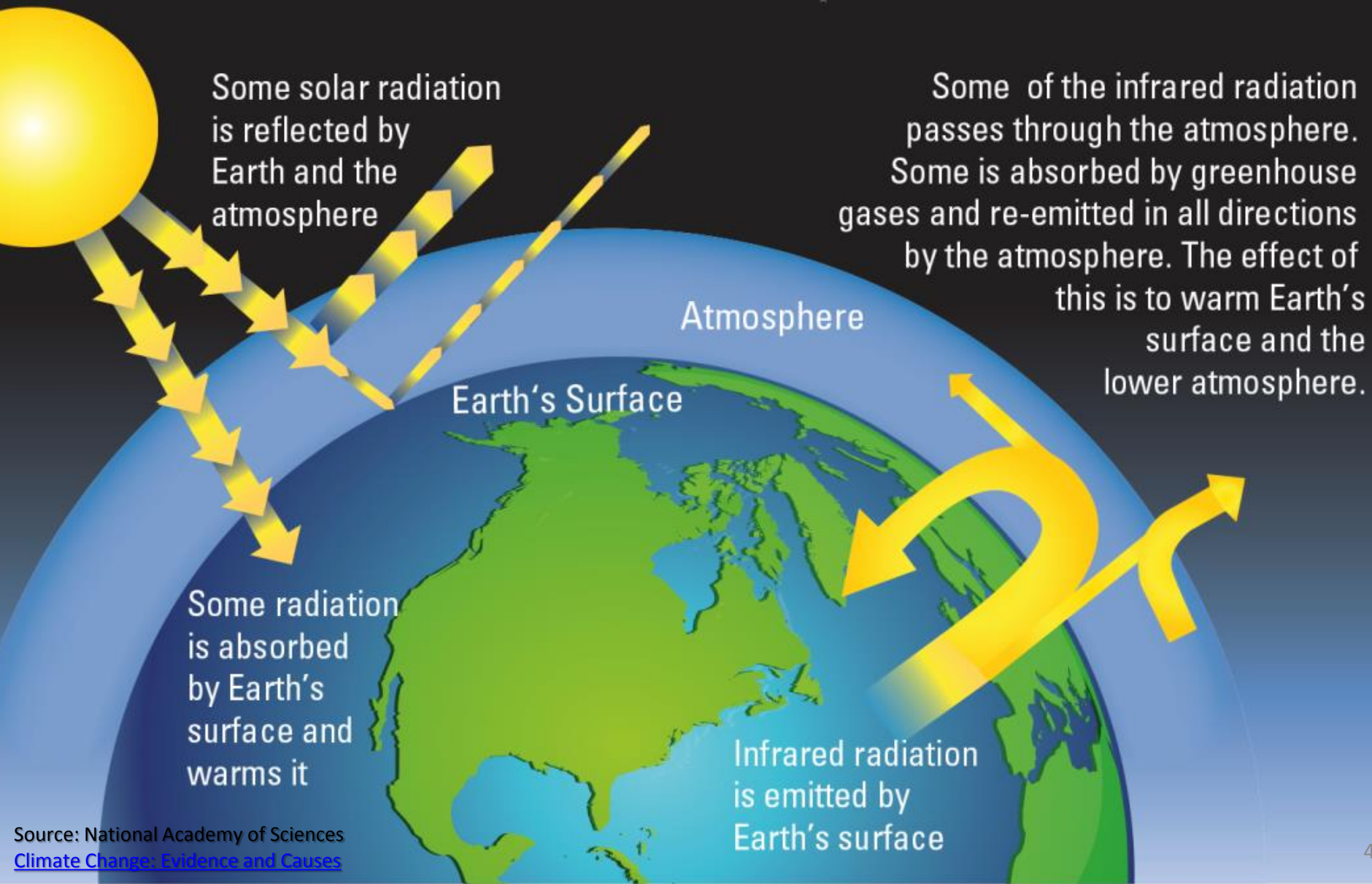
The Utility Power Sector

New Source Performance Standards

Best System of Emission Reduction

Greenhouse Gas Emissions & Regulation

THE GREENHOUSE EFFECT



Greenhouse Gas Emissions

U.S. GREENHOUSE GAS POLLUTION INCLUDES:



CARBON DIOXIDE (CO₂)

Enters the atmosphere through burning fossil fuels (coal, natural gas, and oil), solid waste, trees and wood products, and also as a result of certain chemical reactions (e.g., manufacture of cement).

84%



FLUORINATED GASES

Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes.

2%



NITROUS OXIDE (N₂O)

Emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.

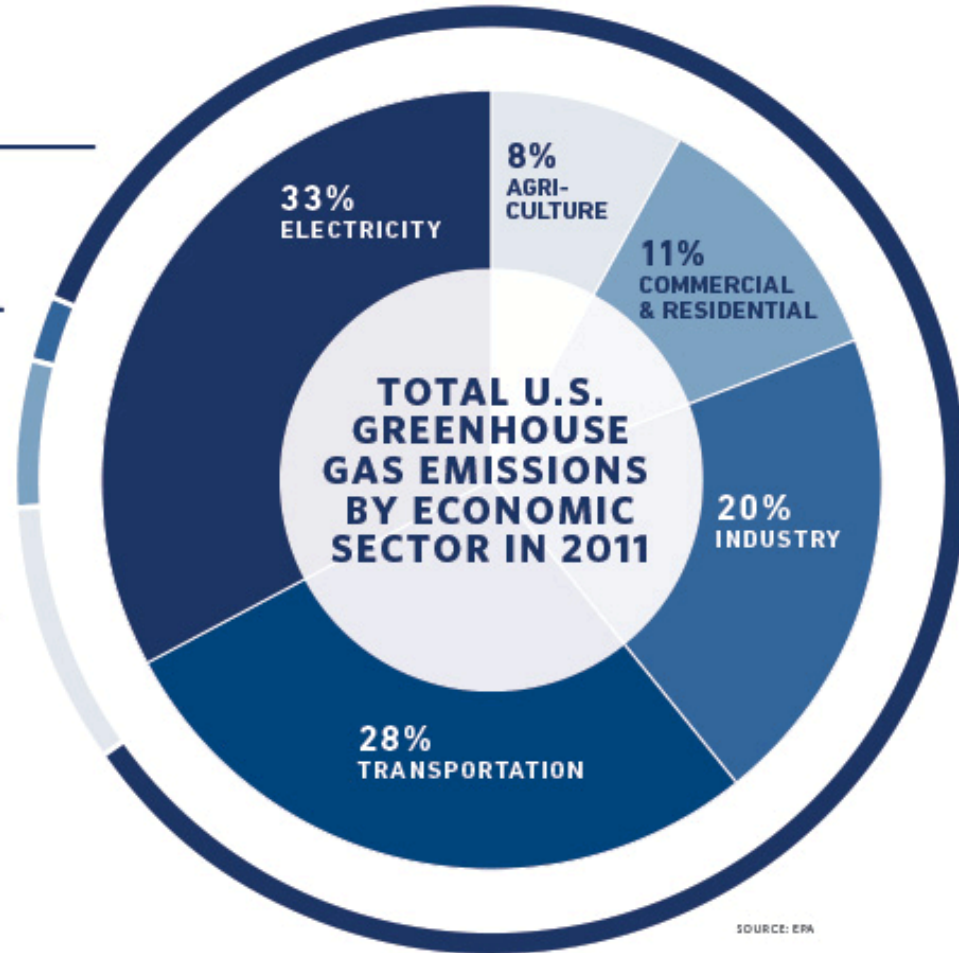
5%

METHANE (CH₄)

Emitted during the production and transport of coal, natural gas, and oil as well as from landfills.

9%

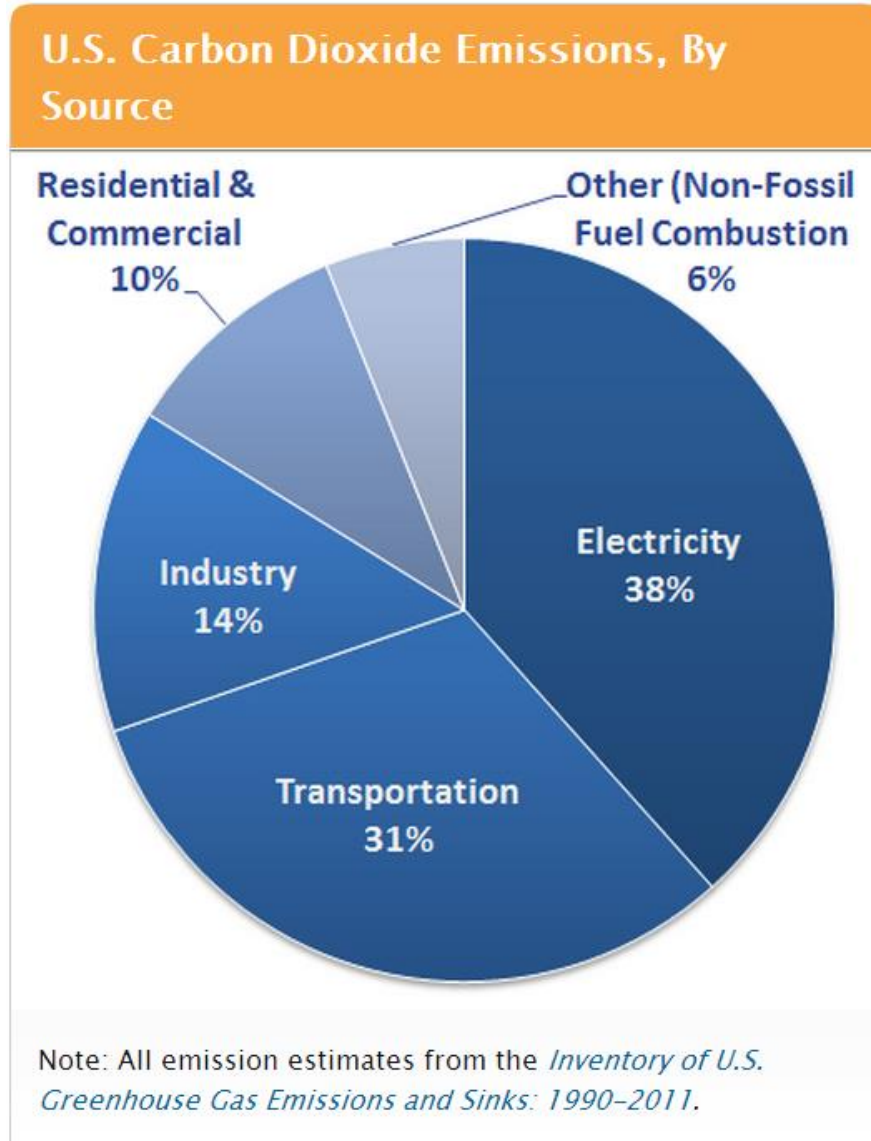
SOURCE: EPA



Source: EPA

<http://www2.epa.gov/carbon-pollution-standards>

Greenhouse Gas Emissions



The Utility Power Sector



Gigawatts (GW)
1,000 MW



Megawatts (MW)
1,000 kW



Kilowatts (kW)
1,000 W



Watts
(W)



