SCOTTMADDEN
Management Consultants

Meet With Us

The Energy Industry Update

Highlights of Recent Significant Events and Emerging Trends

November 2011

Vol. 11, Issue 2

Table of Contents

SCOTTMADDEN Management Consultants

Unprecedented Uncertainty, Extraordinary Investment

The energy and utilities industries continue to face challenges as world economic growth remains slow coming out of the Great Recession. Reduced energy demand has staved off the industries' acute demand for new infrastructure, but aging plants, shifting demand patterns, continued growth of renewable resources, and costly environmental regulations are driving significant investment needs.

Environmental Regulation...and Events...Create Unprecedented Uncertainty	❑ The release of radioactive material by the Fukushima Daiichi nuclear plant has caused the worldwide nuclear industry and its regulators to pause and consider enhancements to safety assets and protocols. In some cases, it has steeled resistance by anti-nuclear advocates to both relicensing existing and proposed nuclear plants. ❑ Shale gas remains a game-changer for both the natural gas and power generation sectors and persistent low dry gas prices in the U.S. do not seem to hamper the interest in further shale gas development. However, regulation of hydraulic fracturing, or outright bans on fracking, could slow shale gas production. ❑ An active EPA has promulgated a number of new, very stringent regulations of emissions affecting industrial and power generation facilities that could result in retirements or costly retrofits. In a politically contentious debate, some contend it could jeopardize reliability and that the timeline for compliance is draconian and unrealistic. ❑ Recent drought conditions, population migration patterns, and possible cooling tower retrofits for some power plants have focused attention water resource management as a strategic priority.
We're Going to Need a Bigger Balance Sheet	❑ Utility rate recovery has been lagging and continues to fall below amounts sought, putting more stress on company balance sheets. In some cases, utility companies are employing alternative structures to shorten recovery times. ❑ Energy and utilities companies are also merging, seeking stronger and larger balance sheets, operational synergies, new market opportunities (especially for mining and upstream natural gas companies), and regional and business diversification. ❑ Utilities continue to be interested in smart grid and smart grid-enabled behind-the-meter products and services. But the scope of the opportunity and whether customers and regulators will embrace it and pay for it —which will drive utility investment decisions—remain open questions.

View from the Executive Suite

SCOTTMADDEN Management Consultants

Electric & Combination Utilities

- **Disciplined cost management** overcomes weak wholesale power prices
- **Investments in intelligent grid** exemplify the **smart, targeted growth**
- Pursuing **regulatory models** providing forward-looking cost-recovery mechanisms and performance **incentives for new infrastructure** to meet rising demand
- **Likely acceleration of technological change** in usage (e.g., self-generation, home automation)
- **Cash to fund opportunistic investments** consistent with points of view
- **Customer outreach, customer education around digital smart meters**
- Mergers creating **"premier regional energy provider"**
- **Restructuring corporate organization**: reduce admin costs and return autonomy, accountability to operating subs
- **Right mix of "arrows"**– including nuclear, coal, natural gas, renewables, and energy efficiency

Electric Distribution Utilities

- **Invest prudently in capital plant**
- **Intense regulatory activity** with the end of several long-term fixed-rate plans
- Tune to customer and regulator needs and drive business performance, **moving from global to regional models**
- States adopting **policies to promote aggressive utility pursuit of cost-effective energy efficiency, revenue decoupling, and related business models**
- **Exposed to bad debt risk**, which is affected by unemployment rates
- Focus on **investing in electric system reliability, building a smart grid, advancing transmission, and growing energy services business**
- **Review of our storm restoration process**
- **Merger as a natural fit of two companies with adjacent geographic footprints and similar strategic goals**

IPPs & Merchants

- **Realities of supply and demand point to substantially lower commodity prices**
- **Refinancing legacy credit facilities**: more balanced maturity profile and more flexible covenants
- **Converting coal-fired generation to run primarily on natural gas**
- **Monitor efforts to circumvent market forces to dampen pricing signals**
- Expanding to **retail, electric vehicle services, and distributed energy operations**
- **"Mass gravitational force" of relentlessly low gas prices** leaving share prices languishing
- **Solar power as a national development opportunity**; building multi-technology portfolios
- **Aligning [green] retail expertise with our fast-growing, large-scale renewable generation to sell RECs**
- **Position to capture any opportunity** that arises as a result of government action or inaction [on environmental regulations]

Gas Local Distribution Companies (LDCs)

- **Accelerate, expand plans to reinforce our gas infrastructure**
- **Rigorous programs to monitor and maintain pipelines and other gas assets**
- **Close gap between actual and allowed returns** through innovative rate design, more timely filings of rate cases, and capital cost-recovery mechanisms
- **Growth of distributable cash** through solid performance of LDC and energy services
- Benefits from **cost-of-service gas reserves contractually dedicated** to the LDC
- **Multi-year programs to upgrade our system and CNG refueling station networks**
- **Expand presence for both utility and non-utility businesses through acquisition and opportunities to leverage core competencies into new gas-related markets**
- Investment in **high-deliverability storage**
- **New [efficient end-use] products** will offer growth opportunities

Gas Pipelines

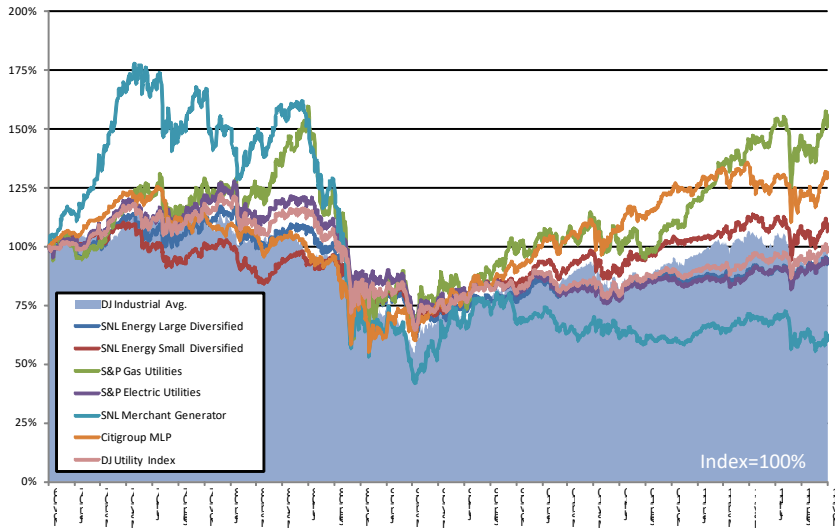
- **Capex for new growth prospects** against a backdrop of lower overall throughput, lower gas prices, shifting supply and demand patterns, and lower demand
- **Competitive business threats from LNG**
- **Significant commodity price protection through hedges**
- **Growth in shale moving from "proof-of-concept" into "manufacturing mode"**
- **Own and operate primarily fee-based assets that are core to the energy infrastructure of growing markets and produce relatively stable cash flow in all market conditions**
- **New pipelines to move gas around the country as the supply sources have changed**
- **Growing demand for ethanol due to renewable fuels mandates**
- **Large geographic footprint** provides additional growth opportunities
- **Financial flexibility** enables us to generate more distributable cash flow accretion from investments

Sources: Company annual reports, websites, and investment analyst presentations

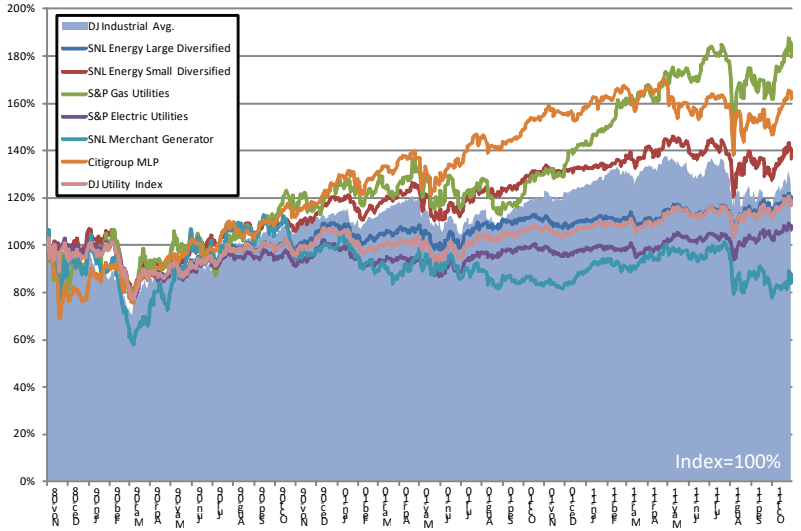
Selected Stock Indexes: Gas-Related Stocks Are Strong, Merchants Wither, and Small Diversifieds Shine

SCOTTMADDEN
Management Consultants

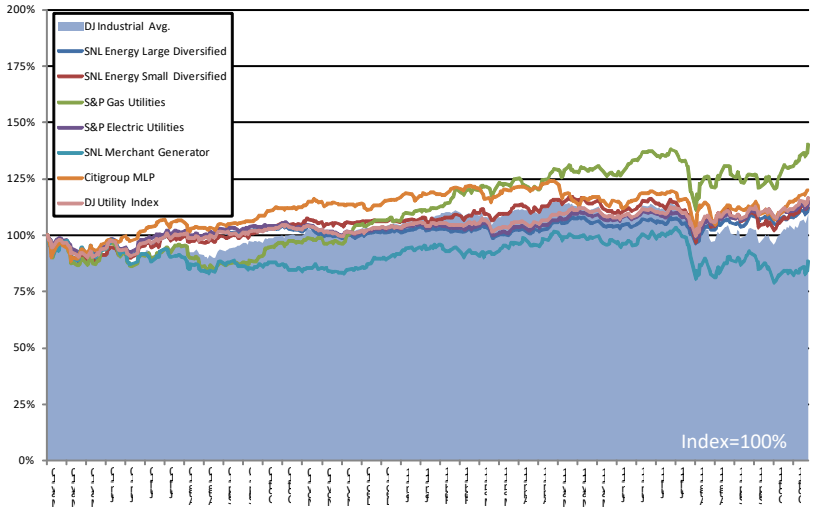
Selected Stock Index Values—Nov. 2006 to Nov. 2011



Selected Stock Index Values—Nov. 2008 to Nov. 2011



Selected Stock Index Values—May 2010 to Nov. 2011



Index = 100%	Since May 2010	Since Nov. 2008	Since Nov. 2006
SNL Energy Large Diversified	109%	118%	93%
SNL Energy Small Diversified	109%	137%	106%
S&P Gas Utilities	**134%**	**180%**	**151%**
S&P Electric Utilities	112%	107%	93%
SNL Merchant Generator	**85%**	**84%**	**60%**
Citigroup MLP	118%	162%	129%
DJ Industrial Avg.	105%	125%	97%
DJ Utility Index	112%	117%	98%

Sources: SNL Financial; ScottMadden analysis

Energy and Utility Merger Activity Is Punctuated by Some Large Deals

SCOTTMADDEN Management Consultants

Major Strategic Combinations Have Some Common Characteristics and Drivers

- ❑ Lower premiums being paid
- ❑ Focused on scale
- ❑ Expanding balance sheet size for upcoming wave of capital investment
- ❑ Moving in many cases to adjacent geographies and gaining operational synergies as well
- ❑ Citing fuel and asset diversification (by some) as a rationale

In Some Energy Sectors, M&A Is Driven Growing Demand and Industry Consolidation

- ❑ M&A in global mining surged last year, driven by major players seeking scale to meet growing worldwide needs of metallurgical coal
- ❑ In upstream gas, prospects in various shale plays have attracted investment and acquisition of smaller players with leases

Asset Transactions Also on the Upswing

"Despite [crippled power markets], we have seen an increased number of power plant transactions since January 2009....Environmental and renewable energy regulations appear to be in the driving seat in much of the M&A activity as a growing number of transactions imply the intention to diversify...away from the old, least efficient coal-fired facilities and into the newer, efficient coal and renewable generators." —*Wood Mackenzie (March 2011)*

