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July 8, 2010

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Ann Cole
Director, Office of the Commission Clerk
Florida Public Service Commission
2540 Shumard Oak Blvd
Tallahassee, Florida 32399-0850

RE: Docket No. 100009-EI In Re: Nuclear Cost Recovery

Dear Ms. Cole:

On behalf of the Southern Alliance for Clean Energy, I have enclosed for filing the originals and fifteen (15) copies of the direct testimony of Dr. Mark Cooper and of Arnold Gundersen in the above-stated docket. I thank you for your attention to this matter.

Sincerely,

E. Leon Jacobs, Jr.
Attorney for Intervenor

Enclosures

COM 5
APA 1
ECR 6
GCL 1
RAD 1
SSC
ADM
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DOCUMENT NUMBER-DATE
05610 JUL-8 2
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BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

In re: Nuclear Plant Cost Recovery Clause	))))	**DOCKET NO. 100009-EI** **FILED: July 8, 2010**

DIRECT TESTIMONY OF DR. MARK COOPER

ON BEHALF OF
SOUTHERN ALLIANCE FOR CLEAN ENERGY (SACE)

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IN RE: NUCLEAR PLANT COST RECOVERY CLAUSE

BY THE SOUTYHERN ALLIANCE FOR CLEAN ENERGY

FPSC DOCKET NO. 100009-EI

DIRECT TESTIMONY OF

DR. MARK COOPER

INTRODUCTION AND QUALIFICATIONS

Q. Please state you name and address.

A. My name is Dr. Mark Cooper. I reside at 504 Highgate Terrace, Silver Spring, Maryland.

Q. Briefly describe your qualifications

A. I have a Ph.D. from Yale University and have been providing economic and policy analysis for energy and telecom for almost thirty years. I have been the Director of Energy and the Director of Research at the Consumer Federation of America for 27 years, although the opinions I express in this testimony are my personal opinions and not those of the Consumer Federation. I am a Fellow at various universities on specific issues, including the Institute for Energy and the Environment at Vermont Law School. I have testified over 100 times before public utility commissions in 44 jurisdictions in the U.S. and Canada on energy and telecommunications issues and about twice as many times before federal agencies and Congress on a variety of issues, including energy and electricity. A copy of my resume with energy related activities is attached as Exhibit MNC- 20.

PURPOSE, OVERVIEW AND SUMMARY OF TESTIMONY

Q. What is the purpose of your testimony?

A. I have been asked by the Southern Alliance for Clean Energy ("SACE") to examine the long-term feasibility of completion of Florida Power & Light's ("FPL") Turkey Point 6 & 7 Reactors ("Turkey Point") and Progress Energy Florida's ("PEF" or "Progress") Levy Nuclear Reactors ("Levy") (collectively "reactors" or "projects"), and to determine whether or not it is reasonable and/or prudent for FPL and PEF to incur any additional costs on these proposed reactors given current economic and other uncertainties.

Q. Please provide a general overview of your testimony.

A. In a mere four years since the passage the Florida Renewable Energy Technologies and Energy Efficiency Act of 2006, which sought to promote nuclear power in the state, the "nuclear renaissance" in Florida has been reduced to the largest investor - owned utilities in the state, PEF and FPL, urging the Commission to allow them to charge ratepayers hundreds of millions of dollars to do nothing more than hold their place in a line of proposed nuclear projects at the Nuclear Regulatory Commission. The number of utilities in the line has shrunk dramatically as other proposed new nuclear projects have been cancelled around the country. For PEF and FPL, the movement of the line has slowed to a crawl, and reserving their place in the line has little if any value to the Florida ratepayers because the line is almost certainly leading nowhere any time soon.

Ironically, this sad state of affairs represents significant progress from last year. In contrast to the utilities' testimony in last year's cost recovery docket (Docket No. 090009-EI), PEF and FPL now admit that the economics of nuclear reactor construction are highly uncertain. For FPL the uncertainty is so great and the risks so high that they now say they have not determined whether they will actually build these proposed new reactors in the state.

Progress hopes that a five-year delay will resolve the uncertainty, but maintains that it is still committed to construction.

The movement in the utility positions is in the direction I pointed them in my testimony last year, but they have not moved far enough, and as a result, additional millions of ratepayer dollars have been wasted and more is proposed to be wasted over the coming years. Furthermore, while PEF and FPL promise a thorough economic review before they make the momentous decision to proceed with construction of these proposed reactors, in the interim they continue to ask that the Florida ratepayers foot the bill, without a well-grounded showing that completion of these reactors is feasible in the long-term. In my opinion, it is not reasonable or prudent to allow PEF and FPL to incur additional costs of these proposed reactors from Florida ratepayers so that the utilities can do nothing more than sit in line until they themselves determine if completion of the reactors is feasible. This is a decision that the Commission can and should make now.

In light of these developments, in my testimony I repeat two of my primary recommendations that I made in my testimony last year. First, the Commission should not allow the recovery of the line-sitting fee from ratepayers. If anything, the Commission should only allow a small sum to allow FPL and PEF to continue to monitor and study the nuclear option.

Second, the Commission should develop a comprehensive and careful template for evaluating the build-no-build decision, when, if ever, it is presented to the Commission.

Q. Please summarize your findings.

A. In the 2009 nuclear cost recovery proceeding, Docket 090009-EI, I presented evidence that the fundamental economics of nuclear reactor construction no longer supported the construction of new reactors in Florida, if they ever did. I emphasized the dramatic changes, for the worse, in key variables that affect the economics of nuclear reactors:

- declining natural gas costs,
- declining estimates of carbon prices,
- declining demand due to the economic slowdown,
- reduced need for nonrenewable generation due to likely efficiency and renewable mandates in climate change legislation,
- rising projections of nuclear construction costs, and
- the high degree of uncertainty in the economic environment that new reactors face.

All of these factors are still at work and many have continued to develop in a manner that further undermines the long-term feasibility of ever completing these proposed nuclear reactors in Florida. As a result, it is neither reasonable nor prudent to incur additional costs for these proposed reactors.

The decisions by Progress and FPL to seek to build these proposed nuclear reactors were based on a number of important assumptions that have been called into question in the time since the evidence was filed in their petitions for determination of need ("Need Docket"), as well as the evidence filed in Docket 090009-EI. More specifically:

(1) They assumed a high rate of demand growth. While the utilities have lowered their demand projections in testimony filed this year, they still have not recognized the full implications of lowered demand in the evaluation of the proposed reactors in the timing and pattern of need for new generation assets.

(2) They downplayed the contribution that efficiency and renewables can make to meet the need for electricity. The utilities continue to fail to incorporate the impact of these policies on

demand growth and the need for non-renewable generation in the evaluation of the proposed reactors.

(3) They assumed high prices for fossil fuels based on high commodity prices. While they have lowered those projections in testimony filed this year, they have not lowered the price projections to accord with reality.

(4) Based on the belief that public policy would put a high price on carbon, they assumed natural gas would be much more costly than the latest analysis prepared by the EPA indicates. While they have lowered their estimates of the price of carbon, they are still too high and have not dealt with the possibility that carbon taxes may be delayed, or that flexibility may be built into the allowance regime to keep costs low and make emissions allowances available.

(5) They used a low estimate of the cost of nuclear reactors. Although they have raised these estimates in testimony filed this year as compared to last year, both PEF's and FPL's estimates remain well below estimates of other analysts. Furthermore, PEF and FPL have not offered a firm, fixed cost estimate or proposed any mechanism to insulate ratepayers from future cost increases.

(6) They assumed that the design review of the AP-1000 reactor technology would proceed quickly, but that has proven to not be the case. The 17th revision is still unresolved, while contentions have been admitted at the Nuclear Regulatory Commission.[1]

(7) They use an approach to modeling the need for generation that systematically biases the results in favor of construction of nuclear reactors. Slowing demand growth makes it even

[1] Lyash, p. 9, notes that the Atomic Safety Licensing Board, "ruled on their contentions and admitted parts of three contentions to the LNP COL.

more important to properly value the flexibility of generation resources, including, but not limited to, natural gas generation, that can add needed increments to capacity but do not require long lead times like nuclear reactors.

The impact of the changed factors on these assumptions that have developed since the Need Docket and Docket 090009-EI can be summarized as follows:

Market Factors	
Declining Demand	Eliminates need for large quantity of new generation
Falling price of natural gas	Makes natural gas more attractive
Policy	
Uncertainty	Federal carbon policy is not defined
	State policies supporting nuclear or alternative resources remain uncertain
Regulatory Factors	
Efficiency/renewable standards	Reduces need for non-renewable generation, such as nuclear
Carbon cost reduction	Makes low carbon resources less attractive
Technological Factors	
Nuclear cost uncertainties	Raises prospects of cost overruns
Growing confidence in cost and availability of alternatives	Makes alternatives more attractive
Financial Factors	
Tight Financial markets	Makes finance more difficult
Increasing concerns on Wall Street about nuclear reactors	Makes finance more expensive

Execution Risk

Design problems	Raises questions about the ability to execute and
Increasing cost estimates	the long-term feasibility of completing these proposed reactors

In Mr. Lyash's testimony, Progress identifies many of these risks lumped together as "enterprise risk." Whatever we call them, they combine to make it clear that the construction of the proposed new nuclear reactors is not feasible, and incurring substantial costs to continue to pursue these projects at this time is imprudent. Exhibit MNC-1 defines the six categories of risk I use in the evaluation of nuclear reactors and identifies over three dozen specific risks. Exhibit MNC-2 notes how the early assumptions made generally to justify nuclear reactor construction and create the illusion of a nuclear renaissance have proven to be incorrect. Exhibit MNC-3 identifies the risks and uncertainties that Progress now cites as reason to delay the project. These are the same factors that have led FPL to defer the decision to build Turkey Point 6 and 7.

Any of these changed factors alone could demonstrate that completion of these reactors is not feasible in the long term, and that incurring additional costs on these proposed reactors is neither reasonable nor prudent. However, taken together, these factors thoroughly undermine the case that the companies have tried to make to demonstrate (1) the long-term feasibility of these nuclear reactors at this time and (2) the prudence of incurring additional costs on these proposed reactors. The evidence presented by the companies to the Commission does not take these changed factors fully into account and does not reflect the highly uncertain future that nuclear reactors face.

If the Commission were to merely conclude that the changes in conditions make the future highly uncertain, that conclusion alone would argue strongly against continuing to invest ratepayer's money for these reactors. In an uncertain environment, the assets a prudent person acquires should be flexible, have short lead times, come in small increments and not involve the sinking of large capital costs. The characteristics of nuclear reactors are the antithesis of those best suited to an uncertain environment. They are large, "lumpy" investments that require extremely long lead times and sink massive amounts of capital. Therefore, it would be imprudent to allow the companies to recover any more costs from ratepayers at this time because the companies have failed to demonstrate the long-term feasibility of completing the reactors.

There are other factors that will be documented by other witnesses that reinforce the conclusion that these reactors are not feasible in the long-term, and that as a result it is not prudent to incur additional costs, including the failure of some of the projects to obtain regulatory approvals, which were being counted on to stay on schedule and uncertainties and delays in the Nuclear Regulatory Commission ("NRC") licensing process. While one can point to some positive developments for the construction of nuclear power plants, such as the possibility of the creation by the U.S. Congress of a Clean Energy Development Authority, these are vastly outweighed by the negative developments.

Q. Are you sponsoring any exhibits to your testimony?

A. Yes, I am sponsoring the following exhibits:

Exhibit MNC-1: Risk Factors Facing Construction Of New Nuclear Reactors

Exhibit MNC-2: Unrealistic Assumptions Masking The Real Economics Of Nuclear Reactors

Exhibit MNC-3: Increasing Risks Facing Nuclear Reactor Construction Projects

Exhibit MNC-4: Negative Events In The Nuclear Renaissance

Exhibit MNC-5: Exelon's View Of The Deteriorating Nuclear As A Carbon Abatement Option

Exhibit MNC-6: Projected Natural Gas Prices Compared To EIA Projections

Exhibit MNC-7: The Decade Of Volatile Natural Gas Prices May Have Been The Exception, Not The Rule

Exhibit MNC-8: Declining Peak Load Projections: Progress

Exhibit MNC-9: Declining Peak Load And Capacity Needs Progress

Exhibit MNC-10: Declining Peak Load Projections: FPL

Exhibit MNC-11 Declining Peak Load And Capacity Needs: FPL

Exhibit MNC-12: Projections Of Carbon Compliance Costs

Exhibit MNC-13: Projections Of Overnight Construction Costs

Exhibit MNC-14; Declining Cost Of Renewables

Exhibit MNC-15: Flexible Gas Additions Lower Revenue Requirements

Exhibit MNC-16: Cumulative Cost Difference: Flexible v. Lumpy Treatment of Natural Gas Generation Additions

Exhibit MNC-17: Nuclear Construction Pressures Capital Requirements

Exhibit MNC-18: Overnight Costs As A Predictor Of Net Savings: FPL

Exhibit MNC-19: The Risk of Nuclear Reactors in the Eyes of Industry Analysts

Exhibit MNC-20: C.V. of Dr. Mark Cooper

Q. How is your testimony organized?

A. First, I briefly summarize my testimony from Docket 090009-EI. I then discuss the changing approaches of both PEF and FPL from Docket 090009-EI to the current docket due to the profound and fundamental changes in the economic landscape facing new nuclear reactor construction, and the fact that, although the approaches have changed, PEF and FPL continue to utilized flawed analyses to reach the conclusion that building these proposed new nuclear reactors remains feasible and prudent. Next, I discuss and rely upon the opinions that other experts, specifically Wall Street analysts and other electric utility executives, have in regards to new nuclear construction. I then proceed to reevaluate the risk factors that I identified in my testimony in Docket 090009-EI and update my 2009 analysis with a focus on recent developments. Finally, I quantify the benefits of retaining flexibility in generation resources rather than continuing to imprudently spend money on these proposed nuclear reactors which are not feasible in the long term.

Q. Please briefly summarize your testimony in Docket 090009-EI.

A. In my testimony in the 2009 Nuclear Cost Recovery proceeding I concluded that the proposed new nuclear reactor construction is uneconomic, uncertain and risky. I presented evidence on the marketplace, policy, regulatory, technological, execution and financial risks of these reactors proposed for construction in Florida by Progress and FPL. I showed that, whatever the circumstances might have been in the 2008 Need Determination Proceeding, circumstances had dramatically changed since affirmative determinations of need were made by this Commission for these reactors. These changed circumstances and resulting risks led me to conclude that completion of the Turkey Point and Levy reactors was no longer feasible in the long term and that incurring additional costs on these reactors would not be prudent.

Q. Have your conclusions regarding long-term feasibility and the prudence of incurring additional costs on these reactors changed since the time of your testimony last year?

A. No. In fact, my conclusions have been only been further substantiated by developments occurring since my testimony last year. In fact, PEF and FPL have now been forced to admit the extreme uncertainty surrounding construction of new nuclear reactors, and, as a result, the utilities have resorted to mere "line sitting" in the hopes that the Commission will continue to approve costs for these proposed reactors until the utilities are in fact ready to decide whether or not it would be beneficial to their bottom lines to actually construct the reactors.

Q. Have the utilities changed their approach from Docket 090009-EI?

A. Yes, but not enough. In Docket 090009-EI, the companies rejected the suggestion that they be required to update their economic analyses for purposes of demonstrating long-term feasibility, claiming that it did not make sense to let short-term changes in economic projections affect long-term decisions. However, both FPL and PEF underestimated the profound and fundamental changes in the economic landscape facing new nuclear reactor construction. As the adverse economic evidence continued to mount, the utilities have had to belatedly concede that their approach in 2009 could not be credible in 2010. When shifts in key economic variables appear to be permanent, or at least long-term, it would be imprudent and irrational for the utilities not to adjust the economic analyses on which they base their decisions. This year PEF and FPL have modified their economic analyses and both now admit that building a new nuclear reactor <u>today</u> would be imprudent. The Commission should acknowledge this admission as progress.

Unfortunately, the progress stops short of the correct conclusion. The utilities continue to recommend the imprudent expenditure of ratepayer funds, and the methodology they apply to evaluate the long-term feasibility of these reactors is fundamentally flawed. For example, FPL states in its Petition for Approval of Nuclear Power Plant Cost Recovery (May 3, 2010, p. 8):

> The developments at the national level, state level and project level needed for a clear path to construction have not achieved a high level of predictability. Therefore expenditures beyond those required to obtain the necessary licenses, permits and approvals would be premature in 2010 and 2011.

> By continuing to seek the necessary licenses, permits and approvals, FPL is maintaining progress toward delivering the benefits of new nuclear generation to FPL's customers without experiencing unnecessary costs or schedule risks. Once this phase of the project is complete, FPL will be able to review the then-existing economics, the accumulated experience of other new nuclear projects and the state and federal energy policy environment in its consideration of project next steps

Q. Do you agree with FPL's assessment?

A. I whole heartedly agree with the first and last sentences, but thoroughly disagree with the middle two sentences. FPL is correct in stating that now is not the time to be committing resources to the construction of nuclear reactors. However, FPL is incorrect in stating that it would be prudent to continue to expend funds to seek permits, licenses and other approvals. The expenditure of over $28 million for FPL in 2010 and 2011 for those purposes is a total waste of ratepayer money and therefore imprudent. FPL does not need to be seeking these licenses in 2010 and 2011 in order to bring the reactors on line in 2022, when they might be needed, if they are ever needed.

Q. What about Progress Energy Florida?

A. Progress takes a somewhat different view. Having signed an EPC contract very early in the overall process, it has chosen to remain fully committed to building the proposed LNP reactors, although on a much longer time schedule, "deferring significant capital expenditures to a later time period when the Company may benefit from, among other things, additional certainty with respect to federal and state energy policy, plant licensing, and improved financial conditions. More importantly, our decision moves forward with the EPC agreement, and thus preserves the long-term benefits of nuclear generation for the Company and its customers in Florida." (Testimony of Lyash, p. 6). While FPL states "the developments at the national levels, state level and project level needed for a clear path to construction have not achieved a level of predictability" to create "a clear path to construction," Progress hopes the uncertainties will resolve themselves in time to validate its conclusion that the nuclear reactor is beneficial. Progress and its shareholders should bear the risk of this ill-considered gamble, not ratepayers. Meanwhile, Progress is seeking to have ratepayer pay in excess of $164 million to keep its place in line.

The difference between the FPL and the Progress positions may be the result of the fact that Progress has signed an EPC and is liable for penalties if it backs out of the contract. If the risks and uncertainties surrounding nuclear generation that have become so clear lead the Commission to conclude that these proposed reactors are no longer feasible, the cancellation fees should certainly not be recoverable from ratepayers. The Commission should make this clear immediately.

