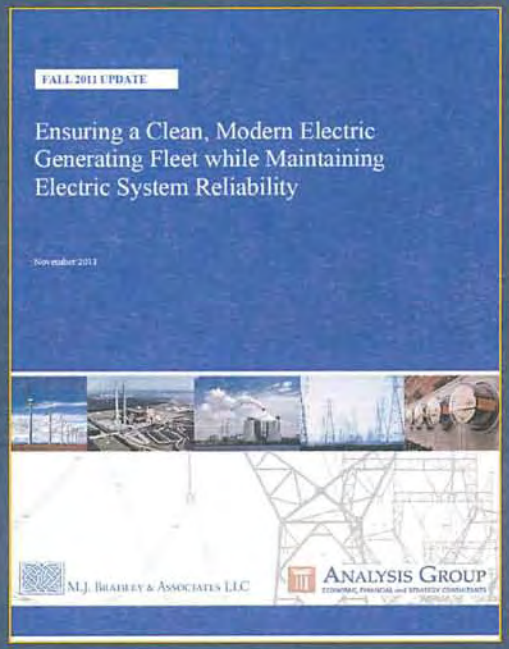
Ensuring a Clean, Modern Electric Generating Fleet while Maintaining Electric System Reliability



MJ Bradley Associates & Analysis Group

November 2011

Background

Series of analyses focused on the reliability implications of two EPA clean air rules affecting the electric power sector:

1. Cross-State Air Pollution Rule ("Transport Rule") (also "CASPR")
2. National emission standards for hazardous air pollutants ("Utility Toxics Rule") (also "MATS")

Three reports:

1. August 2010 – overview of upcoming regulations and issues
2. June 2011 – update on planning for compliance (and retirements)
3. November 2011 – focused on tools available to the industry

Two key findings – consistent across 3 MJBA/AG reports:

Electric system reliability planning and implementation:

- The electric power sector relies on a wide range of planning and operational tools and market mechanisms to ensure the reliability of the Nation's bulk electric power system.

Managing electric system reliability while bringing the fleet into compliance with EPA's air rules:

- Options are available under existing law to manage electric system reliability as the industry makes the investments necessary to comply with EPA's clean air rules.

"....the electric industry is well-positioned to comply with the EPA air regulations without threatening electric system reliability...."

"The industry has the tools it needs to respond with flexibility and timely action."

Standard reliability tools used in the electric industry – 1

Reliability planning is an on-going process

- **Long-term planning: "resource adequacy"**
  - Designed to ensure adequate resources (with reserve margin) ahead of need
  - "Resources" include power plants, transmission interconnections, demand-response capacity
- **Nearer term special assessments, system impact studies**
- **Operational tools for reliable operations in near-term and real-time**

Standard reliability tools used in the electric industry – 2

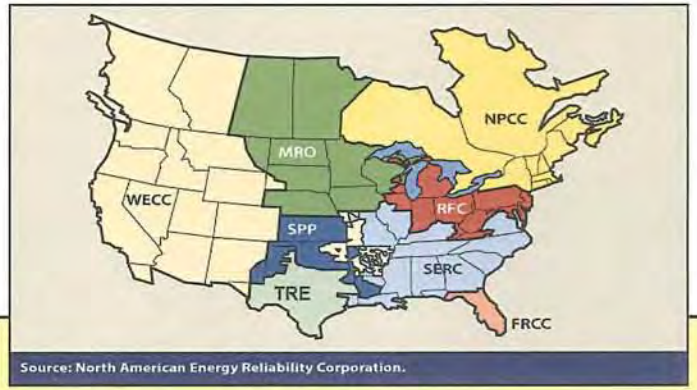
Reliability planning involves multiple groups at the various stages

- **Reliability organizations:**
  - North American Electric Reliability Corp (NERC) – standards, enforcement, studies
  - Regional reliability entities – assessments, implementation
- **Grid operators:**
  - RTOs and transmission entities – planning, dispatch, system operations
- **Market participants:**
  - Generating companies, transmission companies, demand-response providers
- **Regulators:**
  - FERC: reliability standards approval, transmission planning oversight, markets
  - State PUCs: planning requirements (especially generating and demand-side resources), certificates of public need and convenience / siting, emergency powers
  - DOE: emergency authorities

Standard reliability tools used in the electric industry – 3

Resource margins

- Target reserve margins vary by region, between 12.5%-to-15% above projected peak demand
- In all regions, reserve margins greatly exceed minimum requirements



Source: North American Energy Reliability Corporation.