Significant Recent Energy & Utility Deals: Pending and Completed

Acquirer/Target	Industry	Deal Value	Rationale
Energy Transfer Equity/ Southern Union Co.	Gas Utility/ Pipeline	$9.2B	▪ Complementary assets aligned with growth strategy ▪ Extract synergies
Arch Coal/ International Coal Group	Coal	$3.1B	▪ Expand into global met coal markets ▪ Balance sheet strength
Exelon Corp./ Constellation Energy	Electric Utility	$10.6B	▪ Economies of scale ▪ Similar fleets, businesses
AES Corp./ DPL Inc.	Electric Utility	$4.6B	▪ Extract synergies ▪ Scale with adjacent utility
PPL Corp./ Central Networks (U.K.)	Electric Utility	$6.5B	▪ Increase market share in U.K.
Alpha Natural Resources/ Massey Energy Co.	Coal	$7.6B	▪ Access to new markets, reserves ▪ Scale economies
Duke Energy Corp./ Progress Energy	Electric Utility	$25.7B	▪ Economies of scale ▪ Extract synergies
AGL Resources/ NICOR Inc.	Gas Utility	$3.1B	▪ Economies of scale ▪ Regional diversity
Northeast Utilities/ NSTAR	Electric Utility	$7.6B	▪ Economies of scale ▪ Balance sheet strength
PPL Corp./ E.ON U.S.	Electric Utility	$7.6B	▪ Economies of scale ▪ Regional diversity
FirstEnergy Corp./ Allegheny Energy	Electric Utility	$9.3B	▪ Economies of scale ▪ Geographic, asset alignment

Sources: SNL Financial; ScottMadden analysis; PriceWaterhouseCoopers, Power Deals: Annual Review 2010; Wood Mackenzie press release (Mar. 8, 2011); company press releases, filings, and earnings conference calls

Outlook for Nuclear Post-Fukushima: The NRC Task Force Provides Some Recommendations

SCOTTMADDEN Management Consultants

NRC Fukushima Task Force Recommendations

Clarify the regulatory framework

1. Logical, systematic, and coherent regulatory framework balancing defense-in-depth and risk considerations

Ensure protection

2. Require licensees to re-evaluate and upgrade design-basis seismic and flooding protection
3. Evaluate potential enhancements to prevent or mitigate seismically induced fires and floods

Enhance mitigation

4. **Strengthen station blackout (SBO) mitigation capability at all operating and new reactors for design and beyond design basis external events**
5. Require reliable hardened vent designs in boiling water reactor (BWR) facilities with Mark I and II containments
6. Gain insights on hydrogen control, mitigation inside containment, and other buildings
7. **Enhance spent fuel pool makeup capability and instrumentation**
8. **Strengthen, integrate on-site emergency response capabilities**

Strengthen emergency preparedness (EP)

9. Require that facility emergency plans address SBO and multi-unit events
10. Pursue additional EP topics related to SBO, multi-unit events

Implications for New and Existing Units

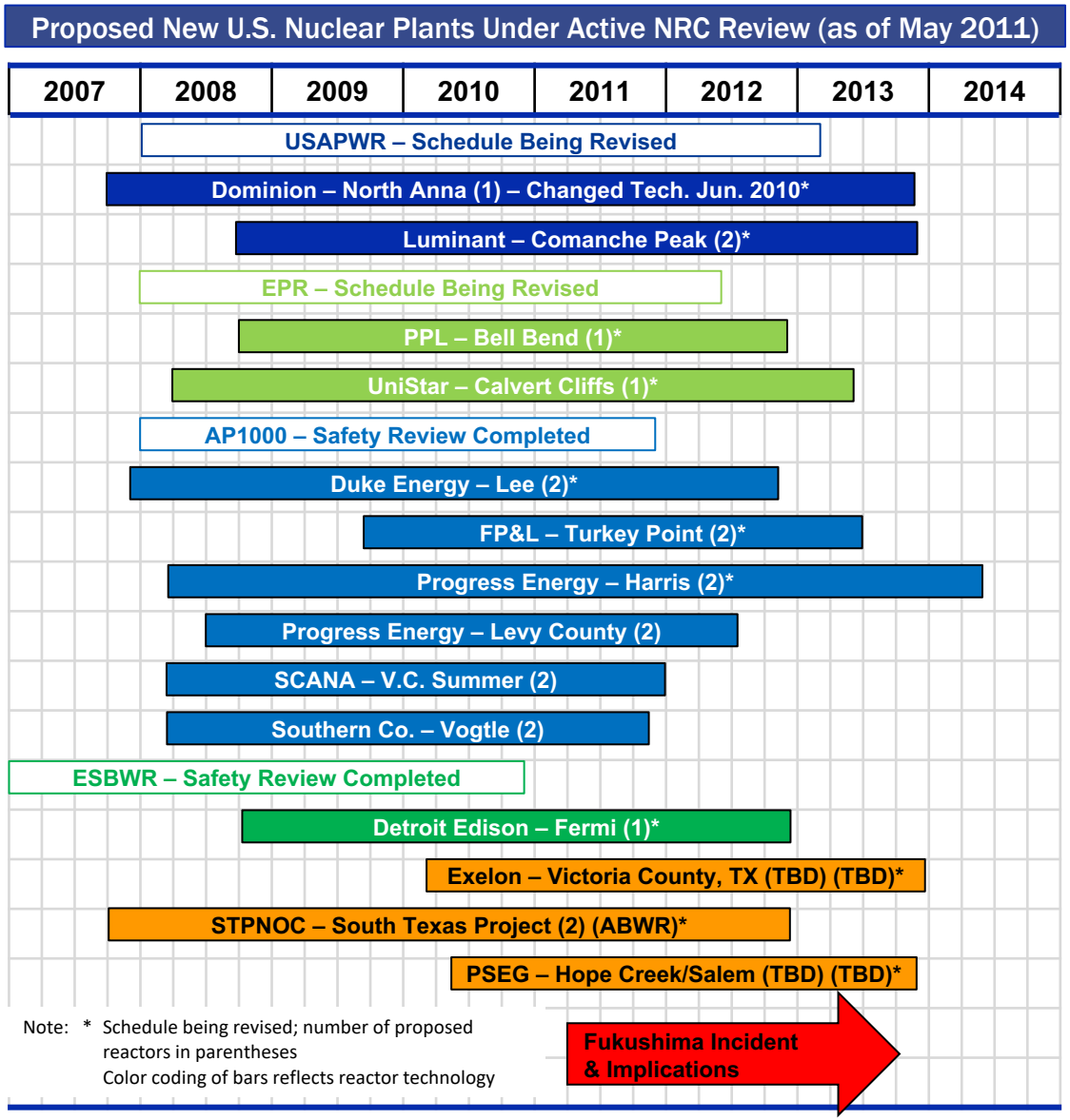
- ❑ SBO enhancements and enhanced emergency responses recommended for new construct-operate licenses as well as the existing nuclear fleet
- ❑ Task Force points out that AP1000 and ESBWR designs have many passive design features that satisfy the recommendations
- ❑ The nuclear industry is engaged in coordination of enhanced industry practices
- ❑ Opponents of licensing new units and relicensing existing units are using the Fukushima incident and subsequent NRC activity to draw out processes (e.g., Indian Point, Vermont Yankee, Diablo Canyon), but local laws (siting, certification, rate recovery) are likely to have the biggest impact on those efforts

Notes: **Bold font** indicates recommendations specifically noted by the task force as applicable to new units.
ESBWR is the Economic Simplified Boiling Water Reactor, a passively safe reactor design by GE Hitachi Nuclear Energy.

Sources: U.S. Nuclear Regulatory Commission (NRC); Nuclear Energy Institute (NEI); SNL Financial; ScottMadden analysis

Outlook for Nuclear Post-Fukushima: Natural Gas Prices, "Wait and See" Are More Significant Factors

SCOTTMADDEN Management Consultants



- Construction on SCANA's Summer and Southern's Vogtle plants continues
- Low natural gas prices, with the ramp-up of shale gas production, has changed the regulatory equation for some proposed new nuclear units
- Many utilities are taking a "wait-and-see" approach, watching progress on the first units under development
- Many have revised schedules for to ascertain early movers' outcomes, to reconsider design choice, or to reflect additional time required for design changes
- Some say reassessments spurred by the Fukushima incident could lead to more credible regulatory agencies and improved safety measures and in turn, increase public confidence in the energy source

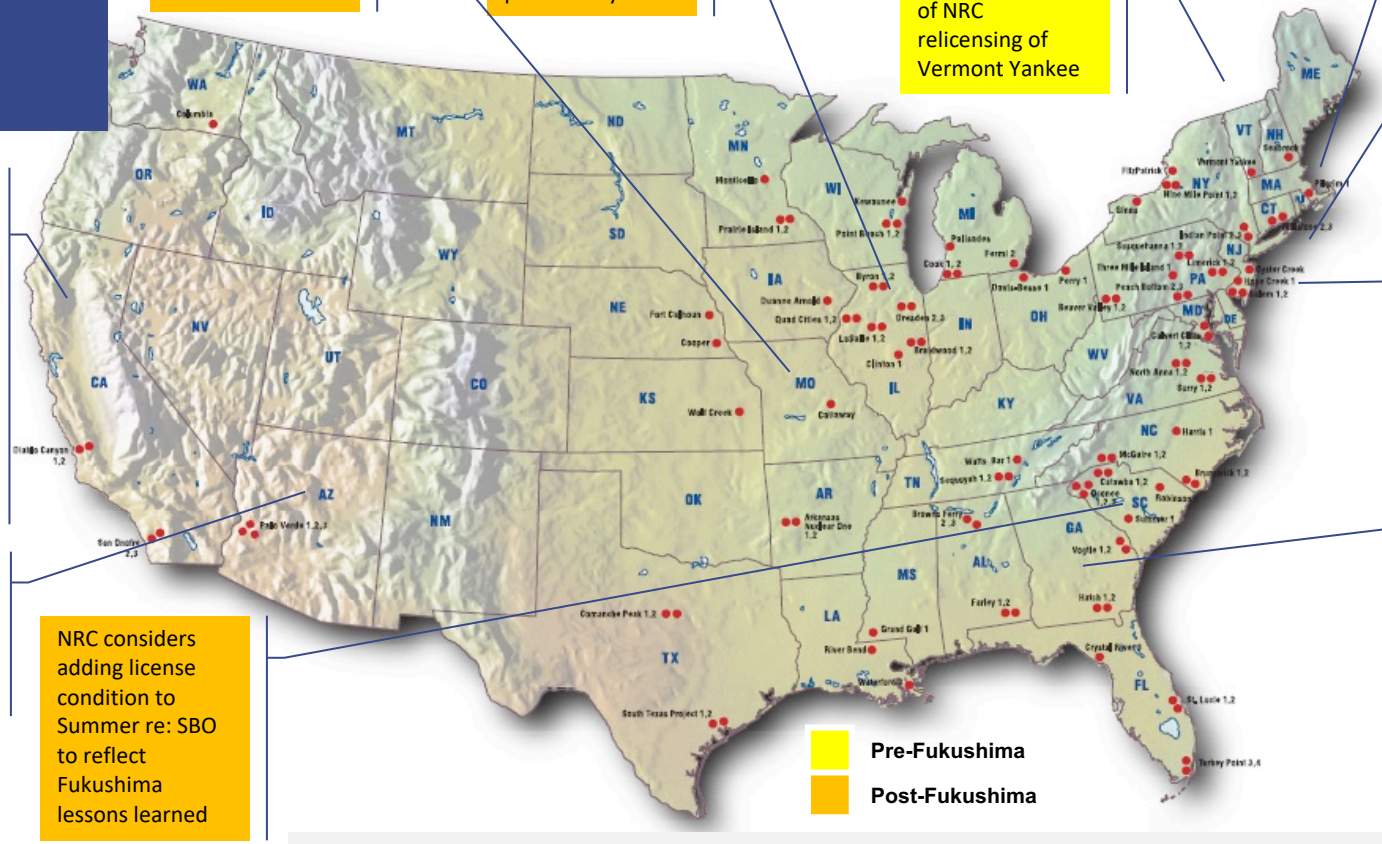
Sources: U.S. Nuclear Regulatory Commission; SNL Financial; ScottMadden analysis

Outlook for Nuclear Post-Fukushima: Will It Amplify State Public Policy Activism?