Q. What aspects of the analysis do PEF and FPL have in common?

A. While the two utilities take different positions with respect to whether they are moving ahead with actual construction of the proposed reactors, both FPL and PEF's analyses continue to make erroneous assumptions, all of which favor nuclear reactors. These erroneous assumptions lead them to erroneously conclude that nuclear power will be needed in the mid-term and will be less expensive than meeting demand with combined-cycle gas plants. These erroneous assumptions in the 2010 analyses include, but are not limited to, the following:

- The cost of natural gas used in the analyses is still higher than projections by the U.S. Department of Energy Information Administration ("EIA").
- The cost of carbon is still higher than the U.S. Environmental Protection Agency projects from the energy bill that has passed one house of Congress.

- The utilities have also failed to take the full implications of climate change policy into account. Both FPL and PEF assume a price of carbon is going to be imposed, but at the same time ignore the efficiency and renewable mandates that are likely to be included in any climate change legislation. As a result, they propose to build new reactors well before there will be a need for them to meet system reserve margin requirements if climate change policy is enacted.
- Their electricity and financial models do not reflect the problem of excess capacity and the value of being able to add natural gas generation resources in smaller increments and with shorter lead times than large central station facilities like nuclear reactors.

Q. What conclusions can you draw based on these erroneous assumptions made by PEF and FPL?

- A. Taking these erroneous assumptions into account, I reach two specific conclusions about the long-term feasibility of the proposed FPL and PEF reactors: First, contrary to the utility findings that nuclear reactors are a little less costly than natural gas – saving ratepayers about $ 5 billion in discounted, 2010 dollars in the base case – my analysis demonstrates that they are likely to be more expensive, costing ratepayers $10 to $20 billion more in discounted, 2010 dollars.
- Second, because of the high cost and other inherently unattractive economic characteristics of new nuclear reactors (long-lead time, sunk costs), it will be at least a decade, probably two, and maybe even more, before nuclear generation can

potentially become cost competitive with the other options available in a carbon constrained world. During this long time frame, the economics of other options can change dramatically. Therefore, it is imprudent to spend ratepayer funds on nuclear reactors at present, especially given that the utilities are at present merely line sitting as I discuss in more detail below.

These two findings reinforce my overall conclusion, that spending hundreds of millions of dollars of ratepayer funds today so that PEF and FPL can continue to sit in the line waiting to build new nuclear reactors is imprudent, unreasonable, and wasteful. In fact, the imprudence of continuing to spend ratepayer money on these projects is symbolized by the fact that the generation resources that these projects would bring on line would not even appear in the utility's ten year site plan for another two years, if then.

Q. If the reactors will not be needed for such a long time, why are the utilities continuing to seek ratepayer funds to develop them?

A. For both utilities the primary concern now is line sitting. For example, Progress Energy Florida claims to need to stay in line because of the activity in the industry.

> If we terminated the EPC agreement and cancelled the project, the nuclear option will be lost for the foreseeable future as both private (the Consortium and other vendors) and federal (the NRC) resources shift to nuclear projects under development elsewhere in the country or around the world. Our decision therefore preserves for our customers and the Company the long term benefits of fuel portfolio diversity, reduced reliance on fossil fuels for energy production, carbon free energy generation, and base load capacity at a low cost fuel source that nuclear generation provides (Lyash, p. 6).

FPL makes a similar argument, claiming that the decision to move forward is just around the corner, based in part, on a fiction that the nuclear industry is thriving and therefore FPL must move ahead quickly, or lose its place in line.

> The input representing the greatest risk for the Company is skilled labor trained to construct advanced nuclear facilities. At this time, however, FPL does not anticipate any major problems with respect to procurement of raw materials, long lead components, or skilled workers. Nevertheless, with development in the nuclear industry gaining steam, competition for these resources will increase (Testimony of Reed, p. 49).

The suggestion that the vendors are in the driver's seat and the utilities will lose their chance if they do not continue to spend ratepayer funds does not accord with reality. The vast majority of projects in the U.S. have been delayed or cancelled, as summarized in Exhibit MNC-4. There is little demand for the technology the Florida utilities have chosen.[2] Frankly, if the supply-train is stretched as thin as the utilities suggest, the danger of delays and escalating costs is probably much greater than being bumped out of the line because once the project starts, delays escalate, which is what drove cost escalation during the first nuclear building cycle.

Q. Do other experts share your view of the economics of nuclear reactors have continued to deteriorate?

A. Yes. Both FPL and Progress claim that the economics of nuclear reactors have improved dramatically since the Need Determination two years ago. The analysis of FPL claims that the break even capital cost – the amount of money FPL could spend on nuclear construction in overnight costs

[2] The number of reactors under construction outside of Russia and China has been basically flat increasing from 21 to 24 since the certificate of need was issued, http://www.world-nuclear.org/info/reactors.html. The vendor for both FPL and Progress appears to have a total of 4 units under construction, all in China, http://ap1000.westinghousenuclear.com/ap1000_nui_ic.html. In the U.S. two projects using this technology appear to be ahead of the Florida reactors (Georgia and South Carolina), but there does not appear to be a crowd behind them. One AP-1000 has been delayed, the other abandoned.

– has increased by more than one-third since the need determination in 2008.[3] For Progress, the mid fuel, no CO2 scenario has gone from a negative $3 billion to a positive $1 billion.[4] However, this is the opposite of what most analyses say, including those of Wall Street utility analysts and other utilities.

My review of utility industry analysts on Wall Street and elsewhere finds that they generally see the economics of new nuclear reactors moving in the opposite direction than what PEF and FPL claim, as demonstrated by Exhibit MNC-19. They definitely do not see an improvement. Some of the biggest nuclear utilities have also concluded that the economics have become so unfavorable that they have abandoned their plans for new nuclear reactors at present. A most stunning example was provided in a recent analysis from the CEO of Exelon. See Exhibit MNC-5. In his evaluation the cost of nuclear has more than doubled, and nuclear has moved well down in the list of options for carbon abatement. In the 2008 view, new natural gas was somewhat less costly than nuclear, but by 2010, gas was seen as much less costly. The CEO of Entergy, another major nuclear utility, has expressed similar sentiments.[5] The service territory conditions that J. Wayne Leonard indicates led him to the conclusion that "no same [sic] businessman would currently build a nuclear power plant" – plentiful reserves and slow growth – are exactly the conditions in which the Florida utilities now find themselves. Cushioned by the promise of cost recovery from the ratepayers, PEF and FPL have simply failed to adjust adequately to the new reality.

ANALYSIS OF RISK FACTORS

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[3] Sim, 2009, Table 45, inflated at 1.03 per year to $5456, compared to Sim 2010, Ex. SRS-1.
[4] Progress Energy Florida, *Levy Nuclear Project NCRC Updated Life-Cycle Net Present Worth (CPVRR) Assessment*, Exhibit JL-3, 2007 results inflated at 2 percent per year.
[5] Thomson Reuters, *Entergy at Thomson Reuters Global Energy Summit-Houston*, May 24, 2010.

Q. Have you updated your analysis of the risk factors since you prepared your testimony in Docket 090009-EI based on recent developments?

A. Yes. I have reevaluated how each of the categories of risk that affects new nuclear construction in Florida, with an emphasis on the importance of recent developments. In each case I also show the benefits of waiting to make the build-no build decision and the folly of incurring costs while we are waiting. While FPL has decided to wait, Progress has declared it is going ahead with the construction decision, just on a slower time line. The self-serving economic analysis of nuclear reactors that both utilities present still indicate that these proposed new reactors are the preferred option. My analysis indicates otherwise.

MARKETPLACE RISK

Natural Gas Prices

Q. Are the utilities' projected natural gas prices still a concern to you?

A. Yes. There are two key components of gas costs in this analysis – the commodity cost and the compliance cost. Both are overestimated by both FPL and PEF.

In regards to commodity cost, the reality of lower natural gas prices is slowly sinking in. However, both utilities continue to overestimate the price of natural gas. As shown in Exhibit MNC-6, using the EIA long-term projection of wellhead natural gas prices and adding in the cost of transportation, I find that the utilities have projected prices that are higher than indicated by EIA by about 13 percent (14 percent undiscounted, 12 percent discounted). Since natural gas prices account for two-thirds or more of the total cost of gas generation, this represents almost a nine percent overestimation of the cost of the project. That difference alone is large enough to reverse the conclusion that gas is more expensive in most of the scenarios analyzed by the utilities.

I discuss compliance costs below under the analysis of policy risk.

Demand

Q. Have there been changes in demand that affect the long-term feasibility of these nuclear reactors and the prudence of incurring additional costs on the proposed reactors?

A. Yes. There has been a dramatic change in the marketplace, and demand more specifically, since the companies prepared their need analyses in the respective need dockets and the testimony in Docket 090009-EI. The nation has plunged into the worst recession since the Great Depression. Some even call it a depression. Moreover, there is a growing recognition that this change is not simply a severe dip in the business cycle, but rather a major shift in the economy. The spending binge on which the U.S. embarked for a decade, in which households and business became highly leveraged, is likely over. A massive amount of household wealth was destroyed when the housing market bubble burst. Retirement accounts have been devastated by the collapse of the stock market.

Ironically, the decade on which the projections were based in the Need Determination coincided almost exactly with the decade in which the housing and consumption bubbles were pumped up by excessive leverage. That level of growth was unsustainable. It is my opinion that the shift in consumption is permanent and signals slower growth in the future. However, even if this were just a severe downturn in the business cycle, it would affect the demand for electricity sufficiently to raise questions about the long-term feasibility of these new nuclear reactors.

A reduction in the growth rate of demand has two implications for large central station facilities like nuclear reactors. Since both FPL and Progress have excess capacity at present, slowing demand growth pushes the date at which new generation will be needed farther into the future. In my 2009 testimony I estimated that the need for the nuclear reactors was at least half a decade away.

> In 2017, which is a crucial year in the 2008 analysis because that was the year the reserve margin hit the limit of 20 percent, the 2009-projected peak is 11 percent lower than the peak projected in 2008. Under the 2009 projection, the FPL does not reach the 2017 peak projected in 2008 until 2022, five years later.[6]

In the current proceeding the utilities affirm my calculations, having pushed the in-service dates to the 2021-2023 period.

Slower demand growth has a second effect. It makes smaller increments to capacity preferable since lumpy generation additions create excess capacity. Excess capacity that is capital intensive imposes unnecessary costs on consumers. To avoid this excess capacity, I later demonstrate that it is preferable for PEF and FPL to build a series of natural gas-fired power plants instead of these proposed nuclear reactors.

Q. Have the utilities reflected this change in demand in their analysis?

A. Yes, they have pushed their expected in-service dates out by about four or five years. The online dates for these reactors are now more than a decade away, beyond the ten-year plan, 2021 and 2022 for Progress, 2022 and 2023 for FPL. That delay makes it unnecessary, imprudent and unreasonable to continue incurring the costs of licensing today. This becomes even more apparent when the impact of likely energy efficiency and renewable energy mandates are taken into account, as I discuss below in the policy risk section.

Q. How does waiting to make a build-no-build decision reduce marketplace risk?

[6] Cooper, 2009, p. 9 line 51.

A. The uncertainty about both natural gas prices and demand growth are likely to diminish. In both of these areas we are coming off of unprecedented events. The decade of growth in demand prior to the need determination was extremely high. Repairing the economy and learning whether it is on a whole new trajectory will take time, and continuing to incur costs on these proposed nuclear reactors during this time is in my opinion unreasonable and imprudent.

Similarly, the volatile natural gas prices were unique to the past decade. That decade may be the exception, rather than the rule, as Exhibit MNC-7 suggests.

POLICY RISK

Need for Non-renewable Resources

Q. Should policy considerations enter into the Commission's evaluation of the long-term feasibility of these reactors and the prudence of incurring additional costs for these reactors?

A. Yes. The companies' economic feasibility analyses were driven by assumptions about federal regulatory policy. The companies have put a high price on carbon in their economic analyses. Without the high price on carbon, the economics of nuclear reactors would look very different. To my knowledge, the state of Florida has not put a price on carbon, nor is it contemplating doing so. Thus, the companies have decided to pursue these projects and the Commission has allowed cost recovery based, in part, on assumptions about federal climate change policy.

Q. Are you suggesting that the Commission should not take future climate change policy into account when considering the long-term feasibility of these reactors?

A. Quite the contrary. I believe the Commission should take federal policy into account when considering the long-term feasibility of these reactors, since that is a major source of regulatory risk to state decisions. However, I believe the Commission must take the **entirety** of projected federal policy into account. The idea of putting a price on carbon is only a part of the legislation that is moving through the Congress. H.R. 2454, the American Clean Energy and Security Act, the first piece of climate change policy legislation to pass a house of Congress, does not simply put a price on carbon directly. Rather, it establishes an elaborate scheme of allowances to emit carbon, which will indirectly set a price on carbon. Moreover, policies other than putting a price on carbon, particularly policies to promote efficiency and renewables, play a large role as well.

Q. Please describe the full suite of federal policies that affect the long-term feasibility of these nuclear reactors.

A. On the supply-side, the legislation that has passed the House has a renewable energy standard that would require utilities to meet an increasing part of their load with renewables. Within a decade, they would be required to get 20 percent of their generation from renewables, with as much as 8 percent of that total coming from efficiency. At the same time, the legislation includes a number of provisions that have sharply lowered projections of the cost of carbon credits, such as efficiency and renewable mandates, subsidies for carbon control technologies and domestic and international offsets. All of these lower the demand for allowances and therefore the price of allowances. This means that the assumed compliance costs of fossil fuels are lower than projected by the companies in prior proceedings and this proceeding.

On the demand side, there is a substantial mandate for energy efficiency. This is embodied, in part, in the ability to meet two-fifths of the renewable resource standard with efficiency and, in part, in dramatic improvements in building codes and appliance standards. Mandates to improve the energy efficiency of new buildings by 30 percent in the near term and 50 percent in the longer term will have a substantial impact on energy demand over the life of the reactors being considered in this proceeding. Funds from certain allowances are set-aside to improved efficiency, particularly for natural gas. Similarly, the American Recovery and Reinvestment Act of 2009 includes a huge increase in funding to improve the energy efficiency of existing buildings. As the efficiency of buildings and appliances improves, the demand for electricity and natural gas declines.

These regulatory factors – increased renewables, lower demand through efficiency, and a lower price on carbon – must be considered in the evaluation of alternative scenarios for future supply of electricity. Extracting only the price of carbon from the policy landscape and inserting it in the economic analysis, while ignoring the other aspects of policies, distorts the picture being presented to the Commission. Factoring in these other policies would further undercut the claim that nuclear reactors are feasible in the long-term. Many of these other aspects have been part of the climate change policy debate for quite some time. Taken together, these changes on the demand side, as well as the renewable standard, will have a substantial impact on the need for new non-renewable generation and undermine the long-term feasibility of building these reactors.

Q. What impact does including the efficiency and renewable policies in HR 2454 have on projections for load growth and demand for nonrenewable resources such as nuclear reactors?

A. They would have a major impact. Exhibits MNC-8 and MNC-9 set forth demand scenarios that model the impact of the efficiency and renewable mandates in HR 2454 on the need for non-renewable generation in the Progress territory.. It applies the national average results estimated in the EPA analysis of the legislation to Florida. I have factored in planned retirements in this calculation. The results are similar to the analyses I provided in the 2009 Nuclear Cost Recovery Proceeding. As shown in Exhibit MNC-9, under this scenario, Progress does not reach the peak demand projected in the Need Docket for 2017 until 2040.

Exhibits MNC-10 and MNC-11 present a similar analysis for FPL. New resources to meet the reserve margin requirement are not needed by FPL until 2037. Simply put, with the efficiency and renewables factored in on top of the declining growth rate of demand, neither utility needs new capacity to cover the reserve requirement out until well past 2030.

Q. Are there constraints, other than the reserve margin requirement, that might affect the utilities?

A. Yes. In modeling the full impact of the climate legislation we must pay attention to the mandates to reduce greenhouse gas emissions. Doing the minimum under HR 2454 is not enough for long-term compliance. In the mid-term, allowances can be purchased to keep compliance costs under control and economically attractive options are available beyond the minimum. Buying time in the current environment, at least a decade, perhaps a quarter of a century, to develop the next generation of low cost, low carbon resources is the key strategy.

Under the pending legislation, the entire industry will be working on the problem, as will the public sector institutions. A full range of alternatives will be examined including more efficiency and renewables, whose costs are projected to decline, new forms of storage, which will make renewables more cost effective, expanded transmission that improves access to out of territory renewables, carbon capture and storage, and nuclear generation. Using the maximum amount of time possible to gather information before making these decisions is very valuable because it keeps options open. National policy will be promoting the development of low cost, low carbon options.

Florida ratepayers can benefit by keeping their options open rather than committing to a high cost, long lead-time approach like nuclear reactors.

Compliance Costs

Q. Are there other ways in which delaying the build/no-build decision is valuable in this uncertain regulatory environment?

A. Yes, several. First, and most obviously, the contours of climate policy will become clearer. It is unclear that Congress will pass any climate legislation this year or that any legislation that passes will put a price on carbon. Emphasis seems to be shifting to complementary policies that promote or require efficiency and renewable, and this will have an impact on the need for non-renewable generation and the cost of carbon, as well as the cost of natural gas. The targets and timing, as well as the mechanisms for setting the price will have a big impact on the cost of carbon. However, Commission approval of costs necessary for PEF and FPL to sit in line, as the utilities are requesting, is simply a waste of ratepayers' money at this time and is not necessary in order to delay the build/no-build decision.

Q. Are the utility estimates of compliance costs still a concern?

A. Yes. The analyses continue to be centered on compliance costs that are higher than those projected by EPA, as shown in Exhibit MNC-12. FPL has dropped its highest cost compliance scenario, but its mid case is still above the EPA estimate for HR 2454 and the Kerry Lieberman bill in the Senate. Progress has a zero carbon cost analysis, but its mid-range estimate is still 30 percent above the EPA estimate.

Q. How does waiting to spend ratepayer moneys on these reactors reduce the policy risk?

A. The uncertainty about federal policy is likely to diminish. With the need for generation resources now farther out in the future and the large impact that federal policy can have on the need for non-renewable resources, it would be prudent to wait to see what course federal policy takes before committing any more resources to the reactors, especially resources which are only necessary to allow PEF and FPL to continue to line sit, and certainly the resources that would be committed with the build/no-build decision. The issues that will affect the need for the reactors in the federal legislation include targets and timing of carbon reductions, mandates for alternatives and flexibility in approaches, including the ability to purchase allowances at lower costs than building reactors.