NPPD Gerald Gentleman Station

North Platte, NE

1,365 MW



NPPD Beatrice Power Station

Beatrice, NE

217 MW



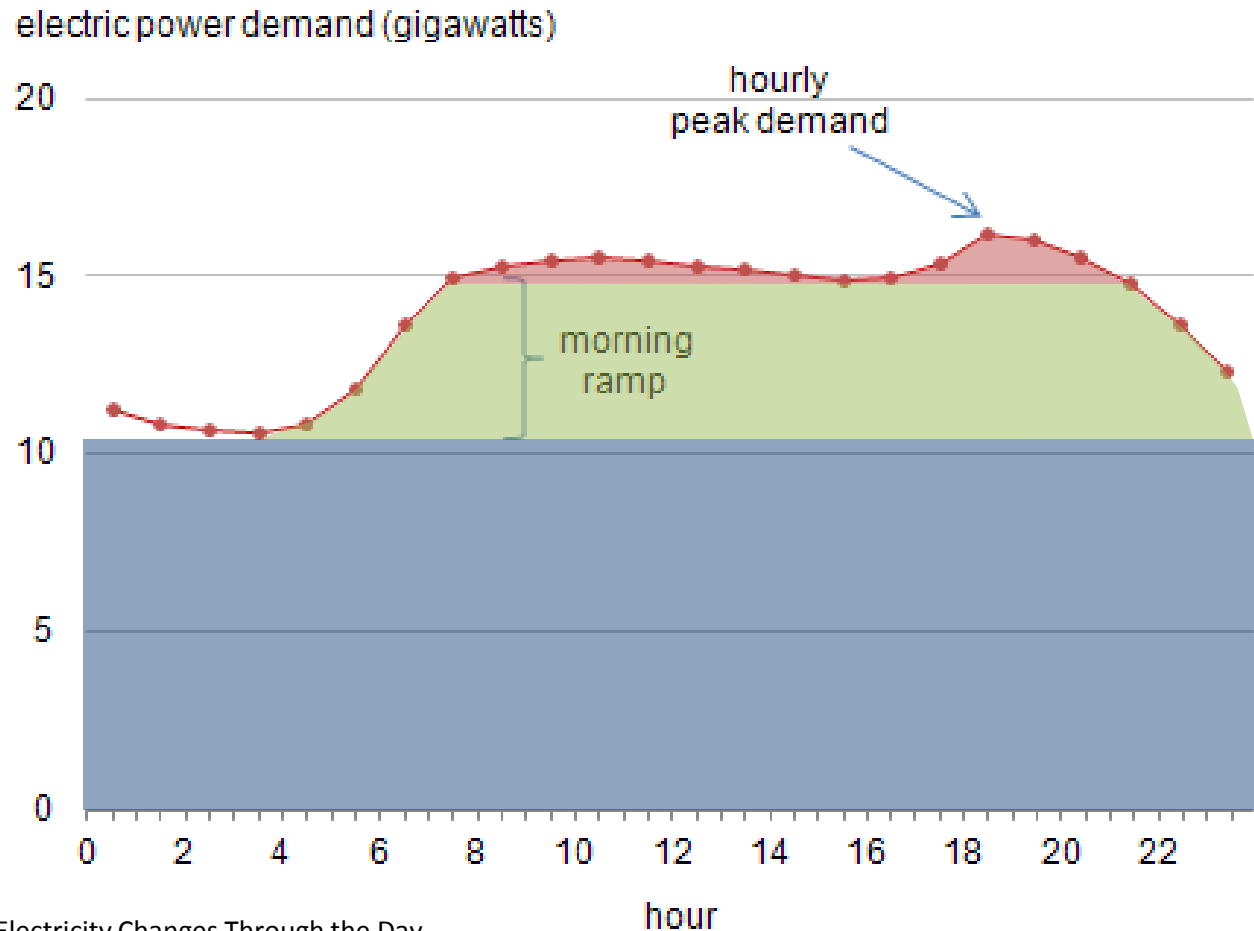
Broken Bow Wind LLC
Broken Bow, NE
1.6 MW/turbine



The Utility Power Sector Generating Capacity

Electric load curve: New England, 10/22/2010

Peak
Intermediate
Baseload



The Utility Power Sector

Simple vs. Combined Cycle

Simple Cycle Systems

- Combustion only, no heat recovery
- Simpler, less expensive to build
- Faster and easier to respond to changing power demand

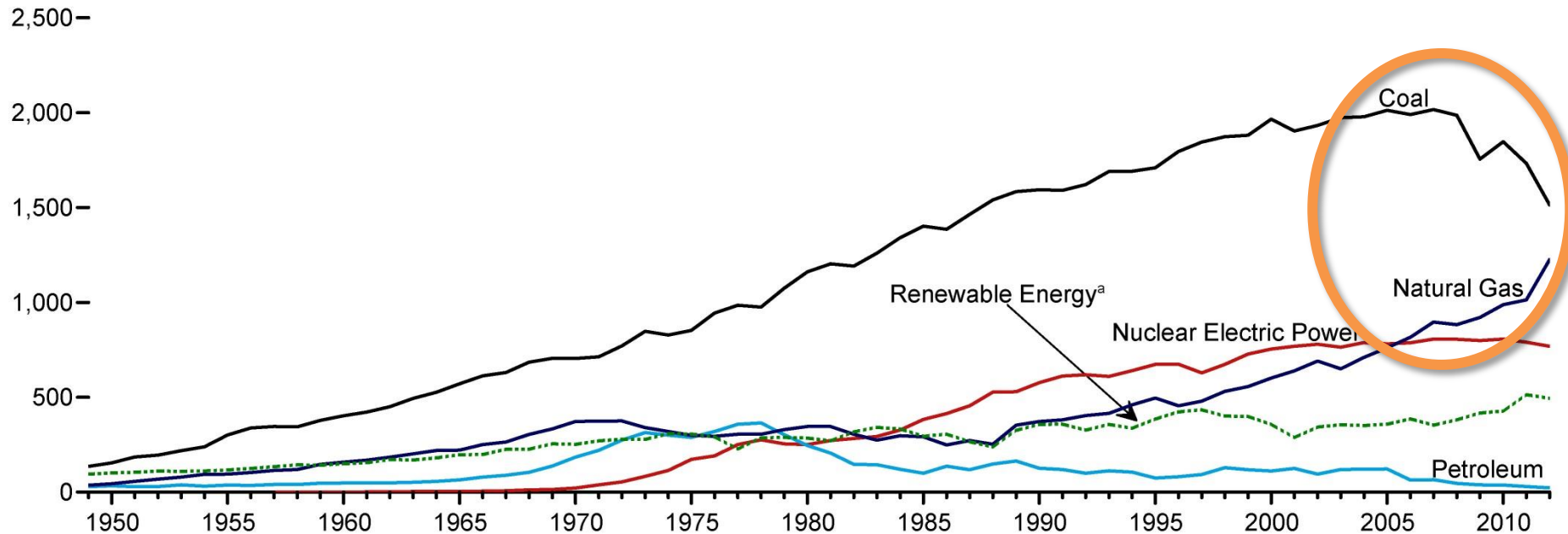
Combined Cycle Systems

- Recover waste heat from combustion for reuse
- 50% more efficient than simple cycle
- Cheaper long-term energy solution

The Changing Utility Power Sector

Figure 7.2 Electricity Net Generation
(Billion Kilowatthours)

Total (All Sectors), Major Sources, 1949–2012



^a Conventional hydroelectric power, wood, waste, geothermal, solar/PV, and wind.

^b Blast furnace gas, and other manufactured and waste gases derived from fossil fuels.

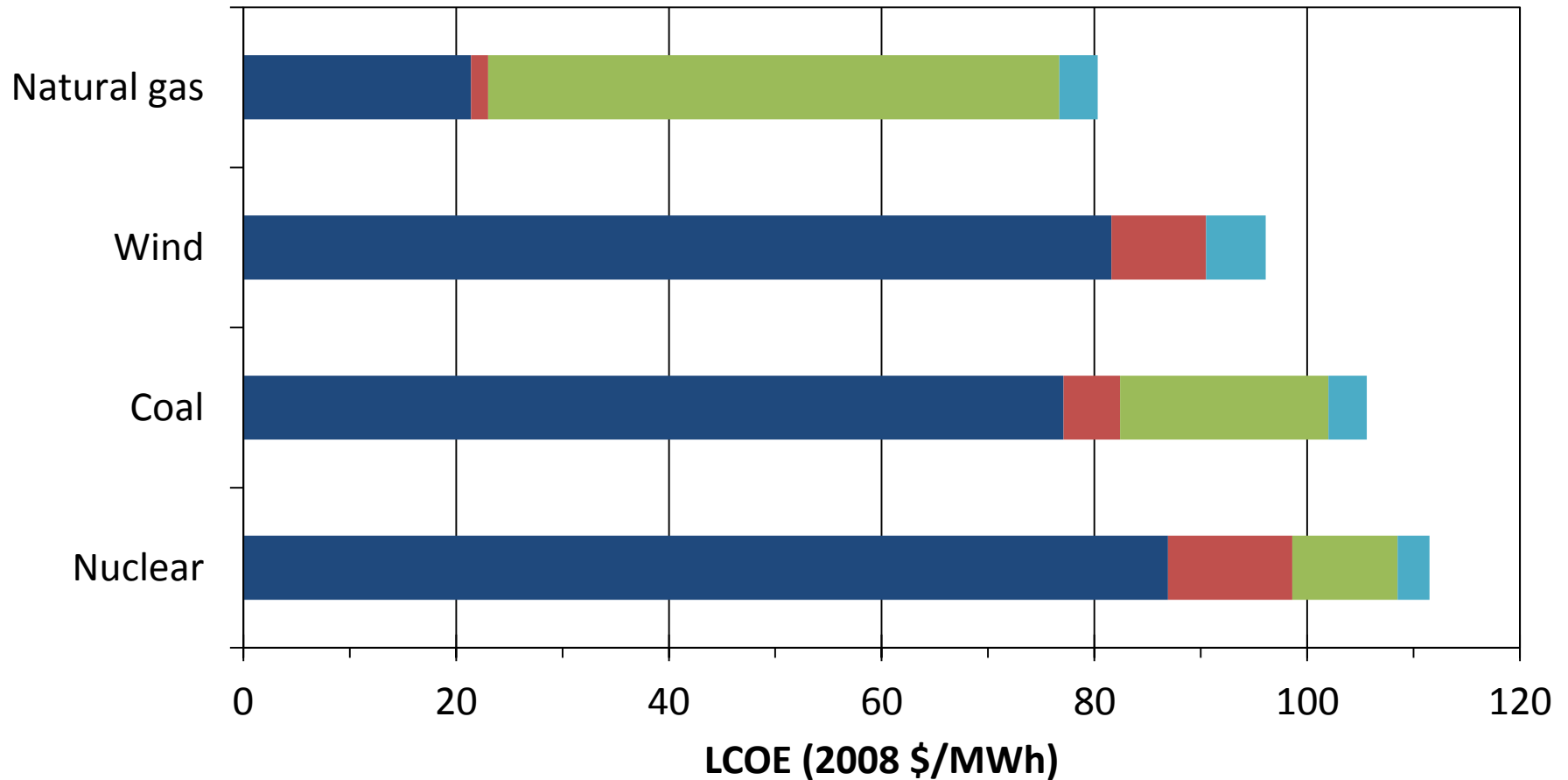
^c Conventional hydroelectric power.

Web Page: <http://www.eia.gov/totalenergy/data/monthly/#electricity>.