SCOTTMADDEN Management Consultants

Even before Fukushima, plants applying for relicensing or license extensions were facing increased scrutiny.

Locations of Existing U.S. Nuclear Plants



- CA state senate reviews gas pipeline, nuclear safety after an earthquake
- U.S. rep from CA asks NRC to suspend Diablo Canyon license renewal

AZ Corp. Comm'n conducts hearings on AZ nuclear plant safety

NRC considers adding license condition to Summer re: SBO to reflect Fukushima lessons learned

MO PSC conducts hearings on MO nuclear plant safety

IL's U.S. senators conduct inquiry into IL nuclear plant safety

VT General Assembly seeks reconsideration of NRC relicensing of Vermont Yankee

MA gov. to meet with nuclear regulators re: Pilgrim plant

NY gov. pledges to make Indian Point safety review a "top priority"

NJ legislature begins review of safety of Peach Bottom, Hope Creek

GA PSC looks into risk-sharing for Vogtle cost overruns, concerned about new costs after Fukushima; Southern addresses concerns

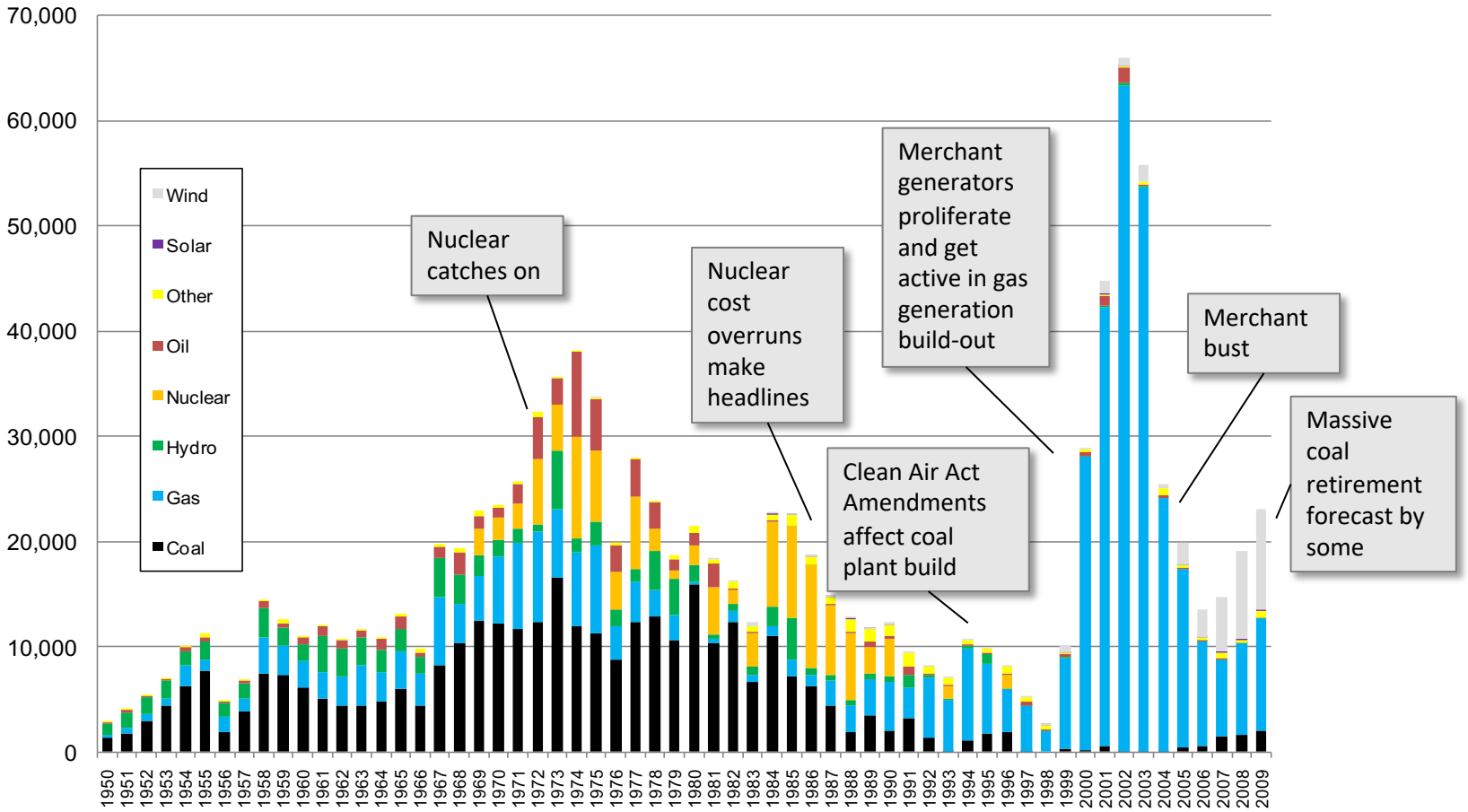
- ❑ NRC, however, has made public statements validating safety at Pilgrim, Beaver Valley, Farley, Vogtle, Oyster Creek, Salem, and Hope Creek, among others
- ❑ Massachusetts Attorney General "urges DOE and NRC to re-examine the safety implications of wet storage of spent fuels...at nuclear power plants,...particularly at the Pilgrim and Vermont Yankee plants"
- ❑ NY Gov. Cuomo announces NRC has agreed to make Indian Point "top priority in plant seismic risk review"

Sources: SNL Financial; Energy Central; news reports

Portfolio Diversity and the Nation's Power Supply: Are We About to Be Imbalanced Again?

SCOTTMADDEN Management Consultants

Current U.S. Operating Power Generation Capacity by Fuel and by Initial Operating Date (as of Year-End 2009)



Source: EIA

Notes: Excludes capacity in operation before 1950.
Hydro is run-of-river and pumped storage; excludes tidal, etc. Coal includes lignite and refined coal, but does not include petcoke, black liquor, and the like. Gas does not include propane or syngas. Oil includes residual, distillate, and "other" oil, which includes waste oil products like butane, sludge oil, tar oil, and propane.

Natural Gas Prices Are Projected to Remain Low Near Term; The Extended Outlook Is Less Predictable

SCOTTMADDEN Management Consultants

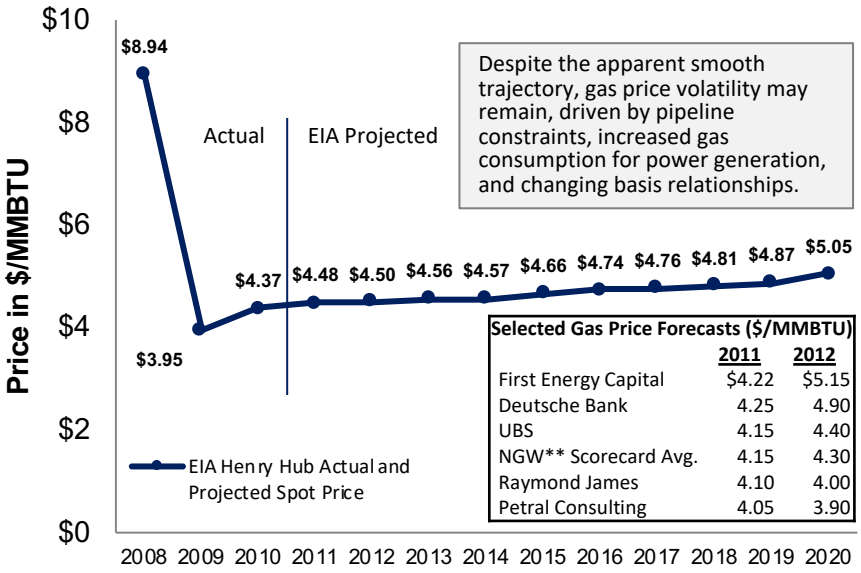
Gas Prices Remain Depressed

- Natural gas prices are not projected to return to pre-recession levels in the near to intermediate term
- U.S government forecasts (shown right) reflect steady 2%+ per year growth
- Some contrarians, however, posit that natural gas could reach $6/MMBTU by 2015

Demand May Pull Up Prices, but Supply Response and Impact of Worldwide Demand Create Uncertainty

- Industrial gas demand is expected to increase in the medium term but is growing slowly in keeping with the slow rate of economic growth in the U.S.
- Short-term gas demand from electric power generation is projected to increase, but that demand growth levels off longer term (~10 years)
- While Chinese and Indian demand is expected to drive a large increase in gas demand, there is presently no truly global gas market and thus is unlikely to affect U.S. gas prices in the near to medium term
- However, more Canadian gas may go to Asia as LNG facilities in western Canada emerge to take Canadian gas traditionally exported to the U.S.—now displaced by shale gas—to Asian markets
- Some big question marks: the impact of production efficiencies, drilling inventory, and gas demand response

EIA Actual and Projected Henry Hub Average Spot Price and Selected Forecasts ($/MMBTU)



Selected Gas Price Forecasts ($/MMBTU)

	2011	2012
First Energy Capital	$4.22	$5.15
Deutsche Bank	4.25	4.90
UBS	4.15	4.40
NGW** Scorecard Avg.	4.15	4.30
Raymond James	4.10	4.00
Petral Consulting	4.05	3.90

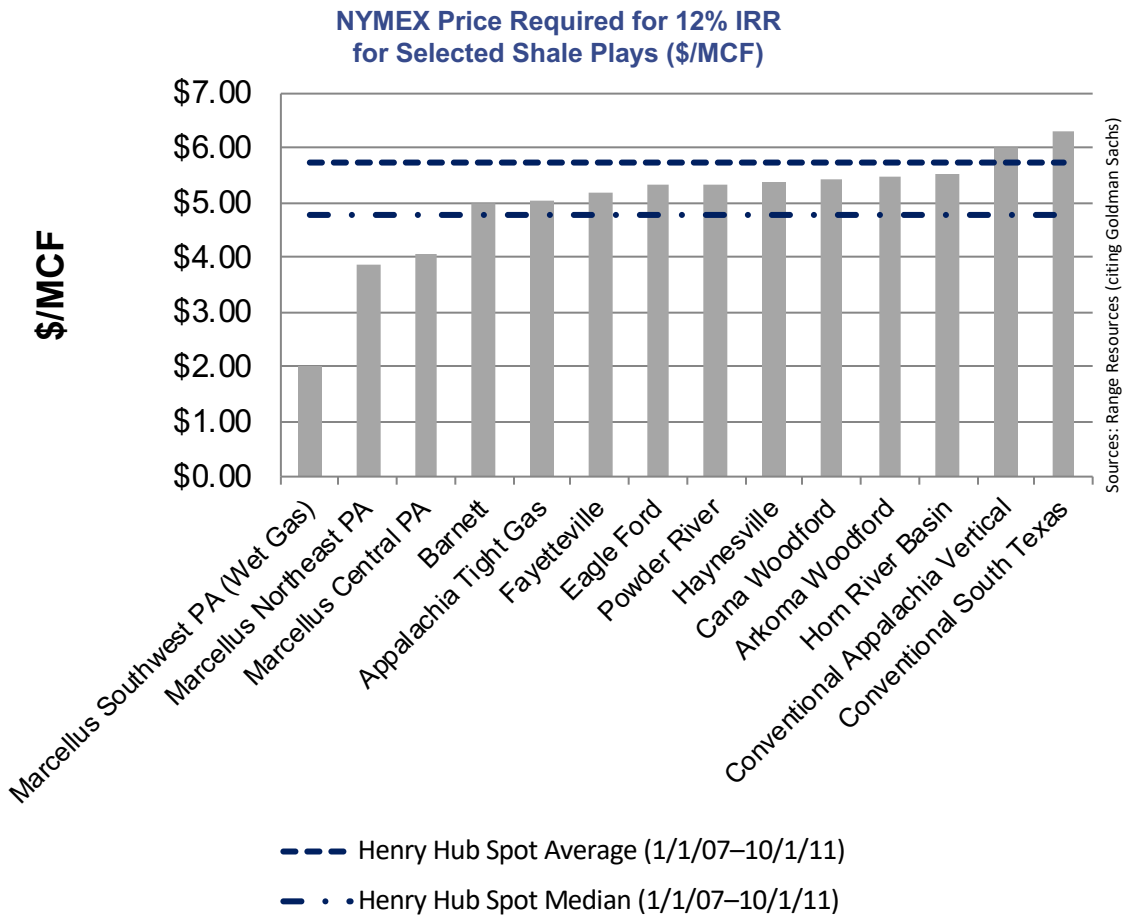
"New infrastructure has a big impact on regional and national supply, as well as demand and prices. Demand will be influenced by power generation, industrial demand, economic recovery and policy direction, among other things. Unconventional gas production will make up a larger share of supply, but it has a lot of risks."

