SCOTTMADDEN
Management Consultants

Meet With Us

# The Energy Industry Update

## Highlights of Recent Significant Events and Emerging Trends

## January 2010

Vol. 10, Issue 1

# Table of Contents

SCOTTMADDEN Management Consultants

# Executive Summary

SCOTTMADDEN Management Consultants

## Looking Beyond Recession

A year into a new presidential administration and the feared collapse of the world financial system, business has regained its footing and the world economy appears to be rebounding. Uncertainty over the pace and durability of recovery, an expanding federal regulatory and legislative agenda, and mixed state regulatory relationship makes the near-term murky, but companies are thinking beyond the current ambiguity and how best they can position themselves for a potential industry dynamic three to five years hence.

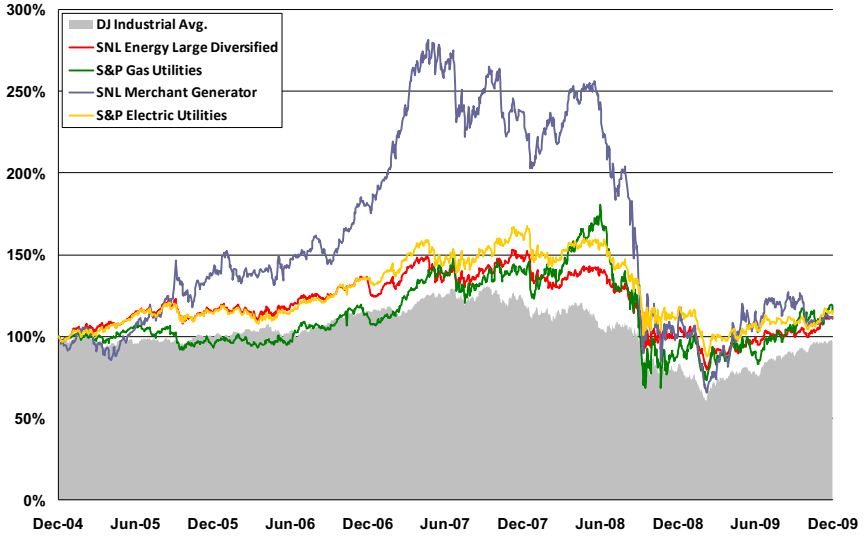
| | |
|---|---|
| **Everybody's Weighing in on Carbon** | ❑ Carbon regulation continues to hang like a Damoclean sword over the energy and utilities sector. In addition to the Waxman-Markey bill passed in the House last spring, a Senate bill (Kerry-Boxer), a framework (Kerry-Lieberman-Graham), and an EPA rulemaking are competing for traction<br>❑ Meanwhile, carbon markets grew, but prices were down in 2009 and are expected to stay down in 2010 amid decreased energy usage. On the horizon, though, are new U.S. regional protocols and the next phase of European carbon emissions reduction |
| **Smart Grid Advances** | ❑ The American Recovery and Reinvestment Act—the 2009 stimulus—yielded $4 billion in matching grants for demonstration, pilot and commercial smart grid projects. While investor-owned utilities received the majority of these awards, many firms that did not receive stimulus funding are re-evaluating their own plans<br>❑ Industry players inch toward smart grid standards, facilitated by the U.S. National Institute for Standards and Technology |
| **Greentech Remains Interesting** | ❑ Greentech investment continues, and interest in carbon capture and storage has increased as the industry hedges its bets on fuels<br>❑ Energy storage is making technical strides and garnering more attention for both grid applications (supporting renewables and smart grid applications) and for large scale supply needs |
| **Too Much Supply?** | ❑ A combination of low demand and newly recoverable stores of shale gas has led to excess supply and low prices in both gas and power markets. It is unclear whether this will be a sustained trend and how gas price volatility will be affected by this overhang<br>❑ Nuclear capacity has made strides even without new build as uprates are expected to add over two gigawatts of capacity over the next four years |
| **Will Investors Sour on Utilities?** | ❑ Utility investors and managers fear their relatively steady returns to shareholders and attractive dividends will be overshadowed by other higher growth opportunities with less regulatory risk, particularly if the dividend tax cut expires in 2011 |

# Stock Prices: A Mixed Bag with Many Still Lagging Broader Indices

SCOTTMADDEN Management Consultants

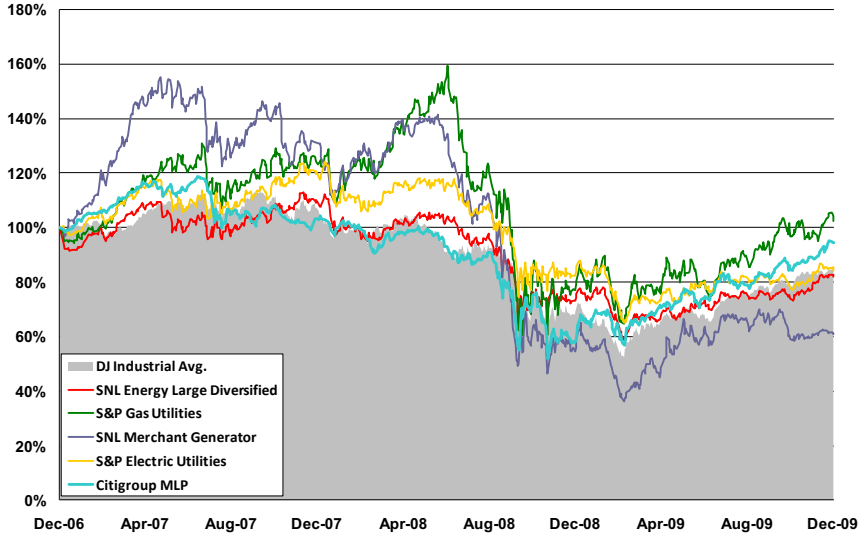
## After Five Years, Energy Slightly Outpaces the Dow

### 5-Year Sector Performance
### Normalized Daily Index Values (Year-End 2004–Year-End 2009)




## Sectors Diverge as the Lens Is Narrowed to the Past Three Years

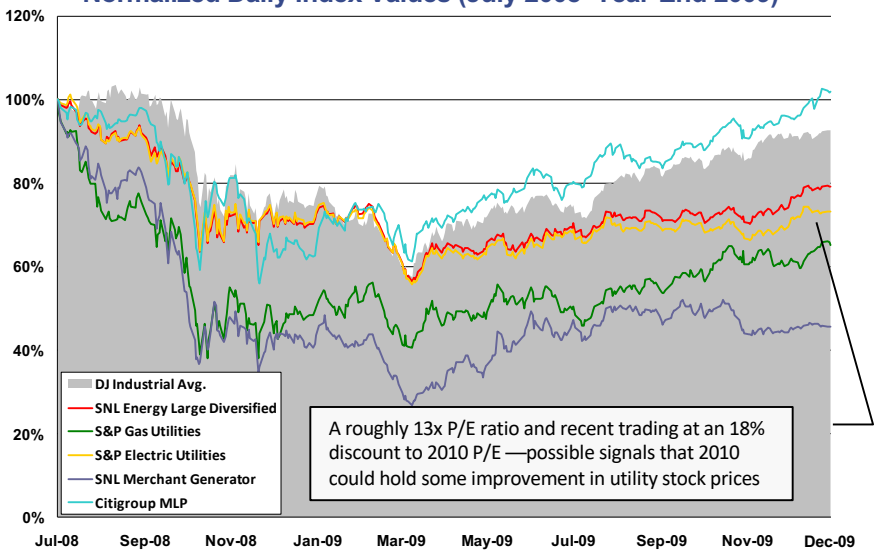
### 3-Year Sector Performance
### Normalized Daily Index Values (Year-End 2006–Year-End 2009)




- After a difficult year for the economy and the stock market, utility stock prices have rebounded to roughly the same level as the S&P 500, although some sectors still lag the Dow Industrials
- Midstream gas (reflected in master limited partnerships or MLPs) fared best among energy companies for the past 18 months, with investors favoring safe yields and tax advantages
- Some attribute a lackluster stock performance in 2009 for utilities to industry headwinds: reduced energy demand and depressed natural gas prices (which reduced wholesale power prices)
- Analysts project a mixed to favorable outlook for the utility sector in 2010, anticipating better economic growth, continued constructive regulation, increased capex into rate base (estimated at 200% of depreciation), normal summer weather, and higher gas prices
- However, they are divided on whether a desire for predictable earnings and dividends will favor utility stocks or an appetite for increased risk (and reward) will drive investor to other sectors

## More Pronounced Differences Since Mid-2008

### 18-MonthSector Performance
### Normalized Daily Index Values (July 2008–Year-End 2009)




Sources: SNL Financial (citing investment research by Macquarie Equities, Jefferies & Co., Wunderlich Securities, BMO Capital Markets, and Sanford C. Bernstein & Co.); Dow Jones & Co.; Standard & Poors; FitchRatings; ScottMadden analysis

# Heard on "The Street"—
# Views of the Energy and Utilities Sectors

SCOTTMADDEN
Management Consultants

| | |
|---|---|
| **Fuel commodity price divergence**  | ❑ The Street appears to be assuming $7 per MMBTU long-term natural gas prices<br>❑ Upward cost pressures for coal—due to safety requirements and difficulty in receiving Eastern mine permits—and increased volatility in coal prices |
| **Continued weakness in power market margins**  | ❑ Loose power markets—less demand, more supply—for now<br>❑ Demand for electricity likely to recover to 2007 levels in 2011, leaving power demand effectively flat over a four-year period<br>❑ Rising confidence that efficiency programs and rollout of smart meters will slow rate of demand<br>❑ Many face negative earnings growth through 2012-13 with hedge roll-off and falling capacity revenues<br>❑ Compression in "dark spreads" for coal generators that was not anticipated in years past |
| **Capital expenditures on a roll**  | ❑ No reason to believe rate base investment will slow<br>❑ Power capex will be well in excess of internal cash sources; for electrics, expected for 2009-11 around 11% of net plant and over 2X depreciation and amortization<br>❑ Rate at which electric/diversified utility invested capital will grow is likely to exceed 5%<br>❑ Low and manageable capex for gas distribution utilities |
| **Environmental policy remains a key driver**  | ❑ Aggressive EPA policy around CAIR/CAMR will have a long-dated impact on earnings<br>❑ "Two-year assumed" delay in passage of U.S. carbon legislation, if at all |
| **Situation-specific outlook for utilities, but a generally gloomy outlook**  | ❑ Uncertainty of carbon cost—despite likely rate recovery by regulateds and benefits to low-carbon generators—could push broader investor base from sector<br>❑ Negative regulatory developments in key states, like those that have occurred in Florida, could spook utility investors<br>❑ Expiration of dividend tax cut looms at the end of 2010, but difference between utility yields and Treasury yields keeps defensive (regulated) utilities an attractive income play<br>❑ Companies are heterogeneous: Diversified utilities differ in business mix, generation mix, market exposure, and hedge profile<br>❑ Gas utilities perceived as "stable"—weak sales growth but lowered rate pressure (with greater gas supply), consistent regulatory treatment, and manageable funding requirements |
| **Midstream, pipeline opportunities**  | ❑ Shifting sources of gas supply to unconventional plays, not demand, will drive additional "low-risk, contractually supported" gas infrastructure |




Sources: Oppenheimer & Co.; Morgan Stanley; Credit Suisse; Wells Fargo Securities; FitchRatings