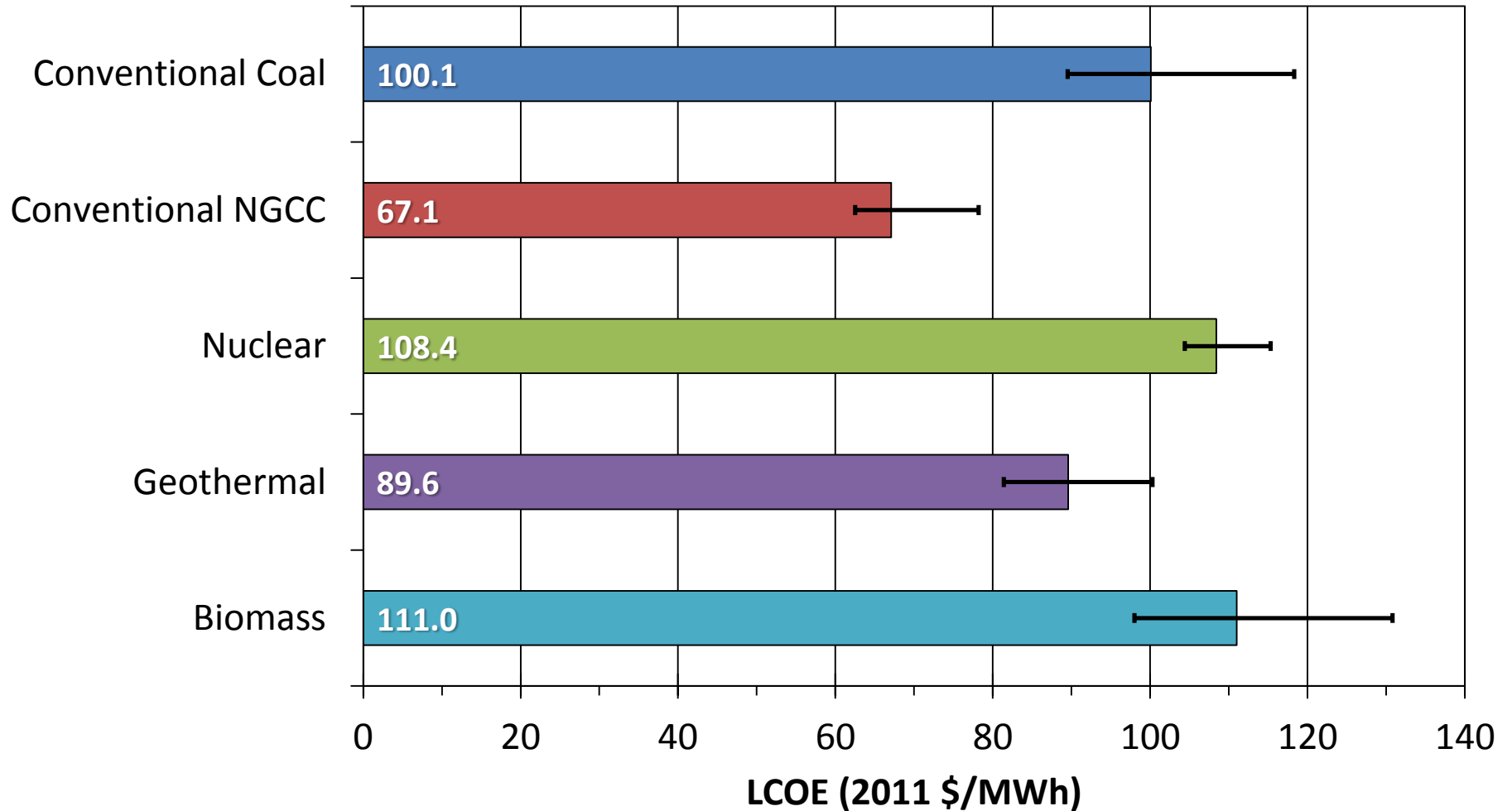
Sources: Tables 7.2a–7.2c.

Levelized Cost of Electricity (LCOE)

■ Capital ■ O&M ■ Fuel ■ Transmission



Average LCOE of Dispatchable Generation

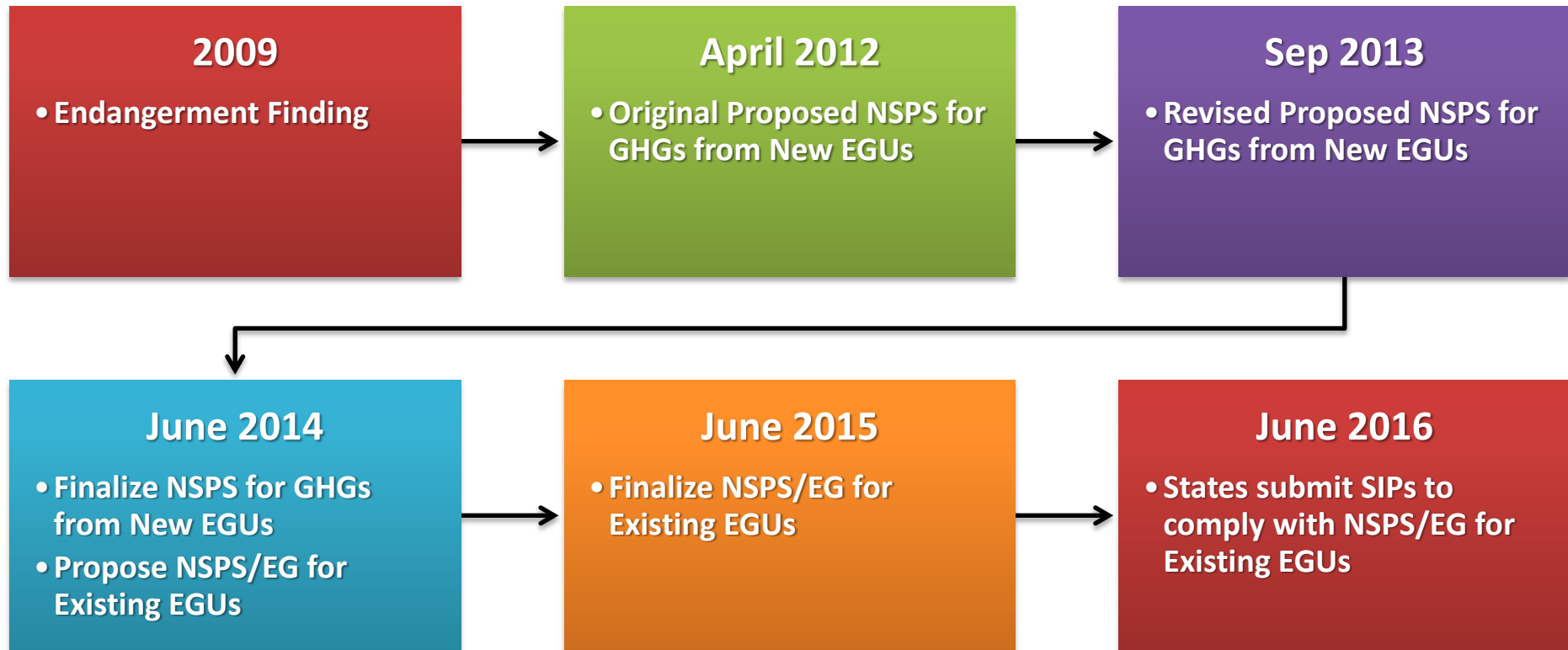


New Source Performance Standards

New Source Performance Standards

- Statutory Authority
 - CAA Section 111 (b) – NSPS
 - Applies to new stationary sources
 - Commence construction, modification, or reconstruction after applicable standards are published or proposed
 - CAA Section 111 (d) – Emission Guidelines (EG)
 - Applies to existing stationary sources
 - Any source other than a new source
 - Required for sources of an air pollutant that:
 - Is not regulated elsewhere under the CAA; and
 - Would be subject if the existing source were a new source

New Source Performance Standards GHG Regulatory Timeline



New Source Performance Standards

- Statutory Authority

- Standard of Performance:

-

- reflects

- the application of the best system of emission reduction which

- has been adequately

- demonstrated.”

New Source Performance Standards



GHG NSPS for New EGUs

Applicability

	Coal-fired EGUs	Natural Gas-fired EGUs
Build Date	After Jan 8, 2014	
Capacity	> 73 MW	
Fuel Usage	> 10% fossil fuel use on a 3-year rolling average basis	
Built for the purpose of supplying, and supplies...	One-third or more of its total potential electrical output	
	<u>AND</u>	
	More than 219,000 MWh net-electrical output to the grid...	
	...on an <u>annual</u> basis.	...on a <u>3-year rolling average</u> basis.
Not Subject	Oil-fired EGUs	
	Existing EGUs that undertake modification or reconstruction	

GHG NSPS for New EGUs

Emission Limits

	Coal-fired EGUs	Natural Gas-fired EGUs	
BSER Determination	Partial CCS	Natural Gas Combined Cycle	
Subcategories	–	≤ 250 MW	> 250 MW
Emission Standard (lb CO₂/MWh)	1,100	1,000	
Compliance Options	12-operating-month rolling average 84-operating-month rolling average	12-operating-month rolling average	
Compliance Determination	First 12-operating-months of data Rolling average updated each operating month thereafter		
Startup, Shutdown, & Malfunction	No exemption for startup or shutdown periods Affirmative defense for malfunctions		

GHG NSPS for New EGUs

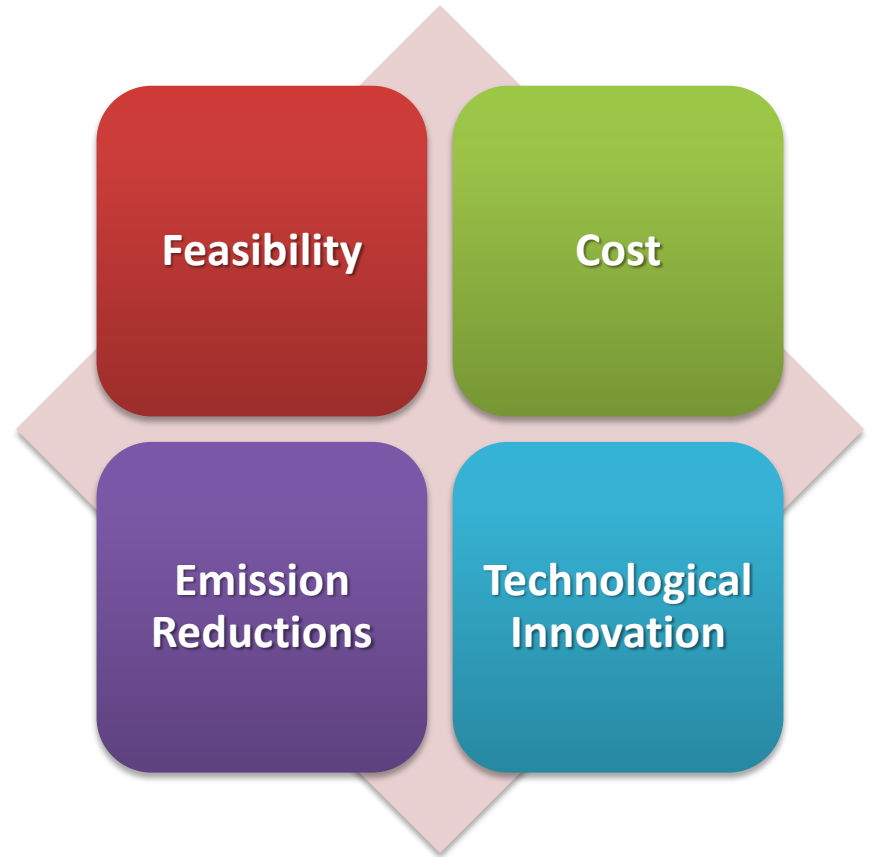
Other Requirements

	Coal-fired EGUs	Natural Gas-fired EGUs
Continuous Emissions Monitoring System (CEMS)	<p>Required for solid-fuel EGUs</p> <p>Must measure exhaust gas CO₂ concentration, flow rate, & moisture content</p>	<p>Optional</p> <p>If not used, must install fuel flow meter</p>
Other Monitoring Requirements	<p>Hourly EGU operating time & gross output in MWh</p> <p>Site-specific monitoring plan</p>	
Recordkeeping	<p>Calculations for emissions data, CEMS, gross output</p> <p>Maintained for 3 years total (2 years on-site) 10 years total for 84-operating-month compliance option</p>	
Reporting	<p>Quarterly emissions summary & excess emissions reports</p>	