	MBJA & Analysis Group 11-2011 Report			New NERC 2011 Assessment (2015 Moderate Case)
NERC Electric Reliability Region	**Projected Reserve Margin in 2014**	**NERC Target Reserve Margin**	**Cushion Above NERC Target Reserve Margin In 2014**	
TRE	31.0%	12.5%	12.5 GW	Needs to add capacity even in reference case
FRCC	31.7%	15.0%	7.4 GW	Resources well above target reserves
MRO	28.3%	15.0%	5.5 GW	Resources well above target reserves
NPCC	30.1%	15.0%	9.5 GW	NE needs to add MW even in reference case; NY well above target
RFC	34.0%	15.0%	34.8 GW	Resources well above target reserves
SERC	29.4%	15.0%	30.4 GW	Resources well above target reserves
SPP	40.3%	13.6%	12.3 GW	Resources well above target reserves
WECC	40.2%	14.7%	33.2 GW	Resources well above target reserves
Total			**145.7 GW**	

Standard reliability tools used in the electric industry – 4

Reliability studies are routinely conducted in advance of proposed changes in electric infrastructure:

- **System planners conduct "power flow" studies to identify reliability issues related to:**
  - A new plant proposed (or upgrade affecting capacity) to be connected to the grid
  - A plant proposed to be retired
- **After the studies, system planners identify changes that are required to accommodate the proposal in a reliable way**
  - E.g., transmission system upgrades to handle changed power flows
    - **Before a new plant interconnects and begins operation**
    - **Before an upgrade at an existing power plant can commence operation**
    - **Before an existing plant can be retired**
  - E.g., "reliability must run" agreements to keep the plant operating pending upgrades

Standard reliability tools used in the electric industry – 5

RTO/ISO	Advance Notice Requirement prior to proposed retirement (or "delisting") of a facility
ERCOT (Texas)	90 days notice (for units to be taken out of service for periods that exceed 180 days)
Midwest ISO	26 weeks
New York ISO	180 days (for generators larger than 90 MW) and 90 days (for generators smaller than 80 MW)
PJM	90 days
SPP	45 days

Standard reliability tools used in the electric industry – 6

Roles of the market:

- **Proposals to build new generating plants and other resources**
  - In some RTO regions, forward capacity markets
  - In traditionally regulated states and other states, utility integrated resource plans and competitive procurement processes
- **Project proposals are underway in various**
  - **Utility and non-utility companies plan for, permit, engineer and construct new power projects.**
  - **Typical lead times:**
    - 2-3 years to fully develop, permit and construct a simple cycle gas turbine
    - 3-5 years to fully develop, permit and construct a gas-fired power plant.
    - New coal or nuclear plants will likely require much more time.
    - Demand-side resources take much shorter lead times (e.g., <1 year).