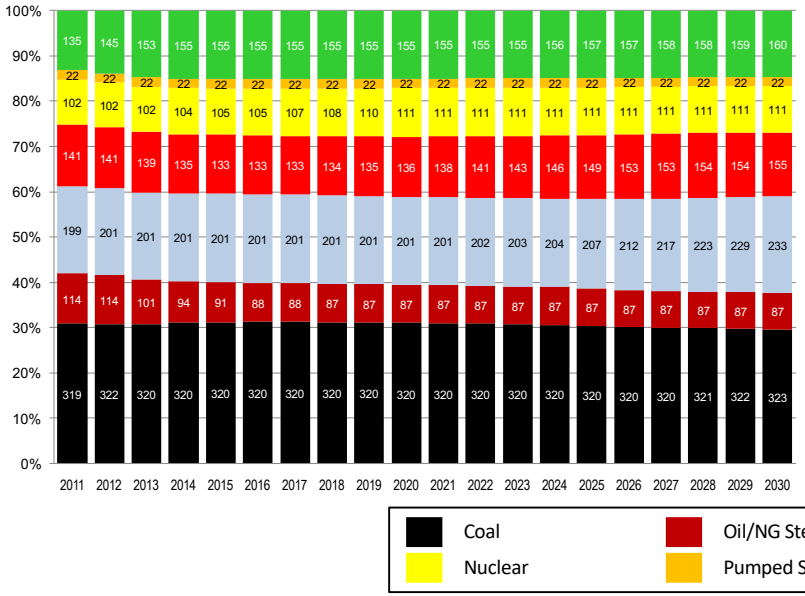
 

# The Fuel Mix: What's on the Horizon

SCOTTMADDEN Management Consultants

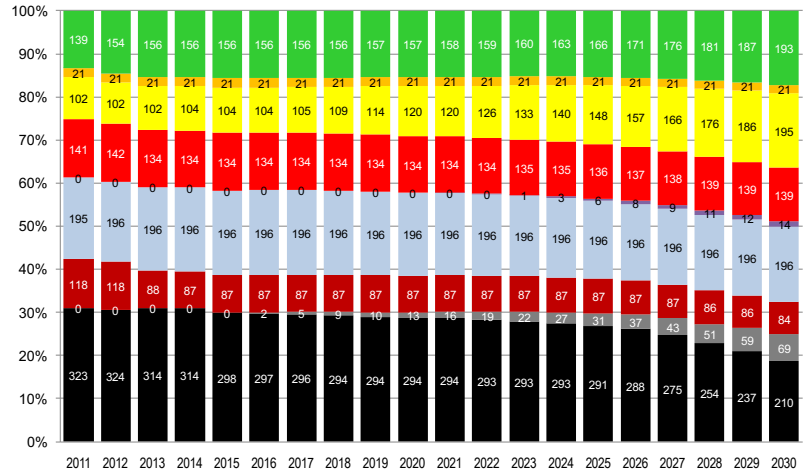
## EIA Projects Gradual Displacement of Some Coal by Natural Gas Combined Cycle

### EIA Projected Installed Capacity by Type 2010 Base Case (GWs and %)




## Under Waxman-Markey, Traditional Coal Is More Rapidly Displaced Especially by Nuclear, Renewables, and Coal with Carbon Capture

### EIA Projected Installed Capacity by Type After Waxman-Markey (GWs and %)



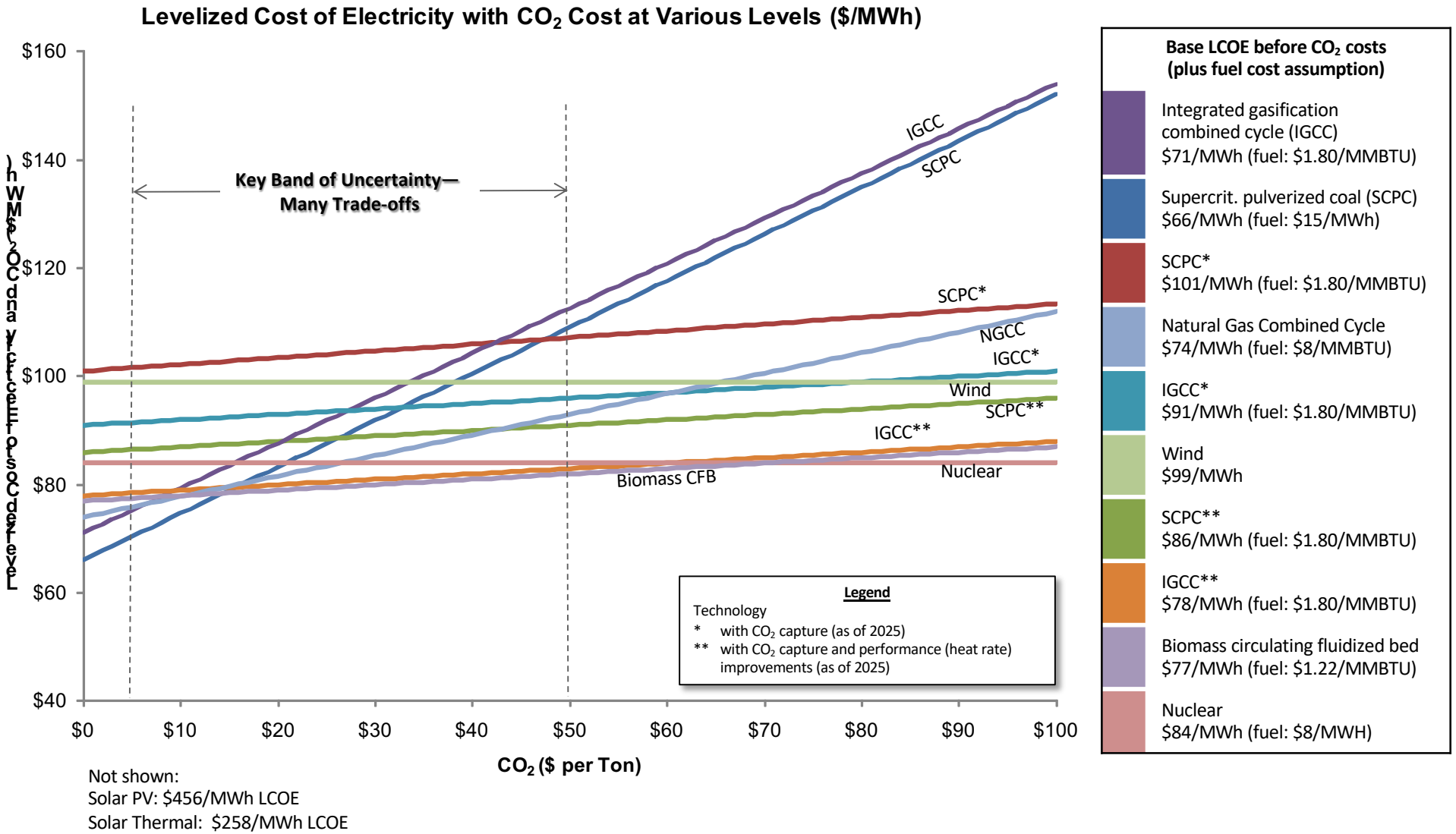

- While forecasts vary, the North American fuel mix continues to shift away from coal- and oil-fired generation
- Coal capacity additions, either with or without carbon legislation, appear to be on hold for the foreseeable future. One analyst projects that 46 GWs of coal capacity will be retired in the next 20 years due to SO2, NOx, and mercury retrofit requirements as well as carbon regulation uncertainty. Cheap natural gas is accelerating this trend (e.g., Progress Energy's decision to retire 1.5 GWs), as are emerging environmental regulations (ash and carbon "endangerment")
- Retrofitting existing coal plants as biomass hybrids appears to be gaining interest—e.g., NRG's Somerset (MA), Wolverine Power Supply Coop.'s Rogers City (MI), Dominion's Virginia City Hybrid (VA), and Old Dominion Electric Coop.'s Cypress Creek (VA)
- Natural gas combined cycle generation, as a percentage of U.S. generating fleet composition, is projected to rise under EIA's base case. It is uncertain how much the EIA forecast would be affected by an extended period of low gas prices as a result of the bullish supply prospects of shale gas
- The range of uncertainty about which central station generation technologies will be economically favored remains wide (see next page) and depends upon, in part, the following:
  - The pace of development of commercial-scale CCS and performance improvements for IGCC and traditional pulverized coal
  - The slope of the technology learning cost curve of newer technologies ("Nth of a kind")—particularly nuclear and solar
  - Labor and material price inflation, which was pronounced pre-recession but has moderated over the past year

Sources: SNL Financial; industry news; EIA, *Annual Energy Outlook 2010: Reference Case*, Presentation by Richard Newell at the Paul H. Nitze School of Advanced International Studies, Washington, DC (Dec. 14, 2009); EIA, *Energy Market and Economic Impacts of H.R. 2454, The American Clean Energy and Security Act of 2009* (Aug. 2009)

# Levelized Cost of Electricity—Technology Trade-Offs at Various $CO_2$ Cost Levels

ScottMadden Management Consultants

## Latest EPRI-TAG Estimates of Levelized Cost of Electricity (LCOE) in 2015† with $CO_2$ Costs at Various Levels (in Dec. 2008 $/MWh)




Not shown:
Solar PV: $456/MWh LCOE
Solar Thermal: $258/MWh LCOE

Notes: † except for capture technology, which is assumed to be in place as of 2025 (see legend)

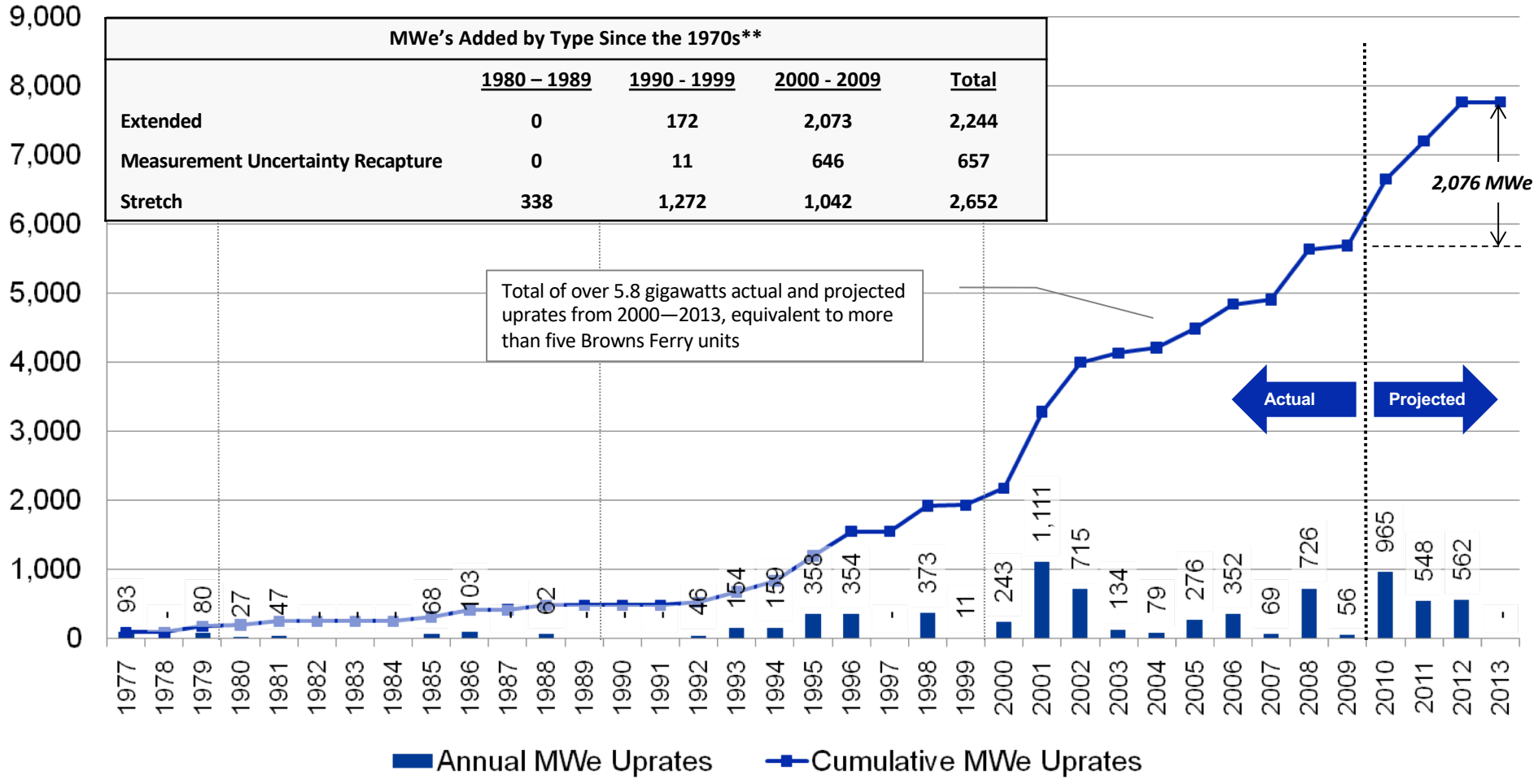
Sources: SNL Financial; industry news; EPRI, *Program on Technology Innovation: Integrated Generation Technology Options*, Report 1019539, §1.10 (Tech. Update, Nov. 2009); EPRI, *Generation Technology Options in a Carbon-Constrained World* (Oct. 2009 rev.)