Best System of Emission Reduction

**Partial Carbon Capture &
Sequestration**

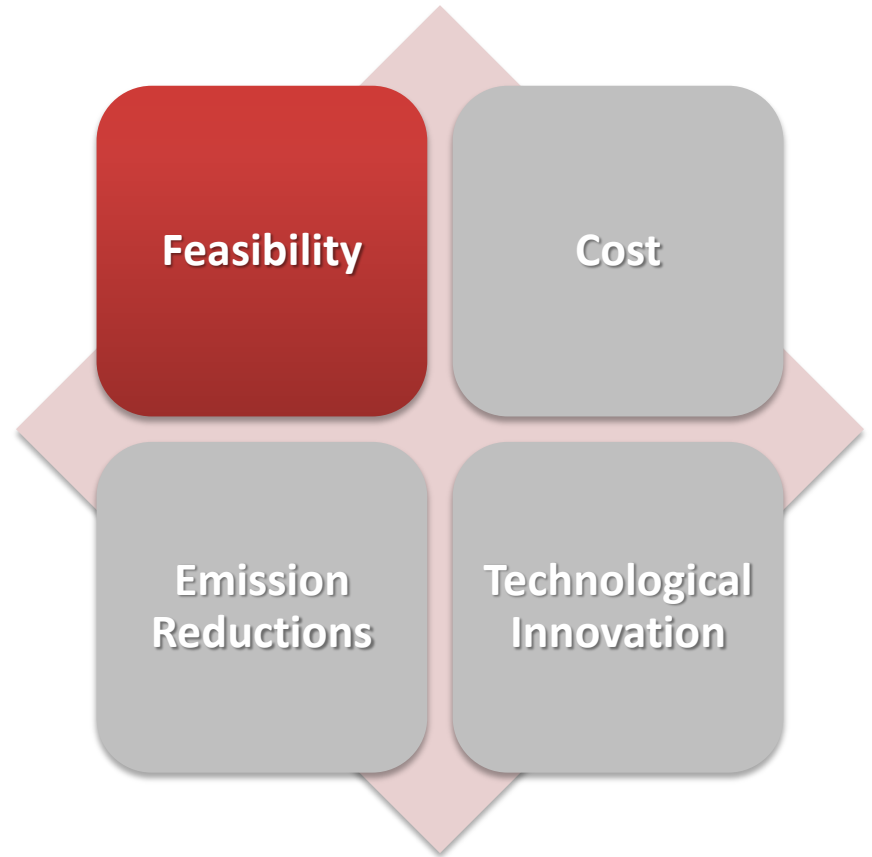
Best System of Emission Reduction



Best System of Emission Reduction

Technically
Feasible

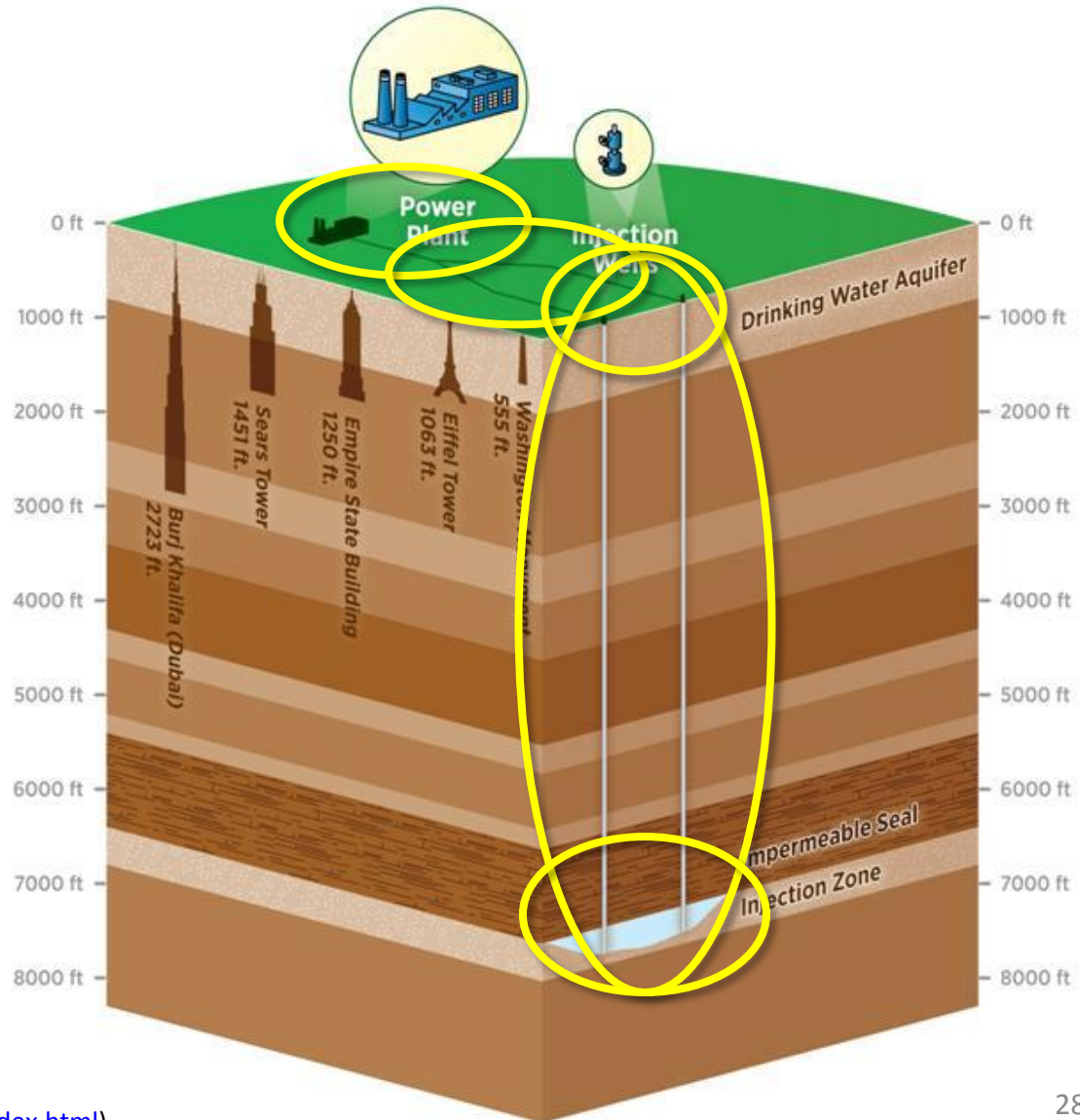
Adequately
Demonstrated



Best System of Emission Reduction

Partial CCS – Five-Stages

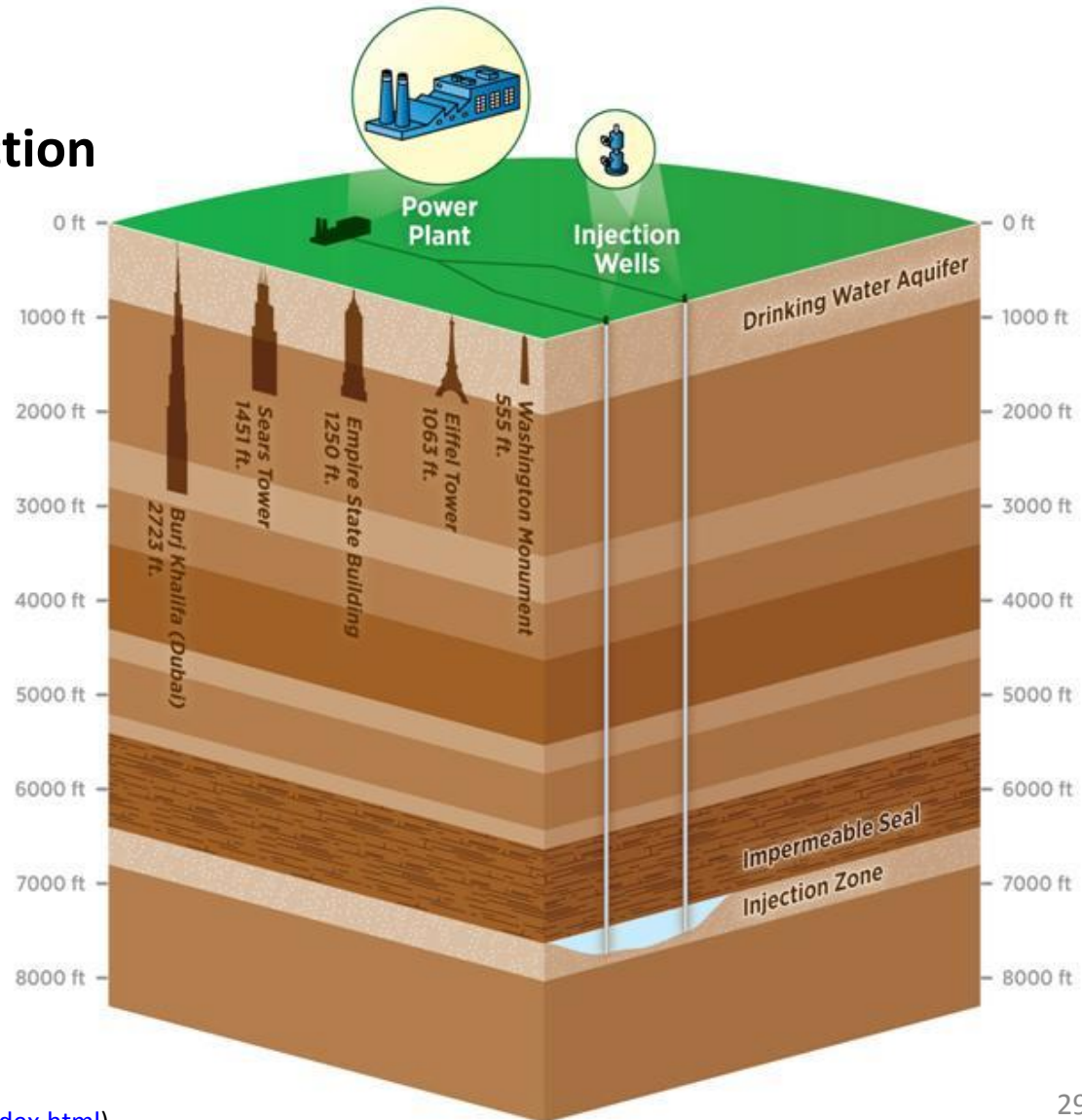
1. Capture
2. Transport
3. Injection
4. Sequestration
5. Monitoring



