

# NUCLEAR POWER: The Investment Outlook

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As the partial meltdown at the Three Mile Island nuclear power station in 1979 fades from memory and as demand for electricity grows, executives at some electricity generation companies hope to order and build new nuclear plants in the United States for the first time in over three decades. But nuclear power executives must overcome a significant roadblock before they can start to build: for bank lenders, bond investors, and other sources of project capital, the exceptional risks of investing in new nuclear power projects continue to outweigh the potential rewards, according to many of the nearly two dozen participants in an evening discussion preceding the Manhattan Institute's March 28, 2007, conference, "Is the Atom the Answer? Meeting America's Energy Needs."<sup>1</sup>

The nuclear bulls hope to benefit from fundamental changes in the industry that have taken place since companies built their first generation of domestic nuclear plants. First, and most recently, the federal government offers an improved regulatory climate as well as generous new incentives to encourage new nuclear construction.

Second, deregulation of the power markets means that the mechanisms for recouping risky investments in new sources of generation have changed. While deregulation still sometimes works better on paper than in real life, power executives in most states, particularly in the Southeast, generally can expect to pass through new construction costs to their ratepayers.

Third, "fleet" companies now specialize in operating portfolios of nuclear power plants. Companies that carve a niche out of nuclear operations, rather than operating just one or two nuclear plants as in a past era, can achieve economies of scale, unlocking more value from their assets than single-nuke operators.

Finally, the possibility—even the high probability—of a national constraint on carbon emissions, whether a carbon tax or a cap on such emissions, arriving in the U.S. in the next couple of years could potentially change both the politics and economics of new nukes.

But, as the discussion participants concluded, the obvious hurdle looms: key sources of financing are reluctant to step forward in today's political, regulatory, economic, and investment climate to take on the very real risks of investing money in these capital-intensive projects, whose costs could easily exceed \$1 billion per reactor<sup>2</sup> when the time horizons for financing payback still outlast most political and economic cycles.

## ABOUT THE AUTHOR

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Gelinas has published analysis and opinion pieces on the op-ed pages of *The New York Times*, *The Wall Street Journal*, the *Los Angeles Times*, the *San Diego Union Tribune*, the *New York Sun*, the *New York Daily News*, the *New York Post*, the *Dallas Morning News*, the *New Orleans Times-Picayune*, and the *Boston Herald*. She has also written for *Crain's New York Business* and *National Review Online*.

Before coming to *City Journal*, Gelinas was a business journalist for Thomson Financial in New York, where she covered the international syndicated-loan and private-debt markets. She also wrote a regular op-ed column for the *New York Post*.

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# NUCLEAR POWER: THE INVESTMENT OUTLOOK

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Nicole Gelinas

## THE DEMAND SIDE: NEW NUKES IS GOOD NEWS

Power companies are scrambling to add new electricity generation capacity for one reason: American consumers, individuals as well as large commercial and industrial consumers, have demonstrated an insatiable demand for electricity. “Consumption of energy in our society has gone up, and will keep going up,” said conference attendee Mark Mills, an energy-industry expert and cofounder and partner of Digital Power Capital, an energy-tech venture fund. Indeed, domestic power consumption has nearly doubled in the past thirty years, from 1,948 to 3,813 billion kWh annually since 1977, according to the Department of Energy,<sup>3</sup> despite forecast after forecast in the 1970s predicting that demand was saturated.

And “as the economy as well as per-capita wealth continues to grow, power consumption will continue to grow apace for as far as we can see in the future,” says Mills. Here, the Energy Information Administration’s prediction echoes Mills’s: domestic demand, driven by commercial consumption, will increase by 53 percent in the next two and a half decades, from 3,669 billion kWh in 2003 to 5,619 billion kWh in 2030.<sup>4</sup> Just think of Google’s “server farms,” which Mills describes as “buildings the size of Wal-Mart, full of heat-generating microprocessors that have to be constantly cooled.”

And while alternative forms of energy, such as wind and solar power, are expected to grow immensely to help meet rising de-

mand for power, Mills sees their impact as marginal. Indeed, technologies such as wind and solar presently provide less than 1 percent of U.S. energy consumption. Given rising demand, even with anticipated growth these technologies will struggle to maintain their small share in today's energy economy. Mills doesn't forecast a large-scale reduction in the nation's dependence on hydrocarbon-based energy, in large part because of the laws of physics: it takes raw energy to make the highly refined energy needed in modern economies.