Standard reliability tools used in the electric industry – 7

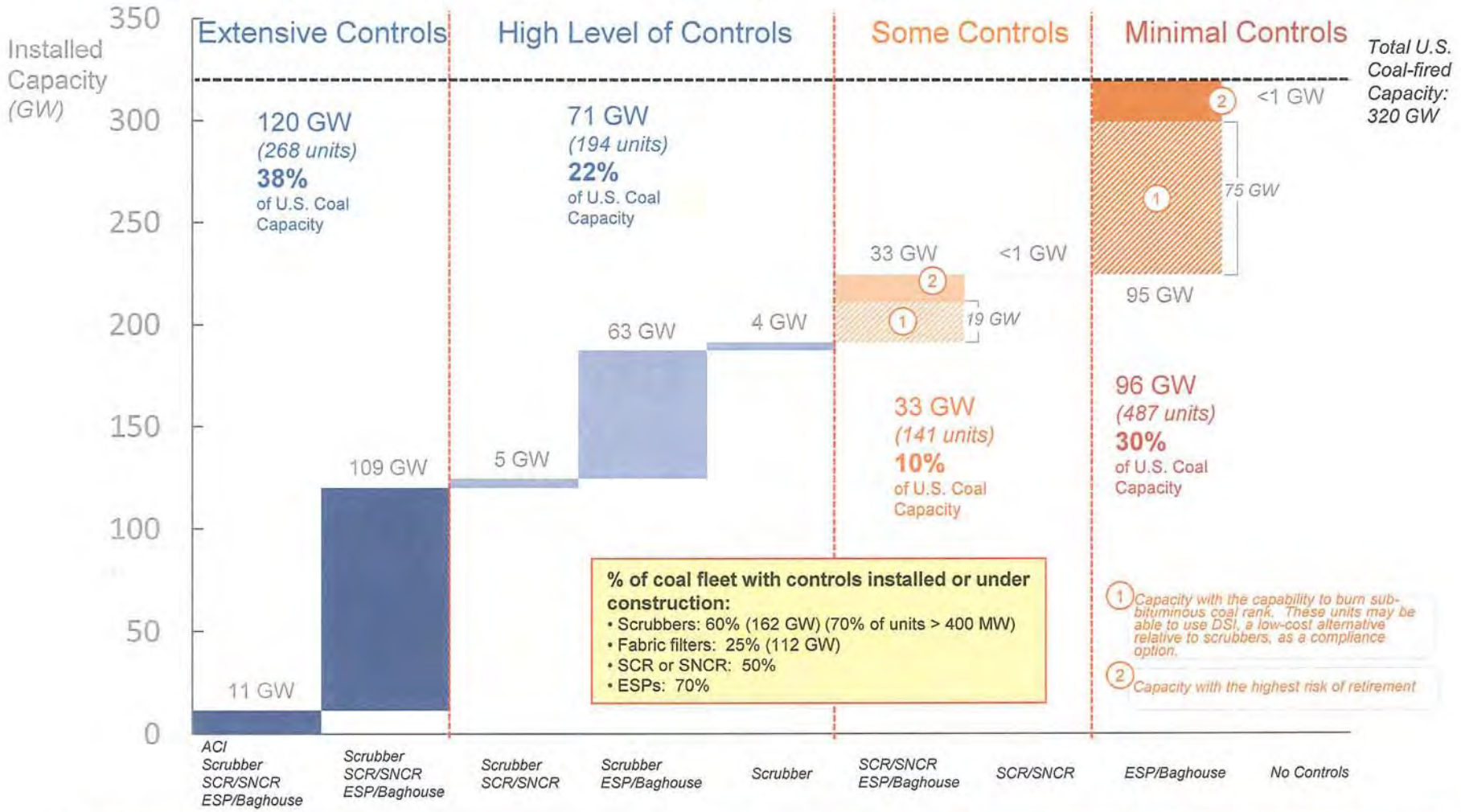
Market response: Many new power projects are underway, spurred by:

- relatively low prices for natural gas,
- renewable energy requirements, and
- potential retirements

NERC region (not including the West)	Announced Capacity Additions (GW)	Total Under Construction (all technologies and fuels) (GW)	Total Natural Gas Projects Under Construction (GW)	Total Natural Gas Projects In Advanced Development (GW)
ERCOT	43.9	1.5	0	4.4
FRCC	11.1	1.4	1.3	1.3
MRO	41.3	1.3	0.4	0.0
NPCC	17.4	1.2	0.5	0.6
RFC	48.9	5.1	1.3	0.7
SERC	43.3	13.2	7.8	1.3
SPP	33.5	1.3	0.0	0.0
Total	239.4	25.0	11.3	8.3

Existing options for managing the transition – 1

Many coal plants already have appropriate pollution control equipment



Existing options for managing the transition – 2

Compliance planning and construction projects are well underway at facilities around the country:

- **Recent corporate earnings and press statements indicate that many generating companies impacted by the EPA clean air rules are well positioned to comply because of earlier investments in their fleets:**

- AES
- Ameren
- Buckeye Power
- Calpine
- CMS Energy
- Constellation
- Dominion
- Duke
- Dynegy
- Edison Int'l
- Exelon
- FirstEnergy
- GenOn
- Great Plains
- Lower CO Rvr
- NextEra
- NRG
- PowerSouth
- PPL
- Progress
- PSEG
- Santee Cooper
- SCANA
- Seminole Elec Coop
- TECO Energy
- Vectren
- Wisconsin Energy
- Xcel