Best System of Emission Reduction

Capture, Transport, & Injection

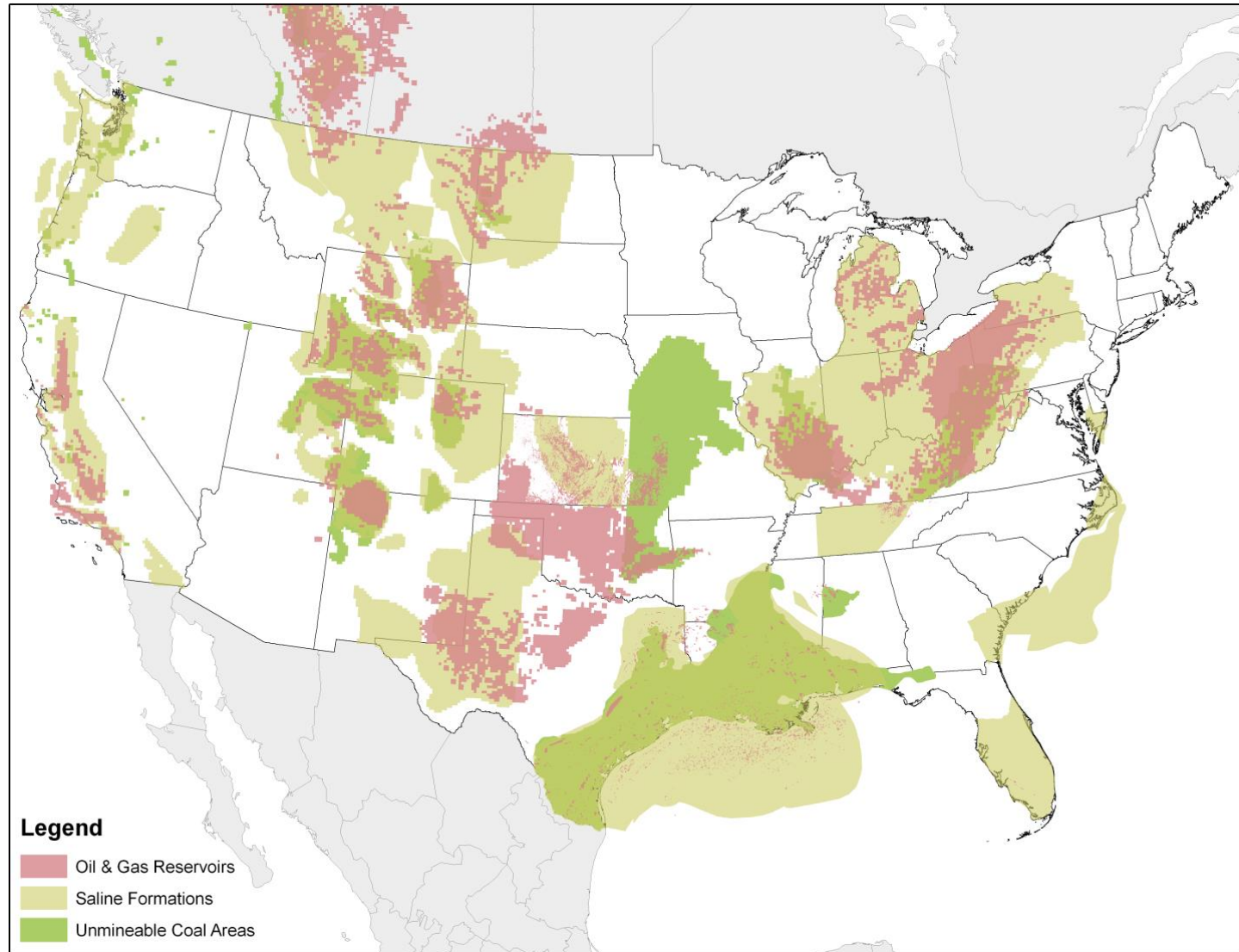
- CO2 captured since 1930s
- Transported and used for EOR since 1970s



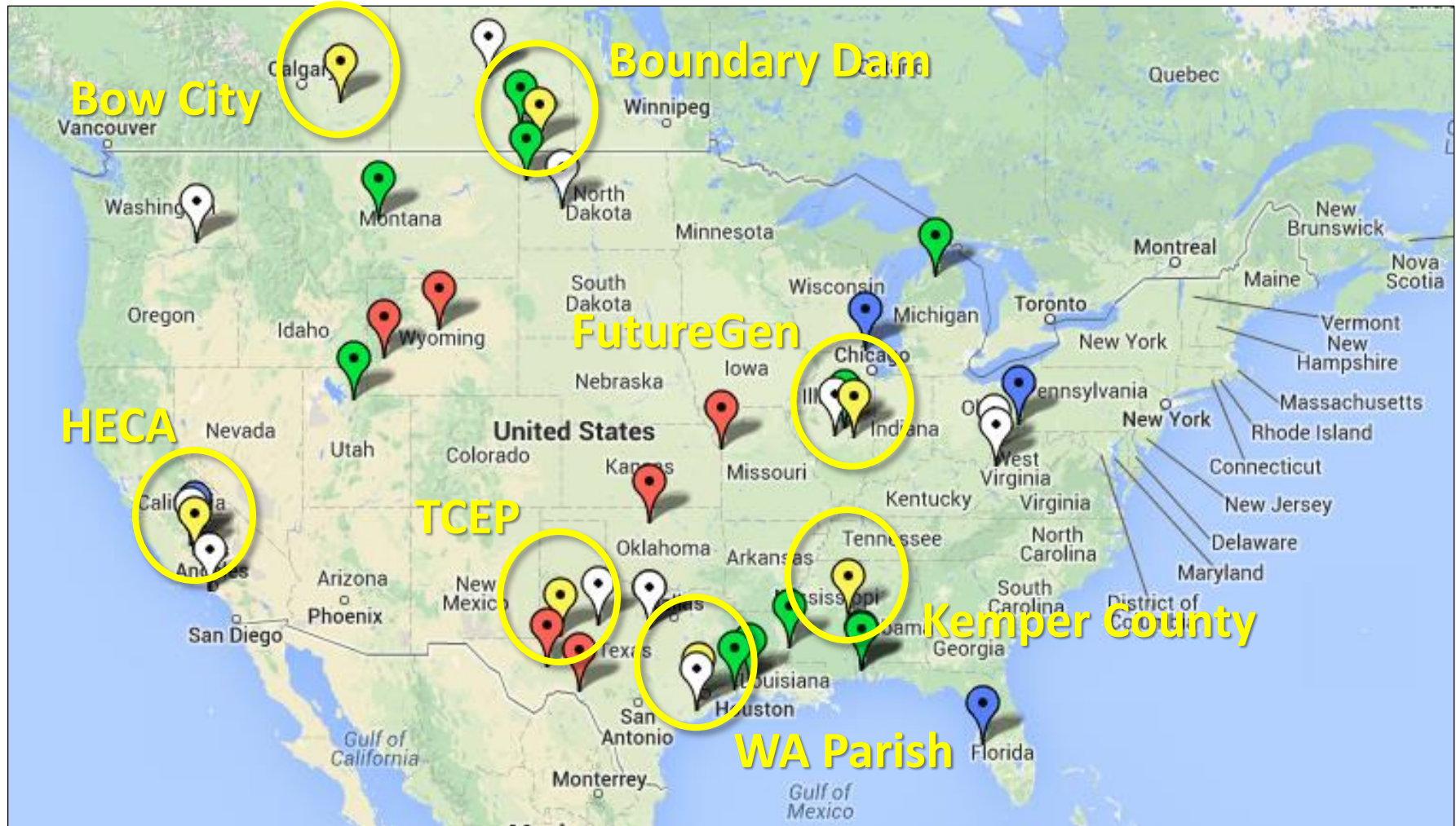
Best System of Emission Reduction

Sequestration

- 3,000 Gigatons
- 500 years' worth of 2011 CO₂ emissions (5.5 Gt)



Best System of Emission Reduction

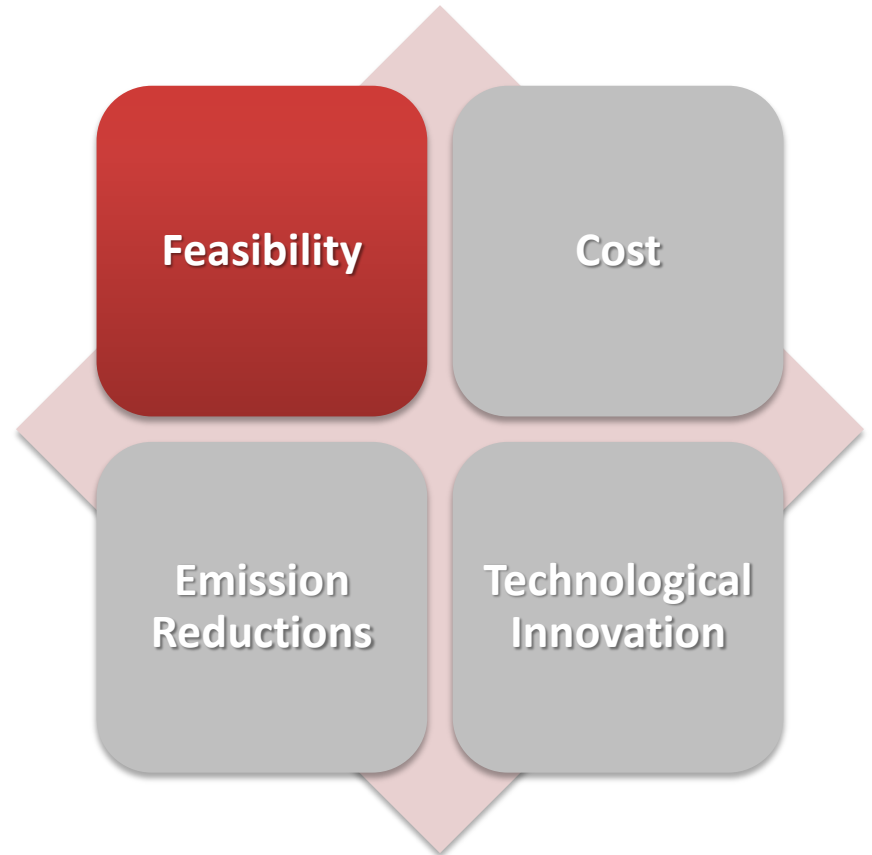


- 📍 — Power Plant CCS Projects
- 📍 — Non-Power CCS Projects
- 📍 — Commercial EOR Projects
- 📍 — Pilot CCS Projects
- 📍 — Cancelled or Dormant CCS Projects

Source: Carbon Capture & Sequestration Technologies @ MIT

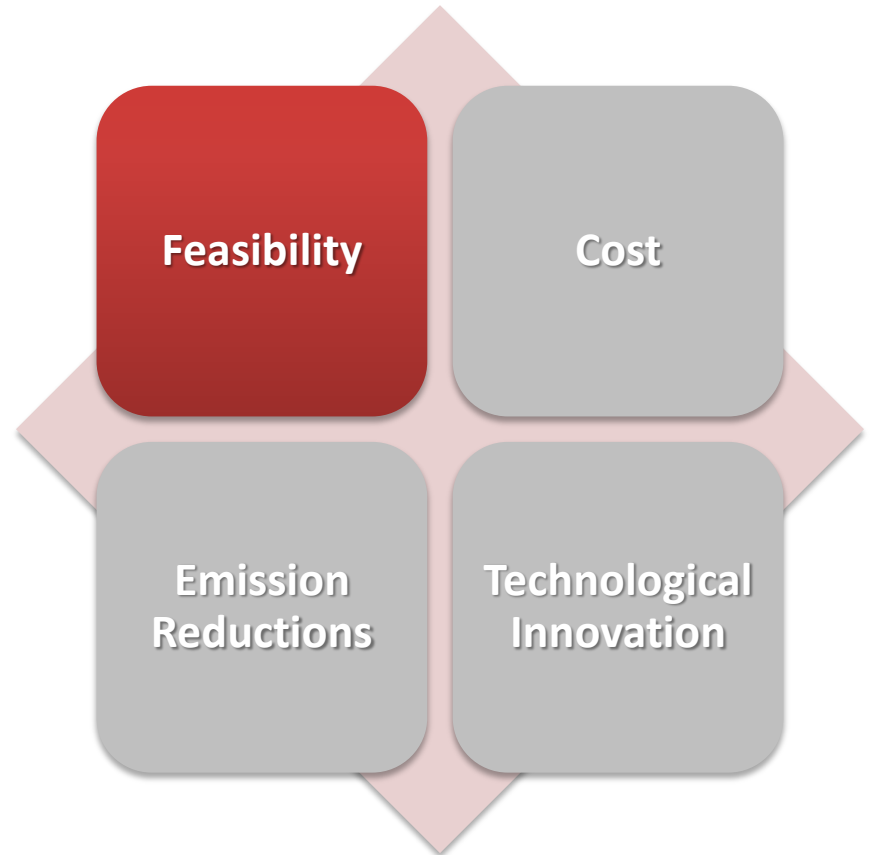
Best System of Emission Reduction

- Courts & case law
 - BSER is feasible if it is expected to be available to new sources
 - Does not have to be available to every source
 - Standard may prevent construction of some new sources



