BEFORE THE FLORIDA PUBLIC SERVICE COMMISION

DOCKET NO. 090009-EI
FLORIDA POWER & LIGHT COMPANY

IN RE: NUCLEAR POWER PLANT COST RECOVERY AMOUNT TO BE RECOVERED DURING THE PERIOD JANUARY – DECEMBER 2010

REBUTTAL TESTIMONY OF:

S. SIM

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

FLORIDA POWER & LIGHT COMPANY

REBUTTAL TESTIMONY OF DR. STEVEN R. SIM

DOCKET NO. 090009 - EI

August 10, 2009

Q. Please state your name and business address.

A. My name is Steven R. Sim and my business address is Florida Power & Light Company, 9250 West Flagler Street, Miami, Florida 33174.

Q. Have you previously submitted direct testimony in this proceeding?

A. Yes.

Q. Are you sponsoring any rebuttal exhibits in this case?

A. Yes. I am sponsoring the following exhibits that are attached to my rebuttal testimony:

Exhibit SRS-6: A Discussion Regarding Screening Curve Analyses from Steven R. Sim Testimony in Docket No. 080407 – EG

Exhibit SRS-7: An Alternate Calculation for Witness Cooper's "Diversity of Resources" Analysis

Q. What is the purpose of your rebuttal testimony?

A. The purpose of my rebuttal testimony is to discuss and respond to a number of statements and recommendations made by Southern Alliance for Clean Energy (SACE) Witness Cooper who has filed testimony in this docket.

Q. Please summarize your rebuttal testimony regarding SACE's witness Witness Cooper.

A. SACE's witness Witness Cooper declares there is a high level of uncertainty in the future. Then, when reviewing FPL's current economic analysis of Turkey Point 6 & 7, Witness Cooper - who does not appear to have any utility system planning or electric generation analytical background or experience - attempts to persuade the state of Florida to discontinue the on-going evaluation of this option which would provide emission-free, fossil fuel-free, capacity and energy at a 90% capacity factor for at least 40 years. He attempts to do so by choosing to suspend his belief in future uncertainty at carefully selected points. At those points he selects a specific futures forecast, or contentious pending legislation, as certain guideposts for how the future will unfold for the next 50 years. Finally, he offers no meaningful economic analysis that contradicts FPL's 2009 economic analyses, nor is he able to support his conclusion that other resources will improve FPL's system fuel diversity more than new nuclear capacity.

Therefore, Witness Cooper's recommendation that Florida stop its on-going evaluation of the new Turkey Point 6 & 7 nuclear units does not warrant serious consideration.

Q. Please provide an overview of your rebuttal testimony.

A. I have organized my comments regarding Witness Cooper's testimony into the following four categories for discussion:

I. How to Address Uncertainty;

II. FPL's Economic Analyses and the Assumptions Used;

III. Witness Cooper's "Economic Analyses";

IV. Witness Cooper's "Diversity Analysis"; and,

I. How to Address Uncertainty

Q. What do you believe the main points of Witness Cooper's testimony are?

A. I believe there are three main points to Witness Cooper's testimony: (i) he believes there is great deal of uncertainty in the future (and, for purposes of this testimony, I'll call this his 'core belief'); (ii) he believes that some key assumptions are currently not favorable for new nuclear units; and (iii) therefore, Florida should cease any further evaluation of, and expenditures on, new nuclear units.

Q. What is your reaction to these points?

A. I agree with his first point – there is great deal of uncertainty in the future. I'm sure that most people would share that view. However, I disagree with his second and third points.

Q. Please explain.

A. I don't agree with his second point, that a number of key assumptions are currently unfavorable for new nuclear units, for several reasons. First, Witness Cooper discusses only a few assumptions that are important in an evaluation of resource options. He does not meaningfully address a number of other assumptions, nor does he address various attributes of nuclear units, that are important to any resource planning evaluation of new nuclear units. A partial list of these items that Witness Cooper does not discuss in a meaningful way would include, in no particular order: (i) the flexibility in both FPL's resource planning and operations that would be gained with 2,200 MW of additional baseload capacity; (ii) the increasing costs of securing firm transportation for natural gas to support new gas-fired generation as an alternative to nuclear generation; (iii) the significant reductions in system emissions, including carbon dioxide (CO_2), that results from having 2,200 MW that operates with zero emissions at a 90% capacity factor and will do so for at least 40 years; and, (iv) the significant improvements in system fuel diversity that will result from having 2,200 MW that uses no fossil fuel in operating at a 90% capacity factor for at least 40 years. I will address several of these items later in my testimony.