But inexorably rising demand for power doesn't necessarily mean demand for new nukes. What might create that demand is a lack of other fuel sources for new power plants. Natural gas is one potential source, but domestic production of natural gas has declined relative to growing demand, and importing natural gas from abroad means not only constructing new import terminals, which are difficult to site due to community opposition, but also competing with Europe on price, which itself depends more and more on natural gas as a power source each year. Coal is another potential source, but coal-fired power plants, using current technology, are the least efficient power sources in terms of carbon-dioxide emissions. Increasing our reliance on current-technology coal plants would be contrary to the burgeoning national consensus that we must start cutting our carbon-dioxide and other greenhouse-gas emissions. It's the demand for new power coupled with these

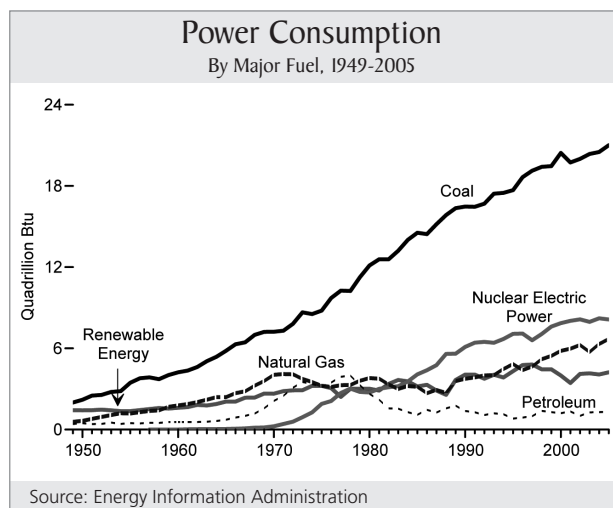
constraints that could set the stage for nuclear power's resurgence.

## THE SUPPLY SIDE: MANAGEMENT IS EAGER TO BUILD

At first glance, there are good reasons to believe that such a resurgence is not just wishful thinking. More than a dozen power generation companies, from Entergy to the Tennessee Valley Authority, have either filed, or signaled their intent to file, for new generation permits at new and existing nuke sites from Louisiana to Maryland. As one former nuke exec put it at the discussion, there is "positive nuclear talk at utilities, when five years ago, they'd be all fired" for even considering it.

Power companies are considering new nukes to meet growing demand in large part because regulations at the federal level have changed for the better over the past few years, because of legislation as well as executive changes at the Nuclear Regulatory Commission (NRC). "We think we have prepared the table. I think we will see someone take advantage of it, and submit a license application," said Clay Sell, deputy secretary at the Department of Energy.

To build the first generation of nuclear plants, would-be operators had to overcome a two-step regulatory process, Manhattan Institute senior fellow Max Schulz notes. First, a company had to apply to the NRC for a construction permit. Second, once the plant was complete, the company had to apply for an operating permit, and there was no guarantee that a newly built plant would win the vital second permit. Today, companies can apply to the NRC for a single license to build and operate a plant. The feds have further sought to minimize permitting risk by giving local governments and other interested parties clear opportunities during the process to oppose or seek to modify new plants. Another improvement: nuclear operators once had to design each individual plant as they went along, hoping that the NRC would approve, Schulz notes; today, companies can choose from standard designs approved by the agency rather than starting from scratch each time.