# Nuclear Uprates: The "Quiet" Build-Out

SCOTTMADDEN Management Consultants

## Annual and Cumulative Nuclear Reactor Uprates in Megawatts-Electric (MWe)* Actual Through 2009 and Projected Through 2013

| MWe's Added by Type Since the 1970s** | | | | |
|---|---|---|---|---|
| | 1980 – 1989 | 1990 - 1999 | 2000 - 2009 | Total |
| Extended | 0 | 172 | 2,073 | 2,244 |
| Measurement Uncertainty Recapture | 0 | 11 | 646 | 657 |
| Stretch | 338 | 1,272 | 1,042 | 2,652 |




**While development of new nuclear units has moved more slowly than desired, nuclear capacity is being added through reactor uprates, and more is expected.**

Notes: * Megawatts-electric estimated at 1/3 of megawatts-thermal, which comprises the measure of the reactor uprate. Sum may differ from sum of components shown due to independent rounding.

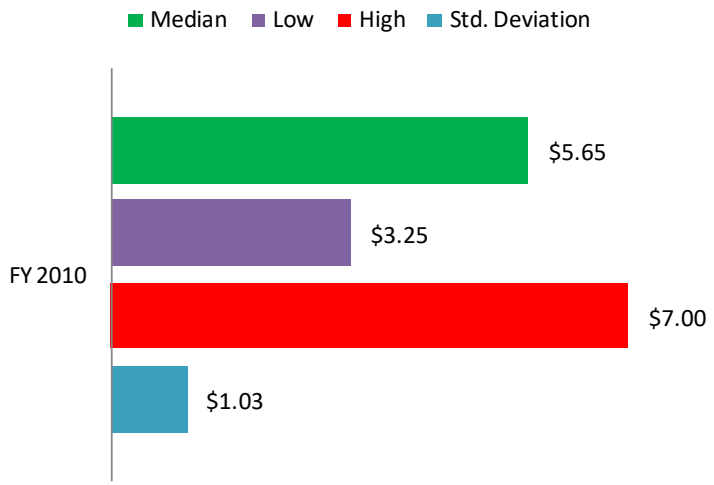
** Extended power uprates are greater than stretch power uprates and have been approved for increases as high as 20% and require significant modifications to major balance-of-plant equipment such as the high pressure turbines, condensate pumps and motors, main generators, and/or transformers.
Measurement Uncertainty Recapture are less than 2% and are achieved by implementing enhanced techniques for calculating reactor power, particularly the use of state-of-the-art feedwater flow measurement devices to more precisely measure feedwater flow.
Stretch uprates are typically up to 7% and are within the design capacity of the plant. Stretch uprates usually involve changes to instrumentation setpoints but do not involve major plant modifications.

Sources: Nuclear Energy Institute; U.S. Nuclear Regulatory Commission

# Natural Gas Prices: Low in the Near Term, Less Certain in the Longer Term

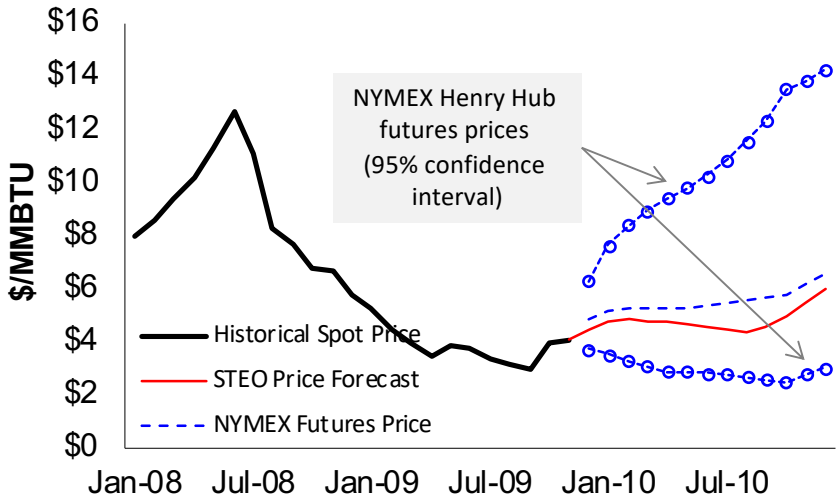
SCOTTMADDEN Management Consultants

**Natural Gas Price Forecast Range for 2010 of Sixteen Firms (in $/MMBTU)**

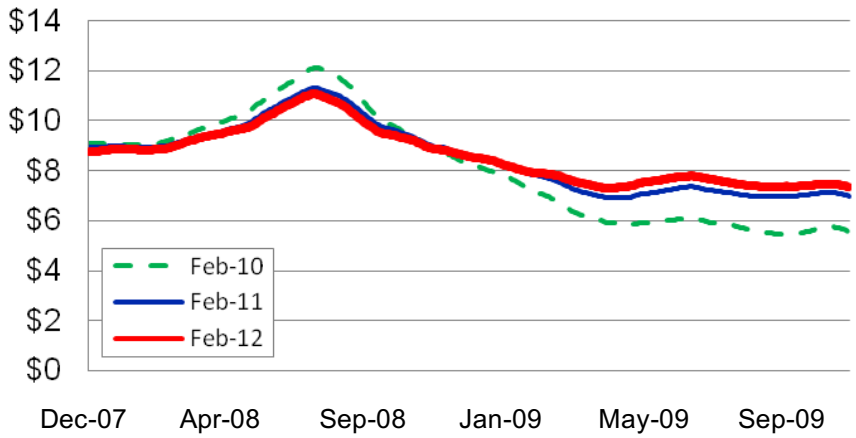



- Many natural gas industry analysts are expecting prices to remain low for the next one to four years, as a combination of low-cost shale gas production, expanded LNG capacity, expanded gas storage and pipeline infrastructure, and a soft global economy have forced prices down
- Gas price forecasts vary, though, with increasing uncertainty looking beyond 2010
- Futures prices point to some stabilization of gas prices in 2011 and 2012, as excess supply may potentially be absorbed with higher demand
- Sustained lower prices could stress smaller producers lacking scale economies and limited access to capital, and lead to consolidation (and perhaps pricing discipline) in the sector
- An important development emerging is the decoupling of gas and oil prices, the latter of which has advanced over the past six months

**Henry Hub Natural Gas Prices**
**Actual vs. Energy Information Administration Forecast**




**NYMEX Futures Settle Price (50-Day Moving Average in $/MMBTU) for Delivery in February 2010, 2011, and 2012**




Sources: Energy Information Administration, *Short-Term Energy Outlook* (Nov. 2009); Energy Intelligence *Natural Gas Week* (Oct. 26, 2009); SNL Financial; ScottMadden analysis

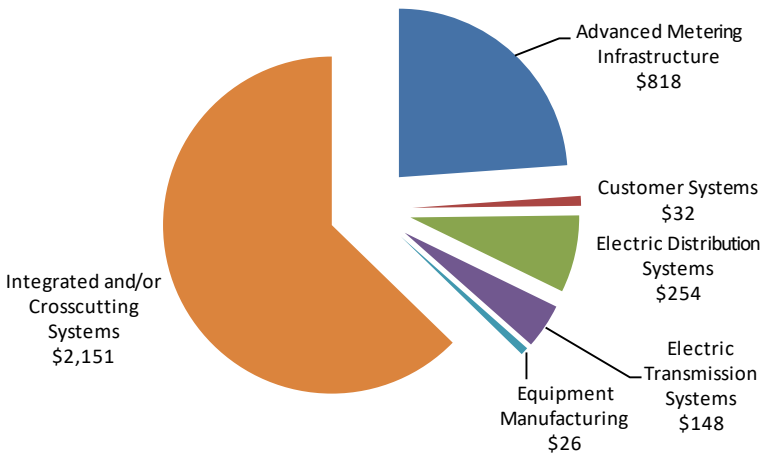
 

# Smart Grid Stimulus Awards: What Won?

SCOTTMADDEN Management Consultants

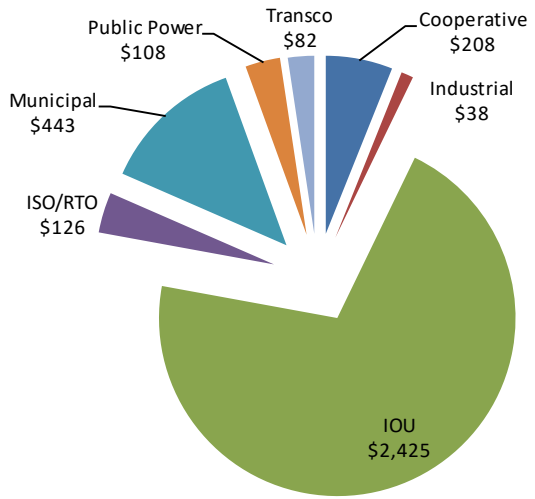
## Integrated and Cross-Cutting Systems Were Favored