REGULATORY RISK

Q. What regulatory risks do nuclear reactors face?

A. The major regulatory policy risk remains at the Nuclear Regulatory Commission. There are continuing issues with the licensing of the generic design of the AP-1000 technology, as discussed in more detail by Arnold Gundersen on behalf of SACE in this proceeding. The certification of a standard design was supposed to be a key to speeding up the process. The design proposed by the utilities/vendors has encountered numerous problems. Therefore, allowing PEF and FPL to spend ratepayers' money to stand in line while the regulatory hurdles are passed provides no benefit whatsoever to the ratepayers.

Q. How can taking the maximum time possible to make the build, no-build decision lower regulatory risk?

A. The AP-1000 design will possibly have been certified and the licensing process at the NRC may have become more routine after the initial plants have gone through the process. Later plants will benefit from the smoother certification process.

TECHNOLOGICAL RISK

Nuclear Reactor Costs

Q. Have the utilities increased their estimates of nuclear construction costs?

A. Yes, but I still have the opinion that they are underestimating the costs. Furthermore, they have still not offered firm, fixed prices. Therefore, these reactors are likely subject to ongoing future increases, putting ratepayers at risk.

Q. Pleases describe the uncertainties about the cost of nuclear reactors.

A. As described in Exhibit MNC-13, early in this decade vendors and contractors at the Department of Energy produced very low estimates of the cost of nuclear reactors, claiming that things had changed since the first generation of reactors. In the eight years since those initial, promotional studies were released, the estimates of the cost of nuclear reactors has increased dramatically, especially among Wall Street and independent analysts. As long as the costs placed before the Commission are "non-binding," the Commission must be aware of the growing uncertainty about the cost of nuclear reactors. As long as they are "non-binding," the prospect of cost escalation places ratepayers at risk, especially where costs for construction work in progress is being granted.

In fact, the extreme uncertainty about nuclear reactor costs has caused FPL to create a whole new framework for evaluating options. As FPL stated in the Need Docket:

> The second difference in the economic analysis approach step that developed the CPVRR costs for the resource plans is that no generation or transmission capital costs associated with Turkey Point 6 & 7 were included in the analysis. The reason for this is that *FPL does not believe it is currently possible to develop a precise projection of the capital cost associated with new nuclear units with in-service dates of 2018-on.* Consequently, FPL's economic analysis approach normally used to evaluate generation options has been modified to include a second economic analysis step." ("Need Study for Electrical Power, Docket No. 07-0650-EI, Florida Power and Light Company, October 16, 2007, pp. 104-105, emphasis added).

Similarly, Progress has recently increased the cost estimate previously placed before the commission for construction of the LNP.

In the 33 months since that statement was made, there have been dozens of studies of the projected costs of nuclear reactors. The cost in 2008 $ have ranged from a low of just under $2400/kW to a high of just over $10,000/kW. The Florida utilities' estimates are still in the low end of the range of estimates. Recent cost trends in generation construction suggest that the utility cost projections did not incorporate the run up in nuclear construction costs. Moreover, the cost of construction for non-nuclear generation rose more slowly during the recent phase of price increases and has fallen more quickly in recent months.

The two conclusions I would draw from this analysis are (1) the range of costs considered by FPL and PEF is too narrow and too low, and (2) the uncertainty is huge. This only reinforces my opinion that the prudent course would be to avoid rigid, expensive choices, especially if there is time to let the uncertainties diminish before decisions must be made. The Commission should not allow ratepayer funds to be spent to hold the utilities place in line or to fund a build, no build decision made prematurely.

Efficiency and Renewables

Q. Should changing technological conditions factor into the analysis of the long-term feasibility of these reactors?

A. Yes. While climate policy is seen as giving a direct advantage to reactors by putting a price on carbon, that policy does much the same for other technologies. In fact, there are ways in which the alternative technologies are likely to receive an even larger boost. There are also many programs targeted at various technologies that are in earlier stages of development that may enjoy larger cost reductions as the science advances and the scale of production ramps up.

I believe there are two technological developments that are shifting the terrain in ways that disfavor nuclear reactors, in addition to the uncertainties about nuclear technology discussed above – the availability and cost of conserved energy and the availability and cost of renewables.

Q. Please describe the emerging terrain for efficiency technologies.

A. There is a growing consensus that the cost of many alternatives is lower than that of nuclear reactors. For efficiency, the change in the terrain is largely a matter of increasing confidence that substantial increases in efficiency are achievable at relatively low cost. The detailed analysis of potential measures and the success of some states at reducing demand through energy policies have increased the confidence that efficiency is a reliable option for meeting future needs for electricity by lowering demand. At the same time that the policy process has opened a range of uncertainty and flexibility, studies from three major national research institutions have sent a strong signal indicating the direction that the effort to meet energy needs in a carbon-constrained environment must follow.

In fact, since I filed testimony in the 2009 cost recovery proceeding, three major national research organizations have affirmed the potential of efficiency to contribute to an affordable, low carbon future. The National Research Council (NRC), relying on a study by the Lawrence Berkeley

National Laboratory (LBL),[7] and McKinsey and Company[8] concluded that efficiency could cut energy consumption by 25 percent to 30 percent at costs that are far below the current and projected future cost of new energy generation. The American Council for an Energy-Efficient Economy (ACEEE) took a somewhat different approach by modeling the energy efficiency provisions of the House bill. It found that, as passed, ACES would result in an 8 percent reduction in energy use nationwide by 2030, relative to the *Annual Energy Outlook 2009* forecast.[9] At the same time, the ACEEE study found that more aggressive efficiency policies would save a great deal more energy, approximately 27 percent, and produce much larger dollar savings. Another ACEEE that was done specifically for Florida found that aggressive policies to reduce energy consumption could lower demand by 20 percent at a cost of less than 3.5 cents per kWh.[10]

Thus, independently of any regulatory mandate, as the technology of efficiency is proven out, the Commission should consider greater reliance on it as part of the least cost approach to meeting the need for electricity. The combination of regulatory and technological changes will drive efficiency into the electricity sector, undermining the long-term feasibility of the reactors and the prudence of spending ratepayer money on these proposed reactors at this time.

Q. Please describe the emerging terrain of renewables.

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[7] National Research Council of the National Academies, *America's Energy Future,* August 2009. The National Research Council relied on a study from Lawrence Berkeley National Laboratory (Brown, Richard, Sam Borgeson, Jon Koomey and Peter Biermayer, *U.S. Building-Sector Energy Efficiency Potential*, September 2008).

[8] McKinsey & Company, *Unlocking Energy Efficiency in the U.S. Economy,* July 2009.

[9] Gold, Rachel, Laura, et al., Energy Efficiency in the American Clean Energy and Security Act of 2009: Impact of Current Provisions and Opportunities to Enhance the Legislation, American Council for an Energy Efficient Economy, September 2009), page 5.

[10] Elliott, R. Neal, et al. *Potential for Energy Efficiency and Renewable Energy to Meet Florida's Growing Energy Demands,* American Council for an Energy-Efficient Economy, June 2007

A. The concern with climate change has sharpened the focus on the cost and availability of renewable technologies. For renewables, the change is in strong cost reductions that are expected as new technologies ramp up production, as shown in Exhibit MNC-14. The combination of regulatory and technological changes will drive renewables into the electricity sector, undermining the long-term feasibility of these proposed nuclear reactors and the prudence of spending ratepayer money on these proposed reactors at this time.

Execution Risk

Q. What is Execution Risk?

A. This is the risk that the project will not be implemented on time and on budget. It focuses on the internal management of the project by the companies. On the one hand, utilities tend to deny that execution risk exists. On the other hand, they tend to blame the slippage in execution of the project on other factors or actors, insisting that causes were beyond their control. This is most evident in the case of Progress, which is attempting to explain a five-year delay in the LNP.

I believe the Commission should look back at PEF's decision to move forward with the project to ensure that a similarly flawed analysis is not used this year to determine whether or not completion of the LNP is feasible. Rushing ahead with the wrong project using models that distort the decision are execution problems from the broader perspective of least cost planning

Q. Can you quantify the benefits of making flexible investments in generating resources, as compared to nuclear power plants?

A. In my 2009 testimony I emphasized the importance of factoring excess capacity into the analysis when I stated.

> The operating cost estimates should not include excess production and the variable costs associated with that production. If capacity is idled because of excess, then the carrying cost of that excess should be subtracted from the savings. These are costs that would not be incurred if the system were "right" sized. Because nuclear reactors come in larger units and have higher capital costs, while natural gas units are small, lower in capital cost and have higher operating costs, ensuring that the model takes these differences into account become more important when demand declines and excess capacity increases....
>
> Over a long time horizon, the ability to match supply and demand (plus the reserve margin requirement) should be rewarded....
>
> While the excess capacity is a few percentage points spread over a number of years, it can make a difference if it is handled properly. The economic advantage claimed for nuclear is actually quite small, when compared to the total costs of the system.[11]

Having concluded that the need to meet the reserve margin should not be the driver of generation investments with demand growth slowing, developing approaches that allow the Commission to consider the differences between large, lumpy additions of capacity and smaller more flexible additions becomes critical. This is one area where the utilities have done nothing, so I have worked up an example of how important this consideration can be.

Q. What data did you use to develop this example?

A. I have used the detailed data on the CVPRR of the individual cost components provided by FPL in the 2009 docket, since this is the only such detail that has been provided in any of the dockets.[12] I use the high capital cost estimate from 2009, since that is close to the reference cases used in this docket. I have adjusted the discount rate since that has a large impact on the present value of costs. To make the adjustment, I inflated the 2009 PV numbers by the 2009 discount rate to arrive at a real, undiscounted estimate of the revenue requirement. I discounted those costs at the 2010 discount rate. I have also adjusted the natural gas costs to the 2010 estimates. By using these

[11] Cooper Testimony in Docket 090009-EI, pp. 34-36.

[12] Response to Staff Seventh Set of Interrogatories Question 64, attachment 1, page 7 of 9.

data provided by FPL, I am not agreeing with the cost inputs assumed by FPL in 2009 or 2010. This example is used to show the relative overall costs of a different scenario of adding natural gas generating capacity.

I used the 2009 capital costs as originally stated because several factors offset one another. The weighted average cost of capital has been reduced from 10.2 percent to 8.4 percent, but the capital cost of the project has been increased by 9 percent. Since I am focusing on the relative cost of nuclear and gas, not the absolute numbers, the example provides good insight into the impact of treating gas generation flexibly. In the 2009 analysis in the mid-gas, mid-compliance cost case, FPL calculated gas as 7.5 percent more costly than nuclear (without the capital cost of the new reactors). In the 2010 analysis, the difference was 7.7 percent.[13]

Q. How do you model the impact of installing smaller gas fired units incrementally?

A. FPL assumes that natural gas must be added in large increments that are roughly the same size at roughly the same time. Ironically, they sequence two nuclear reactors (about 18 months apart), but they do not sequence three combined cycle natural gas units to gain the economics of sequencing. If gas is treated as a more flexible source of generation, which it is, the Commission gets a very different picture of the relative economics.

Since FPL assumes three combined cycle units added at one time, Exhibit MNC-15 contrasts a scenario in which gas plants are added in three separate steps five years apart. Progress adds combined cycle units two at a time, suggesting there is some flexibility.

Exhibit MNC – 15 shows the small advantage that nuclear has in the FPL base case, because FPL projects that the large capital costs are eventually offset by rising natural gas prices. However,

[13] Compares Response to Staff Second Set of Interrogatories Question 45, attachment 1, to Sim Ex. SRS-10.

the net effect of treating gas as a more flexible resource is to lower the cost of gas by 17 percent, giving natural gas a cost advantage over nuclear that is larger than the base case advantage claimed for nuclear.

Exhibit MNC-15 also shows the effect of flexible gas additions with gas prices set at EIA gas projections. The combination of treating gas a resource that can be added in small increments and using a more reasonable projected price of gas lowers the gas cost by almost one-quarter.

Finally, MNC-15 shows the impact of a ten-year delay in the online operation of the proposed nuclear reactors. This would be consistent with the scenario in which climate policy reduced need for non-renewable resources as discussed above. The gas scenario would be almost 40 percent less costly than the scenarios that bring these reactors on line in the early 2020s.

Q. Do these results apply to Progress?

A. The reference cases for the two utilities are quite similar. As noted above, the gas price and carbon cost assumptions are similar. Progress has a slightly lower weighted average cost of capital because of assumed lower borrowing costs and a slightly lower discount rate. In the end, their base case results are quite similar, although that similarity is obscured by the methodology adopted by FPL to back into the capital cost number. FPL calculates how much it could spend on the nuclear project and still have it be less costly than gas. Progress estimates how much the nuclear project would cost if it spent a specific amount on the nuclear project and then asks how much consumers would save at the assumed cost of nuclear.

Using the data from the FPL scenarios, we can reconcile the two approaches. Exhibit MNC-16 shows that for every $1000/KW of overnight costs added to the nuclear project, the CVPRR of the nuclear project increases by $2.81 billion. Using FPL's high-end estimate of overnight costs of

$4950, which appears to be in the middle of the range considered by Progress, I calculate that FPL claims the nuclear project saves consumers $4.511 billion. This is quite close to the Progress mid-fuel, mid- carbon cost case reference capital cost case, which claims consumers would save $4.77 billion.

There are differences, however. Progress adds gas facilities in smaller increments. It has more excess capacity in the early years and is retiring gas plants, which could be put into inactive reserve. Moreover, Progress claims a very large cost savings by adding the two nuclear units in a year apart (i.e. the first unit costs almost twice as much as the second, (Updated Life-Cycle Net Present Works Assessment, JL –3, p. 3), which makes the increase in generation capacity from the nuclear project extremely large in an environment with more slowly growing demand.

The purpose of this example is not to offer a precise estimate of the costs, but to impress upon the Commission the importance of looking at the excess capacity issue and the value of the addition of smaller and more flexible increments. The specific parameters and assumptions that are applicable will affect the outcome of the analysis, but the order of magnitude of these effects indicate that they are extremely important for the Commission to consider.

Financial Risk

Q. Are there other quantifiable benefits of deferring the decision on nuclear construction further than the time proposed by PEF and FPL?

A. Yes. Utilities face capital constraints in the current environment and pursuing nuclear projects will make them worse, as shown in Exhibit MNC-17. The near-term capital requirements of nuclear reactors are much larger than those of gas plants. The financial ratios of the utilities can be analyzed with and without the nuclear project and the impact of the weaker ratios of the cost of capital can be estimated.

Q. Are there other capital cost issues that the Commission needs to aware of?

A. Yes. The Commission must be careful not to establish a "Catch 22" that could ultimately costs ratepayers billions. It recently lowered the return on equity allowed for FPL. This has the effect of lowering the cost of capital-intensive project like nuclear reactors. FPL also uses the lower ROE to lower the discount rate in its analysis of long-term feasibility in this docket. This has the effect of increasing the net present value cost of alternatives with rising fuel prices, like natural gas.

However, FPL claims that the ROE set by the Commission may not be high enough to enable it to attract capital for nuclear reactors.[14] If the utility has trouble raising capital and the Commission is convinced to increase the ROE, then the long-term feasibility analysis required as part of this docket should be revisited, because both the changed ROE and discount rates will affect the results. This is not just an accounting question. Nuclear reactors have a higher cost of capital because they are more risky. It may be appropriate to use different costs of capital to assess different types of projects. Alternatively, the Commission could estimate the cost to consumers of the increase in the overall cost of capital resulting form the pursuit of the riskier project.

The Commission also needs to examine the discount rate used in the analysis. The utility is conducting the analysis from the utility point of view, decreasing the discount rate when the ROE is reduced. This has the anomalous effect of lowering the overall cost of both the nuclear and natural gas projects at the higher cost of capital. The higher the return on equity, the higher the nominal

[14] FPL response to OPC's Third Set of Interrogatories, Interrogatory No. 40, p.1.

value of the revenue requirement, but the lower the present value because the entire revenue requirement (not just the capital cost revenue requirement) is being discounted at a higher rate.

A case can be made that the investments should be viewed through the eyes of the ratepayer, not the utility. The ultimate objective of public utility regulation is to deliver reliable electricity at the least cost to consumers. If we take least cost to mean to the consumer, then an argument can be made that the consumer discount rate should be used. The utility cost of capital already reflects the primary utility concern about the revenue requirement. The consumer discount rate and the utility discount rate may or may not move in tandem. Moreover, utilities make choices that affect their cost of capital, but not the consumer discount rate.

Q. Please summarize your conclusions.

A. As I predicted in Docket 090009-EI, dramatically changed circumstances surrounding the licensing and construction of new nuclear reactors has forced PEF and FPL to push the possible construction of these proposed nuclear reactors off into the future beyond the time horizon of the ten-year planning process and even the extremely long lead time that they originally claimed was needed to construct new reactors. Nevertheless, despite even more uncertainty at this point in time, both PEF and FPL want to continue to spend ratepayer funds in the near term, even though those expenditures would provide little benefit to ratepayers. Put simply, the near term expenditure of funds to allow PEF and FPL to sit in line at the NRC is not only unnecessary, but also unreasonable and imprudent. Ultimately, neither PEF nor FPL can demonstrate the long-term feasibility of these proposed nuclear reactors if realistic assumptions are made about future demand and the cost of various alternatives as I have discussed above.

Instead of forcing ratepayers to pay for PEF and FPL to sit in line, the time that recent developments afford the utilities and the Commission should be used to study the landscape and gather information, as opposed to plowing ahead and continuing to spend ratepayer funds on proposed reactors that increasingly look like bad decisions. Over the next few years the high degree of uncertainty regarding all of the key parameters that affect the decision may be sharply reduced:

- Market factors including demand growth after the recession and gas prices.
- Federal climate policy including targets and timing of emission reductions, efficiency and renewable mandates affecting the need for non-renewable generation, the existence, mechanism and level of a price on carbon, flexibility in the purchase of allowances.
- Regulatory uncertainty in the NRC design certification and reactor licensing
- Technology factors including the cost of nuclear, particularly, first of a kind v. later costs, and alternatives
- Financial pressures on the utility balance sheets may alleviate

The Commission can, and should, use this time to require the utilities to build and test models that reflect a broader view of least cost generation supply.

Ultimately, spending valuable ratepayer dollars in the near term to advance projects that are not feasible in the long-term is imprudent. The delays in projected online operation of these proposed reactors should provide a respite from these spending of funds until the utilities can demonstrate that completion of these proposed reactors is feasible in the long-term and that continuing to incur costs on the reactors is reasonable and prudent.