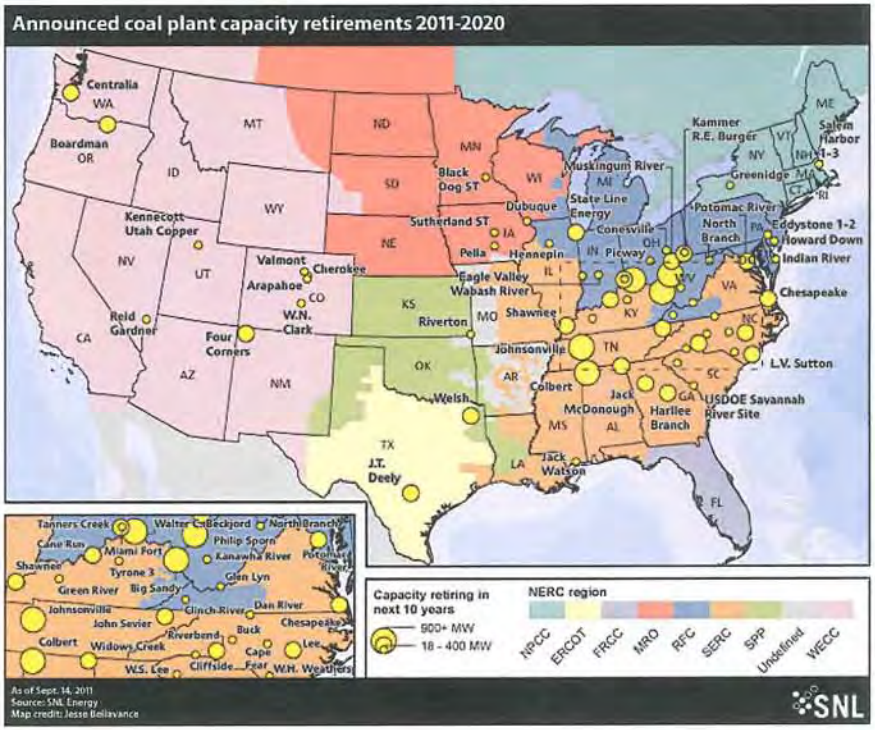
= half of the nation's coal-fired generating capacity

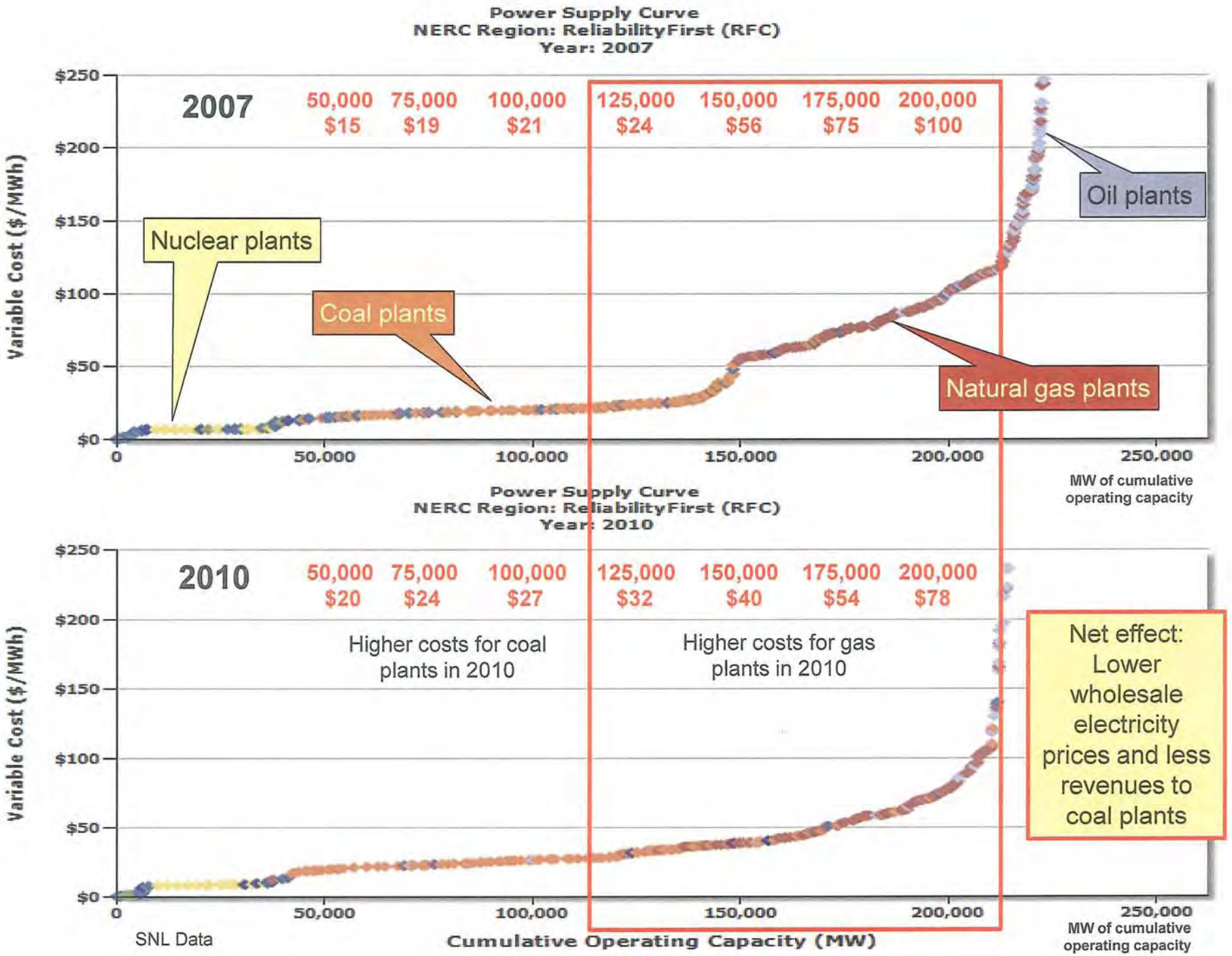
Existing options for managing the transition – 3