### Total Smart Grid Awards by Project Type (in $ Millions)



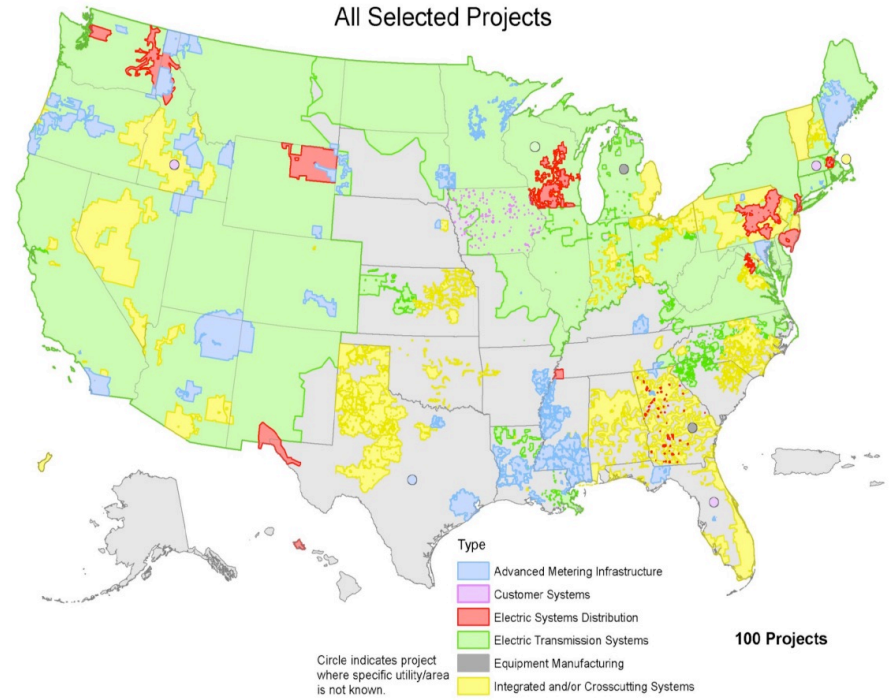

## Investor-Owned Utilities Received the Lion's Share of Awards

### Total Smart Grid Awards by Awardee Type (in $ Millions)




## Awards Were Spread Geographically, But Thin in the Heartland

### Smart Grid Investment Grants by Region and Type



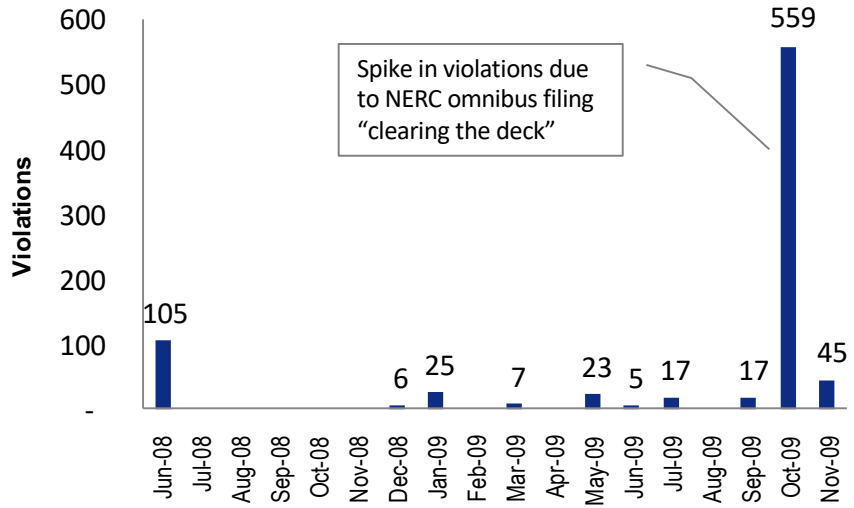

- DOE announced the award of $3.4 billion in funding for Smart Grid Investment Grants (SGIG). These grants will be invested in 100 commercial-ready projects, matched by over $4.7 billion in private funding
- Actual SGIG funding, however, has only reached $1.2 million as of late 2009
- DOE has also awarded $620 million for 30 smart grid demonstration and energy storage projects, by nature not ready for widespread deployment
  - $435 million was awarded for Smart Grid Regional Demonstrations in nine states
  - Total project value for the SGRD's was $877 million, including co-funding from private parties

Sources: SmartGridNews.com; U.S. Dept. of Energy Office of Electricity Delivery and Energy Reliability (http://www.oe.energy.gov/) and recovery (http://www.energy.gov/recovery/) websites

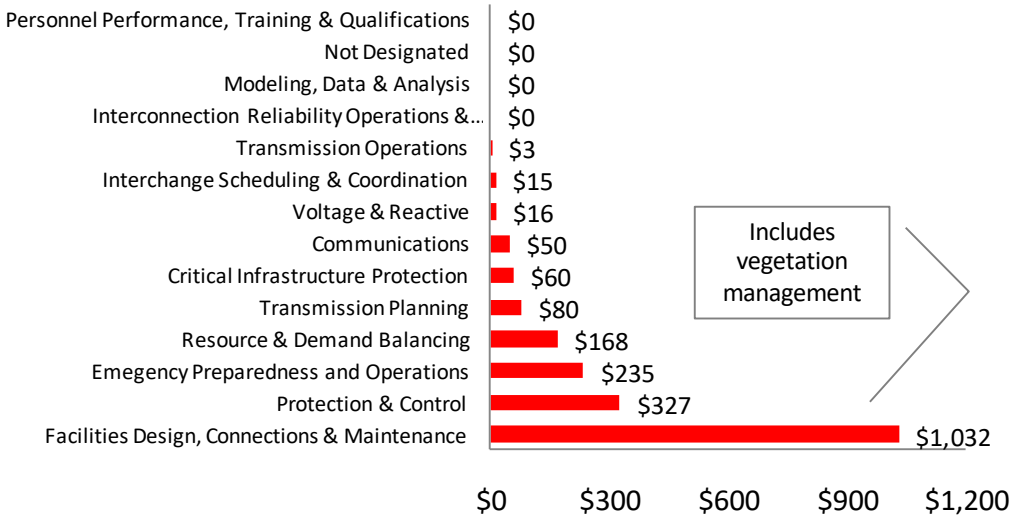
# NERC Violations Scorecard

## October 2009 Was a Big Month for NERC Violations Assessment

### NERC Violations Since June 2008 (Through Nov. 2009)

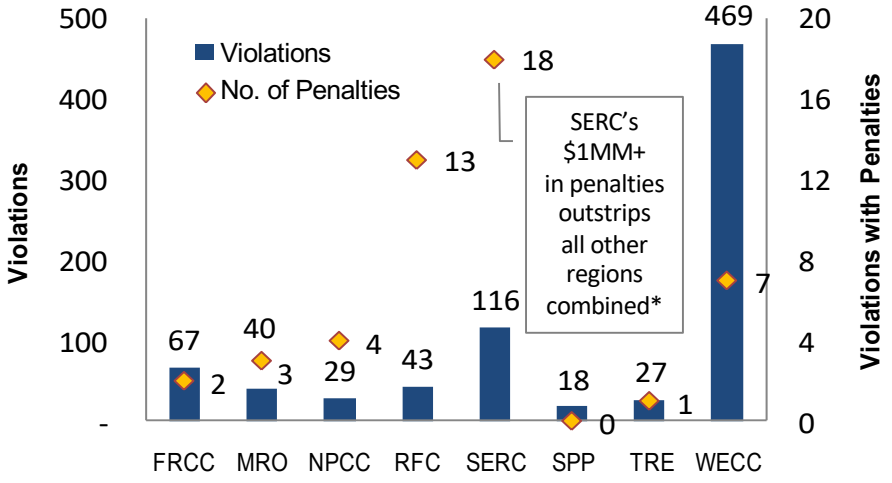



### Cumulative NERC Penalties by Reliability Standard Group (June 2008 – Mid-November 2009) (in $000s)*




## WECC and SERC Have Amassed the Most Violations

### NERC Violations and Monetary Penalties Since June 2008 by NERC Region (as of Dec. 2009)




- Both FERC and NERC have indicated that the industry should expect enforcement to become more rigorous
- NERC has said that leniency in assessing monetary penalties during the transition to mandatory standards is giving way to "an increasing level of compliance with the standards" and commensurate penalties
- The lack of specificity in the FPL stipulation agreement (in which FPL was fined $25 million for NERC violations) will lead to utilities taking an even more conservative approach to compliance with the standards
- In response, utilities will continue to spend significant time and money on NERC compliance effort

Notes: *Excludes FP&L's $25 million settlement in October 2009

Sources: NERC (as of Nov. 15, 2009); SNL Financial; ScottMadden analysis

# Transmission Development—A Quiet 2009, Prelude to an Active 2010?

SCOTTMADDEN Management Consultants

## Capex Ramped Back

- Some transmission and distribution capex anticipated for 2009 has been pushed back to 2010 or 2011 due to:
  - Recessionary pressures—reduced demand and revenues
  - Delayed decisionmaking due "wait-and-see" on smart grid stimulus awards
- Compared to $85 to $100 billion annual global spending on T&D equipment in recent years, some expect that 2009 spending will come in at the low end of that range

## Some New—or More Focused—Players

- Some firms—e.g., Exelon, AEP, and Oncor—are increasing focus in transmission development outside their traditional service territories seeking attractive, stable returns of the wires business

## Projects Revisited

- Two major projects—PATH and MAPP—are being reconsidered, as PJM re-examines whether (in light of reduced demand) the projects are needed for reliability
- Another PJM project, Susquehanna-Roseland, is being questioned by NJ regulators as well, for similar reasons

## Incremental Policy Moves

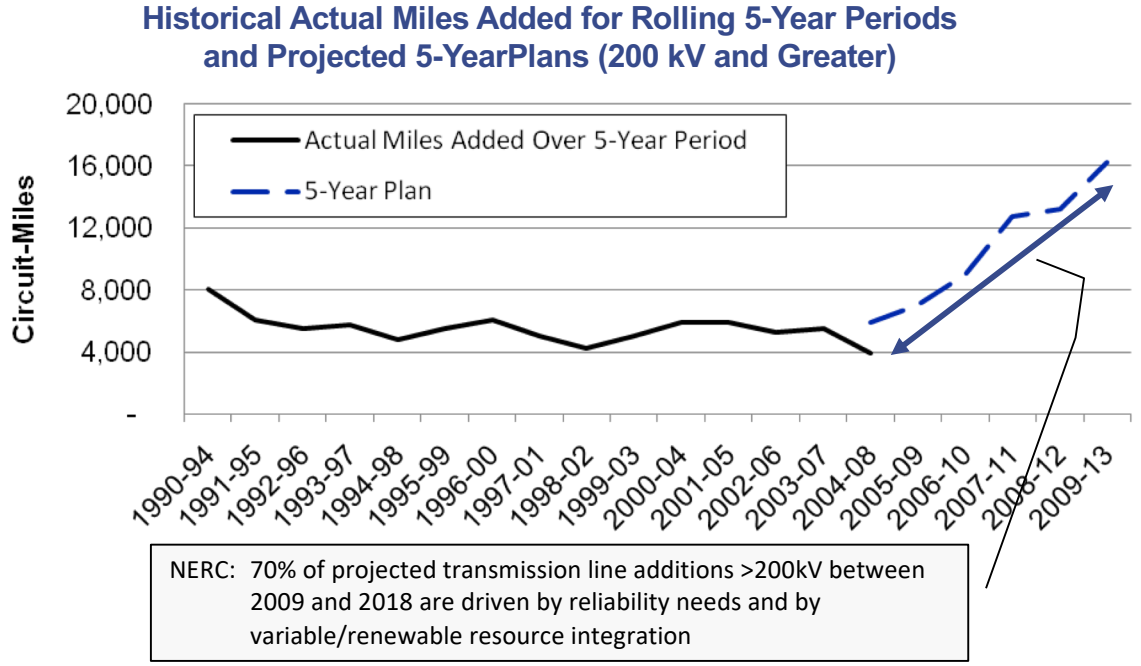
- Federal agencies executed a memorandum of understanding to expedite transmission siting on federal lands. Some key provisions:
  - Single fed point of contact
  - Unified environmental documentation
  - Clear timelines for review
  - Single environmental review and consolidated record

**Forecast of Additional Transmission Lines**

| Year Completed | Number of Projects | Total Announced Miles | Total Under Construction Miles | Total Planned Miles | Estimated Construction Cost ($ Billions) | % of Total Planned Miles |
|---|---|---|---|---|---|---|
| 2010 | 94 | 2,003 | 1,136 | 3,139 | $2.47 | 8.59 |
| 2011 | 69 | 2,180 | 529 | 2,709 | 3.92 | 7.42 |
| 2012 | 88 | 6,529 | 162 | 6,691 | 6.27 | 18.32 |
| 2013 | 72 | 5,020 | 125 | 5,145 | 10.66 | 14.08 |
| >2013 | 132 | 18,771 | 78 | 18,849 | 33.73 | 51.59 |
| **Total** | **455** | **34,503** | **2,030** | **36,533** | **56.98** | **100.00** |

Source: SNL Financial (totals may not foot due to independent rounding)

**NERC Regions Project Significant Transmission Spending in the Next Five to Ten Years**




Sources: U.S. Dept. of Energy, at www.congestion09.anl.gov; NERC, 2009 Long-Term Reliability Assessment (Oct. 2009); "2009 Transmission & Distribution Investment Adversely Affected by Economic Downturn," *T&D World* (Oct. 21, 2009) (citing a Newton-Evans Research Co. report); industry reports; ScottMadden research