*— Kim Colburn, BP Energy VP of Wholesale Marketing and Origination for the Gulf Coast and Southeast**

Sources: Industry news; EIA; IEA Special Report, Are We Entering a Golden Age of Gas?, in World Energy Outlook 2011 (May 2011); EIA, Annual Energy Outlook 2011, Fig. 86 (Apr. 2011); FERC, Winter 2011-12 Energy Market Assessment (Oct. 20, 2011); *"Gas Market Analysts See Prices at $6/MMBTU by 2015," SNL Financial (quoting speakers at the LDC Forum Southeast) (Apr. 13, 2011); **_Natural Gas Week_ (Oct. 31, 2011)

Shale Gas, Especially Marcellus, Continues to Have Competitive Breakeven Costs

SCOTTMADDEN Management Consultants



Shale Gas Economics Remain Favorable

- Shale play economics have been resilient, even as abundant supply and the absence of major Gulf of Mexico hurricanes have pushed down prices
- Natural gas liquids (NGLs) like ethane continue to buoy economics of "wet" plays like Marcellus and Barnett: "Liquid rich gas streams...can add anywhere from $1 to $3 per MCF of gas"*

Utica—The Next Big Shale Play?

- Utica Shale, a 170,000 square mile formation which runs beneath parts of eight states and Canada and deeper than the Marcellus formation, is seen by some as the next major shale play
- ExxonMobil, Chesapeake, and Hess, among others, are making significant investments in leases, largely in Ohio
- Little production, however, has taken place, so Utica's productivity is uncertain, raising concerns about a speculative bubble

"Natural gas is going to enter a golden age we haven't seen since the 1950s." —*Bob Best, Executive Chairman, Atmos Energy*

Sources: Range Resources Company Presentation (Oct. 2011) (citing Goldman Sachs); *Carol Freedenthal, Jofree Consulting, quoted in *Natural Gas Week* (Oct. 31, 2011); El Paso Midstream; Kinder Morgan; Enterprise Products Partners; PennEnergy; Reuters

For New Natural Gas Resources, A Need for New Pipeline Capacity

SCOTTMADDEN Management Consultants

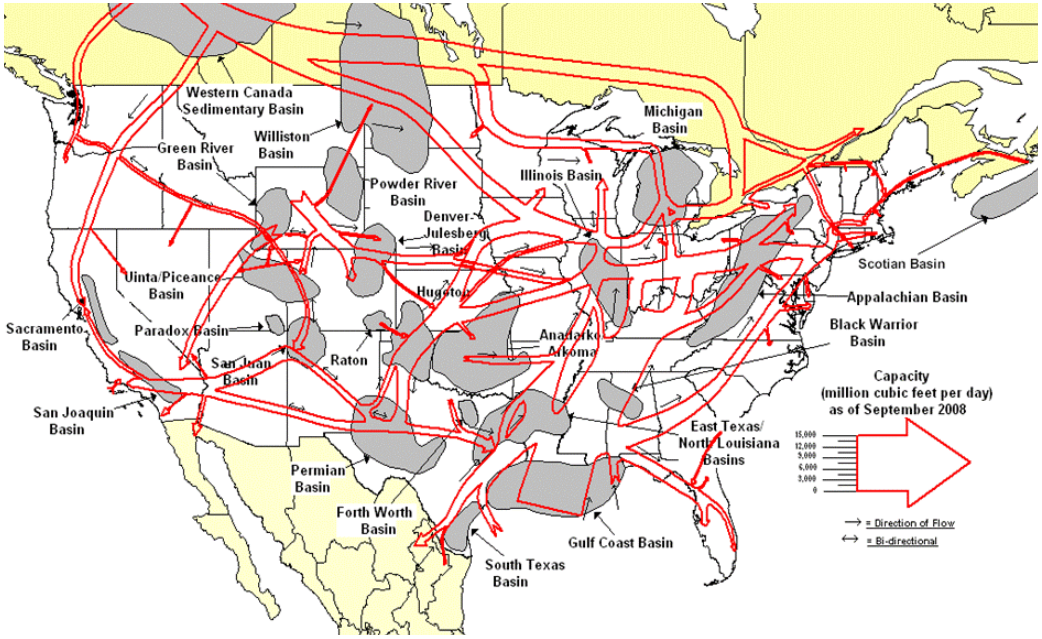
New Pipelines Needed; Much Activity Is Now Focused on Natural Gas Liquids (NGLs)

- Pipeline expansions have been proposed for Marcellus and other shale plays
- Some have been liquids-focused pipelines moving NGLs to markets in the upper Midwest and Canada or Gulf Coast destinations such as Mont Belvieu, TX
- Expansion of dry natural gas pipelines to East Coast urban centers could be contentious, as rights of way are negotiated and hydraulic fracturing opponents seek another potential venue to battle shale gas development

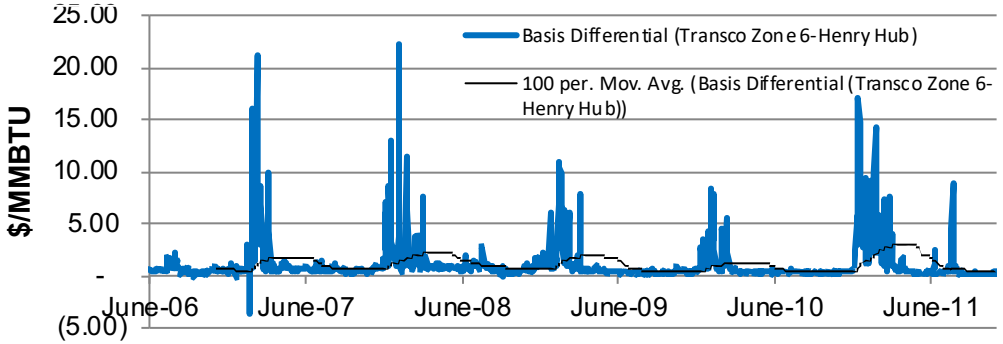
With Additional Pipeline Capacity, Possible Basis Changes

- Approximately six BCF/day in new gas pipeline capacity has been proposed in the Marcellus region
- With the proposed addition of pipeline capacity from new shale gas resources to markets, basis relationships may change
- Historical premiums of some areas such as New York and New England over traditional supply hubs like the Henry Hub are falling
- Even with this increase in capacity, increased gas-fired generation along with winter heating demand may continue to constrain pipeline capacity, leading to volatile winter gas prices

Pipeline Capacity from Selected Basins to Selected Demand Centers as of Sept. 2008 (BCF/Day)



Basis (Price) Differential—NY Transco Zone 6 (NYC) vs. Henry Hub and 100-Day Moving Average (June 2006–Nov. 2011)



Sources: EIA; FERC; Morgan Stanley; Credit Suisse; SNL Financial; ScottMadden analysis

Capacity Markets Stir Continued Debate

SCOTTMADDEN Management Consultants

Debate Over Capacity Markets Continues

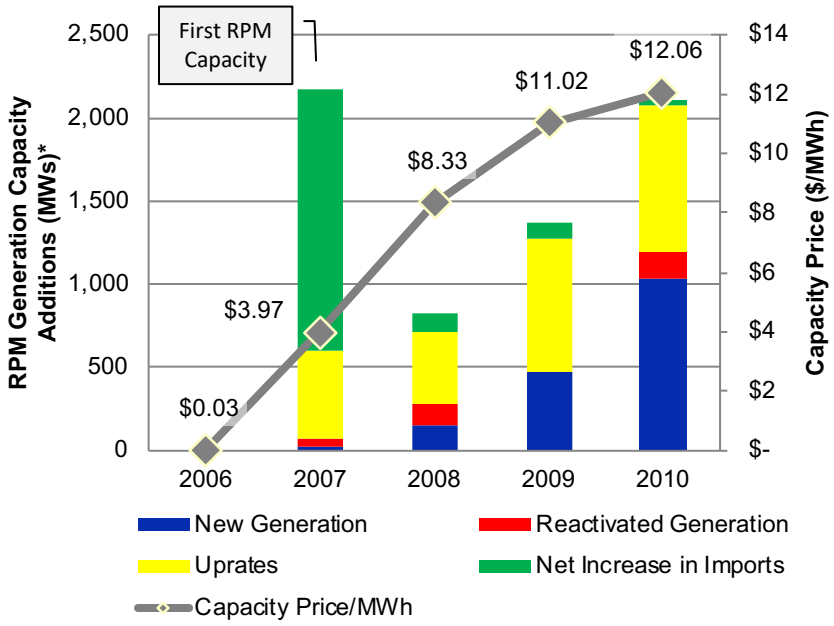
- Six years after PJM filed its Reliability Pricing Model (RPM) proposal with FERC, stakeholders are still debating whether the capacity markets are serving their purpose
- Debate largely pits generators against load-serving entities and revolves around some fundamental issues
  - Efficiency of capacity markets
  - Manipulation of the cost curve using uneconomic bids
  - Incentives to new generation vs. encouraging older, less efficient capacity to stay online
  - Perceived windfall to existing generation
  - Double payment (or double cost borne) by self-suppliers
  - (In)ability to consider non-financial benefits in capacity planning and procurement decisions

States Step in to Adjust Markets

- States are stepping in to affect perceived overpricing of capacity or windfalls to existing capacity and are trying to change market dynamics
- New York City has used tax abatements to incent generation in its load pocket, which some characterize as a subsidy
  - FERC found this could not be used in calculating the cost of new entry (NYISO's capacity value benchmark) to lower capacity values in lower New York State
  - FERC later reversed after New York made the abatements non-discretionary ("as-of-right")
- New Jersey has proposed a law (with Gov. Christie's involvement) to seek bids on two gigawatts of generation. Units would bid zero and be compensated the difference between capacity price received and cost of running
- There is some concern about a contagion effect with similar legislation proposed in nearby states

PJM Capacity Prices Have Increased with the Reliability Pricing Model (RPM) but So Has Supply

PJM RPM Capacity Additions (2007–2010) and PJM Capacity Prices per MWh (2000–2010)



2010/11 "cleared" RPM reserve margin	16.5%
Target PJM reserve margin	15.5%

Note: *For beginning of delivery year (e.g., 2007 is for 2007/08 delivery year)

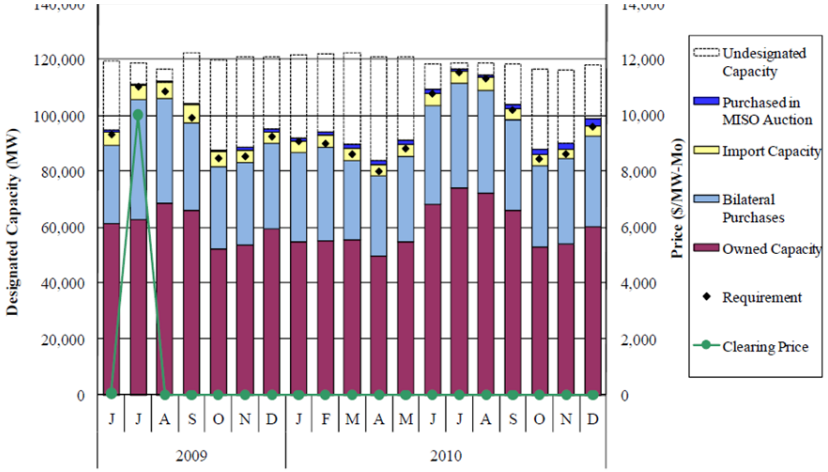
Sources: 2010 State of the Market Report for PJM, Tables 1-8, 5-3, and p. 50 (Mar. 2011); "Capacity Roulette," *Public Utilities Fortnightly* (July 2011); "Capacity Contest," *Public Utilities Fortnightly* (Feb. 2011); *T&D World*; ESAI; Troutman Sanders; FERC; industry news

Capacity Markets Stir Continued Debate (Cont'd)

SCOTTMADDEN Management Consultants

With Excess Supply, Voluntary Markets, and Mostly Self-Supply, MISO Capacity Prices Are Near Zero

Midwest ISO Voluntary Capacity Auction Results 2009–2010



For generators and load-serving entities in active or emerging capacity markets, uncertainty will continue as FERC seeks a middle ground between theoretically efficient markets and practical needs of traditional regulated utilities.