| New Nukes Under Consideration              |                    |           |                      |                        |                     |
|--|--------------------|-----------|----------------------|------------------------|---------------------|
| Project                                    | Sponsor            | Location  | Application Expected | Existing Plant at Site | Requested New Units |
| Bellefonte                                 | TVA/NuStart        | AL        | 2007                 | Yes                    | 2                   |
| Harris                                     | Progress Energy    | NC        | 2007                 | Yes                    | 2                   |
| Lee Station                                | Duke               | SC        | 2007                 | No                     | 2                   |
| Summer                                     | South Carolina E&G | SC        | 2007                 | Yes                    | 2                   |
| North Anna                                 | Dominion           | VA        | 2007                 | Yes                    | 1                   |
| Grand Gulf                                 | Entergy/NuStart    | MS        | 2007                 | Yes                    | 1                   |
| South Texas                                | NRG Energy         | TX        | 2007                 | Yes                    | 2                   |
| Levy County                                | Progress Energy    | FL        | 2008                 | No                     | 2                   |
| Vogtle                                     | Southern Energy    | GA        | 2008                 | Yes                    | 2                   |
| River Bend                                 | Entergy            | LA        | 2008                 | Yes                    | 1                   |
| Calvert Cliffs                             | UniStar            | MD        | 2008                 | Yes                    | 1                   |
| TBD  | UniStar            | TBD       | 2008                 | TBD                    | 1                   |
| Nine Mile Pt                               | UniStar            | NY        | 2008                 | Yes                    | 1                   |
| Callaway                                   | AmerenUE           | MO        | 2008                 | Yes                    | 1                   |
| Amarillo                                   | Amarillo Power     | TX        | 2008                 | No                     | 2                   |
| Comanche Peak                              | TXU                | TX        | 2008                 | Yes                    | 2                   |
| Clinton                                    | Exelon             | IL        | 2008                 | TBD                    | 1                   |
| Fermi                                      | Detroit Edison     | OH        | 2008                 | Yes                    | 1                   |
| TBD  | Florida P&L        | FL        | 2009                 | TBD                    | 1                   |
| <b>2007–09 Total Applications Expected</b> |                    | <b>19</b> |                      |                        |                     |
| <b>Total Units</b>                         |                    | <b>28</b> |                      |                        |                     |
| Source: Department of Energy               |                    |           |                      |                        |                     |

Potential nuclear operators hoping to secure an early indicator of success before starting the process to win a construction and operation permit can also apply for an optional “early site permit” from the NRC. This permit, which addresses preliminary safety and environmental issues at a particular site, is good for ten to twenty years, allowing companies flexibility. Two potential projects—Exelon’s Clinton in Illinois and Entergy’s Grand Gulf in Mississippi—have won early site permits from the NRC after application periods lasting over three years, an indication that attaining a design-operation permit may take even longer; two other projects continue to wait.

In addition to the improved regulatory climate, the 2005 Energy Policy Act, signed into law by President Bush, offers plenty of incentives and subsidies, including:

- “standby support,” which offers federal protection against what the Department of Energy calls the “potentially crippling impact of construction and operational delays beyond the control of the plants’ sponsors” for 100 percent of delay costs for the first two new plants built and 50 percent of the cost for plants three through six<sup>5</sup>
- a maximum 80 percent loan guarantee for emissions-reducing projects, including nuclear projects, that employ “new or significantly improved technologies as compared [to] commercial technologies in service in the United States today”
- a new eight-year tax incentive for new nuclear kilowatt production
- an extension of the Price-Anderson Act for accident indemnity at nuclear facilities<sup>6</sup>

Finally, sponsors are moved to act because their own and their competitors' existing nuclear assets are making good money. As one participant mentioned, nuclear assets "were weird, white-elephant, oddball items, really no one's first priority" until the mid-1990s. But since then, about a half-dozen companies, including Entergy, have made nuclear operations into a specialty and a reliable profit center.

## THE SUPPLY SIDE: LENDERS SAY, "NOT SO FAST"

Despite these bright fundamentals, skepticism abounds, particularly within the financing community. This skepticism could be a deal breaker, because nuclear fleet owners, with small market caps—"these are not ExxonMobil," one attendee noted—do not have the resources to finance capital-intensive new nukes with equity or with corporate-level debt. In recent history, new construction in the power generation sector has been financed mostly with non-recourse debt, meaning that banks and bondholders, rather than shareholders, take the bulk of the risk.

So far, Wall Street isn't biting. "The asymmetry of risk is just too large for Wall Street to finance these projects over time horizons that exceed political and economic cycles.... Utilities [are] willing to make this investment, but I don't see [the debt markets] stepping up and funding this program.... The markets aren't going to support it," said one veteran from Wall Street's power-financing industry who came to the discussion. While the financier characterized the 2005 subsidies as "helpful," he said that it's unlikely that the sector will get off the ground without a far more comprehensive "federally based insurance scheme" that, in effect, would eliminate virtually every risk except, perhaps, commercial risk.

## BUT WHY NOT? FOUR HURDLES TO NEW NUKE FINANCING

### I. Political Risk—and Not Just Inside the Beltway

The world's nuclear industry would not exist but for the United States government, not only, most obvi-

ously, because military money drove nuclear innovation but because the feds have always taken key responsibilities here from the private sector, from liability caps to ultimate radioactive waste disposal. But what Washington gives, it can take away.