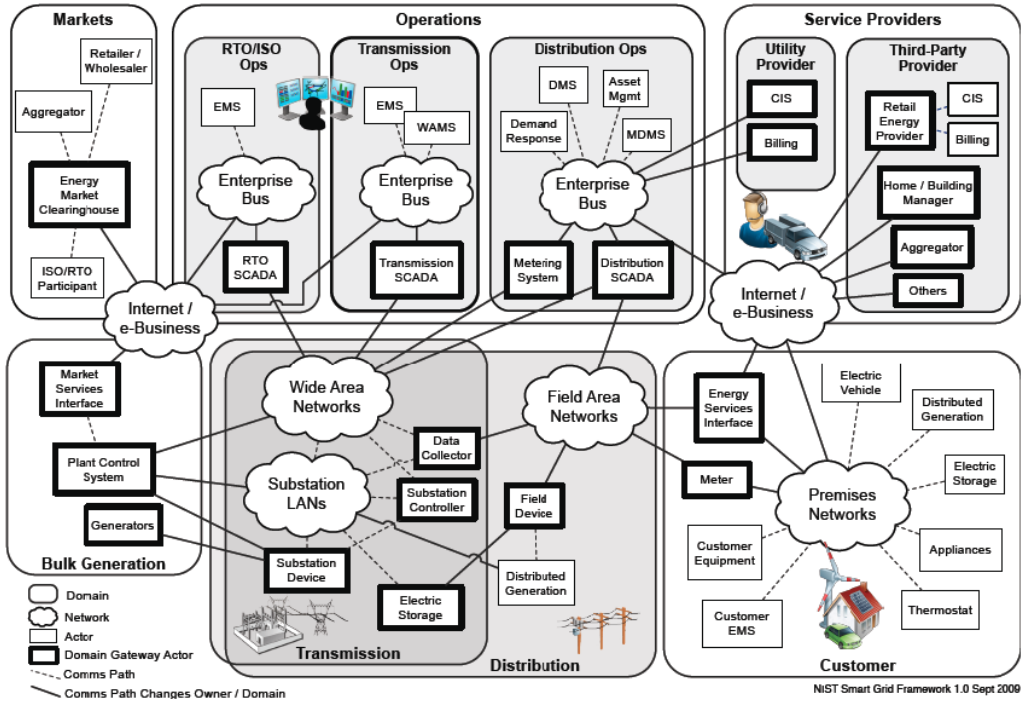
 

# NIST Accelerates Work on Smart Grid Standards

SCOTTMADDEN Management Consultants

- In 2007, Congress gave the National Institute of Standards and Technology (NIST) primacy over development of smart grid interoperability standards
- NIST released EPRI-developed draft standards in April 2009
- After three public meetings on the EPRI draft, NIST released its initial draft framework and roadmap for smart grid interoperability standards in October, with comments due in December
- In tandem, NIST also released a draft smart grid cyber security strategy and requirements. The strategy summarized use cases, risk assessment (vulnerability classes, impacts and threats), and development of security architecture and requirements
- NIST has also formed a public-private Smart Grid Interoperability Panel representing a broad array of stakeholder groups, to oversee activities (not to directly develop standards), provide technical guidance, and specify testing and certification requirements to assess the interoperability of Smart Grid-related equipment

**NIST's Conceptual Model for Actors and Communications Paths in the Seven Domains of the Smart Grid**




## Timetable for Priority Action to Enhance or Revise Draft Smart Grid Interoperability Standards

| Q4 2009 | Q1 2010 | Mid-2010 | Q4 2010 |
|---|---|---|---|
| ▪ Smart meter upgradability standard (completed)<br>▪ Common scheduling mechanism for energy transactions (overdue) | ▪ Common specification for price and product definition (early 2010)<br>▪ Standard demand response signals (Jan.)<br>▪ Standard for energy use information (Jan.) | ▪ Time synchronization<br>▪ Guidelines for use of IP protocol suite in the Smart Grid<br>▪ Guidelines for use of wireless communications in the Smart Grid<br>▪ Electric storage interconnection guidelines | ▪ Common information model for distribution grid management<br>▪ IEC 61850 Objects / DNP3 Mapping<br>▪ T&D power systems models mapping<br>▪ Interoperability standards to support plug-in electric vehicles<br>▪ Standard meter data profiles |

Sources: SmartGridNews.com; *The New York Times*; Federal Register ¶¶52181, 52183 (Oct. 9, 2009) (publishing for public comment the interoperability, cyber security Smart Grid strategies); NIST, *NIST Framework and Roadmap for Smart Grid Interoperability Standards Release 1.0 (Draft)* (Sept. 2009); NIST, *Smart Grid Cyber Security Strategy and Requirements* (Sept. 2009); http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/SGIP

# Comparing Climate Options – The Legislative Track

ScottMadden Management Consultants

## A Comparison of the Principal Climate Change Proposals Under Consideration by Congress

| | Waxman-Markey (American Clean Energy & Security Act, H. 2454) | Kerry-Boxer (Clean Energy Jobs and American Power Act, S. 1733)* | Kerry-Boxer Draft Compared to Waxman-Markey |
|---|---|---|---|
| **Targets** | ▪ 17% reduction by 2020<br>▪ Economy-wide | ▪ 20% reduction by 2020<br>▪ Economy-wide | ▪ Faster 2020 reduction in K-B<br>▪ Out-year targets the same |
| **Allowances** | ▪ 85% allocated; 15% auctioned<br>▪ Designated sectors and percentages<br>▪ Allocations phase out by 2030 | ▪ ~78% allocated; 23% auctioned<br>▪ Allocation similar to House bill, but initial reservation of ~16% for deficit reduction, strategic reserve fund<br>▪ 25% of allocations to be auctioned by 2040 for deficit reduction | ▪ Fewer free allocations<br>▪ Limit on allocations directly to generators (generators get <10% of utility sector allocations) |
| **Allowance reserve price**** | $28/ton (2009$), increasing to 160% of 36-mo. rolling average after 2015 | Soft price collar: $28/ton (2005$) in 2012, increasing by 5%+inflation until 2017, then by 7% + inflation | ▪ Higher allowance reserve price under K-B |
| **Offset amounts** | ▪ 1 billion domestic<br>▪ 1 billion international (1.5 int'l offsets = 1 allowance) | ▪ 1.5 billion domestic<br>▪ 0.5 billion international (1.25 int'l offsets = 1 allowance) | ▪ Preference for domestic offsets in K-B |
| **Carbon market regulation** | FERC for cash markets / CFTC for derivatives | CFTC for cash, derivatives | ▪ CFTC, not FERC, regulates allowances |
| **Competitiveness** | 15% allocation to trade sensitive industries and possible international reserve allowance program in 2020 | "Some" allocation to trade sensitive industries; placeholder language for a "border measure" | ▪ Unclear on level of competitiveness assistance |
| **EPA authority** | EPA pre-empted from further regulation of large GHG sources | EPA continues to regulate large GHG sources as well as the emissions reduction program | ▪ EPA maintains authority |
| **Renewable energy standards/ technology support** | ▪ 15% renewable energy standard with 5% improved energy efficiency (20% total by 2020)<br>▪ Promotes smart grid, electric vehicle deployment<br>▪ Energy efficiency programs, codes for appliances, buildings | ▪ No renewable energy standards, but incentives for CCS, nuclear, biofuels<br>▪ Efficiency standards for transportation, building codes<br>▪ Water, carbon footprint labeling | ▪ No federal renewables standards<br>▪ Maintains state, regional RPS<br>▪ Explicit support for nuclear |

Notes: * Draft bill as reported out of the Senate Environment and Public Works Committee
**Effectively, a price minimum for allowances sold or auctioned from an allowance reserve.

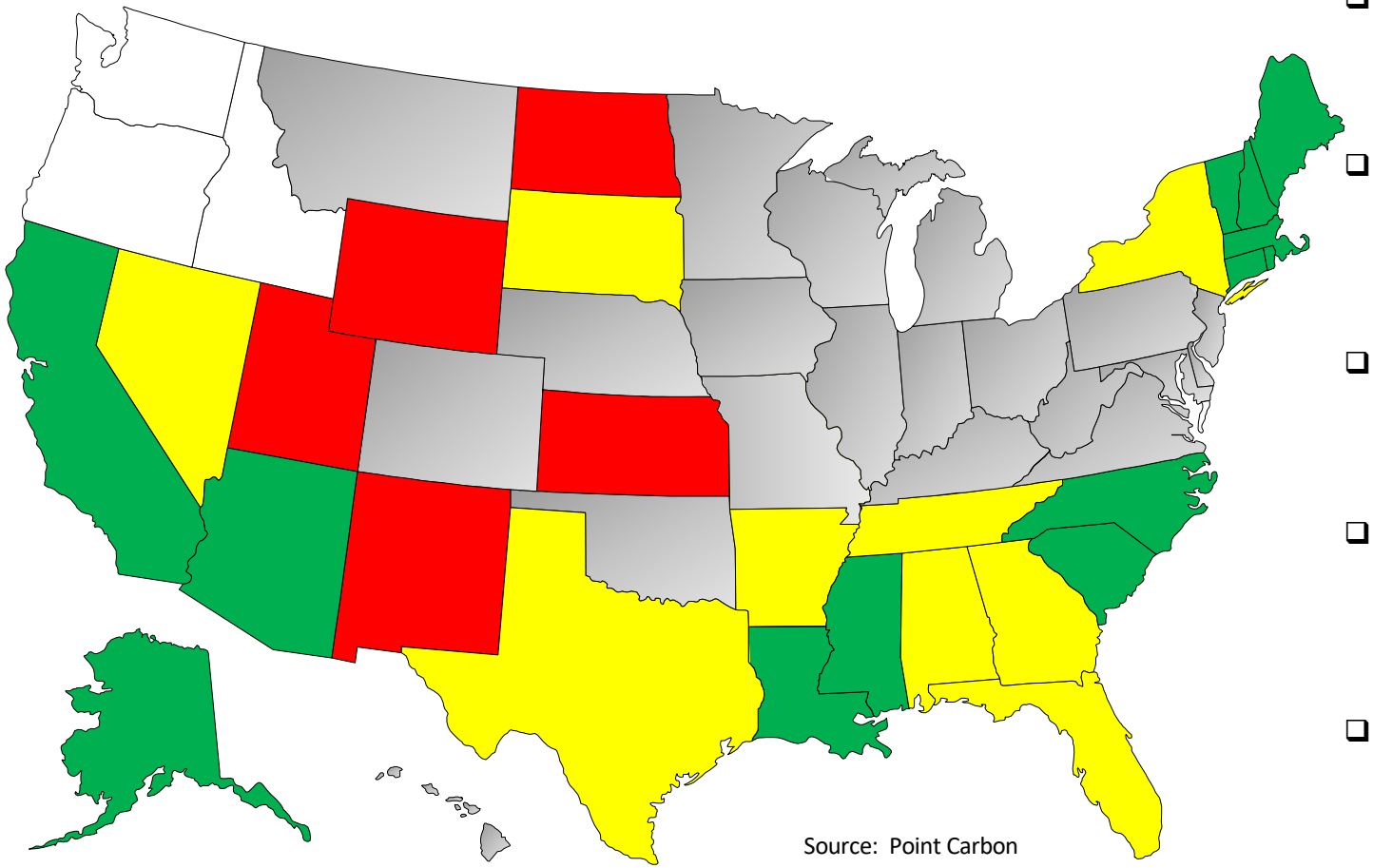
Sources: Point Carbon; Resources for the Future; Pew Center for Global Climate Change; World Resources Institute; P. Maniloff & B. Murray, "Allowance Price Containment Options for Cap-and-Trade Legislation," Nicholas Institute Discussion Memo, Duke Univ. (Oct. 5, 2009)