Q. Does this conclude your testimony?

A. Yes.

RISK FACTORS FACING CONSTRUCTION OF NEW NUCLEAR REACTORS

Category	Source	Specific Risks
Technology risk stems from the fact that the new generation of nuclear reactors are new and uncertain. Cost estimates have increased dramatically over the past five years, doubling or tripling. At the same time, the technologies of alternatives, efficiency and renewables are stable and well known. Costs are declining and availability is rising	New Technology Risk	First of a kind costs Long-lead time
	Alternative technologies	Efficiency potential identified Renewable cost declines
Policy risk stems for the fact that federal policy is in flux. While nuclear advocates have looked to climate policy, which may put a price tag on carbon emissions, as a primary driver of the opportunity to expand the role of nuclear power, they have failed to take account of the equally strong possibility that climate policy will create a very substantial mandate for conservation and renewables, which will dramatically shrink the need for new, nonrenewable generating capacity	Shifting focus	Emphasis on efficiency reduces need Emphasis on renewables reduces need
	Flexible GHG reductions	Lowers carbon cost
Regulatory risk stems from the chance that regulators will move slowly in approving reactors or authorizing their cost recovery. The new designs has proven challenging, with the reference designs going through dozens of revisions. Site-specific issues, which cannot be standardized, have proven contentious. While a few states have approved construction work in progress and other measures to ensure cost recovery, the vast majority has not.	NRC Regulatory Reviews	Lack of Experience Change of requirements Design flaws and revisions Site specific contentions
	Loan Guarantee Conditions	Taxpayer protections inhibit loans
	Rate Review	Recovery of costs challenged

Execution risk stems from the fact that these reactors are new and the industry does not have a great deal of capacity. Of the 20 projects that have applied for licenses at the Nuclear Regulatory Commission, eighteen have suffered from one or more of the following problems, delay, cancellation, cost escalation or financial downgrade.	Construction Risk	Lack of experience Counterparty risk
	EPC contract uncertainties	Cost escalation and volatility
	Size, cost and complexity	Cost overruns Delays
Marketplace risk on the demand-side flow from the current recession, the worst since the Great Depression, which has not only resulted in the largest drop in electricity demand since the 1970s, but also appears to have caused a fundamental shift in consumption patterns that will lower the long term growth rate of electricity demand dramatically. On the supply-side of the market, there are a host of alternatives that have lower cost to meet the need for electricity in a carbon-constrained environment and there is growing confidence in the cost and availability of alternatives.	Uncertain demand growth	Slowing due to recession Shifting due to debt and loss of wealth
	Uncertain fuel costs	Natural gas price decline
	Reactor Costs	Long lead time Cost overruns Rate shock reduces demand
Financial risk stems from all of the above risks and are magnified tight conditions in money markets and the fact that utility balance sheets are weak and too small to support the large size of nuclear reactor projects. The nature of the projects imposes additional financial risks, so much so that, for most utilities, the projects are so large that Moody's has called them "bet the farm" decisions.	General Conditions	Tight money New Liquidity requirements High-risk premiums
	Utility Finance	Increased nuclear operating exposure Existing debt and need to refinance Financial ratio deterioration Rising cost of debt Limited & declining cash & equivalents Weak balance sheets Underfunded pension plans
	Project Finance	High hurdle rate for risky projects Impact of large project Debt load and service burden impact Capital structure distortion

Source: Mark Cooper, *All Risk, No Reward* (Institute for Energy and the Environment, December 20009)

Unrealistic Assumptions Masking the Real Economics of Nuclear Reactors

Technology:

- **Assumption:** Nuclear cost projections were low, while the cost characteristics of alternatives were ignored. The contribution that alternatives (efficiency and renewables in particular) can make to meet the need for electricity was downplayed.
- **Reality:** Nuclear costs are much higher than originally claimed and remain highly uncertain. There is growing confidence in the cost and availability of alternatives that makes them more attractive.

Policy:

- **Assumption:** Public policy would put a high price on carbon and escalate the demand for nuclear because alternatives (especially efficiency and renewables) would not also be promoted by public policy.
- **Reality:** Efficiency/renewable standards are likely to play a large part in climate policy. This makes alternatives more attractive. Reliance on efficiency, international offsets, and other policies that provide flexibility in meeting greenhouse gas abatement goals lowers the cost of carbon.

Regulatory:

- **Assumption:** The standardized designs would lead to rapid approval of licenses and work authorizations. Loan guarantees would flow with little scrutiny and oversight.
- **Reality:** The standard designs have proven not to be so standard, with dozens of revisions forwarded to the Nuclear Regulatory Commission for evaluation. Site-specific issues cannot be standardized and they remain the object of important contentions.

Execution:

- **Assumption:** Standardized design and accelerated certification would enable utilities to quickly move into the construction phase. Low estimates of the cost of nuclear reactors would lead to rapid regulatory approval and support at the state level.
- **Reality:** Standardized designs have gone through numerous revisions. Site approvals remain contentious. Approval of loans has required more time and information than anticipated. Technological uncertainty raises prospects of cost overruns. First of a kind costs and lack of standard design raises construction risk and construction has not begun in the U.S., while projects abroad have encountered difficulties. Operating risks of new designs are unknown and foreign activities to not resolve these concerns.

Marketplace:

- **Assumption:** Demand growth and commodity prices for fossil fuels would remain high.
- **Reality:** Declining demand as a result of the "Great Recession" reduces need for large quantity of new generation. Falling price of natural gas makes natural gas more attractive. Growing confidence in lower cost alternatives makes them more attractive.

Finance

- **Assumption:** Financing would be readily available.
- **Reality:** Tight Financial markets make finance more difficult generally. The large size of the project relative to the balance sheets of utilities and the increasing concern about nuclear reactors makes capital market finance more expensive and difficult, if not impossible.

Source: Mark Cooper, *All Risk, No Reward* (Institute for Energy and the Environment, December 20009)

INCREASING RISKS FACING NUCLEAR REACTOR CONSTRUCTION PROJECTS

Cooper Category	Areas of concern (p. 11)	Negative impact on nuclear build
Regulatory:	Federal licensing and permitting	NRC slippage (pp. 8-11)
	State: DSM	Lower demand (p. 24)
Policy:	Federal	Failure to decide environmental policy (p. 31) Yucca Mtn. waste (p.37) EPA under Clean Air Act (p. 32)
	State	Legislative opposition to nuclear (p. 27) RPS standards (p. 30)
Technology	Capital intensity	Fixed, sunk costs (p. 15)
Marketplace:	Load growth,	Recession slowdown (p. 13
	Consumer pocketbooks	Inability to pay (p.12)
Financial:	Capital market reactions	Fewer internal funds (p. 13)
		Negative ratings (pp. 15-19)

Source: Page References to Direct **Testimony of Jeff Lyash, Docket No. 100009, April 30, 2010**

NEGATIVE EVENTS IN THE NUCLEAR RENAISSANCE

Month	Event
Jan-08	MidAmerican cancels proposed Idaho reactor (1)
Feb-08	NRC suspends application for *South Texas Project* reactors because application is incomplete (NRG has since reapplied) (2)
Feb-08	Florida Power and Light revises cost estimates for *Turkey Point* reactors from around $8 billion to $24 billion (3)
Mar-08	Progress Energy triples cost estimates for *Levy County* reactors to $17 billion (4)
Aug-08	Constellation increases cost estimates for *Calvert Cliffs* reactors from $2 billion to $9.6 billion (5)
Oct-08	Progress Energy increases cost estimates for *Shearon Harris* reactors from $4.4 billion to $9.3 billion (6)
Nov-08	Duke Energy increases cost estimates for *William States Lee* reactors from $5 billion to around $11 billion (7)
Dec-08	TVA increases cost estimates for *Bellefonte* reactors from $6.4 billion to $10.4 billion (8)
Mar-09	Entergy suspends application for *River Bend* reactor in Louisiana (9)
Mar-09	Entergy suspends application for *Grand Gulf* reactor in Mississippi (10)
Apr-09	AmerenUE cancels proposed *Callaway* reactor (11)
May-09	Exelon cancels two proposed *Victoria County* reactors (Has since reapplied for an Early Site Permit) (12)
May-09	Progress Energy in Florida announces at least a 20-month delay on planned reactors at *Levy County* (13)
May-09	PPL's cost estimates for one reactor at *Bell Bend* skyrockets from $4 billion to $13-15 billion (14)
May-09	Moody's downgrades PPL to negative outlook over proposed reactor at *Bell Bend* (15)
Jul-09	Moody's and Fitch downgrade SCE&G due to proposed *VC Summer* reactors (16)
Aug-09	TVA cancels three proposed reactors at *Bellefonte* site (17)
Aug-09	Constellation delays NRC's review of *Nine Mile Point* application to September 2010, a one-year delay (18)
Aug-09	NRC delays the scheduled publication of the final environmental review for Constellation's *Calvert Cliffs* in Maryland to February 2011, a delay of 13 months (19)
Aug-09	TVA delays proposed *Bellefonte* reactor from 2016 to 2020-2022 (20)
Sep-09	AP-1000 design in 17th revision; NRC announces more problems that will likely delay AP-1000 designs like *Shearon-Harris, Lee,* and *Vogtle* reactors
Sep-09	Duke delays *William States Lee* reactors from 2016 to 2021 (21)
Sep-09	Moody's gives negative credit rating to Oglethorpe over planned investment in *Vogtle* reactors (22)

Oct-09 NRC identifies significant safety issues with AP-1000 shield design, potentially signaling delays with over half of the proposed reactors in the US (23)

Oct-09 New cost estimates for *South Texas Project* reactors go up $4 billion, a 30% increase (24)

Nov-09 Fitch downgrades SCANA over risks posed by SCE&G's two nuclear reactors at *VC Summer* (25)

Nov-09 Areva announces plans to modify EPR reactor design at the request of safety bodies in the UK, France, and Finland (26)

Dec-09 Unistar asks NRC to suspend application for *Nine Mile Point 3* reactor (27)

Jan-10 FP&L announces that they'll suspend plans for *Turkey Point* reactors based on decision of Florida PSC to reduce proposed rate hike from $1.26 billion to $75.5 million (28)

Jan-10 Progress Energy announces that they'll slow the *Levy County* process based on the same Florida PSC decision, in which they got none of a $500 million rate hike request (29)

Jan-10 Fitch puts FP&L (*Turkey Point* reactors) on ratings watch 'Negative' after decision by Florida PSC to not provide CWIP (30)

Feb-10 Progress Energy extends delay on *Levy County* reactors to at least 36 months. (31)

Feb-10 Toshiba/Westinghouse indicate that regulatory problems will in Florida (*Turkey Point* and *Levy County*) for up to 3 years. (32)

Mar-10 FP&L announces delay of *Turkey Point* reactors past 2018, signals interest in federal loan guarantees. (33)

Apr-10 Moody's downgrades FP&L from low to moderate risk over *Turkey Point* reactors. (34)

Apr-10 NRC states that design-review certification of US-APWR will take at least an additional six months, shifting deadlines well into 2011. (35)

May-10 Cost estimates move from $17.2 billion for the two reactors to $22.5 billion for *Levy County* reactors. (36)

May-10 Fitch downgrades Progress Energy (*Levy County* and *Shearon Harris* reactors) to just above junk bond status. (37)

May-10 TVA opts to go with old Babcock and Wilcox design for single reactor at *Bellefonte*, citing untested status of new designs. (38)

May-10 The timeline for the two *Levy County* reactors has been pushed back again, with the first due in 2021, the second some 18 months later. The original timeline had the reactors set to come online in 2016 and 2018 respectively. (39)

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4- http://www.tampabay.com/news/business/energy/article414393.ece
5- http://www.nirs.org/factsheets/mdatwhatcostfactsheet.pdf
6- http://www.wral.com/news/news_briefs/story/3759561/
7- http://www.world-nuclear-news.org/NN-Duke_raises_cost_estimate_for_Lee_plant-0711084.html
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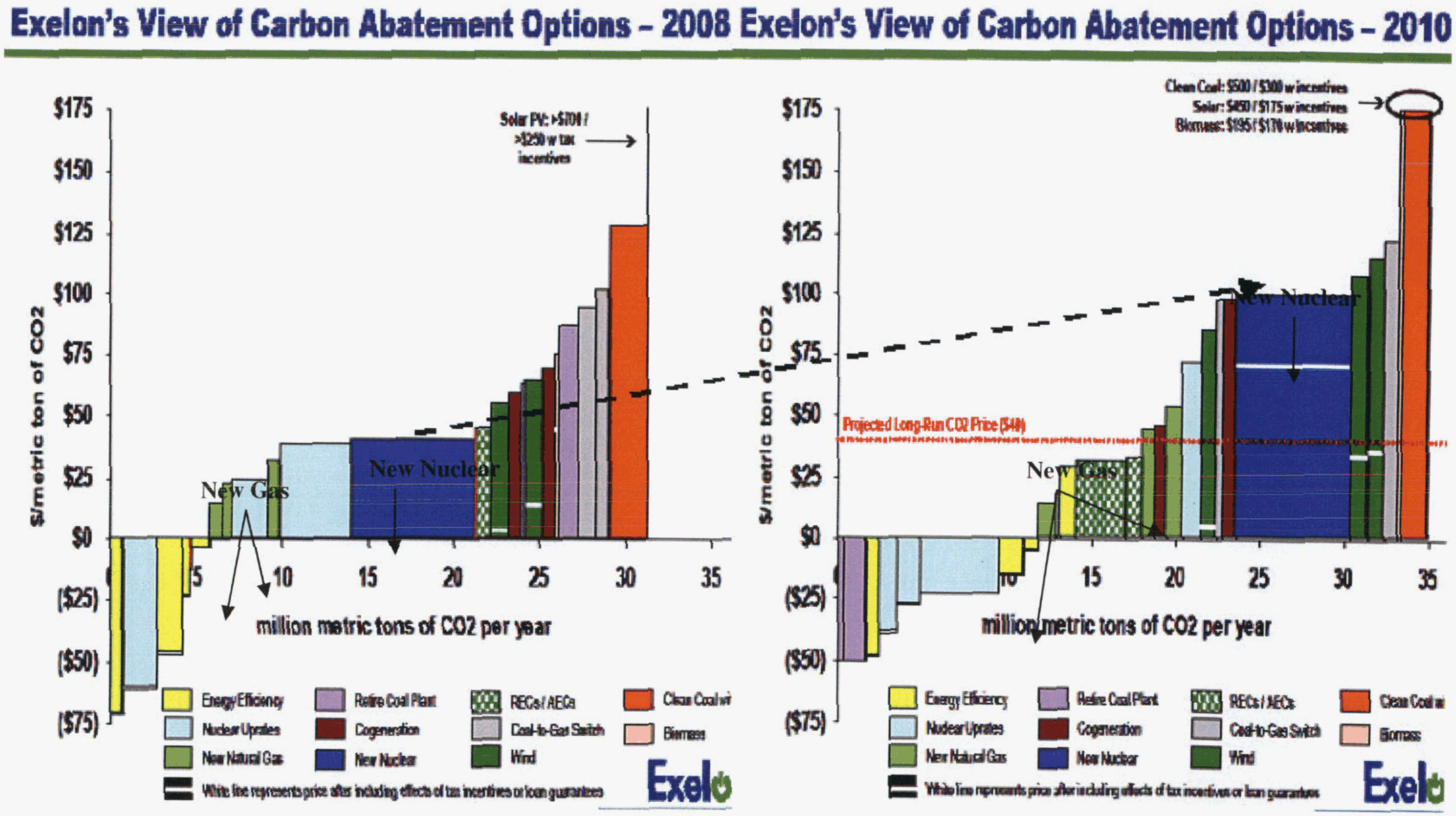
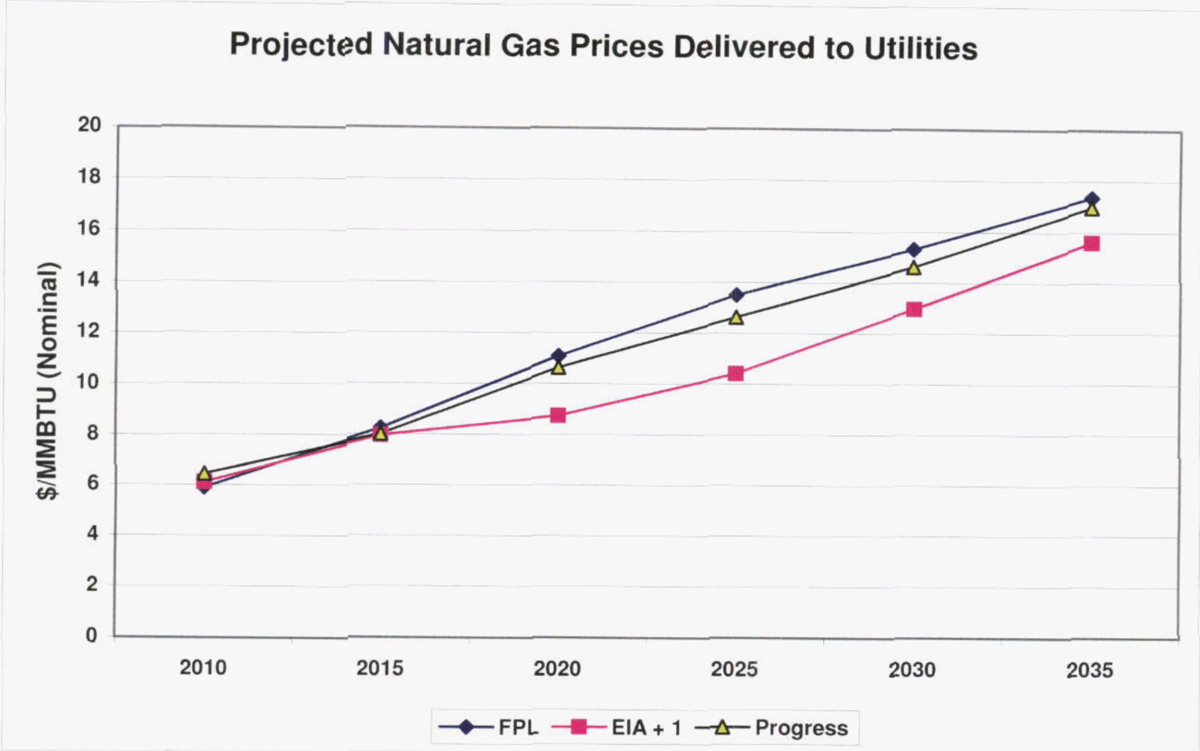
EXELON'S VIEW OF THE DETERIORATING NUCLEAR AS A CARBON ABATEMENT OPTION