Note: Total column height in chart represents the total designated capacity, including imports.

Source: 2010 State of the Market Report for the MISO Electricity Markets, Fig. E-8 (Mar. 2011); "Capacity Roulette," *Public Utilities Fortnightly* (July 2011); Capacity Contest, *Public Utilities Fortnightly* (Feb. 2011); *T&D World*; ESAI; Troutman Sanders; FERC; industry news; ScottMadden analysis

FERC Tries a Balancing Act in Modifying Its Minimum Offer Price Rule (MOPR)

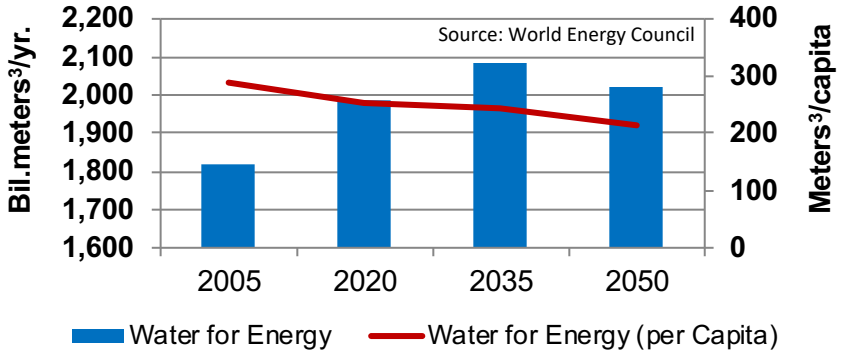
- FERC has reiterated its commitment to capacity markets, reaffirming but modifying its MOPR in PJM and applying buyer-side mitigation to New England as well
  - MOPR applies only to new simple cycle (CT) and combined cycle (CC) units, not to nuclear, coal, IGCC, or hydroelectric units or upgrades or additions to existing capacity resources
  - Under MOPR, a threshold for "uncompetitive bid" conduct—80% of the cost of new entry (CONE) or the cost of a new gas-fired CT or CC unit—which would be mitigated (i.e., re-bid at a "competitive" price)
  - PJM power generators contended that benchmark discount (of 80%) used to conduct the "competitive bid" test effectively allows buyers (esp. self-suppliers and, prospectively, state-mandated resources) to exercise market power to cap auction prices well below CONE
  - FERC approved a PJM proposal to
    1) raise the threshold for non-competitive bid screens to 90% of CONE and
    2) allow ISOs and market monitors to compare bids below that threshold to some unit-specific cost benchmark to determine whether a bid was competitive and thus avoid mitigation
- PJM has also proposed applying qualitative factors in assessing cost competitiveness of bids, such as seller's business model, financial condition, and tax status
  - This effectively factors in the unique needs of generation-owning, load-serving entities
  - FERC now seeks a technical conference to consider mitigation of self-suppliers under MOPR

Water:
The Next Constrained Resource for Energy

SCOTTMADDEN Management Consultants

Intensity of Water Use for Energy Is Projected to Decline, but Aggregate Usage Is Expected to Rise Significantly

Current and Projected Worldwide Water for Energy – Total and Per Capita (Incl. Fuel Production and Wastewater and Drinking Water Treatment)



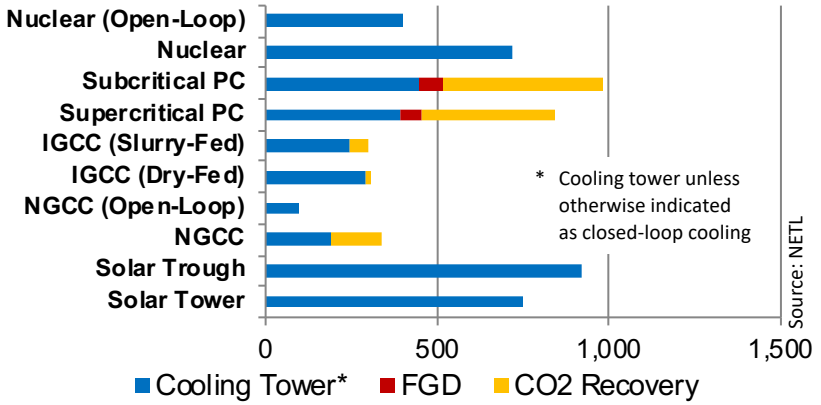
- Water scarcity continues to be an issue for power generation technologies, which may be exacerbated by flue gas desulfurization and carbon capture. Water demand will likely increase under new EPA Clean Water Act §316(b) regulation, which may force many generators to install cooling towers
- Fuels production—including production from emerging resources—involves significant water usage
  - Hydraulic fracturing of a gas well consumes about 3 to 5 million gallons of water over its lifetime
  - Agricultural feedstock for biofuels also poses additional demand as irrigation needs increase
- Energy companies in water-stressed regions will need to (i) manage operational impacts of water scarcity, (ii) pursue water management strategies and technologies, and (iii) prepare for higher costs if proposed market-based solutions to water resource allocation are implemented

Note: BGD is billions of gallons per day; IGCC is integrated gasification combined cycle; NGCC is natural gas combined cycle

Sources: DOE-NETL; DOE Sandia Lab; *Mechanical Engineering*; American Society of Mechanical Eng'rs; World Economic Forum; World Energy Council; ScottMadden analysis

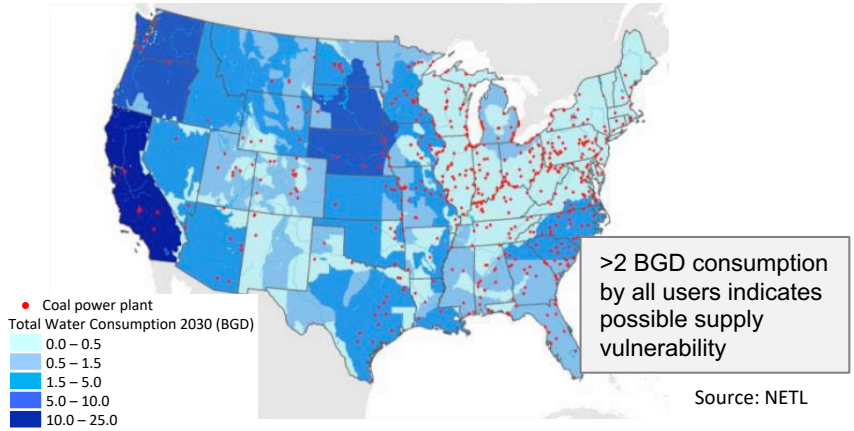
Thermal Power Generation Uses Significant Quantities of Water and Carbon Capture Can Increase Its Consumption by Up to 90%

Water Intensity for Various Power Generation Technologies (Consumption in Gallons per Net MWh)



Competition for Scarce Water Resources Will Adversely Impact Water-Intense Power Generation

Coal-Fired Power Plant Locations and Projected Water Consumption by All Users (2030)



Adopting Smart Grid: Smart Grid Integration

SCOTTMADDEN Management Consultants

	Utility System	Application Functionality	End-User Data
Distribution Automation	EMS, DMS, OMS, GIS	Event detection and condition-based response, fault protection, congestion management, remote switching, voltage control Distribution and substation automation, asset protection, power quality management, automated feeder configuration, operation closer to true system limits	Point-of-consumption voltage and current readings; enhanced customer outage data
Demand Response (DR)	Peak load management and control	Short-interval energy data acquisition; load forecasting and shifting	Data and visualization of energy end use
AMI	AMI, MDM, CIS, outage detection, billing	Remote meter reading, remote connect/disconnect, theft detection, customer prepay, real-time pricing	Loads, outages, voltage, and current readings; consumption
Distributed Generation (DG)	Visibility and control systems for distributed assets	Monitoring, dispatch, and control of distributed assets such as renewables, CHP, and energy storage devices	DG load generation capacity and performance data
VPP and Microgrids	Visibility and control systems for distributed assets	Aggregation of supply and demand resources into a network that is either always grid tied (VPP) or can be islanded from the grid (microgrid)	Customer usage and revenue for DR activities; customer and utility loads; impacts to peak and non-peak
Smart Charging of EV and PHEV	Utility control and load monitoring for EV and PHEV applications	Application data flow for EVs and PHEVs	Vehicle load; storage capability
Customer Solutions	Integration of utility systems into consumer business processes	Application data flow to/from end-user energy and building management systems	Home/building portals, online billing, and pay/prepay; TOU pricing data

Applications and Technologies

Technology Market Readiness
- Momentum now
- Emerging
- Future?