While the government has never reneged on a loan guarantee once issued, the political climate for other subsidies that could make or break new nuke projects could change as federal administrations change. "Everyone is worried about 2008," one attendee noted. Further, while streamlining the existing regulatory process for new plant siting and operation may work in theory, it's important to see how it works in real life, as well.

Beyond Washington, state and local political risks loom, perhaps even larger than federal political risks. Several states, including Illinois, periodically "appear on the verge of passing legislation" to reregulate power rates to residential users and thus curtail the power industry's ability, in a deregulated environment, to pass capital costs through to end users, one attendee noted. The specter of reregulation, of course, is most intense when voters see that their power costs are rising, and even with new subsidies, building new nukes is expensive. Will statehouse legislators allow ratepayers to shoulder those costs?

Cost isn't the only issue, though. In the nuclear industry, other public perceptions matter. The perception of safety remains all-important, despite the comforting fact that no one has ever died in a domestic nuclear power incident. Although one attendee posited that "since the cold war, Americans haven't equated nuclear power with nuclear war" and several attendees cited a positive public attitude toward new nukes in the Southeast, it's still an open question whether state and local politicians will open the doors to their communities to new nuke operators. As a recent *New York Times* / CBS News poll found, 59 percent of Americans said that they wouldn't "accept a nuclear plant in their community," compared with 36 percent who would.<sup>7</sup>

Nor does the industry have a reliable ideological base of support that might be useful in changing these public perceptions. Mainstream environmentalists, for

example, have never consistently supported nuclear power, and traditional liberal and conservative purists alike are wary of subsidizing big business to the extent that new nuclear power must be subsidized.

## 2. Fuel-Supply Risk: Where Is Our Uranium?

“We don’t [currently] have the infrastructure to support a renaissance of nuclear power” in terms of securing an adequate long-term fuel supply, said another attendee, speaking of current levels of uranium production and enrichment. In fact, he noted, the nation barely has enough current sources of fuel to continue to supply the 104 plants already in operation.

It’s unlikely that banks will offer twenty- or thirty-year debt to a new nuke project without a corresponding secure supply of fuel. But one \$1.7 billion new fuel-source project, jointly owned by the British, Dutch, and German governments, is likely already “sold out,” with 80 percent spoken for via take-or-pay agreements to utilities. Moreover, in the absence of significant new investment in uranium mining and enrichment at sources in the U.S., Canada, and Australia, much of the near-term supply will come from Russian weapons, meaning that through heavy investments in nuclear power, the United States likely wouldn’t be decreasing its international “energy de-

pendence”—an oft-stated political goal behind heavy nuclear subsidies—but merely diversifying it.

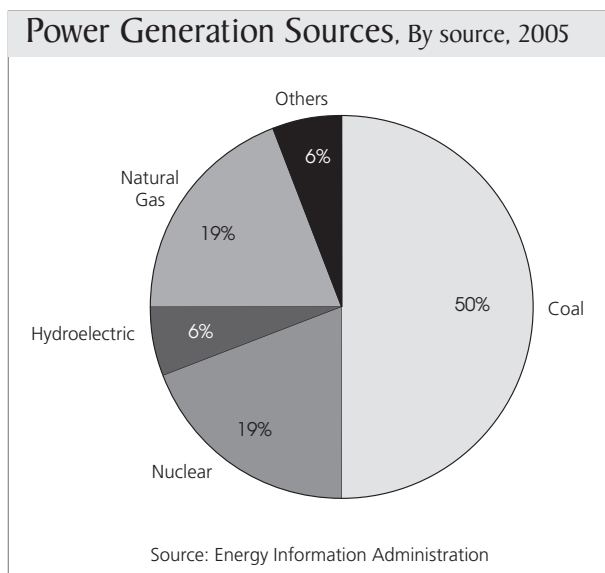
While fuel-supply risk alone likely won’t preclude construction of a few new nukes, it does mean that it is not feasible for nuclear generation ever to dominate the U.S. fleet without significant new investment on the mining side.

## 3. Waste-Disposal Risk: Where Does the Fuel Go?

Theoretically, the federal government’s Yucca Mountain, in the Nevada desert, less than a hundred miles from Las Vegas, awaits spent nuclear fuel, which is currently stored on-site at the nation’s nuclear power plants. But despite the fact that the federal government firmly identified Yucca as a potential nuclear-waste site over two decades ago and ratepayers have long funded preliminary research and construction at the site, the earliest opening date at Yucca is still at least ten years away, assuming no delays from litigation, permitting, or technical glitches—delays that are all but inevitable.