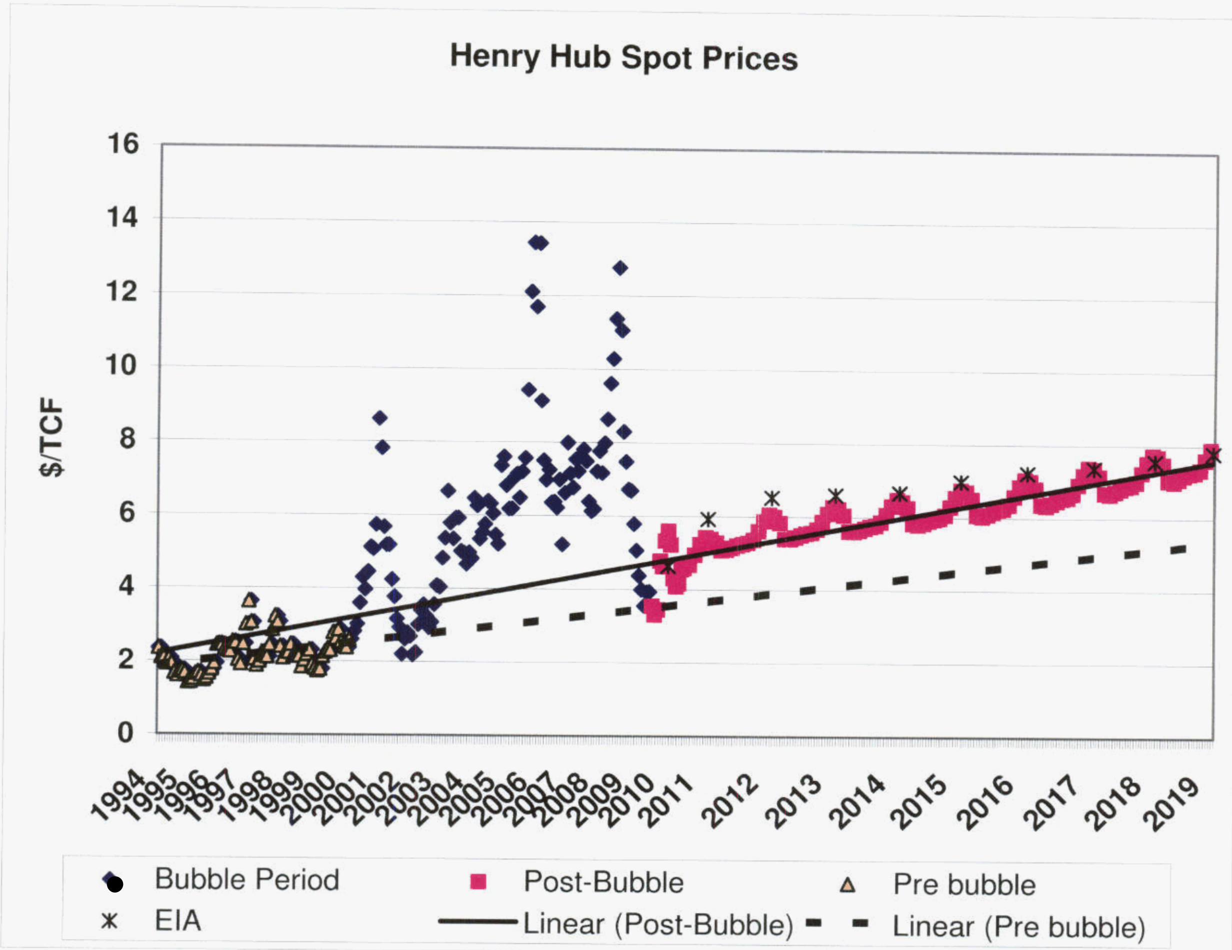
Source: John W. Rowe, *Fixing the Carbon Problem without Breaking the Economy,* Resources for the Future Leadership Forum Lunch, May 12, 2010

PROJECTED NATURAL GAS PRICES COMPARED TO EIA PROJECTIONS



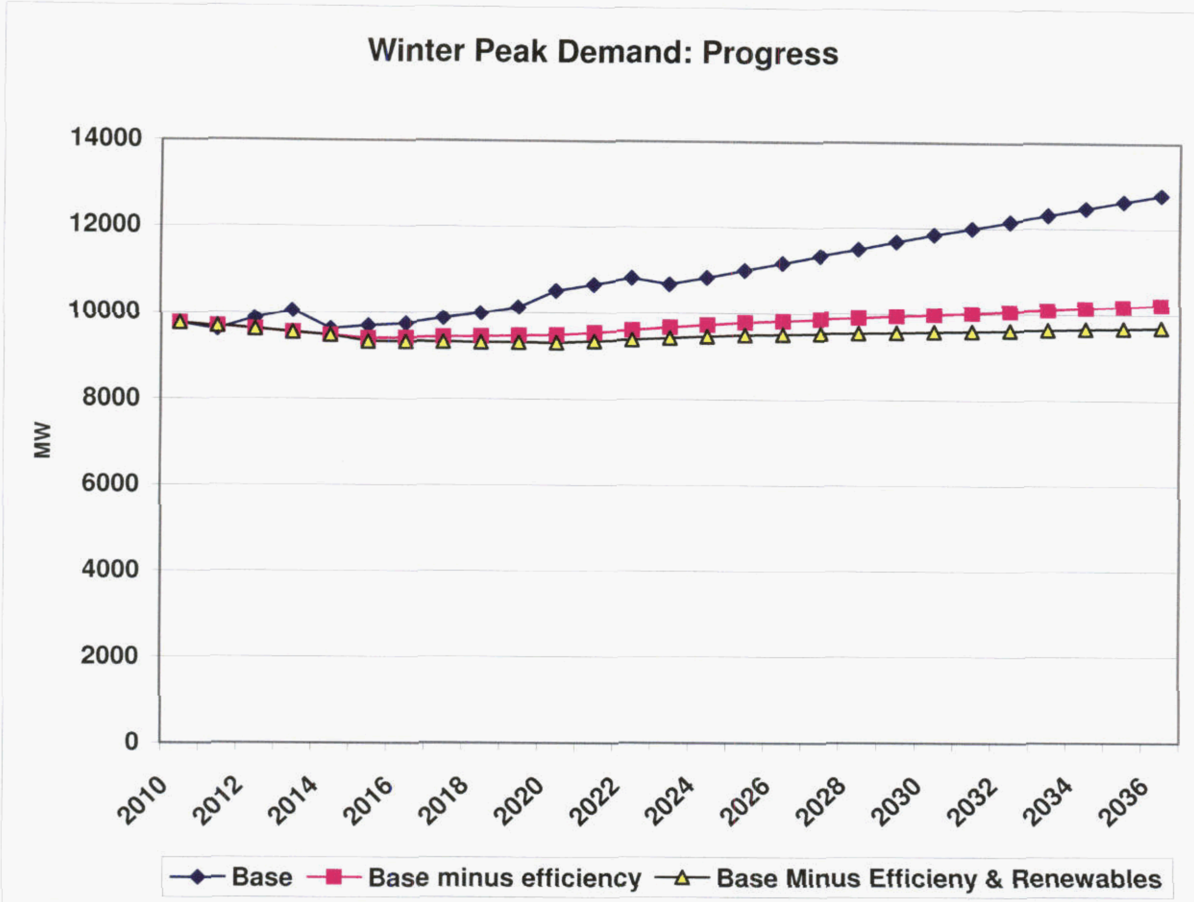
Source: FPL, Sims SRS-2, p. 1-of-1; PEF: Lyash, JL-3, p. 4 of 12. EIA, Annual Energy Outlook, Table 13. *http://www.eia.gov/oiaf/forecasting.html*

THE DECADE OF VOLATILE NATURAL GAS PRICES MAY HAVE BEEN THE EXCEPTION, NOT THE RULE



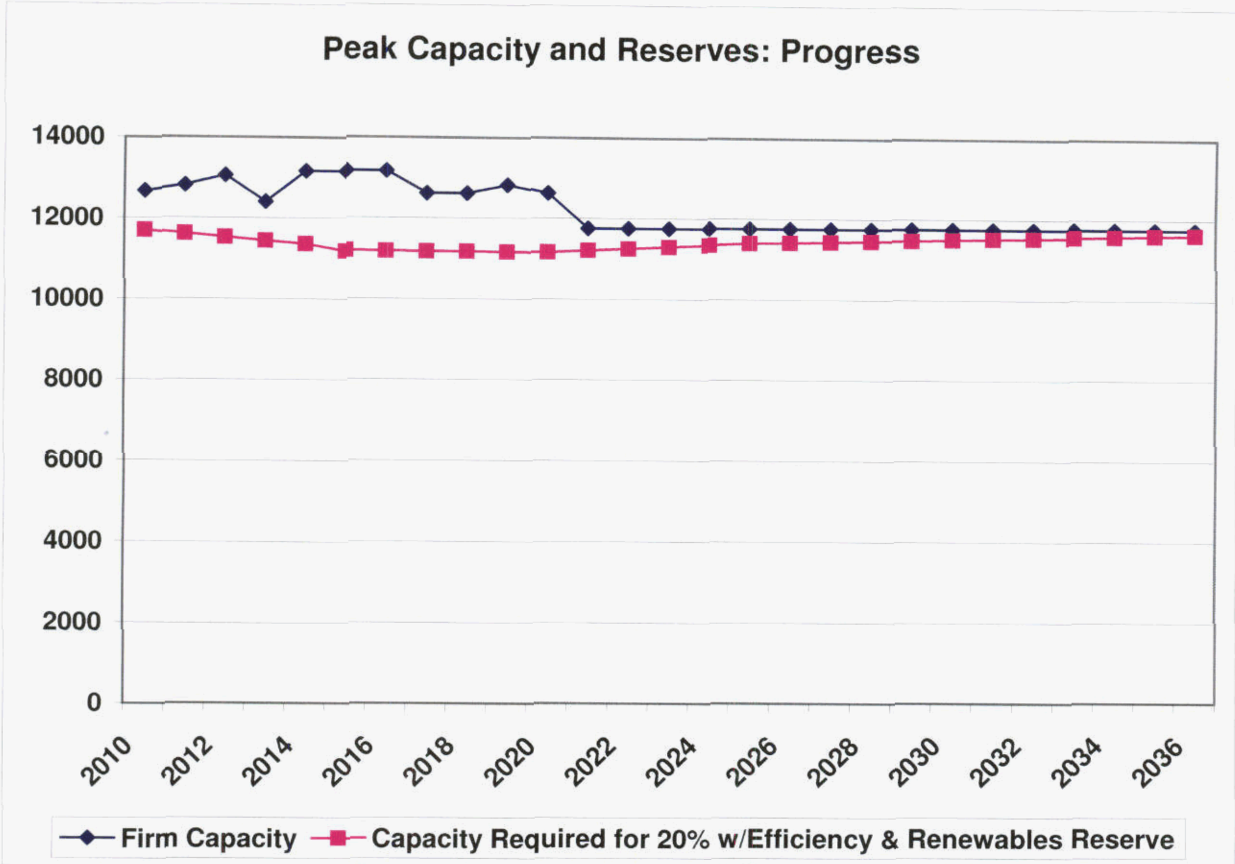
Source: Pre-bubble, Energy information Administration http://www.eia.gov/dnav/ng/ng_pri_fut_s1_d.htm; Post-bubble, NYMEX visited 6/30/10.

DECLINING PEAK LOAD PROJECTIONS



Source: Progress Energy Florida: Levy Nuclear Project NCRC, Updated Life-Cycle Net Present Worth (CPVRR) Assessment, p. 10; efficiency and renewables based on Environmental Protection Agency, *Supplemental EPA Analysis of the American Clean Energy and Security Act of 2009, January 29, 2010,* p. 38.

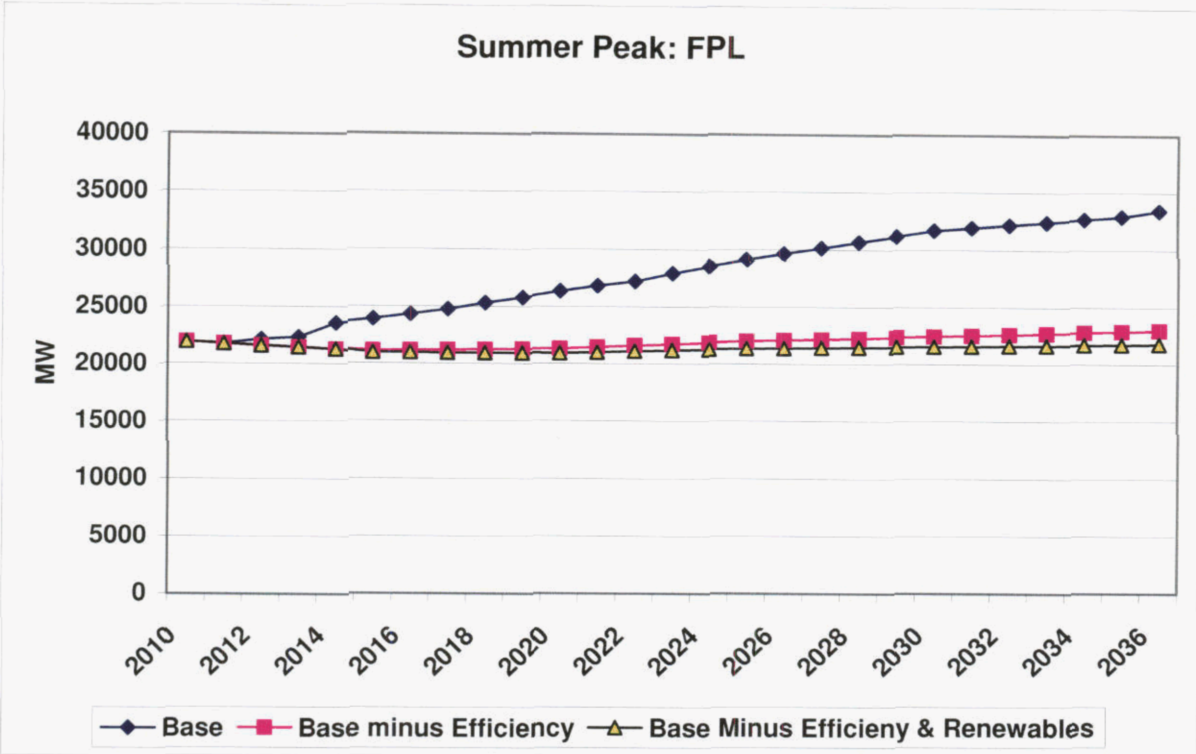
DECLINING PEAK LOAD AND CAPACITY NEEDS



Source: Progress Energy Florida: Levy Nuclear Project NCRC, Updated Life-Cycle Net Present Worth (CPVRR) Assessment, p. 10; efficiency and renewables based on Environmental Protection Agency, *Supplemental EPA Analysis of the American Clean Energy and Security Act of 2009, January 29, 2010,* p. 38.

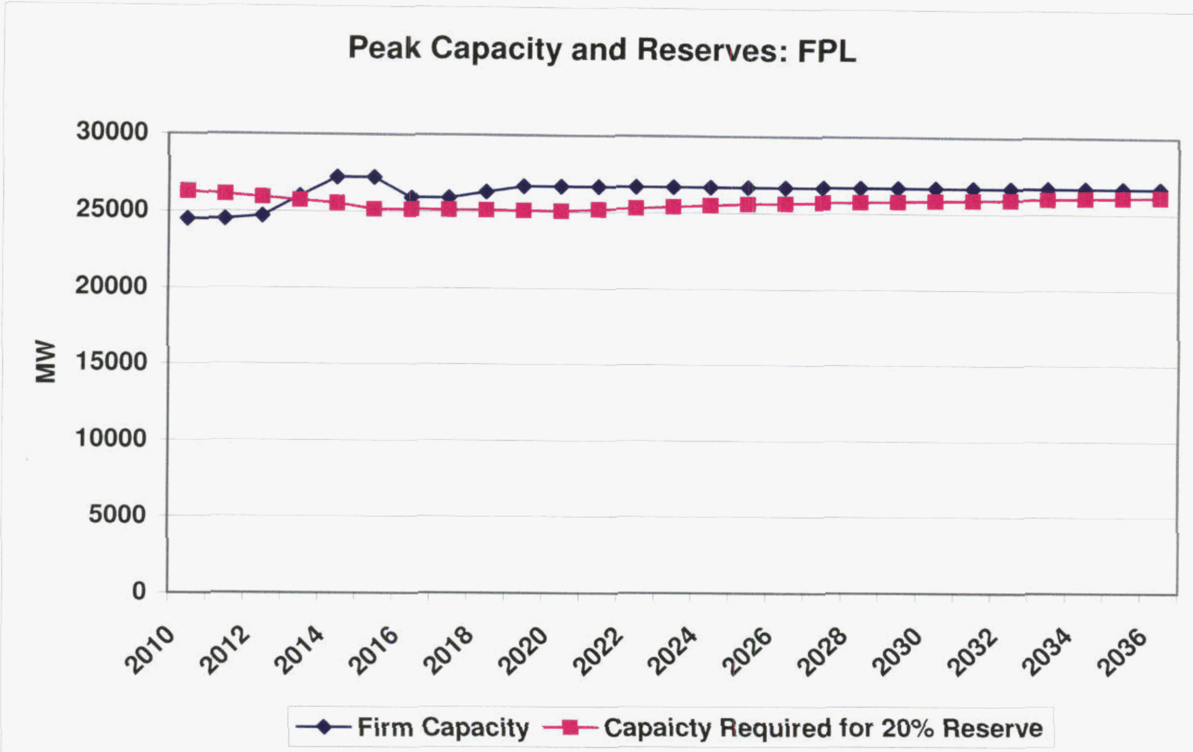
Docket No. 100009-EI
Exhibit MNC-10
Page 1 of 1

DECLINING PEAK LOAD PROJECTIONS



Source: Testimony of Steven R. Sim, Docket No. 100009-EI, SRS-4, efficiency and renewables based on Environmental Protection Agency, *Supplemental EPA Analysis of the American Clean Energy and Security Act of 2009, January 29, 2010,* p. 38.