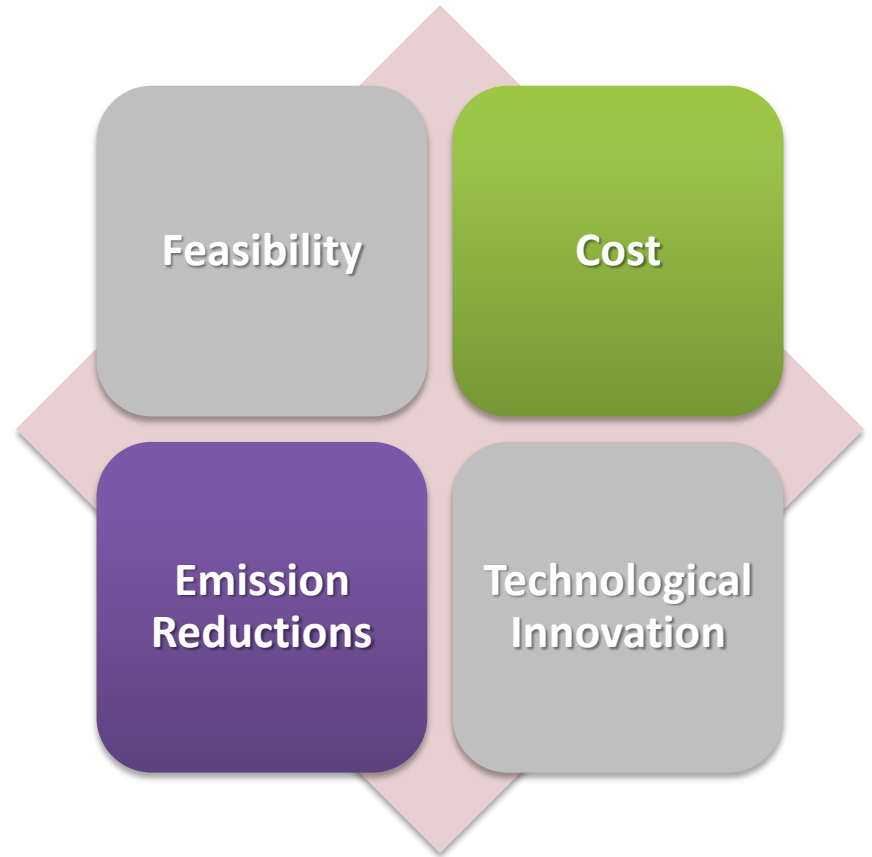
Best System of Emission Reduction

- 2010 Interagency Task Force on CCS
 - “There are no insurmountable technological, legal, institutional, regulatory or other barriers that prevent CCS from playing a role in reducing GHG emissions.”
- Largest barrier is cost



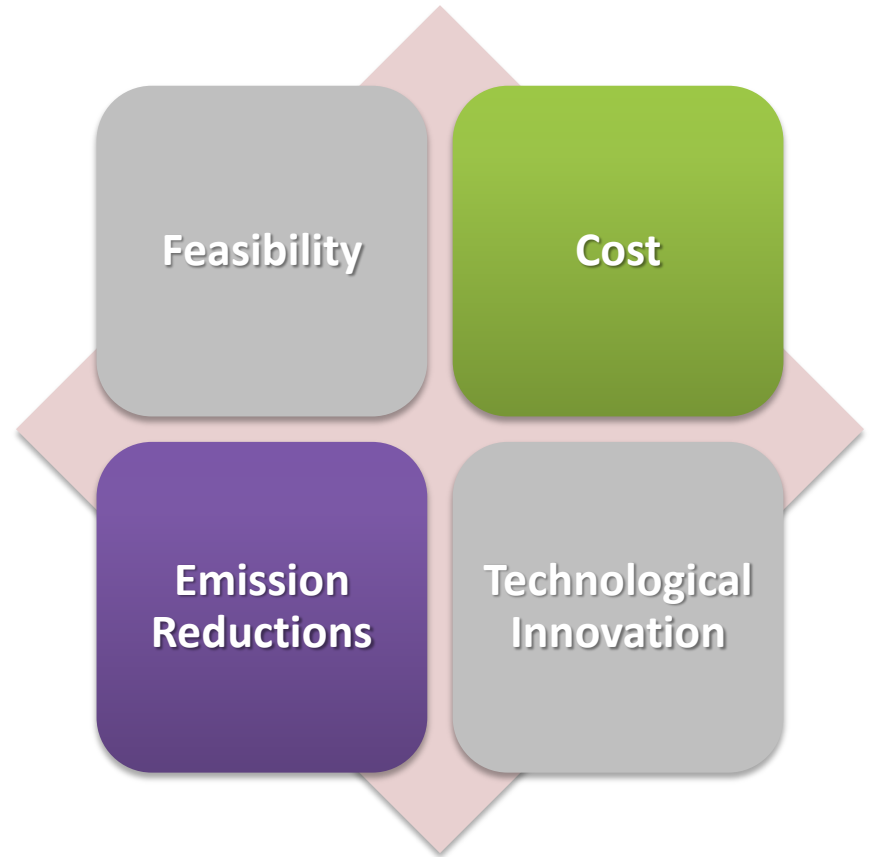
Best System of Emission Reduction

- Cost of BSER must be “reasonable”
- Courts & case law
 - Costs are acceptable as long as they are not:
 - “Exorbitant;”
 - “Greater than the industry could bear and survive;”
 - “Excessive;” or
 - “Unreasonable.”