Further, federal statute governs how much waste Yucca will be allowed to store; it is probable that when and if Yucca opens for business, pent-up demand for storage space from existing reactor waste as well as waste from decommissioned weapons immediately will exceed that statutory storage limit, as Schulz notes. This challenge is not technical, as the actual mountain can store much more waste than the statute authorizes; rather, it’s a political matter of changing the statute.

Although scientific evidence gathered over decades points to Yucca as a secure site for nuclear waste, the entire issue is simply “not settled politically,” said one attendee. Powerful western politicians on both sides of the aisle, including Senate Majority Leader Harry Reid, D-Nevada, have voiced opposition to storing the nation’s nuclear waste at Yucca. Although public perception in general of the safety of nuclear plant operation may be improved, public perception of waste disposal likely has not improved, particularly on the issue of eventual truck or rail transport to Nevada.



France, the world's nuclear generation leader, recycles its nuclear waste. But recycling spent fuel produces weapons-grade uranium, raising an entirely separate but significant risk. In fact, the U.S. has had a ban on recycling such fuel for nearly thirty years, and although the Bush administration has proposed reversing this ban, the idea is unlikely to become reality in the near term.

Until the question of long-term disposal of nuclear waste is settled, the issue could be an obstacle to funding new plants, as the on-site waste that would accumulate over years from new plants could exceed the maximum levels allowed under local permits in some cases.

#### 4. Construction Risk: Parts and Labor Shortfall

If would-be operators of new nukes do advance to the construction stage, they'll be competing with global buyers for the parts to build their plants while at the same time struggling to find experienced industry scientists and technicians to staff their plants. As a recent report by Cambridge Energy Research Associates noted, "Nuclear fleet expansion may be held back by limits on component manufacturing capacity. Mismatches of expansion timing, although growth pains rather than long-term structural problems, may slow new project development as some manufacturers wait for actual orders before committing to expansion."<sup>8</sup>

#### A WILD CARD: WHITHER CARBON?

Despite these significant risk hurdles, unrepentant nuclear bulls may have an important new tool on their side: what many power executives call the "inevitability" of a federal constraint on carbon emissions after January 20, 2009, whether in the form of a tax or a cap-and-trade regime.

The theory behind a government constraint of carbon emissions is that the true cost of greenhouse-gas emissions, particularly from coal generation, is not reflected in the current price for power generation; an economic carbon constraint would reflect this ex-

ternality. California has already passed a law to begin constraining carbon emissions in that state; more than a dozen other states, including New York, have proposed similar regional or state-only plans.

Federal carbon-emissions constraint could affect the climate for new nukes in two ways. First, the intense political debate over the enactment of such a restraint might improve the public perception of nuclear power. Voters, as they learn to be scared of carbon dioxide and global warming, may learn to be less scared of radiation.

Second, a strict carbon cap, or a high carbon tax, would increase both capital and operating costs at coal plants as coal operators would have to pay to dispose of their carbon, gradually altering the economics of nuclear construction for the better (although whether nuclear power would actually become economically competitive to coal would depend on the government-set "price" of carbon, in turn dependent on the scarcity set by the cap). In fact, the U.S. Energy Information Administration estimates that under a relatively generous national cap-and-trade program to constrain carbon emissions, nuclear power operators would add 47GW of new nuclear capacity by 2030, compared with only 9GW expected in new capacity by 2030 without such a carbon cap-and-trade program.<sup>9</sup>

| Technology       | With today's government incentives | On a "level playing field" |
|------------------|------------------------------------|----------------------------|
| Nuclear          | 4.31                               | 5.94                       |
| Old coal         | 3.53                               | 3.79                       |
| "Clean[er]" coal | 3.55                               | 4.37                       |
| Natural gas      | 5.47                               | 5.61                       |
| Biomass          | 5.34                               | 5.95                       |
| Wind             | 5.70                               | 6.64                       |
| Solar            | 12.25                              | 8.82                       |
| Photovoltaic     | 22.99                              | 37.39                      |

Figures are in cents per kWh, 2004 prices. Assumes no federally mandated carbon constraint.  
Source: Author's adaptation of graph from "Federal Tax Policy toward Energy," Gilbert E. Metcalf, Department of Economics, Tufts University, September 2006

## CONCLUSION: WHO BLINKS FIRST— THE BANKS OR UNCLE SAM?

The discussion concluded without participants having solved their obvious fundamental impasse: managers would be happy to reap the profits from running new nukes, but despite the regulatory incentives and subsidies on offer today, debt capitalists who would fund such projects think that the risks outweigh the potential reward.