Power

Generation → Transmission → Substation ⇄ Distribution ⇄ Home or Building

Communications Infrastructure

LAN	WAN	AMI NETWORK	HAN
Local Area Network	The backhaul network between the field assets and the utility	The Field Area Network links the smart meter and the WAN to allow two-way, real-time data transfer	Grid-aware devices linking loads and appliances for utility and consumer control and management

Adapted from Greentech Media Research

Source: Greentech Media Research; EKA Systems; ScottMadden, "Integrating Smart Grid into Strategic and Business Planning" (2009); EPRI, Smart Grid (March 2011); EPRI, Field Area Network (Apr. 2011)

What of Greenhouse Gas Regulation? The Supreme Court's Latest

SCOTTMADDEN Management Consultants

The Case	American Electric Power Co. v. Connecticut
The Claim	Plaintiff states, New York City, and land trusts: federal and state tort law claims, seeking reductions in greenhouse gas (GHG) emissions from fossil power plants
The 8-0 Decision: Federal Nuisance Claims "Displaced"	❑ Plaintiff state governments blocked from filing "public nuisance" damage claims ❑ EPA authority displaces federal tort claims, even if EPA does not act ❑ EPA is better equipped to evaluate GHGs than federal judges
The Concurrence	❑ Justices Alito and Thomas concurred, although not conceding their disagreement with the result in Massachusetts vs. EPA (that EPA has statutory authority to regulate emission of greenhouse gases from new motor vehicles and that states have standing to challenge EPA's decision not to regulate them)
The 4-4 Decision	❑ Plaintiff states, cities, and private land-conservation groups had standing to sue ❑ Rejects the assertion that global warming is a political matter too complicated to resolve in court
Open Issues	❑ Whether state nuisance law claims were pre-empted by federal law ❑ Whether there was a federal nuisance tort for GHG emissions
Implications	❑ State law nuisance suits regarding GHG emissions will likely continue ❑ If Congress attempts to limit EPA's authority to regulate GHGs, it opens the door for federal nuisance claims

Sources: American Electric Power Co. v. Connecticut, U.S. Supreme Court slip opinion no. 10-174 (June 20, 2011); The Wall Street Journal; SNL Financial; SCOTUSblog.com; Troutman Sanders; Alston & Bird

Outlook for Coal-Fired Generation : Environmental Rules Are Tightening

SCOTTMADDEN Management Consultants

Unprecedented EPA Scope: 2008–2017	
❑ Ozone	❑ Particulate matter
❑ SOx/NOx	❑ Air toxics
❑ Cross-state air pollution rule	❑ GHGs
❑ Water	

Cost of Selected Alternatives	
Retrofitting a large coal unit	~$800/kW
Retrofitting a marginal coal unit	$1,700 to $2,400/kW
Reference price for a new NGCC	~$800 to $1,000/kW
Reference price for a used NGCC	~$400/kW

Air Toxics

- ❑ "The extremely compressed construction and outage schedules will needlessly drive up costs and threaten reliability." —*Tom Fanning, President and CEO, Southern Company*
- ❑ "There is just no way in the world you can make a rule final in 2011 and expect people to comply with it by January 2012. It is as close to lunacy as you can get." — *Mike Morris, Executive Chairman, AEP*
- ❑ "Provides needed regulatory certainty and can be implemented on time without threatening reliability." — *Exelon Press Release*

GHG

- ❑ "On behalf of the state of Texas, we write to inform you that Texas has neither the authority, nor the intention of interpreting, ignoring, or amending its laws in order to compel the permitting of greenhouse gas emissions." — *Texas Attorney General and Chairman, Texas Commission on Environmental Quality: Letter to Lisa Jackson*

Sources: Edison Electric Institute; SNL Financial; ScottMadden analysis

Outlook for Coal-Fired Generation: Electric Industry Focus Is on Three Major EPA Rules

SCOTTMADDEN Management Consultants

Proposed Rule	Affected Units	Requirements	Implications and Issues
Cooling Water Intake under Clean Water Act §316(b) (final rule by July 2012)	❑ Existing (commenced construction before Jan. 18, 2002) and new ❑ Power generation, manufacturing, and industrial facilities ❑ Two million gallons per day water usage ❑ Use 25%+ of water for cooling	❑ National requirements ❑ Based on location, design, construction, and capacity of cooling water intake structures—not "one size fits all" ❑ Site-specific "best technology available" for impingement and entrainment mortality	❑ Invest or retire decision ❑ Concern about localized reliability issues (e.g., LA, Chicago) ❑ EPA estimates affects 257 facilities with potential <u>average</u> cost of $0.7M to $8.9M per facility ❑ New facilities to use closed-loop systems; perhaps some existing facilities as well? ❑ Mixed opinion on potential for plant closures
Air Toxics Rule (final standards by November 2011)	❑ New and existing coal- and oil-fired utility steam generating units ❑ Natural gas plants <u>not</u> affected ❑ First national standards for utilities to reduce emissions of metals (including mercury, arsenic, chromium, and nickel), acid gases, and particulate matter	❑ Must eliminate 91% of mercury emissions from coal ❑ Acid gases, non-Hg toxics: numerical limits ❑ Maximum achievable control technology for power plants; limited flexibility on compliance ❑ May require scrubbers on all coal units ❑ Monitoring changes for industrial, commercial, and institutional steam generating units	❑ Invest or retire decision ❑ Mainly affects coal-fired plants ❑ Per EPA, affects 1,350 coal- and oil-fired units at 525 plants ❑ Estimates of potential plant retirements vary; confounded by multiple EPA regulations and low gas prices ❑ Strong industry reaction; comments filed
Cross-State Air Pollution Rule (issued July 2011; 2012/14 implementation)	❑ Power plants in 28 affected states (including TX) ❑ Per EPA, affects 3,632 electric generating units at 1,074 coal-, gas-, and oil-fired facilities	❑ Defined state (not regional) SO_2, NOx emissions budgets; considering "upwind" contribution to "downwind" non-attainment ❑ Two compliance phases (with following annual % reductions from 2010 levels) — Jan. 2012: 20% of SO_2, 12% of NOx (beginning May 2012 for ozone season NOx reductions for 20 states) — Jan. 2014: 50% of SO_2, 18% of NOx	❑ Invest or retire decision ❑ Likely requires state-of-the-art SO_2 and NOx controls ❑ Estimates of potential plant retirements vary; confounded by multiple EPA regulations and low gas prices ❑ Strong industry reaction ❑ Litigation likely, especially in the case of TX

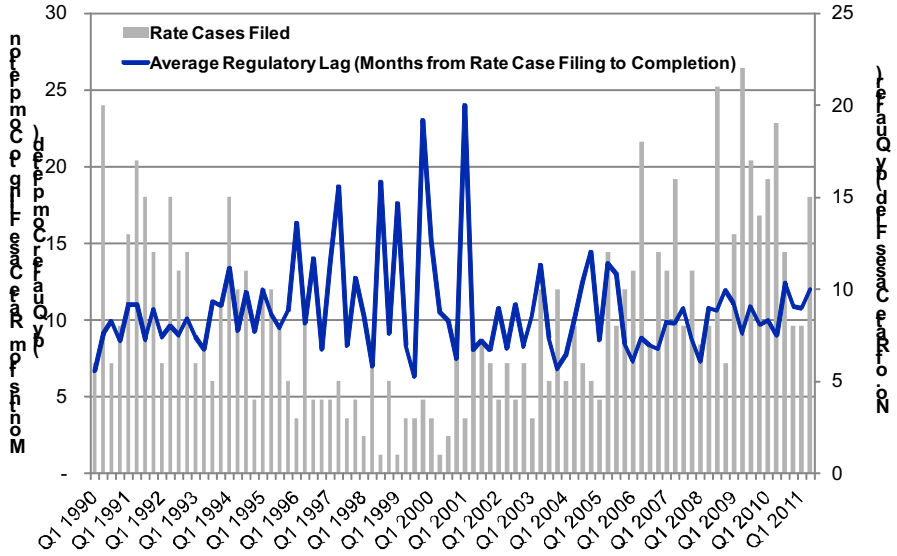
Sources: EPA; Van Ness Feldman; Bryan Cave; World Resources Institute; industry news

Rate Case Activity: No Good News on the Horizon

SCOTTMADDEN Management Consultants

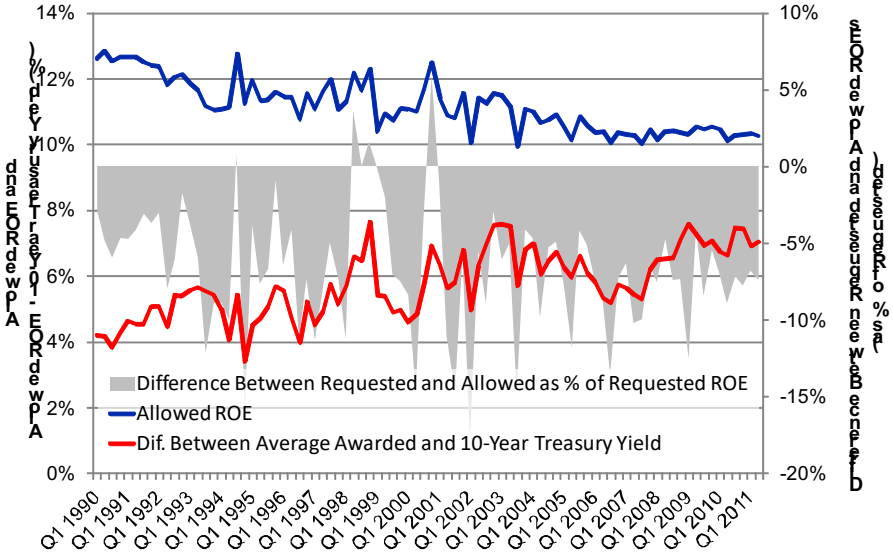
Rate Case Activity Continues but at a Slower Pace than 2010, and Resolution Is Taking About 11 Months on Average

Electric Rate Case Activity by Quarter—Regulatory Lag



Allowed ROEs Continue to Fall Short of Requested Levels, but Their Implied Spread Over T-Notes Is Growing

Electric Rate Case Activity by Quarter—Allowed ROEs, Spreads over Treasuries, and Difference from Requested ROEs



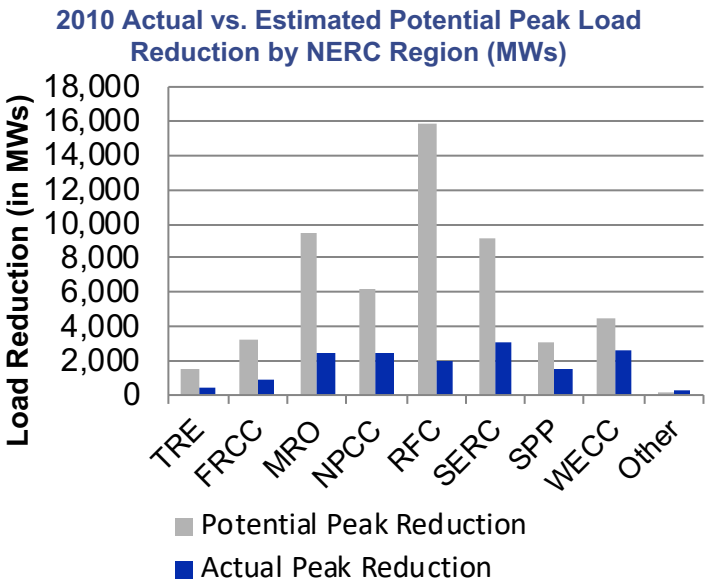
- **Not a record-setting year:** 2011 rate case activity will not likely match 2010's record number of rate case filings
- **Lag is an issue:** Regulatory lag has equilibrated but is slightly above historical levels: from filing to completion of a rate case takes about 11 to 12 months versus an historic median of about 10 months
- **Allowed ROEs continue to fall:** Allowed returns on equity continue to fall as risk-free yields remain extraordinarily low and commissions factor ratepayer "hardship" stemming from a continued (and projected) sluggish economy. Slow economic growth (GDP growth is projected at less than 2% in 2011 and 2012) also exacerbates the need for additional rate recovery
- **Alternative regulation gaining interest:** Some utilities have used alternative regulation, such as trackers, to avoid repeated base rate cases. In California, for example:
  - Utility commission adopted an automatic multi-year cost of capital mechanism for utilities with smart grid, efficiency, and other infrastructure investments
  - Authorized ROEs are annually reviewed and, if changes in utility bond yields exceed certain levels, reset

Sources: International Monetary Fund; Edison Electric Institute; SNL Financial/Regulatory Research Associates; ScottMadden analysis

Order 745: Seeking Comparability and Uniformity in Compensating Demand Response

SCOTTMADDEN Management Consultants

In Keeping with Federal Policy, FERC Seeks to Encourage Demand Response (DR)



Next step under Order 745: FERC approval of RTO filings of net benefits tests, cost allocation for DR compensation, and measurement & verification plan.