# Comparing Climate Options – The Legislative Track (Cont'd)

SCOTTMADDEN Management Consultants

## One Estimate of the Impact of Senate Proposed Climate Change Legislation on Electricity Prices




- The expected impact of carbon on electricity prices varies by region and market, but most expect a "meaningful" escalation in costs and rates
- Estimates are anywhere from under $5/MWh to $17/MWh impacts on electric prices, driven by fuel mix and recovery mechanism and approach (marginal vs. average cost)
- Point Carbon expects that most generators and utilities will be able to recover their net carbon cost (cash cost of allowances needed beyond free allocation)
- Fitch believes that regulated utilities are relatively well-positioned for recovery of costs, especially T&D-only utilities with pass-through commodity and purchased power costs
- Wild cards for rate recovery are the price of natural gas, commodity cost inflation, and the state of the economy

**Potential Impact of Carbon Costs on Electricity Prices**

- < $5 /MWh
- $5-$8/MWh
- $8-$10/MWh
- $10-$13/MWh
- $13-$17/MWh

Notes: Some key assumptions behind these estimates:

- Carbon price is $15/ton, a recent Point Carbon forecast average for 2012—2019
- Allocation assumptions are based upon Kerry-Boxer allocations, esp. cap on allocations to generators, which cannot exceed 10% of utility sector allocations
- Calculations are based upon fuel mix and regulated vs. unregulated wholesale market (average vs. marginal cost recoveries). Calculations reflect differentiated impact of carbon modeling for states (regulated markets) or markets (deregulated markets)

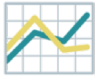
Source: Point Carbon, *Carbon Exposure: Winners and Losers in a U.S. Carbon Market* (Nov. 2, 2009); FitchRatings, *Turning Up the Heat* (Nov. 3, 2009)

# Comparing Climate Options – The Legislative Track (Cont'd)

SCOTTMADDEN Management Consultants

## Another Track: The Kerry-Lieberman-Graham Framework

**After party-line differences in committee over the proposed Kerry-Boxer climate change legislation, Sens. Kerry, Lieberman, and Graham proposed a separate track and a framework. No action is expected on any legislation until Spring 2010.**

| | |
|---|---|
|  **Better jobs, cleaner air** | ▪ Market-based system<br>▪ 17% below 2005 emissions levels near-term; 80% reduction in long term<br>▪ Investment in development and deployment of clean energy technologies |
|  **Securing energy independence** | ▪ Increase supply of domestically produced oil and gas on land and offshore; send money back to states that opt to drill<br>▪ Encourage energy efficiency<br>▪ Preserve petroleum refining capacity |
|  **Creating regulatory predictability** | ▪ National GHG system rather than inconsistent state and federal regulations |
|  **Protecting consumers** | ▪ Transition assistance to households and businesses, with protections for low-, middle-income households<br>▪ Several potential methods: price collar, strategic reserve, and energy efficiency programs |
|  **Encouraging nuclear power** | ▪ Encouragement of construction of new nuclear plants by making it easier to finance and by improving efficiency of licensing process for traditional and small modular reactors<br>▪ Funding to train next generation of nuclear workers |
|  **Ensuring a future for coal** | ▪ Resources for rapid development and deployment of clean coal technology<br>▪ Dedicated support for early deployment of carbon capture and sequestration |
|  **Reviving American manufacturing by creating jobs** | ▪ "Significant" assistance to manufacturers to avoid carbon leakage<br>▪ Financial incentives to both large and small manufacturers to improve process efficiency |
|  **Creating wealth for domestic agriculture and forestry** | ▪ Significant amounts of real, monitored, and verified domestic and international offsets and other incentives |
|  **Regulating the carbon market** | ▪ Vigilant carbon market oversight, real-time transparency, adequate settlement requirements to control market risk, and strong quality controls, by "federally elected officials" |
|  **Global problem requiring a global solution** | ▪ Strong international agreement that includes real, measurable, reportable, verifiable and enforceable actions by all nations<br>▪ Enhanced technology cooperation with strong intellectual property rights |
|  **Building consensus** | ▪ Invitation to all colleagues, stakeholders, and constituents to join in finding consensus |

Source: Point Carbon; Letter from U.S. Senators J. Kerry (D-MA), J. Lieberman (I-CT), and L. Graham (R-SC) to Pres. Barack Obama (Dec. 10, 2009)

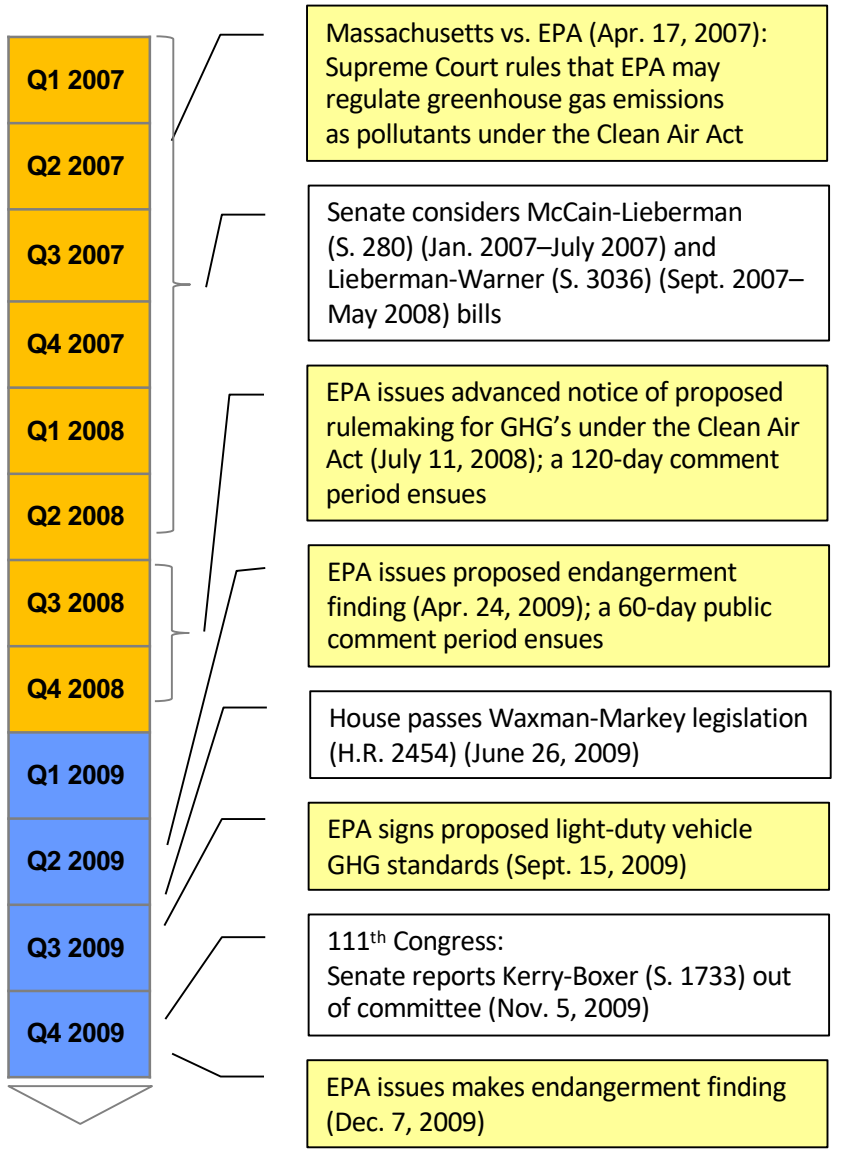
# Comparing Climate Options – The Regulatory Track

ScottMadden Management Consultants

## What Is the "Endangerment" Finding?

| | |
|---|---|
| **The findings** | EPA after initiating proceedings in spring 2009, made two final findings:<br>(1) Current and projected concentrations of six key GHGs in the atmosphere threaten the public health and welfare of current and future generations, finding this evidence "compelling, if not overwhelming"<br>(2) Emissions of these GHGs from new motor vehicles "cause and contribute to" this pollution |
| **What it means** | ❑ The finding permits EPA to pursue light-duty vehicle GHG emissions standards proposed in September<br>❑ While only directly addressing tailpipe emissions, the finding serves as precedent for regulation of large point sources of GHGs, including power generation, gas producers and transporters, and industrial firms |
| **What's next** | ❑ EPA has not established a timeline or a detailed regulatory framework<br>❑ Many expect that there will be legal challenges to the finding, particularly seeking a "credible weighing" of scientific evidence underlying its fact-finding<br>❑ Some key technical questions will need answers before comprehensive regulation: threshold limits for regulation (tons per year emissions) and required "best available control technology" |
| **Possible implica-tions** | Some unintended consequences could be litigation or political pressure to enforce GHG restrictions under other parts of the Clean Air Act, such as:<br>❑ National Ambient Air Quality Standards/State Implementation Plans, now focused on $SO_2$ and NOx<br>❑ Title V permitting, now required only for emitters of 100 tons/year of a pollutant<br>❑ New Source Performance Standards |

## How We Got to This Point




Note: Yellow boxes indicate regulatory activity. Color legend for timeline at left

Source: Pew Center for Global Climate Change, at ; U.S. Environmental Protection Agency, at http://www.epa.gov/climatechange/endangerment.html;

# Regulators Focus on Encouraging Energy Efficiency and "Green" Alternatives

SCOTTMADDEN Management Consultants

**As required investment in new "green" technologies increases and utility revenue paradigms shift emphasis to conservation, efficiency, renewable resources and the "smart grid," some utilities and their regulators test different rate and regulatory approaches.**

## Efficiency/Infrastructure Rate Riders

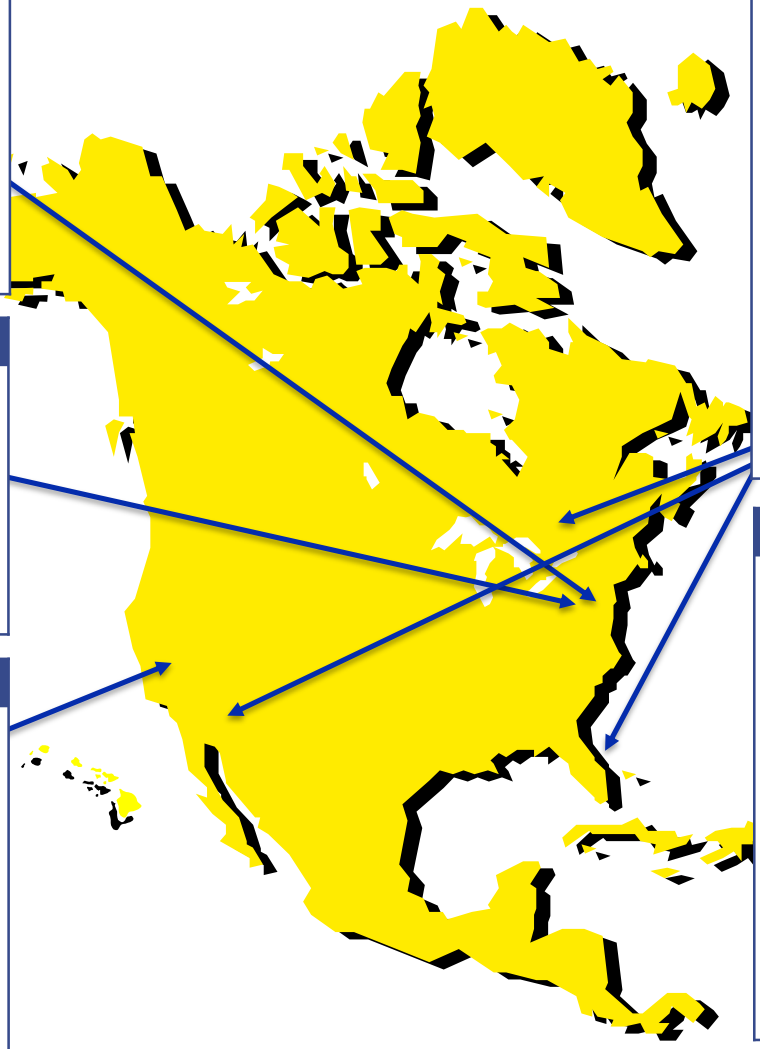
- **Mechanism:** Accelerated investment of nearly $1 billion in efficiency and other gas and electric infrastructure upgrades; accelerated recovery through annual rate adjustments
- **Example:** NJ investor-owned utilities
- **Issues and Considerations:**
  - Cost-effectiveness
  - Potential jobs created