DECLINING PEAK LOAD AND CAPACITY REQUIREMENTS



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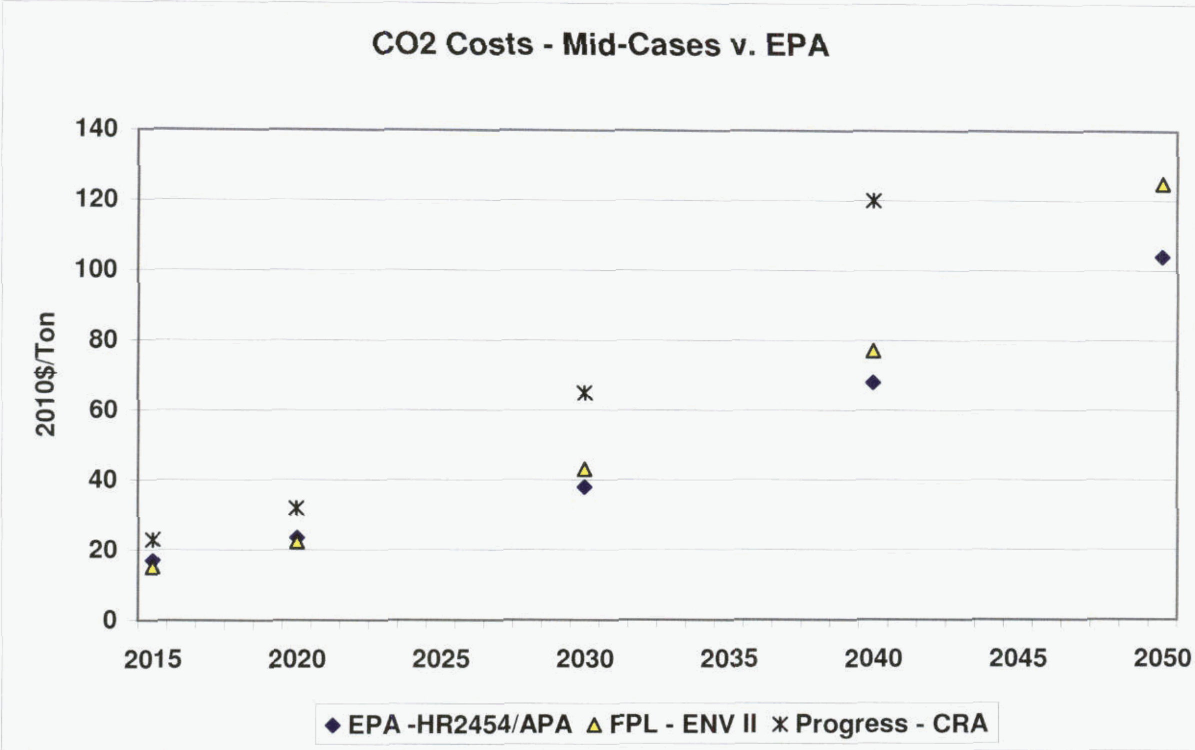
Page 1 of 1

PROJECTIONS OF CARBON COMPLIANCE COSTS



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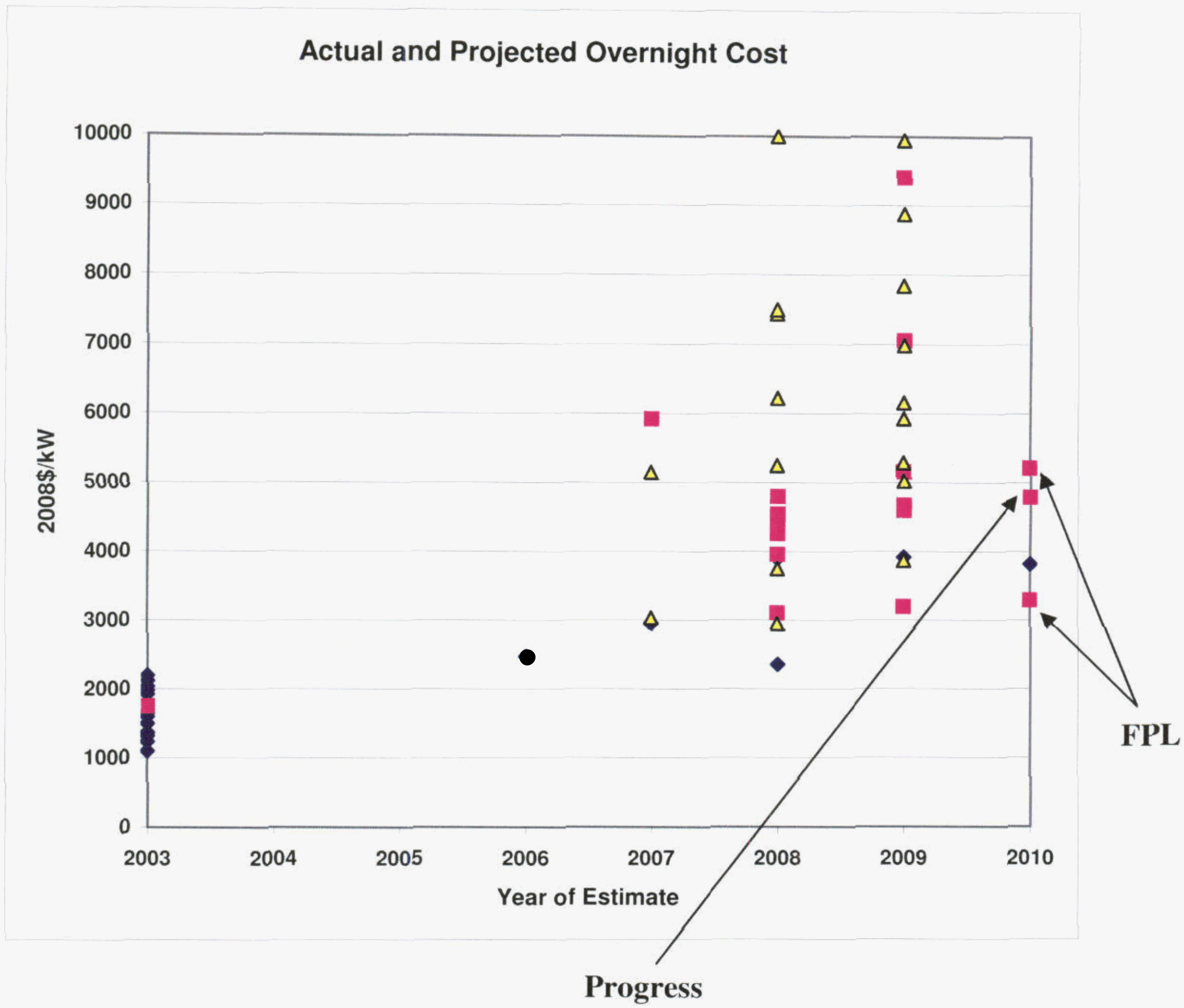
PROJECTIONS OF OVERNIGHT CONSTRUCTION COSTS



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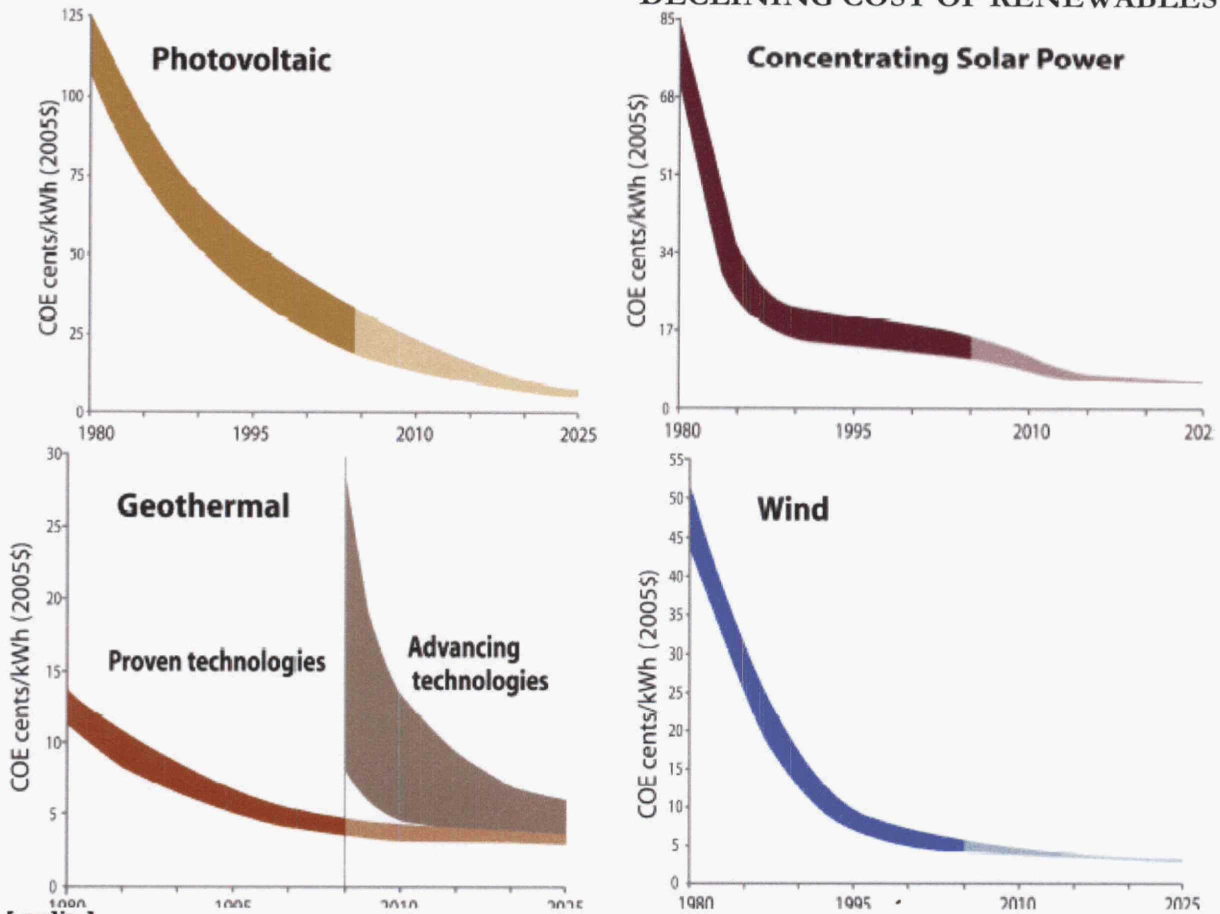
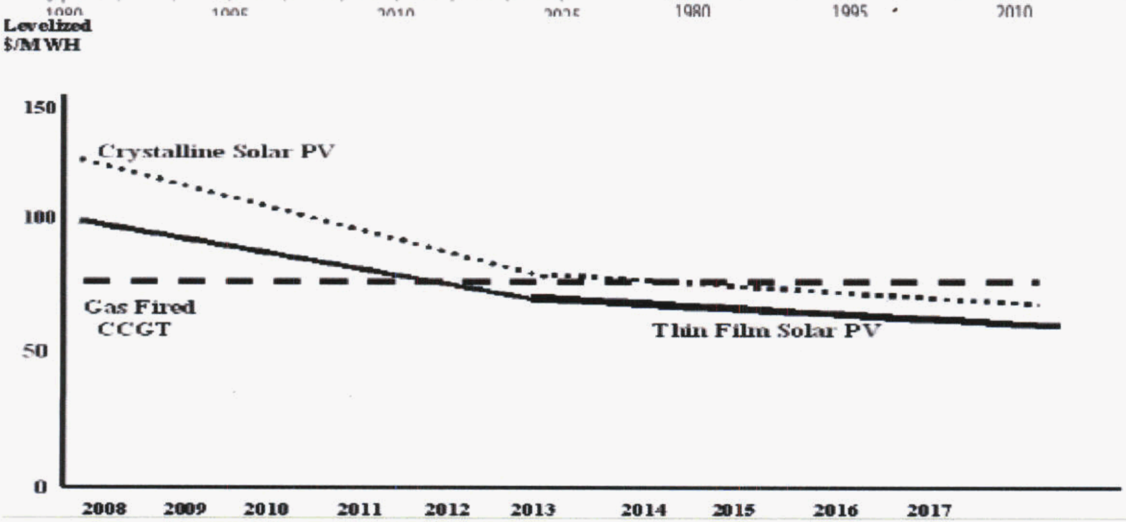
Progress Energy Florida: Levy Nuclear Project NCRC, Updated Life-Cycle Net Present Worth (CPVRR) Assessment, p. 3

Testimony of Steven R. Sim, Docket No. 100009-EI, SRS-5

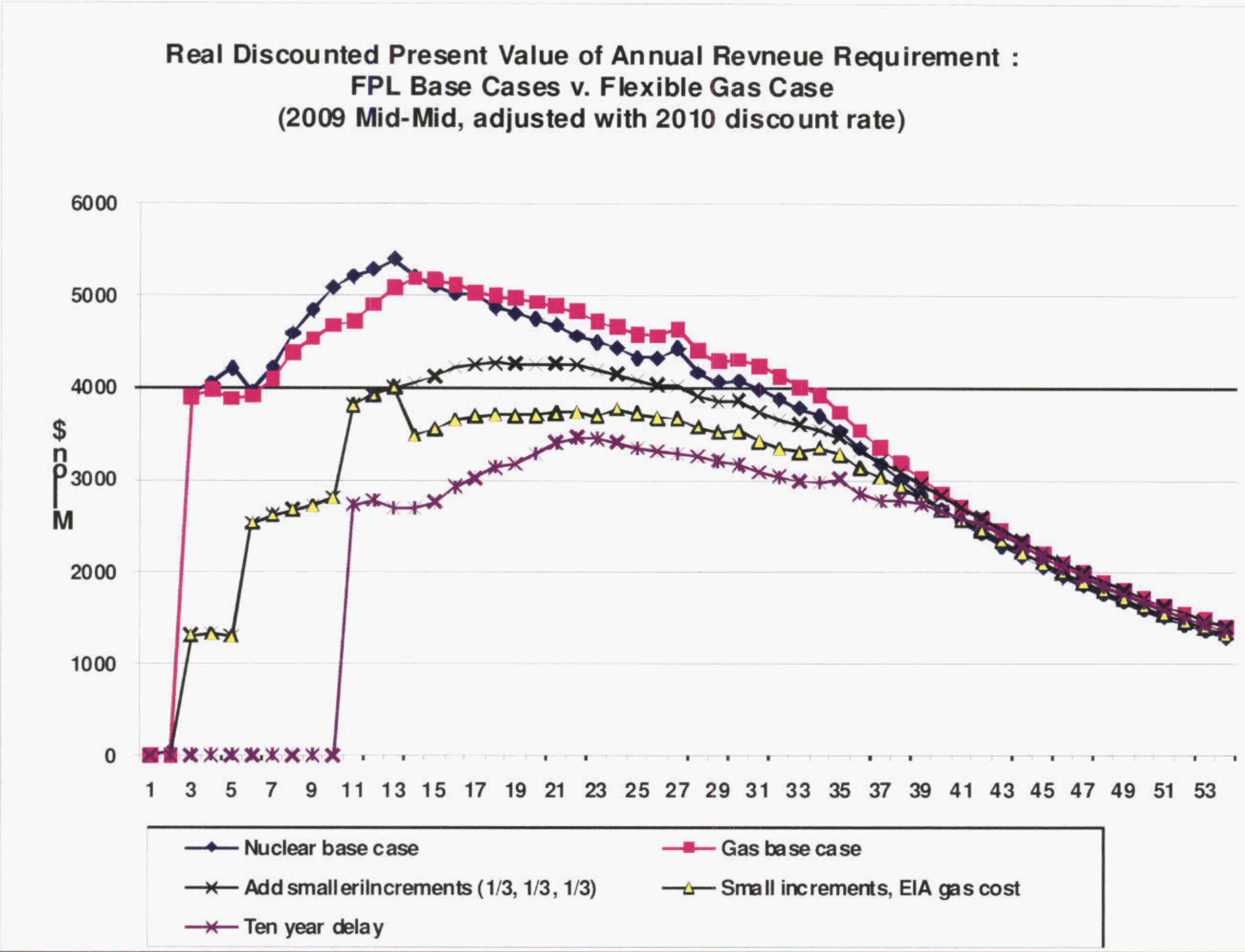
DECLINING COST OF RENEWABLES





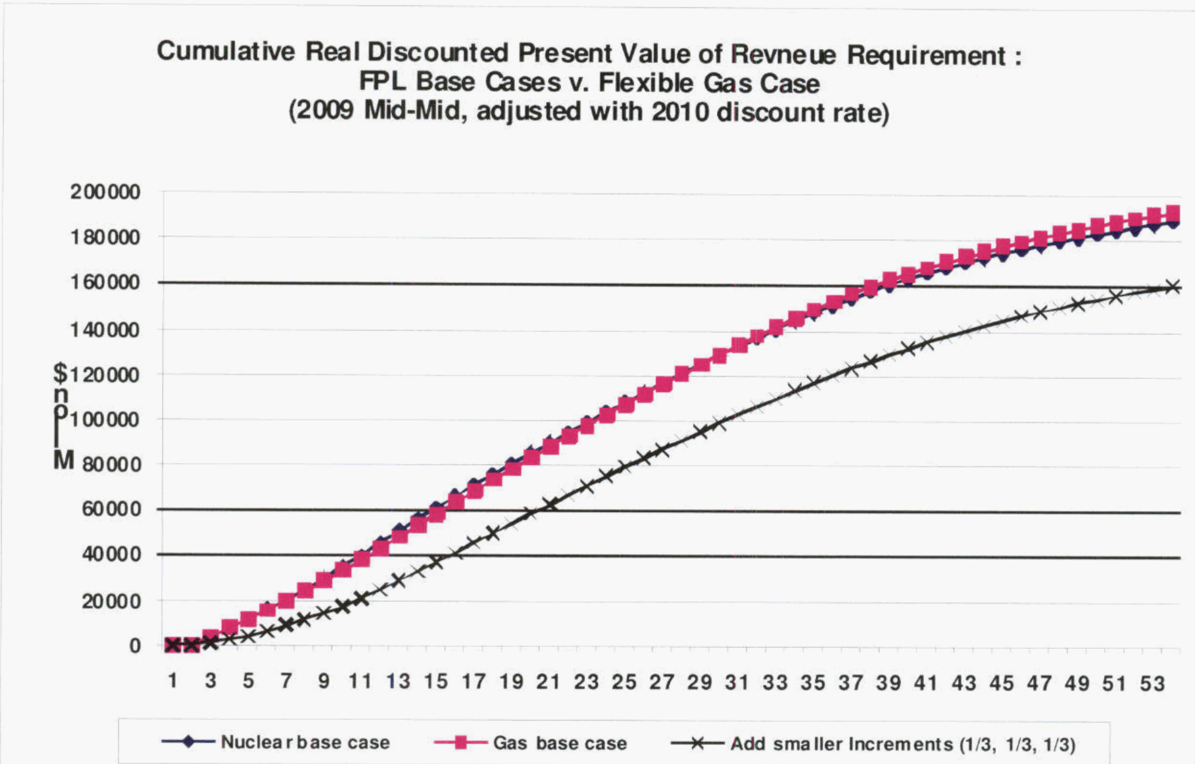
Source: National Renewable Energy Laboratory, *Renewable Energy Cost Curves,* 2005; Lazard, 2008, *Levelized Cost of Energy Analysis—Version 2.0*, June 2008.