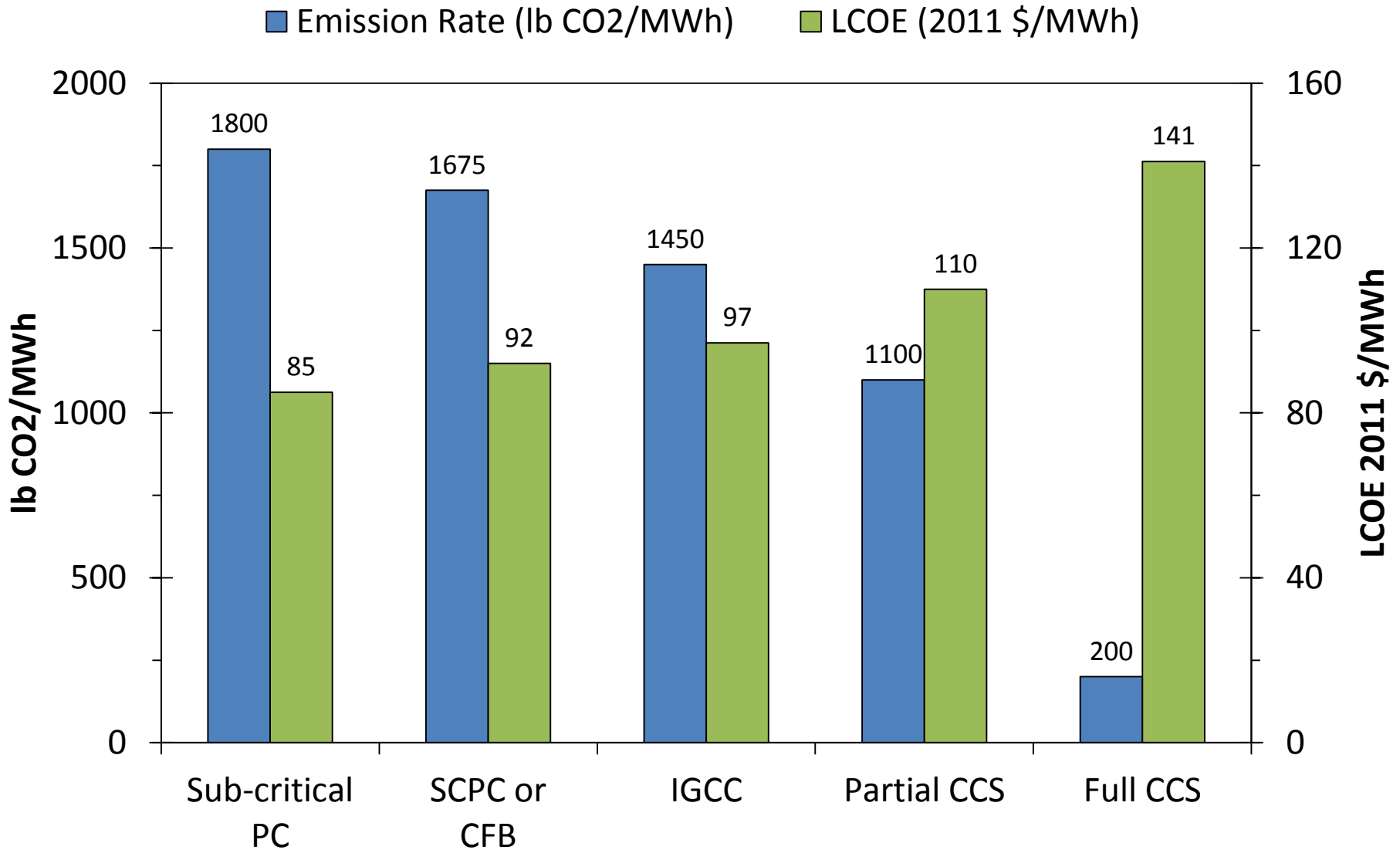


Best System of Emission Reduction

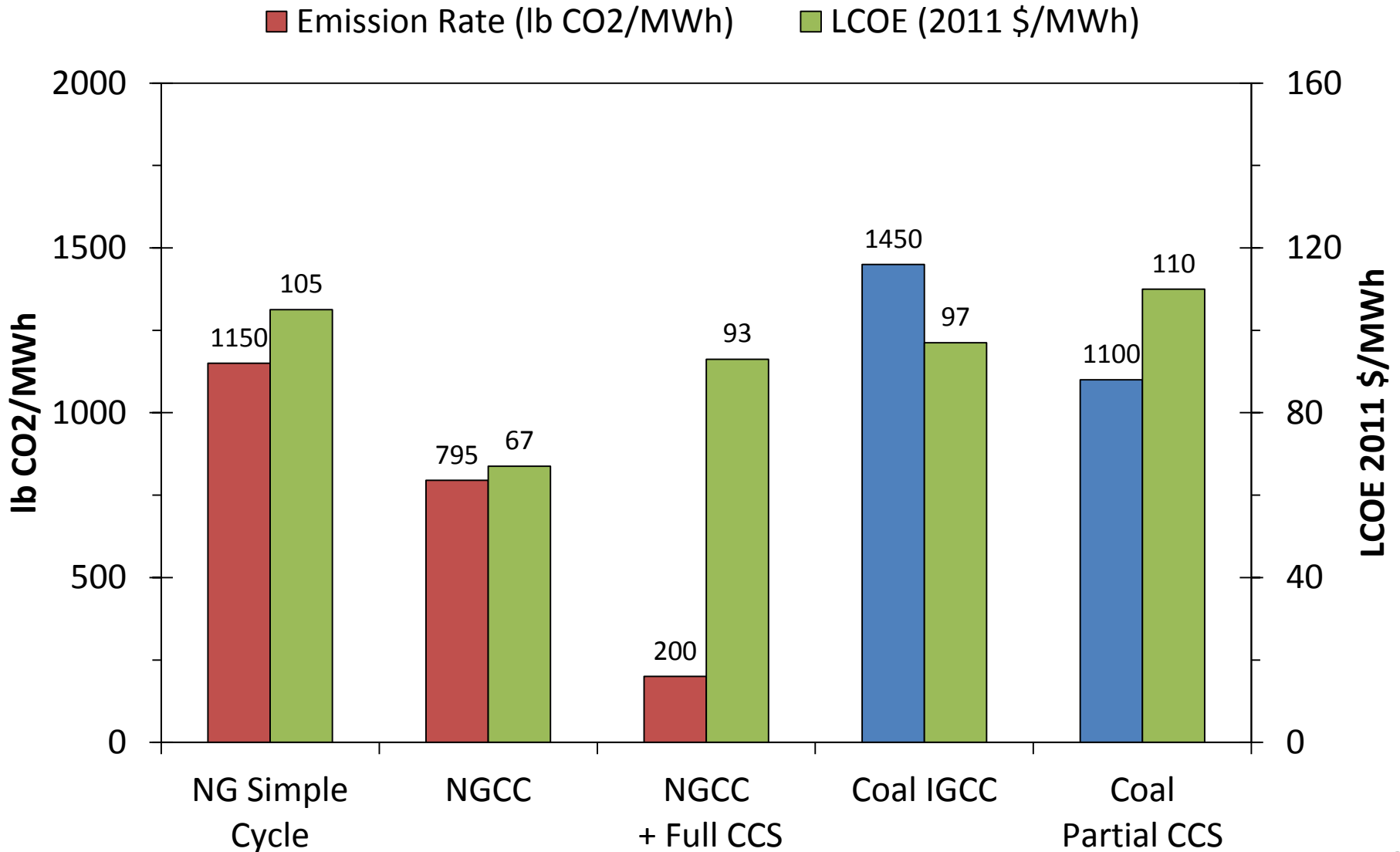
- Emission Reductions
 - Acceptable level not explicitly defined
- Courts & case law
 - EPA “must keep in mind Congress’ intent that new plants be controlled to the ‘maximum practicable degree.’”



BSER Compared – Coal

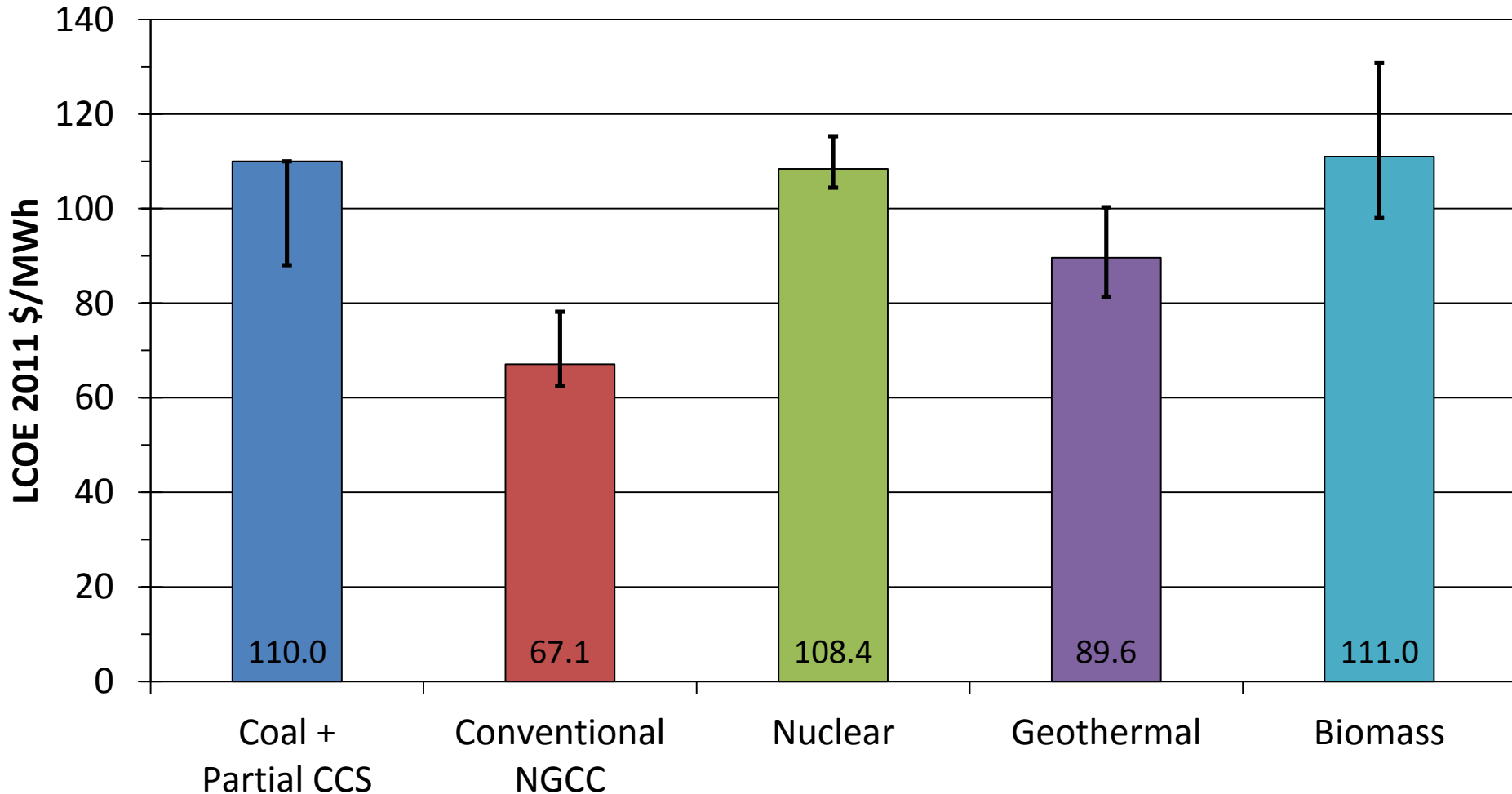


BSER Compared – Natural Gas



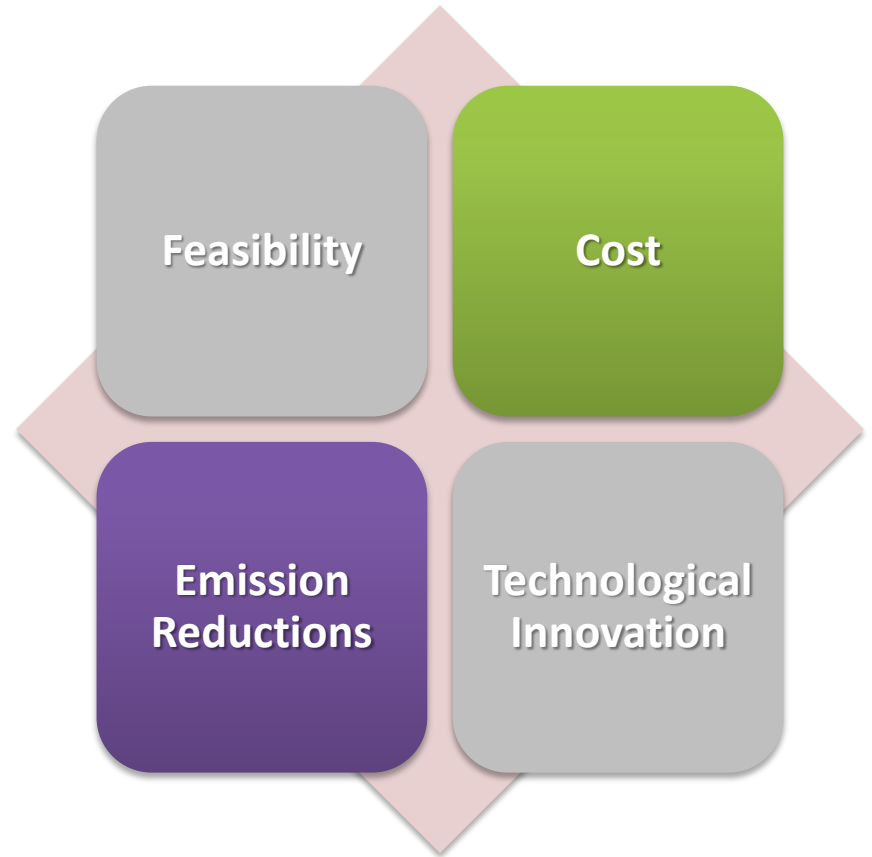
Best System of Emission Reduction

LCOE of Coal + Partial CCS vs. Other Dispatchable Generation



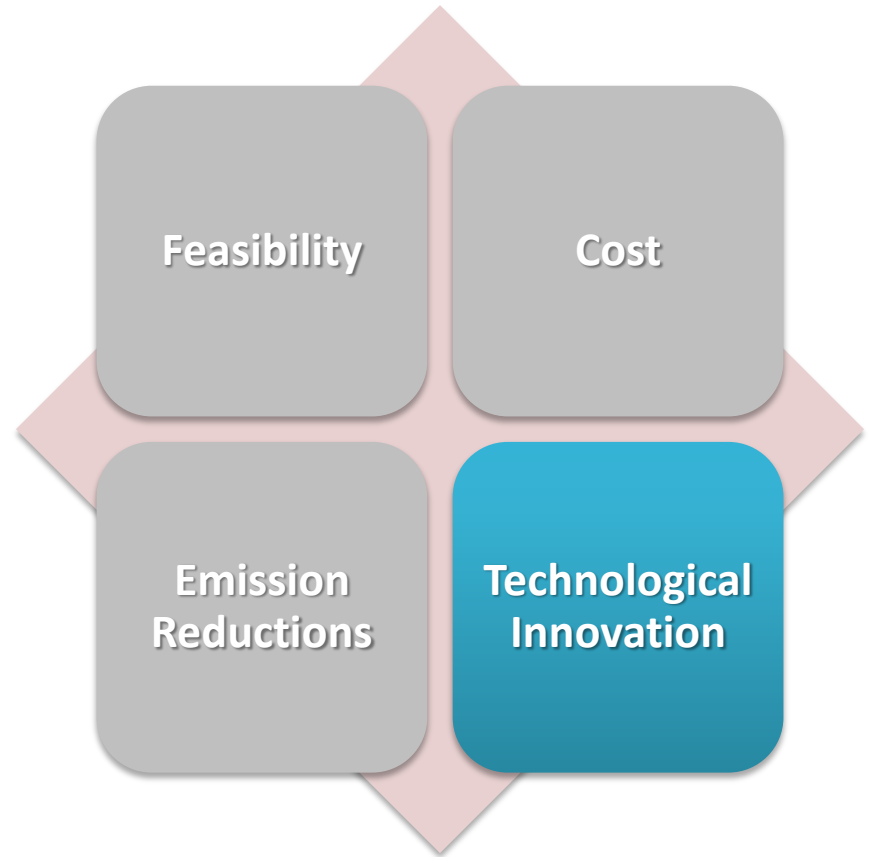
Best System of Emission Reduction

- Courts have never invalidated a standard because it was too costly
 - Have upheld standards that entailed high costs
- Revenue offsets