## "Traditional" Efficiency, Green Programs

- **Mechanism:** Audits, efficiency incentives (including equipment rebates), and subsidized loans funded through annual energy-based or carbon surcharges
- **Examples:** PA, NJ investor-owned utilities
- **Issues and Considerations:**
  - Cost-effectiveness
  - Targeted customer groups

## Efficiency Incentive Awards

- **Mechanism:** Tiered payments to IOU shareholders—a % of "verified net benefits" over 2-year evaluation period as well as per unit (e.g., kWh, therm) penalty (IOU refunds ratepayers) for efficiency shortfalls
- **Example:** CA investor-owned utilities
- **Issues and Considerations:**
  - Perceived windfall for utilities
  - Risk symmetry between incentives and penalties
  - Measurement and verification



## Renewables Feed-In Tariffs

- **Mechanism:** Provide enhanced $/kWh payments for renewable supply, including distributed renewables like solar PV
- **Examples:** Ontario; Gainesville, FL; CA; proposed in IN
- **Issues and Considerations:**
  - Qualifying technologies
  - Differing rates by resource vs. single rate
  - Contract terms
  - Potentially expensive
  - Adequate diversification among technologies
  - Distinction from, interrelationship with net metering

## Decoupling

- **Mechanism:** Distribution revenues assigned per customer or on some other basis not tied to volumes of energy consumed
- **Examples:** Gas decoupling in 18 states; electric decoupling in 5 states
- **Issues and Considerations:**
  - Concern about potential "one-size-fits-all" national decoupling provisions
  - Intent to make utility indifferent to program effects: need for proper design and implementation
  - Various "flavors" of or alternatives to pure decoupling—revenue trackers, rate stabilization, weather normalization

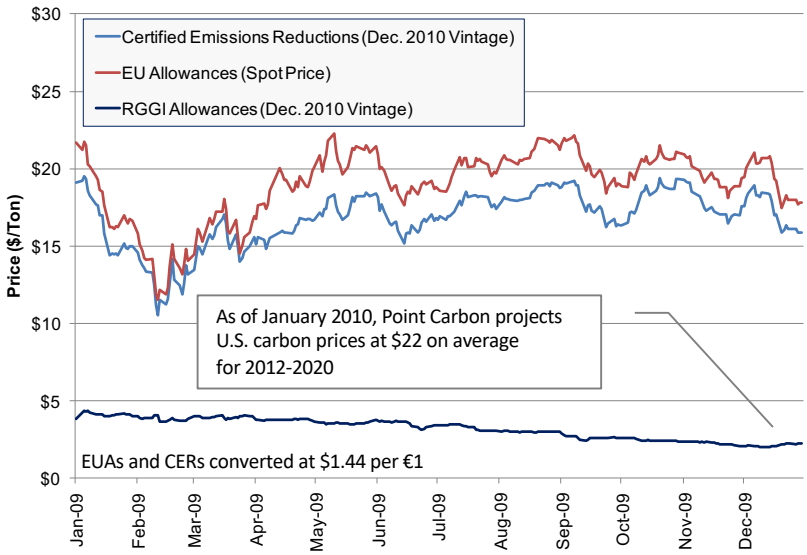
Sources: Edison Electric Institute; American Gas Association; U.S. Federal Energy Regulatory Commission; SNL Financial; *Public Utilities Fortnightly*; Renewable Energy World; *The New York Times*; National Regulatory Research Institute; National Association of Regulatory Utility Commissioners; Federal Energy Regulatory Commission

# Carbon Markets in 2009

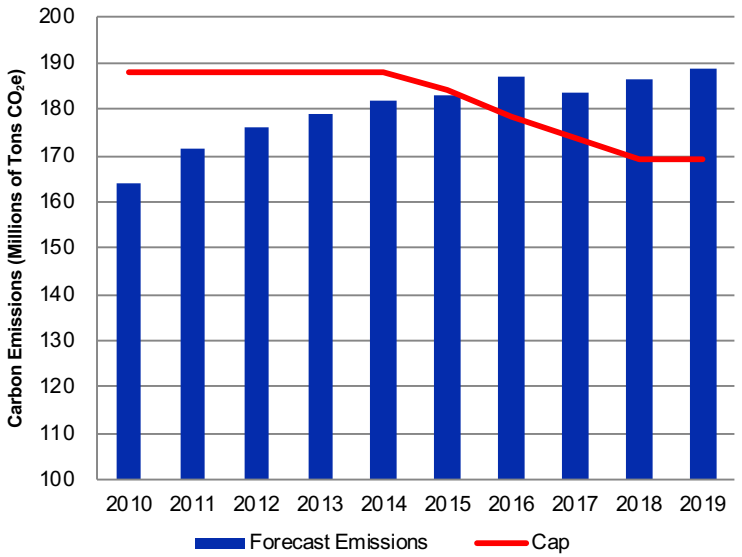
## Emissions Prices Eased Lower During 2009

### 2009 Selected Carbon Emissions Prices ($/Ton)




## Breaching the RGGI Cap Appears Not to Be a Near-Term Issue

### RGGI Forecast Emissions vs. $CO_2$ Cap




- The carbon market grew as carbon volumes were up in 2009, as Phase II of Europe's Emission Trading Scheme generated increased trading
  - The global market grew from $133 billion in 2008 to $136 billion in 2009
  - The Regional Greenhouse Gas Initiative (RGGI) grew from 71 million tons in 2008 to 765 million tons in 2009 at a value of $2.5 billion
- While the market grew, volume growth was offset by falling prices of allowances (EUAs and RGGI) and certified emissions reductions (CERs) from clean development
- Perceived failure of an agreement in Copenhagen has created some uncertainty in the market, as some EU states push back on additional voluntary cuts (30% by 2020)
- Observers expect a flat to slight decline in growth of the carbon market in 2010 driven by:
  - Uncertainty about RGGI conversion to a still-undefined federal scheme
  - Elimination of European cross-border VAT-related emission trading (which inflated 2009 activity)
  - Continued low levels of carbon emissions due to muted economic growth
- Most expect the market to rebound in 2011 as:
  - European firms prepare for post-2012 (Phase III) compliance
  - U.S. firms prepare for 2012 launches of new regional U.S. climate programs in the West and Midwest




Sources: Point Carbon; Bloomberg New Energy Finance; Carbon Finance; Chicago Climate Futures Exchange

# Carbon Capture and Storage: Life Beyond FutureGen

SCOTTMADDEN Management Consultants

## Stimulus Plus Policy Support Yields Renewed Energy Behind CCS

- Nearly two years since the shelving by DOE of FutureGen, new support from DOE Secretary Chu along with stimulus funding ($979 million, with $2.2 billion in private capital) under the American Recovery and Reinvestment Act has led to new major carbon capture projects (see below). Two projects are sponsored by former FutureGen sponsors
- Chu has called for widespread deployment of CCS within 8 to 10 years and 10 commercial-scale demonstration plants by 2016. He has also committed to re-engaging on FutureGen
- A National Coal Council report, prepared at DOE request, recommends coal plant efficiency retrofits (1% to 2% improvement) and partial $CO_2$ capture technologies (50%-60%) to achieve significant near-term emissions reductions pursuant to Obama Administration goal of 80% reduction of greenhouse gases by 2050

## A Worldwide Phenomenon, But Developed Nation-Focused Now

- Projects are advancing worldwide, and the G-8 has a goal of 20 large-scale CCS projects globally by 2010, with a view to deploy the technologies commercially by 2020
- Worldwide, there are 213 active or planned projects; 101 of those are at commercial scale. Of those commercial scale projects, 62 are fully integrated—capture, transport, and storage. Europe (37%), U.S. (24%), Australia (11%), and Canada (10%) lead in numbers of projects, with the balance (18%) in Asia, Africa, and South America
- China is emerging as a fertile ground for projects, as focus shifts to developing nations for CCS advancement, driven by their potential emissions reduction needs, lower installed costs, and a growing desire by China to be an exporter of CCS technology

### Some High-Profile Commercial-Scale CCS Projects – Clean Coal Power Initiative 2009 Selections

| Project (State) | Company | Cost ($MMs) | Duration | Description |
|---|---|---|---|---|
| Hydrogen Energy California Project (Kern County) (CA) | Hydrogen Energy International | $2,300 | Sequestration by 2016 | ▪ New 250 MW coal/petcoke-fired IGCC plant<br>▪ 2 MM tons of $CO_2$<br>▪ Hydrogen to fuel a combustion turbine |
| Post Combustion $CO_2$ Capture Project (ND) | Basin Electric Power Cooperative | $300 | N/A | ▪ Retrofit lignite-fired Antelope Valley plant<br>▪ 120 MW flue gas stream; 1 MM tons of $CO_2$ |
| Mountaineer (WV) | American Electric Power | ~$670 | 10 years | ▪ Retrofit coal-fired Mountaineer plant<br>▪ 235 MW flue gas stream; 1.5 MM tons of $CO_2$<br>▪ Injection to 2 deep saline formation near site |
| Southern Company CCS Demonstration (AL) | Southern Company | N/A (DOE share: $295 ) | 11 years | ▪ Retrofit coal-fired Plant Barry<br>▪ 160 MW flue gas stream; 1 MM tons of $CO_2$<br>▪ Pipeline transport to deep saline formations |
| Texas Clean Energy Project (TX) | Summit Texas Clean Energy | $1,700 | 8 years | ▪ New 400 MW IGCC plant<br>▪ 2.7 MM tons of $CO_2$<br>▪ Pipeline transport to Permian Basin oil fields (W. Texas) for enhanced oil recovery |

Sources: SNL Financial; National Energy Technology Laboratory; Department of Energy; National Coal Council; company websites; *Carbon Capture Journal* (Nov/Dec 2009); "A Sea Change in China's Attitude Toward Carbon Capture," *The New York Times* (June 22, 2009)