Retirements make economic sense in many cases:

Announced / scheduled coal plant retirements as of 9-26-2011					
Scheduled retirement date	2011	2012	2013	2014	2015
Average age at retirement (years)	54	55	51	54	60
Total capacity	2.63 GW	2.56 GW	2.67 GW	8.16 GW	3.28 GW
Cumulative capacity (of these units)	2.63 GW	5.19 GW	7.86 GW	16.02 GW	19.30 GW
Weighted average heat rate (Btu/Kwh)	12,287	11,448	11,313	10,766	10,618

Note: Retiring plants
- account for 5% of total coal-fired generation in 2010
- have lower than average capacity factor compared to all coal plants




Power Supply Curve
NERC Region: ReliabilityFirst (RFC)
Year: 2007
2007
50,000 $15
75,000 $19
100,000 $21
125,000 $24
150,000 $56
175,000 $75
200,000 $100
Nuclear plants
Coal plants
Natural gas plants
Oil plants
Variable Cost ($/MWh)
$250
$200
$150
$100
$50
$0
0
50,000
100,000
150,000
200,000
250,000
MW of cumulative operating capacity
Power Supply Curve
NERC Region: ReliabilityFirst (RFC)
Year: 2010
2010
50,000 $20
75,000 $24
100,000 $27
125,000 $32
150,000 $40
175,000 $54
200,000 $78
Higher costs for coal plants in 2010
Higher costs for gas plants in 2010
Net effect: Lower wholesale electricity prices and less revenues to coal plants
SNL Data
Cumulative Operating Capacity (MW)

Existing options for managing the transition – 4

Many states with coal plants already have strict mercury requirements that have led to installations of controls:

State Year Enacted Policy/Rule

New Hampshire – 2002
Connecticut – 2003
New Jersey – 2004
Delaware – 2006
Maryland –2006
Illinois – 2006
North Carolina – 2006
Montana – 2006
Minnesota – 2006
Massachusetts – 2007
New York – 2007
Colorado – 2007
Georgia – 2007
Wisconsin – 2008
South Carolina – 2008
Michigan – 2009
Oregon – 2010

Existing options for managing the transition – 5

Compliance periods:

- **Utility Toxics: 3-year compliance period**
- **Plus: 1 year (EPA and state regulatory authorities have the discretion to grant, on a unit-by-unit basis, an additional 12 months for the installation of pollution control systems where appropriate)**
- **If 4 years is still not enough time to install the necessary pollution control systems:**
  - **EPA has the statutory authority to enter into administrative orders of consent under §113(a)(4) of the CAA or consent decrees with power plant operators, allowing additional time for the installation of controls.**

Existing options for managing the transition – 6

Compliance periods:

- EPA and the states also have existing legal authority to address potential reliability concerns associated with the retirement of electric generating units.
  - Five of the nation's RTO's have submitted public comments to EPA proposing a "targeted backstop reliability safeguard" to address situations where additional time is required for a unit retirement.
  - The joint RTO commenters anticipate that the reliability safeguard "would not need to be invoked often, if at all".
- If these approaches are exercised, units should operate only for reliability purposes to limit the plant's air pollution emissions during the extension period. The CAA directs that EPA specify "any additional conditions" for the protection of public health during the extension period.