FLEXIBLE GAS ADDITIONS LOWER REVENUE REQUIREMENTS



Source: Florida Power & Light, *Response to Staff's Second Set of Interrogatories, Interrogatory No. 64, p. 7.*

CUMULATIVE COST DIFFERENCE: FLEXIBLE V. LUMPY TREATMENT OF NATURAL GAS GENERATION ADDITIONS



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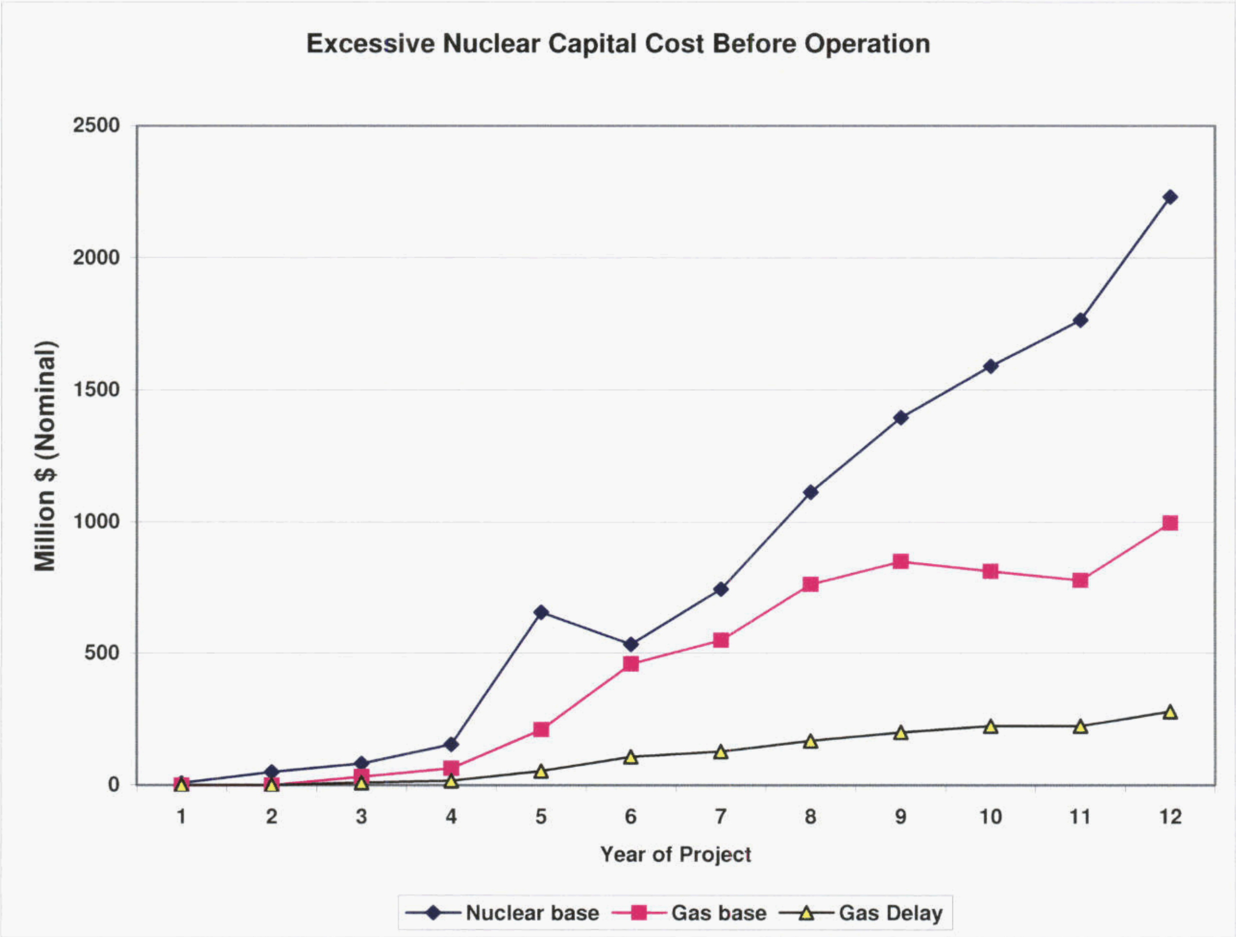
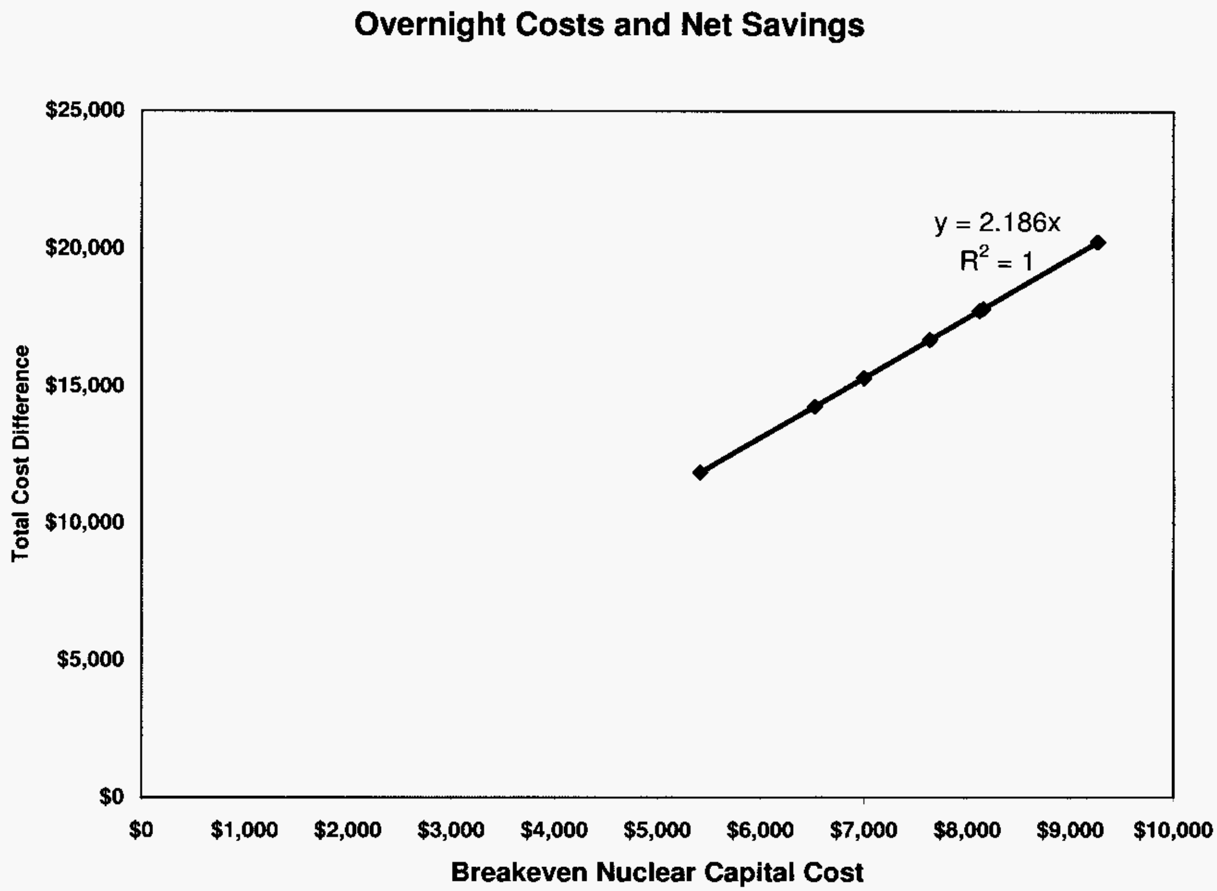
NUCLEAR CONSTRUCTION PRESSURES CAPITAL REQUIREMENTS



Source: Florida Power & Light, ***Response to Staff's Second Set of Interrogatories, Interrogatory No. 64, p. 7***

OVERNIGHT COSTS AS A RPPREDICTOR OF NET SAVINGS: FPL



Source: Testimony of Steven R. Sim, Docket No. 100009-EI, SRS-10.

THE RISK OF NUCLEAR REACTORS IN THE EYES OF INDSUTRY ANALYSTS

EXCERPTED FROM

ALL RISK, NO REWARD FOR TAXPAYERS AND RATEPAYERS

THE ECONOMICS OF SUBSIDIZING THE 'NUCLEAR RENAISSANCE' WITH LOAN GUARANTEES AND CONSTRUCTION WORK IN PROGRESS

Mark Cooper
Senior Fellow for Economic Analysis
Institute for Energy and the Environment
Vermont Law School

November 2009

III. The Risk of Nuclear Reactors in the Eyes of Industry Analysts

The following discussion demonstrates the basis of the framework for risk analysis laid out in the previous section by reviewing recent analyses of the challenge of constructing new nuclear reactors conducted by Wall Street firms[15] and industry consultants.[16]

A. Moody's

Moody's has issued two special comments on new nuclear generating capacity that underscore the challenges that these huge projects face. In the initial comment in May 2008, after discussing the many challenges to building nuclear reactors, Moody's expressed the hope that utilities contemplating building reactors would take steps to prepare their balance sheets for the impact of these large projects.

> Given these long-term risks, a utility's approach to its overall corporate finance policies becomes a critical factor in the overall credit profile assessment during the construction period. In general, Moody's incorporates a view that a utility company would prepare for the higher risk profile associated with construction by maintaining, or strengthening further, its strong balance sheet as well as maintaining robust levels of available liquidity capacity. This is a critical assumption since our preliminary analysis leads us to conclude that financial credit metrics will deteriorate meaningfully without the introduction of significant mitigating factors and/or other structural provisions.[17]

A year later, in June 2009, Moody's took a much dimmer view of the prospects for building nuclear reactors. While Moody's identifies the developments in the project and regulatory areas that are positives for nuclear reactor construction, it still concludes that the

[15] Moody's *Nuclear Generating Capacity: Potential Credit Implications for U.S. Investor Owned Utilities,* May 2008; Moody's June 2009; Dimitri Mikas, "Financing New Nuclear Construction & Implications for Credit Quality," *Is there a Nuclear Renaissance,* p. 20; Standard & Poor's, May 28, 2009; Standard & Poor's, *Utilities Make Some Progress on New Nuclear Power, But Hurdles Still Linger,* March 9, 2009; Standard & Poor's, *For New U.S. Nuclear Power Plants, Liquidity Requirement Could be Substantial,* October 21, 2008; Standard & Poor's, *As Nuclear Power Renaissance Gains a Foothold in U.S., A Host of Details Needs Sorting Out,* March 7, 2008.

[16] Stephen Maloney, *Financial Issues Confronting Nuclear Construction,* Carnegie Endowment for International Peace, November 13, 2008; Stephen Maloney, *Nuclear Power Economics and Risk,* Council on Foreign Relations, July 10, 2009; Edward Kee, *First Wave or Second Wave? It is time for US nuclear power plant projects with a first wave build strategy to consider moving to the second wave,* NERA, July 24, 2009.

[17] Moody's, May 2008, p. 3.

negatives are a great concern and declares that it "is considering taking a more negative view for those issuers seeking to build new nuclear power plants"[18] because "we view nuclear

generation plans as a "bet the farm" endeavor for most companies, due to the size of the investment and length of time needed to build a nuclear power facility."[19] The change in attitude stemmed in part from deteriorating financial market conditions and the failure of the utilities contemplating building reactors to strengthen their financial positions.

> Credit conditions are yet another question. Few, if any of the issuers aspiring to build new nuclear power have meaningfully strengthened their balance sheets, and for several companies, key financial credit ratios have actually declined. Moreover, recent broad market turmoil calls into question whether new liquidity is even available to support such capital-intensive projects.[20]

In both documents, Moody's identifies the cause and implications of these risks. The May 2008 document identified several sources of risk. The financial risks of the project are sharply increased by the execution risk, which is compounded by technology, marketplace and regulatory risks.

> The complexity and long-term construction horizon associated with building new nuclear plant expose a utility to "material adverse change" conditions related to political, regulatory, economic and commodity price environments, as well as technology developments associated with supply and demand alternatives. These long-term risks expose a utility to back-end regulatory disallowance risk or other potential market intervention or restructuring initiatives by elected officials.[21]

The June 2009 Moody's document reiterated these concerns.[22] The inherent nature of these projects continues to be a challenge and creates marketplace and technological risk. Notwithstanding the fact that public policy has created favorable conditions for reactor construction in some aspects of regulation, there are other aspects that pose continued risk in

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[18] Moody's, June 2009, p. 1.
[19] Moody's, June 2009, p. 4.
[20] Moody's June 2009, p. 2.
[21] Moody's May 2008, p. 5.
[22] Moody's June 2009, p. 5.

both execution risk and regulatory risk.[23] Policy risk has increased due to the orientation of climate change policy toward promoting alternatives.

> Less clear today is the effect that energy efficiency programs and national renewable standards might have on the demand for new nuclear generation. National energy policy has also begun eyeing lower carbon emissions as a key desire for energy production—theoretically a huge benefit for new nuclear generation—but the price tags associated with these development efforts are daunting, especially in light of today's economic turmoil. It isn't clear what effect such shifts, or changes in technology, will have for new nuclear power facilities.[24]

Moody's continues to see execution risk in these projects and points to the history of the financial difficulties that utilities building reactors had in the 1970s and 1980s as instructive for evaluating current projects.

> Moody's is considering applying a more negative view for issuers that are actively pursuing new nuclear generation. History gives us reason to be concerned about possible significant balance-sheet challenges, the lack of tangible efforts today to defend the existing ratings, and the substantial execution risk involved in building new nuclear power facilities.[25]

One of the sources of this concern about the execution risk is the failure of those proposing to build new reactors to provide the detailed information that would be associated with a well-thought out investment of this size.

> We remain concerned over the absence of details regarding key elements associated with the decision process to proceed with a project of this scale.

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[23] Moody's June 2009, p. 7.
The sheer size, cost and complexity of new nuclear construction projects will increase a utility's or power company's business and operating risk profile, leading to downward rating pressure. The length of a nuclear construction effort also entails lengthy regulatory reviews and potential delays in recovering investments, changing market conditions, shifting political and policy agendas, and technological developments on both the supply and demand side.

[24] Moody's June 2009, p. 2.
While a constructive regulatory relationship will help mitigate near-term credit pressures, we will remain on guard for potential construction delays and cost overruns that could lead to future rate shock and/or disallowances of cost recovery. Given the lengthy construction time needed for nuclear projects, there is no guarantee that tomorrow's regulatory, political, or fuel environments will be as supportive to nuclear power as today's.

[25] Moody's June 2009, p. 2.

> Information is needed regarding the all-in construction costs and break-down of those costs; the construction timeline and schedule; the Engineering, Procurement and Construction (EPC) contractual arrangements and the allocation of fixed versus variable costs within those arrangements; the financing structure, expected sources of financing and pro-forma capitalization; and, the ultimate impact on consumer rates.[26]

The result of these market, regulatory and technological uncertainties and risks is to create financial pressure on projects, pressures that are reflected by project specific concerns and the general turmoil in the credit markets.

> Given these long-term risks, a company's financial policy becomes especially critical to its overall credit profile during construction. In general, we believe a company should prepare for the higher risk associated with construction by maintaining, if not strengthening, its balance sheet, and by maintaining robust levels of available liquidity capacity.[27]

B. STANDARD & POOR'S

Moody's is not the only credit rating agency to recognize the challenges facing nuclear reactors. Even at a promotional conference, a Standard & Poor's executive noted that "challenges for the industry participants abound."[28] While recognizing that there are positive aspects of the current environment, as Moody's did, Standard & Poor's identifies more aspects of the current situation that are negative. Interestingly, even with a loan guarantee, Standard & Poor's sees significant financial issues as described in Figure III-1.

[26] Moody's May 2008, p. 2.
[27] Moody's June 2009, p. 5.
[28] Dimitri Mikas, "Financing New Nuclear Construction & Implications for Credit Quality," *Is there a Nuclear Renaissance,* p. 20, Standard & Poor's, May 28, 2009.

Figure III-1: Standard & Poor's Credit Profile Considerations

Business risk profile	
New Technology Risk	↑
Construction Risk	↑
How much risk is mitigated by EPC contract?	↑↓
Nuclear operating exposure will increase	↑
Regulatory framework for recovery of investment	↑
Financial risk Profile	
Debt imputation: 25% for projects vs. 50% for regulated utilities	↑
Even with DOE guarantee, debt loads can increase significantly	↑
80/20 vs. 60/40 capital structure	↑
Despite DOE guarantee, debt service will be fully accounted for	↑
Ability to recover cash return on work in progress	↓

Source: Dimitri Mikas, "Financing New Nuclear Construction & Implications for Credit Quality," *Is there a Nuclear Renaissance,* p. 20, Standard & Poor's, May 28, 2009. Arrows point in the direction of the impact on risk.

Standard & Poor's remains more positive on nuclear reactors than Moody's, although it is quite clear that the subsidies from taxpayers and ratepayers are the key to the financing of these projects. In a March 2009 analysis entitled *Utilities Make Some Progress on New Nuclear Power, But Hurdles Still Linger,* the table of contents tells the story:

Support for New Construction Varies from State to State

The Licensing Process and Framework Remain Untested

The DOE's Loan Guarantees Figure in Several Financing Approaches

For Credit Risk, Balance-Sheet Size is Important

Recession and Falling Energy Prices Can Alter Perspectives

The Need for Construction Contracts that Can Help Limit Exposure[29]

This list includes two positive factors, which relate to the taxpayer (Department of Energy loan guarantees) and ratepayer (construction work in progress) funding of the reactors. Four of the six factors listed are sources of concern: regulatory risk (uncertain licensing), financial risk (credit and balance sheet), marketplace risk (recession and energy prices) and execution risk (construction contracts).

Standard & Poor's points out that the approach taken to support projects in the southeastern U.S. goes well beyond turning ratepayers into investors; it takes all of the risk off of the utilities by

- Allowing utilities to receive pre-approval for construction costs and schedules;
- Providing for periodic review to ensure compliance with schedules and budgets;
- Allowing for recovery of a cash return on "construction work in progress" costs for both equity and debt components;
- Preventing future regulatory commissions from reviewing the prudence of previously approved capital spending; and
- Allowing for recovery of abandoned investment and providing for inclusion of the completed plant in the "rate base" (the value of property on which a utility can earn a regulatory-specified rate of return) without a major rate case filing with the regulator.[30]

Ironically, the efforts of the Department of Energy (DOE) to impose conditions on guaranteed loans that would help to mitigate the risk to the Treasury and protect the taxpayer in the event of defaults on the loan – i.e. a first lien for the Treasury and cross collateralization – are seen as creating "complications" and "challenges" for the financing of nuclear projects. That these conditions were imposed by the Bush administration, which had been very supportive of and helped to invent the term "nuclear renaissance," and the fact that the nuclear industry has lobbied hard to eliminate them underscore the risk that the loan guarantee program poses to taxpayers.

From a purely technical perspective, the loan guarantee program would work naturally with a transaction that is project-financed in the traditional sense. In

[29] Standard & Poor's, Hurdles Remain, p. 1.
[30] Standard & Poor's, Hurdles Remain, pp. 2-3.