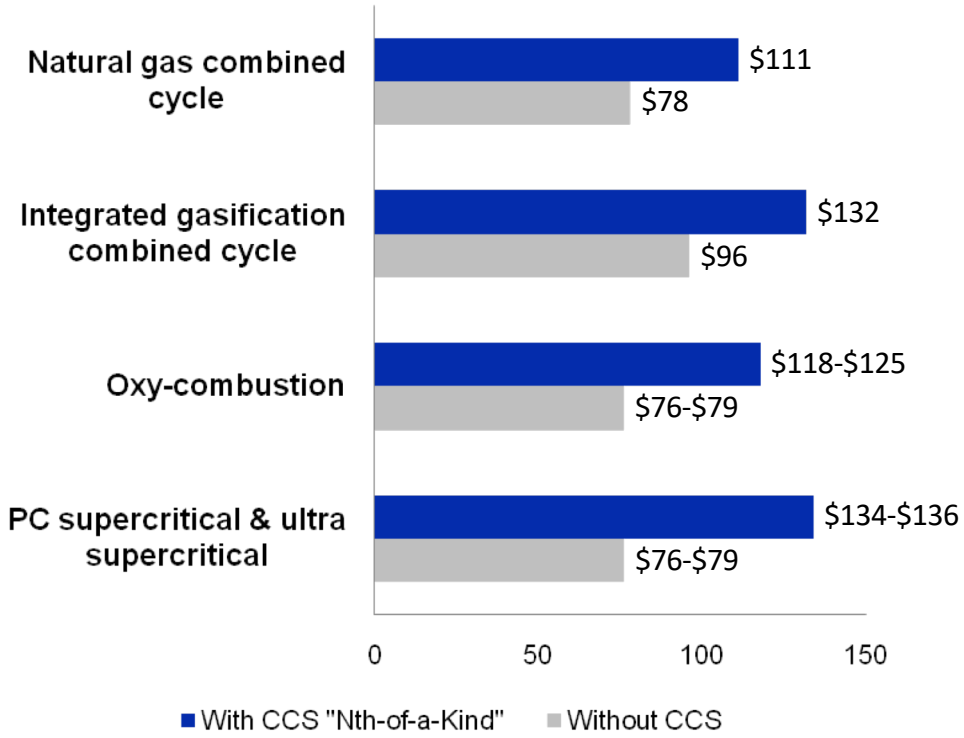
 

# Carbon Capture and Storage: Life Beyond FutureGen (Cont'd)

SCOTTMADDEN Management Consultants

## Still Not Cheap: Another Look at Carbon Capture and Storage Economics

**Levelized Cost of Production for Power Generation With "Nth-of-a-Kind" CCS and Without CCS***




***Reference case assumptions:**
- Year: Q1 2009
- Location: U.S. Gulf Coast/Midwest
- Discount rate: 8.81%
- Owners cost: 15%
- Fuel cost: Coal = $2.76/MMBTU, natural gas = $6.11/MMBTU
- Transportation distance: 250 kilometers
- Storage location: saline aquifer

### The Cost Question

- ❑ Cost remains a major issue for CCS and estimates vary widely
- ❑ Costs may escalate with early adopters
  - — EPRI estimates that the incremental cost of "pioneer plants" (5 GWs to 7 GWs of first commercial-scale demonstrations) is over $1,700 per kW
  - — For "early adopter" plants (60 GWs of commercial plants), it is projected to be over $3,600 per kW
- ❑ A recent Harvard discussion paper pegs the levelized cost of electricity from "first-of-a-kind" plants with CCS (excluding $CO_2$ transportation and storage) at 10¢ per kWh higher than conventional supercritical pulverized coal plants and 2¢ to 5¢ for "nth-of-a-kind" plants
- ❑ Some observers say that cost estimates made in 2007-08 reflected a commodities demand "bubble" that may overstate the true cost of CCS

### Other Persistent Issues

- ❑ Other significant issues also remain for successful advancement of CCS, including:
  - — Legal and regulatory framework for storage
  - — Testing of technologies with carbon emitting heavy industries in addition to power generation (iron, cement, etc.)
  - — Funding sources for commercial-scale projects
  - — Public education and support of the technology
- ❑ Despite the failure of Copenhagen climate negotiations, CCS advocates continue to seek recognition of CCS as a key technology to combat carbon emissions and also seek funding mechanisms for CCS projects

Note: Estimates in chart above prepared for Global CCS Institute by WorleyParsons, Schlumberger, Baker & McKenzie, and EPRI.

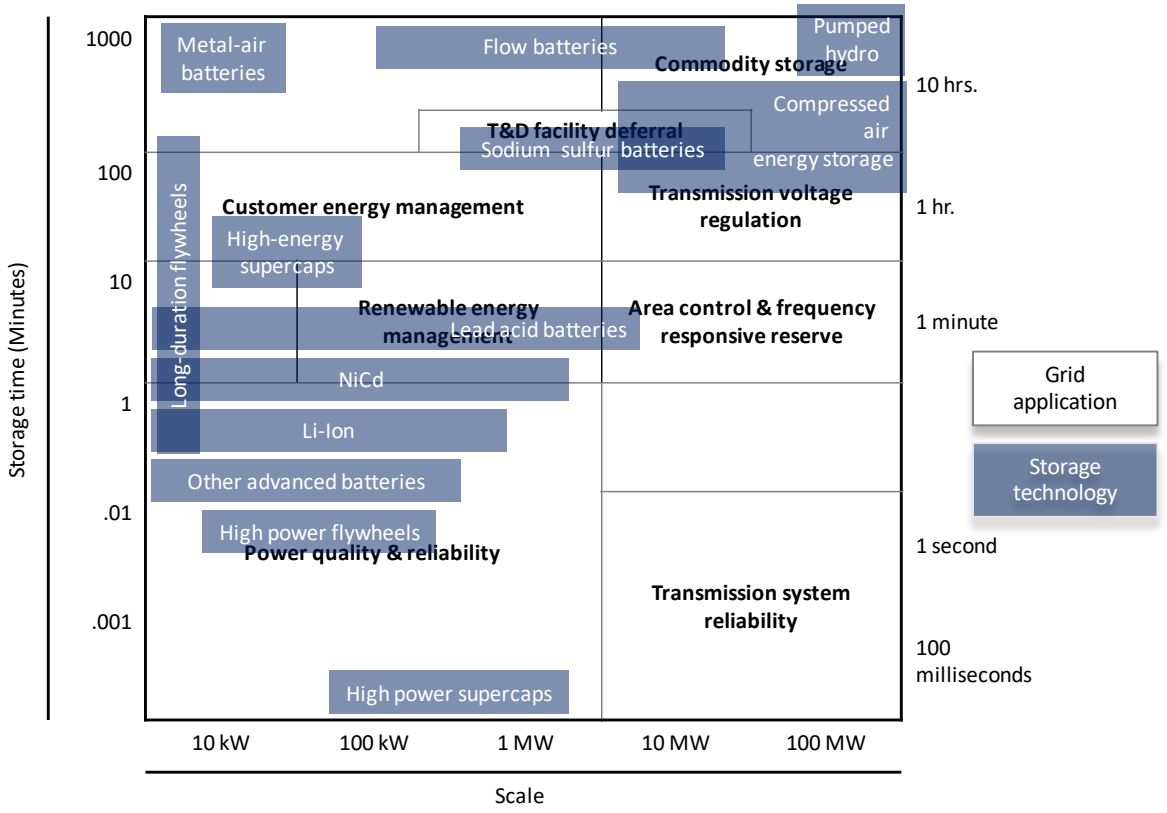
Sources: Global CCS Institute, *Strategic Analysis of Global Status of Carbon Capture and Storage – Report 2: Economic Assessment of Carbon Capture and Storage Technologies* (2009); National Coal Council; *Carbon Capture Journal* (Nov/Dec 2009); M. Al-Juaied & A Whitmore, "Realistic Costs of Carbon Capture," Harvard Belfer Center for Science and International Affairs (July 2009)

# Energy Storage: Still the Holy Grail

SCOTTMADDEN Management Consultants

- Widespread renewable resources and a smart grid depend upon the availability of cost-effective energy storage
- House and Senate bills have been introduced promoting tax incentives for faster innovation and deployment of energy storage technology
- Major benefits anticipated from energy storage:
  - Grid optimization for bulk power production
  - System balancing with variable or diurnal renewable resources
  - Integration of plug-in electric hybrid vehicles
  - Deferral of T&D investment
  - Ancillary services
- Energy storage needs vary by application, depending upon the scale and duration of the power required
- Compressed air energy storage and pumped storage are grid-scale applications; other technologies being pursued are largely distributed utility applications
- Some key differences between technologies:
  - Capital and O&M costs
  - Speed of discharge "burst"
  - Capacity or scale (maximum output)
  - Energy density (output per ton, or unit of volume) and output efficiency
  - Shelf life
  - Cycles (charges and discharges)
  - Applications
  - Technology maturity
  - Siting capability (e.g., reservoir, salt cavern storage)

## Power Requirements for Selected Applications and Hypothetical Capability of Selected Storage Options




## Selected Energy Storage Technologies by Level of Technology Maturity

| Laboratory | Prototype | Commercial |
|---|---|---|
| Lithium ion | Flywheels | Nickel metal-hydride |
| Ultracapacitors | Lead acid/carbon | Pumped storage |
| Flow batteries | Advances CAES | Sodium sulfur |
| | | Compressed air energy storage (CAES) |

Sources: U.S. DOE Electricity Advisory Committee; DOE ARPA-E; Electricity Storage Association; European Commission; Energy Storage Council; Sandia Nat'l Lab; McKinsey & Co.

ScottMadden, Inc. is a leading management consulting firm that specializes in the energy industry, shared services, and outsourcing. The combination of our industry knowledge, consulting experience, and tailored approach distinguishes us from other firms. We assemble small teams of consultants who bring deep experience and knowledge to each challenge and combine them with active client participation to facilitate an open exchange of ideas.

Since its founding, ScottMadden has successfully delivered more than 1,500 projects—a testament to our proven approach to corporate progress. Our clients include some of the largest names in the energy industry as well as many other Fortune 500 companies. We are proud of our heritage and our ability to offer each client individual attention regardless of size.

The culture we bring to clients is one of no bureaucracy, strong work ethic, and personal reward based on client success. We are proud of our relationships cultivated by our candor, honesty, and commitment to our clients' best interests. ScottMadden prides itself in consistently delivering an exceptional consulting experience.

## Recent ScottMadden Insights

| | |
|---|---|
| Transmission | C. Lyons, *The Bar Is Being Raised,* published in *Fortnightly's SPARK* (Dec. 2009), http://www.scottmadden.com/insight/368/The-Bar-is-Being-Raised.html |
| Rates and Regulation | R. Starkweather & J. Davis, *Rate Case Management —Are You Ready for Your Next Case?* (Dec. 2009), http://www.scottmadden.com/insight/366/Rate-Case-Management-Are-You-Ready-for-Your-Next-Case.html |
| Smart Grid, Stimulus | J. Jacobi, *Smart Grid Stimulus Grants: Where the Money Is Going* (Oct. 2009), http://www.scottmadden.com/insight/364/Smart-Grid-Stimulus-Grants-Where-the-Money-Is-Going.html |
| Smart Grid, Stimulus | J. Jacobi, *Smart Grid Investment Grant Management* (Nov. 2009), http://www.scottmadden.com/insight/363/Smart-Grid-Investment-Grant-Management.html |
| Gas | E. Baker, *Business Process Improvement for LDCs* (Oct. 2009), http://www.scottmadden.com/insight/362/Business-Process-Improvement-for-LDCs.html |
| Stimulus | J. Jacobi, *The New Loan Guarantee Program* (Sept. 2009), http://www.scottmadden.com/insight/359/The-New-Loan-Guarantee-Program.html |
| Nuclear, Supply Chain | J. Sequeira & S. Gilbert, *Materials Management within U.S. Nuclear Generation Plants* (Sept. 2009), http://www.scottmadden.com/insight/358/Materials-Management-within-US-Nuclear-Generation-Plants.html |
| Mergers and Acquisitions | J. Jacobi, S. Pearman & J. Sequeira, *Merging Two Generation Organizations* (Jun. 2009), http://www.scottmadden.com/insight/355/Merging-Two-Generation-Organizations.html |
| Gas | E. Baker & J. Davis, *Infrastructure Investment in the Gas Industry* (Jun. 2009), http://www.scottmadden.com/insight/354/Infrastructure-Investment-in-the-Gas-Industry.html |
| Rates and Regulation | R. Starkweather & J. Davis, *Premium Utilities—What Are They Doing Differently?* (Oct. 2008), http://www.scottmadden.com/insight/365/Premium-Utilities-What-Are-They-Doing-Differently.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 more than 25 years, served more than 150 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 *Perspectives* 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 Sustainability Practice Leader
jjacobi@scottmadden.com
404.814.0020

Greg Litra
Director of Research
glitra@scottmadden.com
919.781.4191