“The market environment that we have right now is as good as it gets,” said one conference attendee of the global climate for risk financing in general, not of nukes. But despite an exuberant global investment climate and forgiving discount rates on nearly all types of capital projects, “You [still] can’t cash-flow a nuclear plant because the concept of risk over a period of time is too high.... If we’re not seeing expansion of nuclear investment in this environment, with the political desire and the economic capital that are

so available right now, then one has to wonder when we’re ever going to see it.”

What would it take to attract investment capital to new nuclear construction? Some fundamentals are there: demand for power is increasing, and a national carbon constraint, forcing coal operators to “pay” at least in part for carbon emissions, could make carbon-free nuclear generation even more economically competitive. But in the end, the financiers in attendance at the March discussion did not conclude that recent improvements to the regulatory climate were enough to meet growing demand for electricity with new nuclear power; many bankers seem to be waiting for a full, comprehensive federal-government guarantee of new nuclear power plants. As such a guarantee is not forthcoming, the nation may continue to wait for new nukes unless management can persuade shareholders to provide the capital to allow them to fund such projects with equity.

## APPENDIX: NUCLEAR POWER DISCUSSION ATTENDEES

|                   |                                       |
|-------------------|---------------------------------------|
| Edward John Craig | Manhattan Institute                   |
| Steve Creamer     | EnergySolutions                       |
| Nils Diaz         | St. Petersburg Beach, Florida         |
| Howard Dickman    | Wall Street Journal                   |
| Nicole Gelinias   | City Journal                          |
| Sidney Goodfriend | Credit Suisse First Boston            |
| Howard Husock     | Manhattan Institute                   |
| Adam Ingols       | U.S. Department of Energy             |
| Andrew Kadak      | Massachusetts Institute of Technology |
| James Lucier      | Prudential Equity Group               |
| William Magwood   | Secure Energy North America           |
| Carl Menges       | New York City                         |
| Mark Mills        | Digital Power Capital                 |
| Lawrence Mone     | Manhattan Institute                   |
| Rodney Nichols    | New York City                         |
| Max Schulz        | Manhattan Institute                   |
| Clay Sell         | U.S. Department of Energy             |
| Ray Spitzley      | Morgan Stanley                        |
| Jerry Taylor      | Cato Institute                        |
| Kenneth Theobalds | Entergy Nuclear Northeast             |
| Donna Thompson    | Manhattan Institute                   |

Harvard Club  
New York City  
March 27, 2007

## ENDNOTES

1. For a list of the attendees at the evening discussion, please see the appendix (above).
2. Nuclearinfo.net, run by physicists from the University of Melbourne, Australia. Cited in U.S. dollars.
3. "Annual Energy Review 2006," Energy Information Administration, Department of Energy.
4. "International Energy Outlook 2006," Energy Information Administration, Department of Energy, June 2006, at: <http://www.eia.doe.gov/oiaf/ieo/electricity.html>.
5. Up to \$500 million and \$250 million on 100 and 50 percent coverage, respectively; Department of Energy press release, November 17, 2005, at: <http://www.energy.gov/news/2682.htm>.
6. For a full list of new and existing subsidies, see "New Plant Incentives within the Energy Policy Act of 2005," Department of Energy, at: <http://www.ne.doe.gov/energyPolicyAct2005/neEPACT2a.html>.
7. "Public Remains Split on Response to [Global] Warming," John M. Broder and Marjorie Connelly, *New York Times*, April 27, 2007.
8. "Nuclear Power 'Renaissance' Moving Beyond Talk to Real Action," Cambridge Energy Research Associates, April 2, 2007, at: <http://www.cera.com/asp/cda/public1/news/pressReleases/pressReleaseDetails.aspx?CID=8711>.
9. "Energy Market and Economic Impacts of a Proposal to Reduce Greenhouse Gas Intensity with a Cap and Trade System," Energy Information Administration, January 2007, at: [http://www.eia.doe.gov/oiaf/servicerpt/blmss/pdf/sroiaf\(2007\)01.pdf](http://www.eia.doe.gov/oiaf/servicerpt/blmss/pdf/sroiaf(2007)01.pdf).



## FELLOWS

Peter Huber

Max Schulz

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