Sources: FERC Order 745; ScottMadden analysis; FERC Staff Report, Assessment of Demand Response & Advanced Metering, Fig. 4.11 (Feb. 2011); Covington & Burling; Van Ness Feldman

- FERC is seeking to "level the playing field" and require ISOs/RTOs to compensate demand response resources (DRRs) just like they compensate traditional supply resources
- Key provisions of Order 745
  - Payment to DRR of locational marginal price (LMP) where DRR dispatch is "cost effective" in comparison to supply
  - DRR must be able to provide the service, i.e., displace a generation resource
  - RTOs must apply a "net benefits" test for cost effectiveness of DRR. Under this, RTOs must establish a monthly threshold price beyond which the "overall benefit" from reduced LMP from DR dispatch exceeds cost of dispatch
    - Threshold price is the point along the supply stack beyond which the benefit to load from the reduced LMP, resulting from dispatching DRR, exceeds the increased cost to load associated with the billing unit effect (i.e., reduced MWhs, due to reduced demand, over which to spread costs)
    - Where benefit exceeds dispatch cost, it must pay LMP to those DRRs
  - DRR cost allocated "proportionally to all entities that purchase from the ***relevant energy market*** in the area" where the DR resource is committed or dispatched
- Issues raised with Order 745
  - **"Double payment" of DR:** Compensation should be LMP less avoided generation cost (G), i.e., (LMP – G) instead of LMP
  - **Net benefits test:** Complexity of trying to determine whether customer actually benefited
  - **DRR not equivalent:** "Negawatt" does not equal a megawatt, especially for system reliability, in part because it only has to perform for limited periods
  - **Different strokes:** Whether uniformity is really needed for ISOs/RTOs

Order 1000:
A Big Deal…or Not So Much?

SCOTTMADDEN
Management Consultants

	Major Requirements	Some Issues and Uncertainties
Transmission Planning	❑ Expands regional planning principles for new facilities ❑ Must duly consider public policy requirements ❑ Merchants must provide information to utilities	❑ No bright line for planning principles on what is a plan ❑ Cherry picking by utilities possible ❑ "Due consideration" of public policy undefined
Non-Incumbent Transmission Providers	❑ Eliminates incumbents' right of first refusal (ROFR) except local facilities, those not part of cost allocation ❑ Transparent, "not unduly" discriminatory prices to propose regional plan projects ❑ Non-incumbent rights to own and construct	❑ Limited ROFR may mean more local projects ❑ No mandate for competitive bidding ❑ No time limit or ROFR—risk of late hits ❑ Regions will vary
Inter-regional Coordination	❑ Formal process to coordinate with neighboring regions — Joint planning required — Involuntary cost allocation prohibited ❑ Data exchange, transparency, and stakeholder participation	❑ Not "one size fits all" but little guidance and potential for disputes
Cost Allocation	❑ Order 890, basis for participant funding, not sufficient for "just and reasonable" ❑ Establishes principles — Roughly commensurate with benefits — No benefit = no involuntary cost — Project-specific or aggregate — Benefit to cost threshold not too high; > 1.25:1 requires FERC approval — Within region, unless agreed to by neighbor — Transparent — Can be different for different project types (e.g., reliability, congestion, public policy)	❑ Participant funding may be blocked; could be challenged… ❑ Guiding principles are vague… — Who caused the cost? — What is a benefit? — Who is the beneficiary? ❑ …And are exacerbated by the physics of the electric grid

Note: This term is specifically defined in Order 1000 and includes considerations such as state renewable portfolio standards.

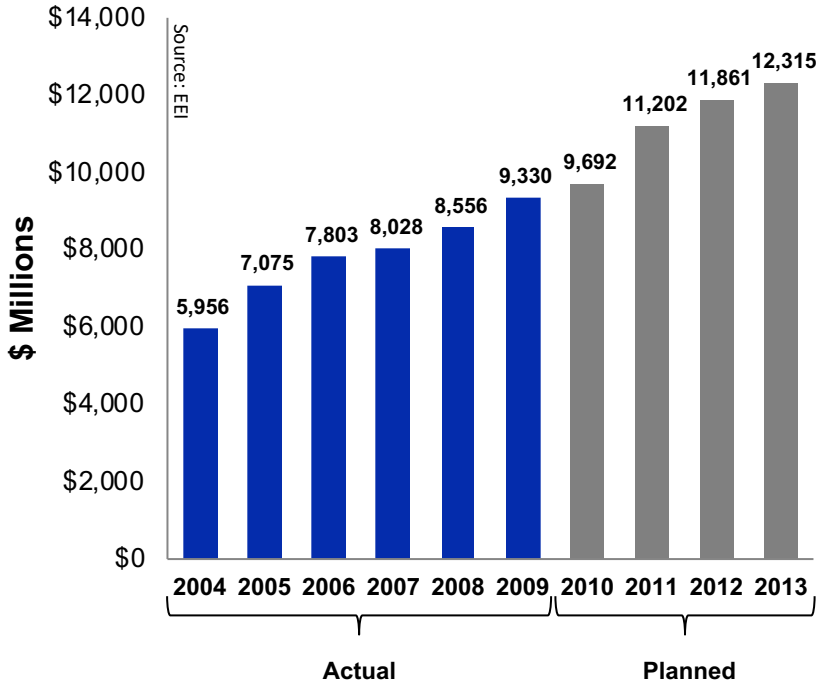
Sources: Bruder, Gentile & Marcoux; Troutman Sanders; Morrison & Forester; SNL Financial

Transmission Expansion: What's Expected and How Much Will It Cost?

SCOTTMADDEN Management Consultants

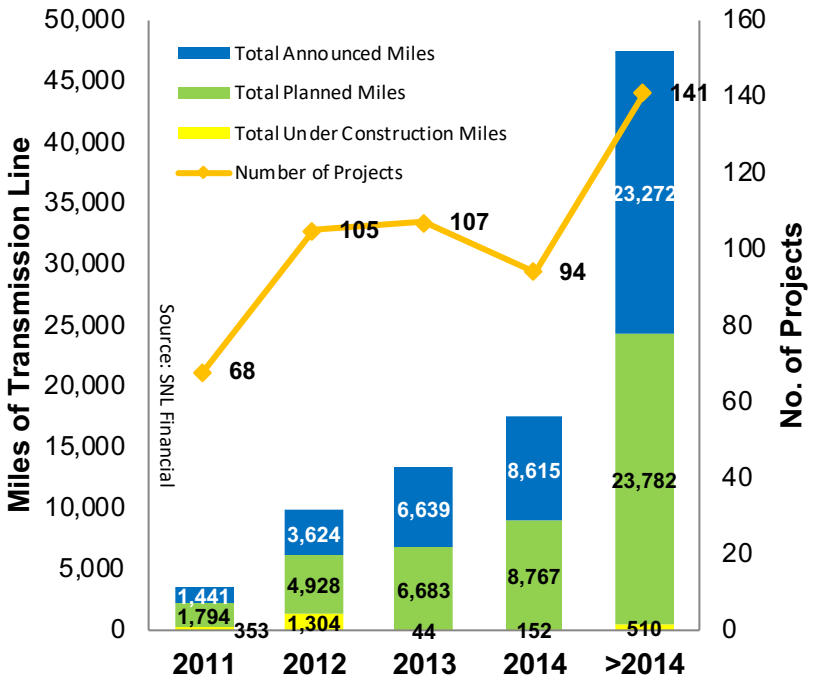
After a Slight Slowdown in 2010, Transmission Investment Is on a Continued Upward Trajectory

Actual and Planned Transmission Investment by Shareholder-Owned Utilities (2004-2013)*



Planned and Announced Miles Far Outstrip "Iron in the Ground," but a Bump Is Expected in 2012

Forecast of Additional Transmission Lines**



Note: *The Handy-Whitman Index of Public Utility Construction Costs used to adjust actual investment for inflation from year to year. Forecasted investment data are adjusted for inflation using the GDP Deflator. Planned total industry expenditures are preliminary and estimated from 91% response rate to EEI's Electric Transmission Capital Budget & Forecast Survey. Actual expenditures from EEI's Annual Property & Plant Capital Investment Survey and FERC Form 1 reports.

**From filings, press releases, and other sources. Not limited to investor-owned utilities.

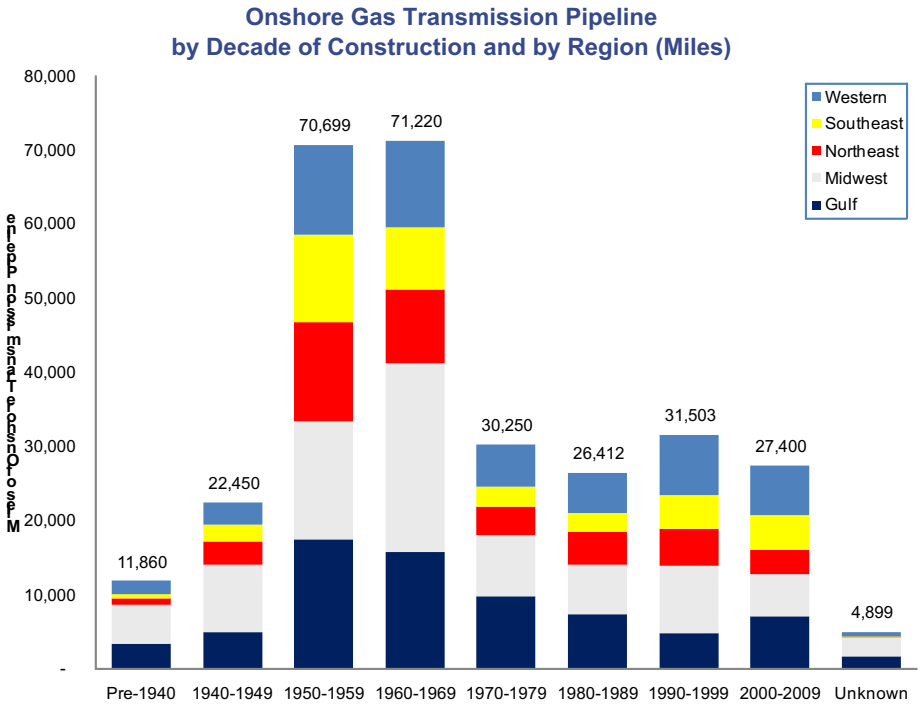
Sources: EEI; SNL Financial

Aging Gas Infrastructure Prompts Increased Industry Focus

SCOTTMADDEN Management Consultants

- The Department of Transportation's Pipeline & Hazardous Materials Safety Administration (PHMSA) has been expanding its regulatory regime (e.g., written integrity management programs) and there is renewed interest in employing improved materials in pipeline construction
- Even with increased oversight, the pipeline explosion in San Mateo, CA has raised the interest of politicians and state regulators in gas pipeline inspection processes as well as the age of pipeline infrastructure
- The industry has responded as well. INGAA, the pipeline industry trade organization, has created an executive-level pipeline safety task force. INGAA's recommendations:
  - Enhance pipeline integrity management outside of high-consequence areas (i.e., population centers), to cover 70% of the population within the Potential Impact Radius by 2020 and 100% by 2030
  - Implement other initiatives including corrosion anomaly management, testing processes for pre-regulation pipelines with limited inspection records, and improved processes for pipeline isolation and response to incidents
- House and Senate pipeline safety bills are being considered, with key differences on issues of:
  - Penalties for "major consequence violations"
  - Legislative requirement of automatic or remote controlled as well as excess flow valves
  - Required verification of maximum operating pressure

About Sixty Percent of Onshore Transmission Pipeline Was Constructed Before 1970



Older than our highways: About 48% of rural interstate bridges were built during the early years of the interstate system, from 1961 to 1970. By comparison, almost 60% of interstate pipeline was built before 1970.