> such a case, if the project falters, the sponsor can walk away and lose its equity, while the DOE takes control of the project assets and makes the lenders whole. Because of the DOE's requirement to have a priority lien over the project assets, regulated electric utilities applying under the program that lack a first mortgage bond indenture can facilitate a loan guarantee request, while the existence of a first mortgage bond indenture can introduce complications. Therefore, regulated utilities with first mortgage bond indentures will likely have to implement funding structures that satisfy the DOE's need while at the same time preserving compliance with their mortgage indentures.
>
> Another challenge that has come up for companies pursuing new construction through a partnership arrangement under the DOE's program deals with the issue of how the department requires all participants to cross-collateralize each other's obligations. This essentially creates a situation where the project participants are jointly and severally liable. This arrangement differs from past projects that incorporated an undivided interest approach in which each participant was responsible only for its own portion of the project.[31]

The large size of the reactors figures into the loan guarantees. Utilities are attempting to find approaches that can fit into the loan guarantee program that let them share the reactors.

> The traditional framework in which regulated utilities use on-balance-sheet financing to build generation plants while merchant generation companies use a project finance approach still holds largely true. However, companies are experimenting with various structures, including partnerships, and they are trying to take advantage of the DOE's loan guarantee program, whether they are regulated or merchant. Partnerships can be very appealing because they not only moderate or spread the construction and financing risk, but they can also help tailor an investment's size to a company's projected load in the time frame in which the plant will enter commercial operation. The loan guarantee program appeals to all participants – whether regulated or merchant, public or investor owned – because it can lower borrowing costs.[32]

These highly technical financial discussions can be boiled down to a simple proposition. With the guaranteed loans equal to as much as 80 percent of the value of very risky projects, the DOE imposes two conditions on the loans that help to protect the

[31] Standard & Poor's, Hurdles Remain, pp. 4-5.
[32] Standard & Poor's, Hurdles Remain, p. 3.

taxpayer's investment should the project falter. The DOE holds the first lien and all of the partners are liable for the entire project. Private sector lenders also want the first lien, which creates a conflict. The nuclear industry is pressing hard to eliminate these taxpayer protections.

The problem that the large size of these projects poses to their financing is a major component of the Standard & Poor's analysis.

> Given the new plant's large projected cost, how big the companies' balance sheets are can be a significant factor in terms of how much credit risk we recognize. A new project that materially affects a company's size can introduce significantly more risk and necessitate that every other aspect of the company's business perform flawlessly to provide the necessary support to its credit profile, especially during the period when capital spending peaks and the financial profile becomes stressed. For a company whose nuclear project investment is small compared with its balance sheet, these same concerns apply but, in our view, are moderated to some extent. Balance-sheet size is also an important consideration in adjusting rates during the construction period (assuming regulators allow the company to get a cash return on its construction work in progress during construction), as well as in the final rate adjustment necessary to include the plant in rate base.
>
> Finally, balance–sheet size relative to the size of the investment in the nuclear project can become an important factor if the company needs to abandon the project. While many regulated jurisdictions provide for recovery of the prudently incurred investment, the time for recovery of the investment remains fairly open. Thus for a company with a small asset base, recovering its abandoned investment in a nuclear plant over a long period of time can adversely affects it financial risk profile.[33]

The Standard & Poor's analyst pointed out that "even with DOE guarantee debt loads can increase significantly."[34] The Standard and Poor's analysis provided estimates of the balance-sheet impact for three companies, showing that the nuclear project equaled 28 percent of total assets for Georgia Power, 76 percent for South Carolina Gas and Electric and 146 percent of Progress Energy.[35] Interestingly, Moody's has downgraded South Carolina Electric and Gas and issued negative advice on the Southern Company, the parent of Georgia Power.[36]

[33] Standard & Poor's, Hurdles Remain, p. 4.
[34] Mikas, *Financing*, p. 20.
[35] Standard & Poor's, Hurdles Remain, p. 5.
[36] Moody's, *Changes Outlook of Southern and Three Subs to Negative*, September 1, 2009.

C. CONSULTING FIRMS

A November 2008 presentation by an analyst at Towers Perrin provided an early warning about the risk of nuclear reactor projects in the emerging economic environment.[37] An updated version of that analysis from July 2009 reinforces the initial observations.[38] The two areas where the analyst was well ahead of the curve in raising concerns were in the recognition of marketplace and financial risk.

The slowing of load growth and the decline of the cost of alternatives, particularly natural gas, were identified as undermining the case for nuclear reactor projects. The decline in demand reduces the need for new reactors. "With falling demand for power, current market conditions generally provide no compelling need or reason for many utilities to immediately take on any more risk than they already face…. The recession is showing no signs of the Government-promised abatement or any response to "stimulus" – demand is low."[39] Weakened balance sheets resulting from declining sales reduce the ability of the utilities to undertake large projects. "In fact, utilities have very significant balance sheet and liquidity challenges in this market with no immediate or obvious resolution…. Therefore, many utilities have no basis [at this time] to count on organic growth to strengthen cash flows, balance sheets, or [offset] pension losses."[40]

The analysis identifies two forms of regulatory risk – uncertainty about project approval by an inexperienced, understaffed Nuclear Regulatory Commission and uncertainties about the allowance of cost recovery by state regulators. Specifically, the untested Combined Construction and Operation License process does not address issues not submitted for review, nor does it preclude subsequent ratchets arising from rulemakings. The gap from the former leaves open restatement of standards applied to such things as field engineering, which typically represent more than half of the overrun potential in any project.

Even with set regulatory requirements, projects face a host of execution risk problems, including the lack of current utility experience constructing reactors, the ability of management to oversee these projects, and the likelihood of the need to rework projects. Particularly notable here is the concern about the vendors and contracts to which many turn to look for help to reduce risk exposure.

The Towers Perrin analysis devotes the greatest attention to the worsening financial conditions, both in the broader financial market in general and for the utility sector in

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[37] Stephen Maloney, *Financial Issues Confronting Nuclear Construction,* Carnegie Endowment for International Peace, November 13, 2008.
[38] Stephen Maloney, *Nuclear Power Economics and Risk*, Council on Foreign Relations, July 10, 2009.
[39] Maloney, *Economics and Risk*, 2009, pp. 4-5.
[40] Maloney, *Economics and Risk*, 2009, pp. 4-5.

particular. Tightening credit and high-risk premiums, as well as federal credit policies are seen as raising the cost of long-term capital. At the same time, market dynamics lower the market capitalization of utilities, limiting their ability to invest. The balance sheets of utilities are weak and becoming weaker, a trend that caused Moody's to change its view in 2009. The analysis offers "some energy sector planning thumb rules":

- Always hedge your risk within your risk capital limits.
- Don't invest in projects claiming more than 10% of your assets.
- Risky issues call for higher returns… indicated returns for nuclear projects should be ~ 18-25% or more.[41]
- Uncertainty (i.e., risk) in initial estimates will grow over the course of a project at rates proportional to the square root of time.
- Since DCF [discounted cash flow] systematically underestimates compound risk and new construction faces significant irreversibilities, never base a risky or uncertain project's success solely on the NPV [net present value] or a DCF calculation.[42]

The analysis focuses on the situation in which construction work in progress is not available and concludes that the long construction period creates a heavy burden on the financial risk profile of the utility. Finally, the analysis expressed concern about federal loan guarantees. It argues that the federal government is not a reliable counterparty and that credit conditions should raise concern about its ability to perform as counterparty.

> Federal loan "guarantees" are risky. Remember: the Federal Government is not a reliable business partner. It is a serial breacher of agreements and its policies systematically fail to perform to forecast while always costing more than promised.
>
> If a utility proceeds with the Federal Government as a guarantor, it would be prudent and responsible to apply risk management protocols normally reserved for high-risk counterparties.[43]
>
> Bottom line: Federal Government has proven itself an unreliable counterparty:
>
> - Policies systematically fail to fulfill promises or hit their forecasts,
> - A serial breacher of agreements,
> -

[41] Maloney, *Economics and Risk*, 2009, p. 10.
[42] Maloney, *Economics and Risk*, 2009, pp. 10-11, 12, 24.
[43] Maloney, Economics and Risk, pp. 5, 23.

- Paper thin Balance Sheets: Federal Government and FRB [Federal Reserve Board] both fail to meet IMF standards,
- Bond auctions show diminishing enthusiasm for more UST [U.S. Treasury] paper,
- Growing international sentiment to diversify off USD [U.S. Dollar] as reserve currency,
- Market concerns over UST "credit card balance."[44]

The weight of these risks and uncertainties led a Vice President of NERA Economic Consulting, a leading utility consulting firm, to recommend that utilities consider pushing off the decision to build nuclear reactors because

> a first-wave project may face higher risks and costs, including scarce nuclear industry resources; uncertainties about carbon control and electricity demand; organized anti-nuclear efforts; some degree of first-of-a-kind (FOAK) risks and higher costs; and difficult markets for nuclear financing and funding.[45]

Appendix B summarizes the reasons given in the NERA analysis, organized according to the framework used in this analysis. Those concerns parallel the discussion in this section.

[44] Maloney, Economics and Risk, p. 5… 23.
[45] Kee, p. 2.

APPENDIX B:

NERA Reasons to Consider Waiting to Construction Until the Second Wave of Reactors

Technology Risk:

A second-wave project that can avoid commitment to a reactor design (or that can switch reactor designs without large costs) should be able to choose from several standard reactor designs that will have been approved by 2014. As these approved reactor designs start construction, the degree of detailed engineering will be much higher than today and the approach to construction (i.e., modular construction) will be better known. Second-wave projects may also be able to learn from the outcomes of first-wave EPC contracts.

While the timing remains uncertain, there is a possibility that one or more alternate reactor designs (e.g., micro-reactors and Generation IV reactors) now in the research and development phase will be commercially available as an option for a second-wave project.

A first-wave project may face higher risks and costs, including scarce nuclear industry resources… some degree of first-of-a-kind (FOAK) risks and higher costs.

Policy Risk:

It is possible that the US approach to control carbon emissions will be in place by 2014, allowing a second-wave project sponsor to better understand the financial implications for new nuclear power plants.

New nuclear plants may benefit from programs or taxes that are targeted at controlling carbon emissions. A year ago, there was hope that a change of administration would result in quick and clear action on controlling carbon. This has not happened and any real action on carbon control may be delayed or watered down or both as a result of the economic recession.

DOE loan guarantees are a critical item, so the current limits suggest that only 2 or 3 plants will be built in the first wave. DOE Loan guarantees for nuclear remain limited to $18.5 billion... Given the high cost estimates for new nuclear power plants, this will only cover a few nuclear units. Also, the terms, conditions, and costs of the DOE nuclear loan guarantees may not be attractive. DOE is reported to be negotiating with a short list of loan guarantee hopefuls; projects not in this short list may not have much chance of a loan guarantee.

Regulation Risk:

To the extent that a second-wave project has delayed the NRC COL process (i.e., the project has the ability to modify the COL application or other details), the lessons from the first-wave projects should provide a clearer view of the timing, issues, and potential for legal challenges to the COL process up to the COL approval point.

One or more new US nuclear power plants may have been built, approved, and placed into commercial operation, providing a much better view of how the NRC COL ITAAC process will work.

Regulated first-wave projects will have placed nuclear plant investments into rate base (and into rates), providing some lessons and guidance for second-wave project sponsors, state regulators, and others.

Execution Risk:

New nuclear power projects outside the US may be close to completion and some may have started commercial operation, reducing uncertainty about total project cost, construction times, reactor design operating performance, modular construction approaches, market success of reactor designs and vendors, and other issues.

Second-wave project sponsors as well as investors, regulators, and others will have a clearer view of the costs of new nuclear power plants and the time required to build them. The differences in cost, time to construct, and operating performance across reactor designs and vendors will also be much clearer.

The learning during construction of the first-wave nuclear plants may allow second-wave buyers to obtain lower costs, less risk, and shorter and more certain schedules from EPC vendors. Modifications to detailed designs and construction approaches to improve quality, lower cost, and shorten time in construction may also be available.

There will be even more experience with new nuclear plants outside the US. Reactor vendors that are not now in the US market may have entered the US market based on the success of build programs outside the US, giving second-wave buyers more options.

Nuclear build experience so far is mixed. There was some hope that nuclear project development experience outside the US would resolve uncertainties to the benefit of the US projects that would follow, but this has not yet happened. The Olkiluoto EPR project has experienced significant cost overruns and delays and is now in arbitration proceedings and the Chinese have just started construction on the first AP1000 unit.

The nuclear fuel cycle, including the used fuel disposition issue and approach to re-processing used nuclear fuel, may be more settled. Several new uranium enrichment facilities may be operational in the US and uranium market prices may be more stable.

Marketplace Risk:

The impact on electricity demand and the need for new baseload generation due to the current economic recession, the building of renewable generation, and other factors will be better known.

Demand for electricity is growing at a slower rate in many parts of the US as a result of the current economic downturn, so that the projected need for baseload capacity may be less and later than the capacity need projected a year ago. For some utilities with industrial customers, this may be a significant change.

Current nuclear power plant cost estimates are high, even though these estimates are considered conservative and may mean fewer cost overruns when the projects are completed. However, the recent cost estimates are much higher than cost estimates from only a few years ago. As these higher nuclear cost estimates are incorporated into generation expansion planning models and policy analyses, new nuclear power plants may no longer be the least-cost generation expansion option.

Financial Risk:

World financial markets are tight and financing any large capital project is difficult. Financing a new nuclear power plant would have been very difficult even without the financial crisis; with this crisis, it may not be possible to finance a new nuclear project. Financial markets will recover, but this may not happen in time for a first-wave project.

Also, the construction funding arranged by first wave developers may provide lessons for developers and lenders that will mean easier access to construction funding for second-wave projects. The real response of the stock market to new nuclear plant investment decisions will be known and will allow a second-wave sponsor to better assess its own decision to invest.

First-wave projects will have arranged and closed permanent financing, providing lessons and guidance for investors, lenders, and developers.

Source: Edward Kee, First Wave or Second Wave? It is time for US nuclear power plant projects with a first wave build strategy to consider moving to the second wave, NERA, July 24, 2009, pp. 4-6.

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President, Citizens Research, 1983 - present

Research Director, Consumer Federation of America, 1983-present

Fellow, Stanford Center on Internet and Society, 2000-present

Associated Fellow, Columbia Institute on Tele-Information, 2003-present

Fellow, Donald_McGannon Communications Research Center, Fordham University, 2005-present

Senior Fellow for Economic Analysis, Institute for Energy and the Environment, Vermont Law School, 2009-present

Fellow, Silicon Flatirons, University of Colorado, 2009-present

Principle Investigator, Consumer Energy Council of America, Electricity Forum, 1985-1994

Director of Energy, Consumer Federation of America, 1984-1986

Director of Research, Consumer Energy Council of America, 1980-1983

Consultant, Office of Policy Planning and Evaluation, Food and Nutrition Service, United States Department of Agriculture, 1981-1984

Consultant, Advanced Technology, Inc., 1981

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Research Associate, American Research Center in Egypt, 1976-1977

Research Fellow, American University in Cairo, 1976

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Consultant, Division of Architectural Research, National Bureau of Standards, 1974

Consultant, Voice of America, 1974

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Lecturer, Washington College of Law, American University, Spring, 1984 - 1986, Seminar in Public Utility Regulation

Guest Lecturer, University of Maryland, 1981-82, Energy and the Consumer, American University, 1982, Energy Policy Analysis

Assistant Professor, Northeastern University, Department of Sociology, 1978-1979, Sociology of Business and Industry, Political Economy of Underdevelopment, Introductory Sociology, Contemporary Sociological Theory; College of Business Administration, 1979, Business and Society

Assistant Instructor, Yale University, Department of Sociology, 1977, Class, Status and Power

Teaching Assistant, Yale University, Department of Sociology, 1975-1976, Methods of Sociological Research, The Individual and Society

Instructor, University of Maryland, Department of Sociology, 1974, Social Change and Modernization, Ethnic Minorities

Instructor, U.S. Army Interrogator/Linguist Training School, Fort Hood, Texas, 1970-1971

PROFESSIONAL ACTIVITIES:

Member, Advisory Committee on Appliance Efficiency Standards, U.S. Department of Energy, 1996 - 1998

Member, Energy Conservation Advisory Panel, Office of Technology Assessment, 1990-1991

Fellow, Council on Economic Regulation, 1989-1990

Member, Increased Competition in the Electric Power Industry Advisory Panel, Office of Technology Assessment, 1989

Participant, National Regulatory Conference, The Duty to Serve in a Changing Regulatory Environment, William and Mary, May 26, 1988

Member, Subcommittee on Finance, Tennessee Valley Authority Advisory Panel of the Southern States Energy Board, 1986-1987

Member, Electric Utility Generation Technology Advisory Panel, Office of Technology Assessment, 1984 - 1985

Member, Natural Gas Availability Advisor Panel, Office of Technology Assessment, 1983-1984

Participant, Workshop on Energy and the Consumer, University of Virginia, November 1983

Participant, Workshop on Unconventional Natural Gas, Office of Technology Assessment, July 1983

Participant, Seminar on Alaskan Oil Exports, Congressional Research Service, June 1983

Member, Thermal Insulation Subcommittee, National Institute of Building Sciences, 1981-1982

Round Table Discussion Leader, The Energy Situation: An Open Field For Sociological Analysis, 51st Annual Meeting of the Eastern Sociological Society, New York, March, 1981

Member, Building Energy Performance Standards Project Committee, Implementation Regulations Subcommittee, National Institute of Building Sciences, 1980-1981

Participant, Summer Study on Energy Efficient Buildings, American Council for an Energy Efficient Economy, August 1980

Member, University Committee on International Student Policy, Northeastern University, 1978-1979

Chairman, Session on Dissent and Societal Reaction, 45th Annual Meeting of the Eastern Sociological Society, April, 1975

Member, Papers Committee, 45th Annual Meeting of the Eastern Sociological Society, 1975

Student Representative, Programs, Curricula and Courses Committee, Division of Behavioral and Social Sciences, University of Maryland, 1973-1974

President, Graduate Student Organization, Department of Sociology, University of Maryland, 1973-1974

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American Sociological Association, Travel Grant, Uppsala, Sweden, 1978

Fulbright-Hayes Doctoral Research Abroad Fellowship, Egypt, 1976-1977

Council on West European Studies Fellowship, University of Grenoble, France, 1975

Yale University Fellowship, 1974-1978

Alpha Kappa Delta, Sociological Honorary Society, 1973

Phi Delta Kappa, International Honorary Society, 1973

Graduate Student Paper Award, District of Columbia Sociological Society, 1973

Science Fiction Short Story Award, University of Maryland, 1973

Maxwell D. Taylor Award for Academic Excellence, Arabic, United States Defense Language Institute, 1971

Theodore Goodman Memorial Award for Creative Writing, City College of New York, 1968

New York State Regents Scholarship, 1963-1968

National Merit Scholarship, Honorable Mention, 1963

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