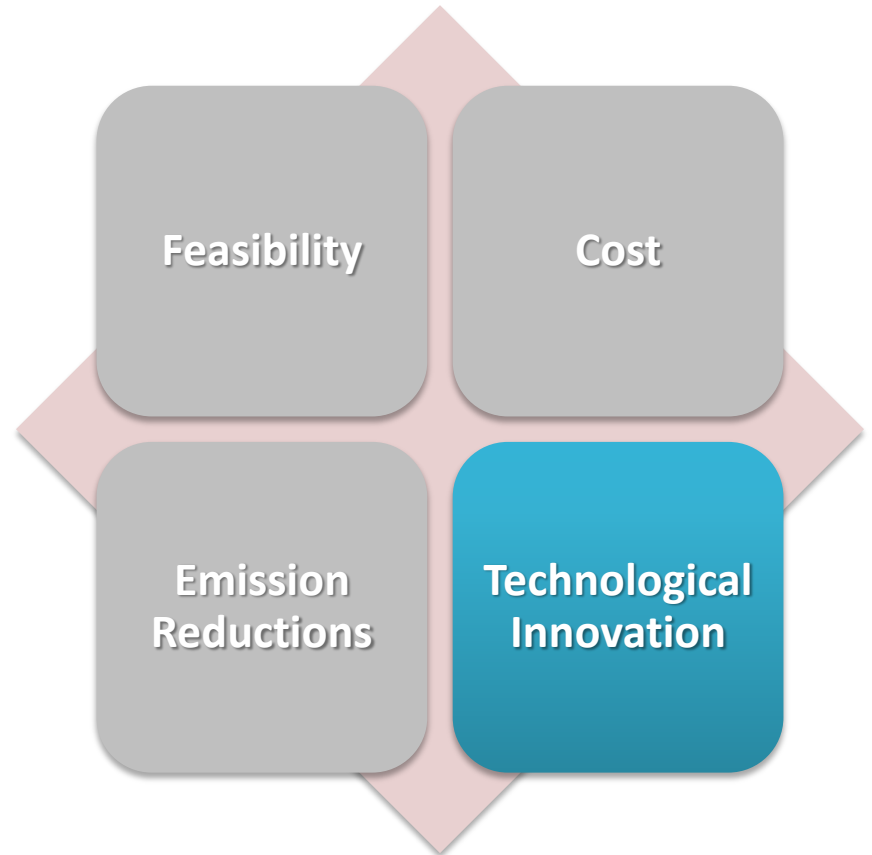
Best System of Emission Reduction

- Standard of Performance
 - Must encourage “constant improvement in techniques for preventing and controlling emissions...”
 - “Stimulate development of new technology.”



Best System of Emission Reduction

- CCS
 - Best option for controlling CO2 emissions
 - “Widescale cost-effective deployment of CCS will occur only when driven by policy designed to reduce GHG emissions.”
- Standard without CCS
 - Does not promote technological development



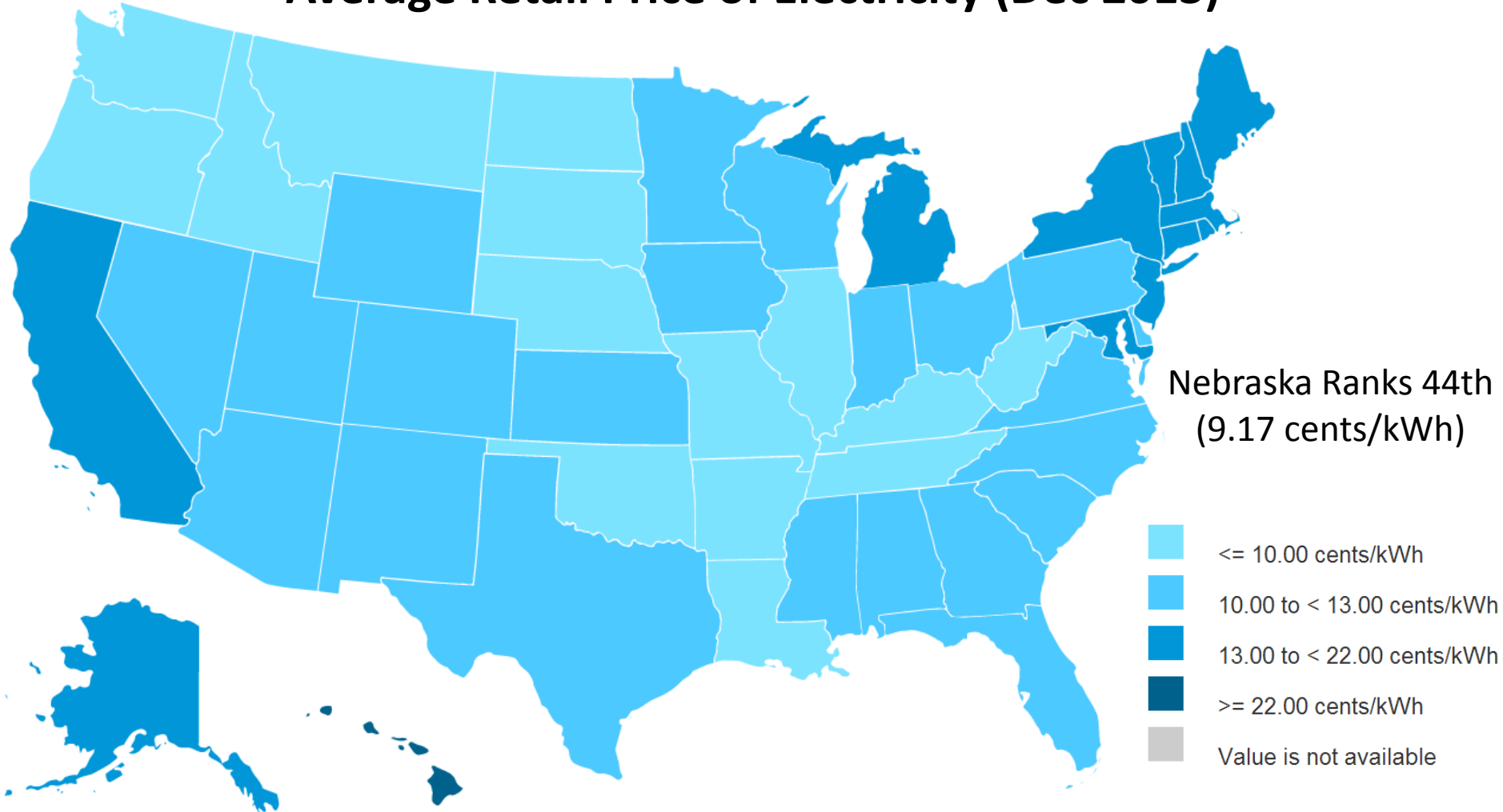
Best System of Emission Reduction

Coal	Adequately Demonstrated	Reasonable Cost	Adequate Emission Reductions	Promotes development of technology
No CCS				
Partial CCS				
Full CCS				

Natural Gas	Adequately Demonstrated	Reasonable Cost	Adequate Emission Reductions	Promotes development of technology
Simple Cycle				
Combined Cycle				
+ Partial CCS				
+ Full CCS				

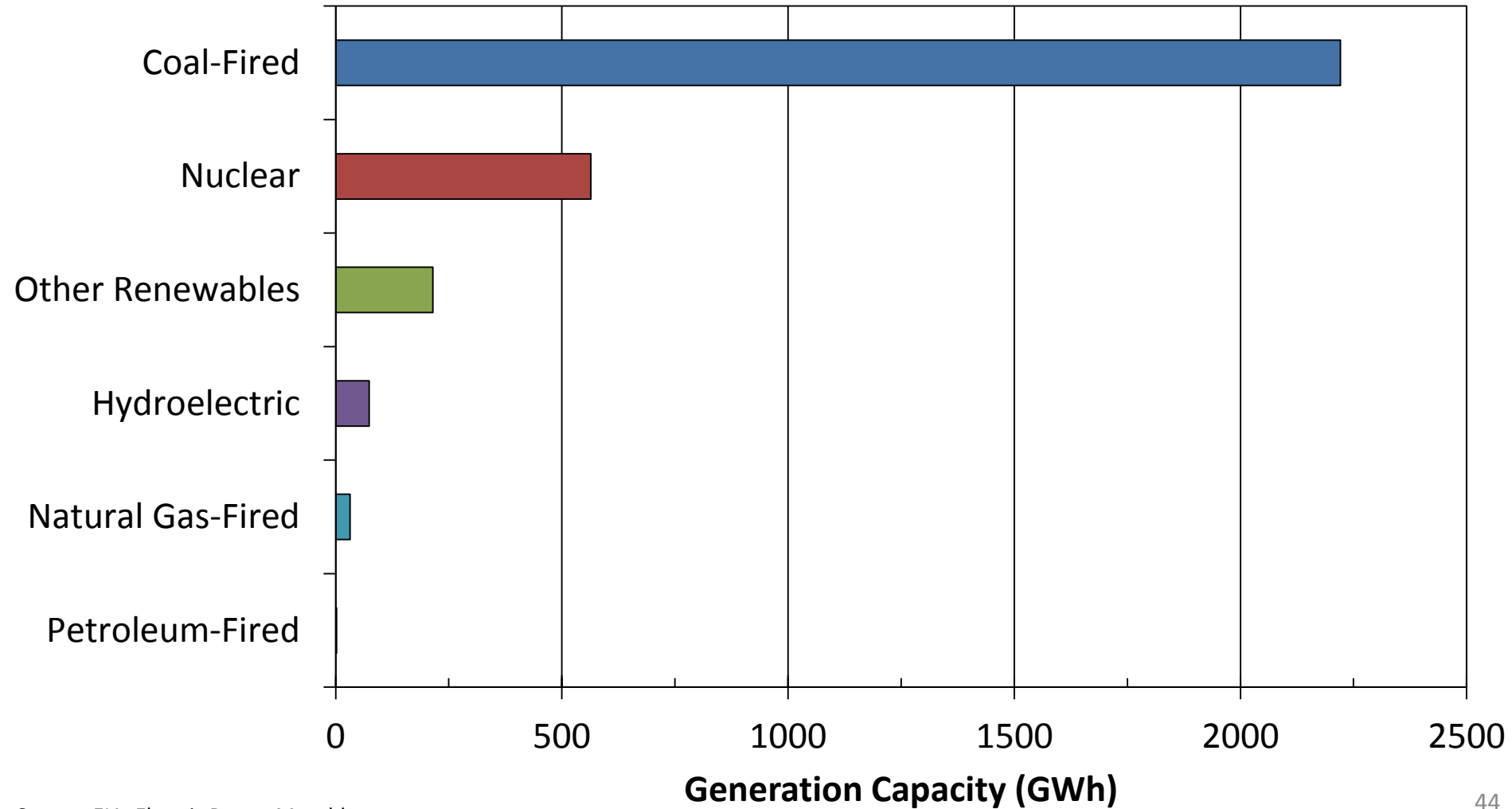
Impact on Nebraska

Average Retail Price of Electricity (Dec 2013)



Impact on Nebraska

Nebraska Net Electricity Generation by Source, Nov 2013



Impact on Nebraska

- OPPD, NPPD, LES Integrated Resource Plans
 - Baseload & intermediate demand will be met using existing facilities
 - Install new natural gas facilities to meet peak demand where necessary
 - Energy efficiency & renewable generation
 - Anticipating CO2 regulation

What Happens Next

- NSPS for New EGUs
 - Public comment period extended to May 9, 2014
 - Final Rule expected June 2014
- Emission Guidelines for Existing EGUs
 - Advanced to OMB review March 31, 2014
 - Proposed Rule expected June 2014
- Litigation anticipated

Watch This Space...