Note: Regions are as follows:
Midwest – AK, IL, IN, IA, KS, MI, MN, MO, NE, ND, OK, SD, and WI
Northeast – CT, DE, KY, ME, MD, MA, NH, NJ, NY, OH, PA, RI, VA, WV, and VT
Gulf – LA and TX
Southeast – AL, FL, GA, MS, NC, SC, and TN
Western – AZ, CA, CO, ID, MT, NM, NV, OR, WA, and WY
Sources: U.S. Dept. of Transportation; Van Ness Feldman; Federal Highway Administration, at http://www.fhwa.dot.gov/infrastructure/intrstat.cfm, accessed Nov. 7, 2011 (interstate bridge conditions); ScottMadden analysis

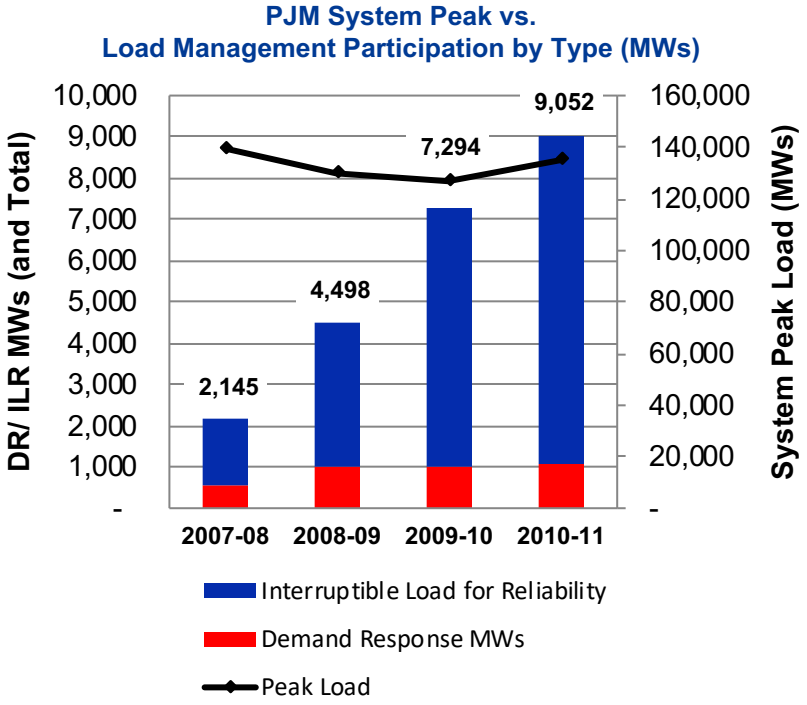
Aggregating Demand Response Resources

SCOTTMADDEN Management Consultants

PJM Proposes Revised Demand Response Capacity Calculation Methodology

- In April, PJM proposed a revision to its tariff for load reductions by demand response resources
  - Its tariff allowed curtailment services providers (i.e., DR aggregators) to nominate a firm service level (permitting reduction to a predetermined level) or guaranteed load drop (GLD) (load reduction of a predetermined amount) in a capacity auction
  - PJM proposed to require that actual load reductions result in load less than the end-use customer's peak load contribution (PLC)
  - PLC is the average of the end user's actual load during the five coincident peak hours of the preceding delivery year
- DR aggregators want to be able to pool DR resources under management and get capacity credit for the full amount of demand reduction achieved and achievable
  - New calculation potentially reduces DR KWs and related compensation
- FERC approved revisions, but suspended implementation pending a technical conference
- Key issues
  - Disconnect between PLC as a baseline and PJM's capacity procurement process: If concern is about sufficient capacity, should measures be the same?
  - Potential lack of recognition of load growth (and hence scale of potential load drop) since PLC is based upon prior year baseline: Should "real" or historical values determine?
  - Effectively ends the GLD option, which DR aggregators believe will limit aggregation and DR participation

Load Management Is Steadily Growing in PJM

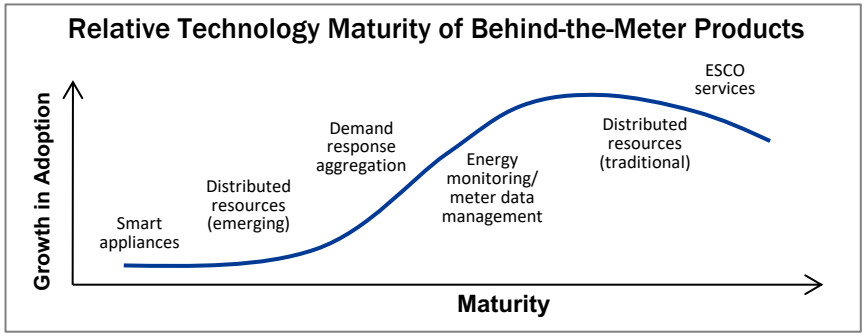


May 2011 PJM capacity auction results (for 2014/15 delivery)	
Total capacity resources procured	149,974 MWs
Demand response resources	14,118 MWs (9.4%)
Efficiency resources	822 MWs (0.5%)

Sources: FERC Order, 135 FERC ¶61,212 (Jun. 3, 2011); Greentech Media; World Energy; SNL Financial (PJM system peaks); 2010 PJM State of the Market Report, Table 2-84 (Mar. 3, 2011) (DR and ILR MWs); PJM Press Release (May 13, 2011)

Behind-the-Meter Products and Services: New Opportunity or Dot-Com Redux?

SCOTTMADDEN Management Consultants



- When will smart grid be capable of creating behind-the-meter opportunities?
- What is different now from prior retail "waves" in energy?
- How much integration is needed across value chain stages?
- What operating and business models will emerge?
- How will customers respond?

Segment	Description	Some Drivers/Issues	
Demand response (DR) aggregation	Intermediators between customers and utilities/regional ISOs that pool DR, peak load management, and other services	❑ Price signals; rate structures; ISO roles ❑ Public policy	
Distributed resources (incl. renewables)	Distributed generation and storage for primary and stand-by power, grid ancillary services and renewables support, etc.	❑ Installed cost (improving) ❑ Public resistance to cross-subsidization ❑ Grid-parity costs (especially renewables)	
Energy monitoring and management/ meter data management	Software, hardware, analytics, and interfaces that provide signals, information on real-time consumption	❑ Improved technology; interoperability standards ❑ Privacy concerns ❑ Level of customer investment	
ESCO services	Energy audits and consulting; energy equipment and installation	❑ Subsidies and financing ❑ Agency issues	❑ Pricing of efficiency ❑ Payback time, return
Smart appliances/ hardware (incl. premise area networking)	Facility appliances and devices with modernized electricity usage systems that monitor, protect, and automatically adjust operations	❑ Technology maturity/lifecycles; interoperability standards ❑ Customer and equipment service	❑ "New normal" frugality ❑ Transparent price signals; supportive rate structures

Sources: Company websites; investment analyst reports; industry news; Cleantech Group, 2010 U.S. Smart Grid Vendor Ecosystem (Sept. 2010); DOE Berkeley National Laboratory; ScottMadden analysis

SCOTTMADDEN
Management Consultants

Energy industry landscape: sharpening contrasts and accelerating change

Every day in this challenging and exciting environment, experienced ScottMadden consultants offer our clients deep energy knowledge and practical business acumen, collaborate with them, and help them succeed.

We have done this for nearly 30 years, served more than 200 energy organizations —including 90% of the top 20—and completed thousands of projects. We have worked with the best in the industry and can help you succeed. Meet with us for industry-leading practices and management insights.

Generation • Transmission • Delivery • Smart Grid • Markets • Utilities • Regulation • Gas

"They are practical; we can put their recommendations into play right away."
Industry Executive

AN EXCEPTIONAL CONSULTING EXPERIENCE

scottmadden.com

Recent ScottMadden Insights—Available at ScottMadden.com/Insight

Asset Management	***ScottMadden Insights on Asset Management***, by Jake Jacobi & Stu Pearman (June 2011), at www.scottmadden.com/insight/453/ScottMadden-Insights-on-Asset-Management.html
Fossil Generation	***Improving Fossil Fleet Performance through Actionable Benchmarking***, by Jake Jacobi (Oct. 2011), at www.scottmadden.com/insight/496/Improving-Fossil-Fleet-Performance-through-Actionable-Benchmarking.html ***Managing Environmental Regulations in Uncertain Times***, by Jake Jacobi & Stu Pearman (Feb. 2011), at www.scottmadden.com/insight/445/Managing-Environmental-Regulations-in-Uncertain-Times.html
Natural Gas	***Distribution Integrity Management Program (DIMP) for Gas LDCs***, by Ed Baker & Jason Davis (June 2010), at www.scottmadden.com/insight/253/Distribution-Integrity-Management-Program-DIMP-for-Gas-LDCs.html
Nuclear Generation	***Improving Nuclear Maintenance Productivity—Insights from ANS***, as published in *Nuclear News* (Oct. 2010), at www.scottmadden.com/insight/424/Improving-Nuclear-Maintenance-Productivity-Insights-from-ANS.html ***Nuclear New Build***, by Ed Baker (Nov. 2010), at www.scottmadden.com/insight/411/Nuclear-New-Build.html
Renewables	***Wind Generation 2011***, by Jake Jacobi & C. Scott Wilson (May 2011), at www.scottmadden.com/insight/450/Wind-Generation-2011.html
Resource and Supply Planning	***Generation Mix Trends***, by Stu Pearman, presented at the Infocast Power Generation Summit 2011 (Nov. 2011), at www.scottmadden.com/insight/501/Generation-Mix-Trends.html ***Resource Planning – Engaging Stakeholders in the Process***, by Randy McAdams (Sept. 2011), at www.scottmadden.com/insight/481/Resource-Planning-Engaging-Stakeholders-in-the-Process.html
Smart Grid	***Smart Grid Integration***, by Cristin Lyons & Jake Jacobi (June 2011), at www.scottmadden.com/insight/455/Smart-Grid-Integration.html ***Smart Grid Planning***, by Cristin Lyons & Jake Jacobi (Feb. 2011), at www.scottmadden.com/insight/444/Smart-Grid-Planning.html
Supply Chain	***The Management of Critical Spares in the Electric & Gas Utility Industry***, Utility Materials Management Benchmarking Consortium Survey (Apr. 2011), at www.scottmadden.com/insight/449/The-Management-of-Critical-Spares-in-the-Electric-Gas-Utility-Industry.html
Transmission	***PRC-005: One of the Most Violated Standards in the Industry***, by Rick Starkweather, presented at EUCI NERC Standards and Requirements Conference (Feb. 2011), at www.scottmadden.com/insight/446/PRC005-One-of-the-Most-Violated-Standards-in-the-Industry-An-InDepth-Examination.html
Water	***Water Resource Planning***, by Jake Jacobi & Rick Starkweather (Oct. 2011), at www.scottmadden.com/insight/497/Water-Supply-Issues.html **Water Supply Shortages: Water Utility Regulatory Insights,** by Jake Jacobi & Rick Starkweather (Aug. 2011), at www.scottmadden.com/insight/469/Water-Supply-Shortages-Water-Utility-Regulatory-Insights.html

Energy Practice

The energy industry landscape is one of sharpening contrasts and accelerating change. The shelf life for conventional wisdom seems to grow shorter with each headline. Every day in this challenging and exciting environment, experienced ScottMadden consultants offer our clients deep energy knowledge and practical business acumen, collaborate with them, and help them succeed.

We have done this for nearly 30 years, served more than 200 energy organizations, and completed thousands of successful projects. We have helped some of the best in the business in nuclear and fossil generation, renewables, transmission, distribution, gas, regulatory, and a host of other areas.

For more information about our Energy Practice, contact:

Stu Pearman
Partner and Energy Practice Leader
spearman@scottmadden.com
919.781.4191

SCOTTMADDEN
Management Consultants

scottmadden.com

Research

ScottMadden Research provides clients with valuable insight on developments, trends, and practices in energy and sustainability. Through its semi-annual *Energy Industry Update* and other occasional publications, our research team helps clients discern and analyze critical issues and inform their business decisions.

We also provide customized, project-based research and analytical support on matters of interest to our clients.

For more information about our research capabilities or content, see the *Insights* section of our website or contact:

Brad Kitchens
President
sbkitchens@scottmadden.com
404.814.0020

Stu Pearman
Partner and Energy Practice Leader
spearman@scottmadden.com
919.781.4191

Jere “Jake” Jacobi
Partner and Clean Tech and Infrastructure Practice Leader
jjacobi@scottmadden.com
404.814.0020

Greg Litra
Partner and Energy, Clean Tech, and Infrastructure Research Leader
glitra@scottmadden.com
919.781.4191