Second, Witness Cooper does not make a convincing case that even the few assumptions he discusses are unfavorable for continuing to evaluate new nuclear units. In discussing these assumptions, which he admits on one hand are uncertain, Witness Cooper repeatedly tries to reach a conclusion by using one specific forecast or projection as if it accurately reflected the future. In other words, when it suits his purpose – stopping further evaluation of new nuclear units in Florida – Witness Cooper is perfectly willing to suspend his 'core belief' ('the future is very uncertain'), and instead express a belief with certainty that a 2009 forecast, or projection (such as the potential passage of pending legislation), accurately represents what the future conditions will be for 50 years or more.

This approach is not only inconsistent with his 'core belief,' it defies basic common sense and experience. We know that most forecasts, particularly those stretching decades out into the future, will almost certainly be wrong in a variety of ways. We just do not know the magnitudes and the directions of the errors. In addition, we also know that forecasts change constantly. Therefore, why should a decision of whether to continue an on-going evaluation of a promising resource option, such as new nuclear units, be based solely on one forecast or projection that is interpreted to be unfavorable at one point in time?

Finally, for the reasons just discussed, I disagree with Witness Cooper's third point – that Florida should cease its on-going evaluation of new nuclear units. I believe that the fact that the future is uncertain is a very strong argument to continue to evaluate new nuclear units, not to cease this evaluation now. The various attributes of new nuclear units, such as those mentioned above, represent tremendous potential benefits for FPL' customers in addition to potentially large economic benefits. It simply makes sense to continue to evaluate the option of the new nuclear units, Turkey Point 6 & 7.

In the following sections of this testimony, I'll focus on the specific assumptions in FPL's 2009 economic analyses that Witness Cooper is concerned about. I'll also discuss Witness Cooper's "economic analysis" and "diversity analysis" regarding new nuclear units and examine some of the exhibits he presented in his testimony.

II. FPL's Economic Analyses and the Assumptions Used

Q. Much of Witness Cooper's testimony regarding the feasibility of pursuing the option of new nuclear units appears to be based on his concerns regarding four assumptions used in FPL's economic analyses. What assumptions is he concerned about?

A. Starting on page 2, line 19, and continuing through to the top of page 5, of his testimony, Witness Cooper discusses concerns with four assumptions that were used in FPL's economic analyses supporting the 2007 need filing for Turkey Point 6 & 7. The four assumptions he has concerns about from this two year- old analysis presented in the need filing are (paraphrasing):

1. A high rate of demand growth in the load forecast;
2. A downplaying of the potential contributions of energy efficiency and renewables to meet the need for electricity;
3. High projected prices for fossil fuels and CO_2 compliance costs; and,
4. A low estimate for the cost of the new nuclear units.

Witness Cooper's concern is that the assumptions used in the 2007 need filing: *"have been called into question in the time since the evidence was filed in their* (FPL and Progress) *petitions for determination of need."* In other words, Witness Cooper has observed that a number of the assumptions used in the 2007 need filing have now changed.

Witness Cooper summarizes his position on page 4, lines 4 – 8: *"The evidence presented by the companies to the Commission does not take these 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 with these reactors."*

Q. What is your reaction to this?

A. Witness Cooper is merely stating the obvious: a number of assumptions or forecasts have certainly changed since 2007. Forecasts are always uncertain and forecasts will continue to change from month-to-month and from year-to-year. Forecasts for fuel costs, like many other commodities, change daily if not more frequently. And, as with all forecasts, no one knows the directions or the magnitudes of these changes.

Most importantly, FPL recognizes the uncertainty in any specific forecast – and the fact that these forecasts will continue to change – in its analytical approach used in conducting economic analyses of the Turkey Point 6 & 7 units. Starting with the 2007 need filing, FPL has used 3 different fuel cost forecasts and 4 environmental compliance cost forecasts for several types of emissions (SO_2, NO_x, and CO_2) in its analyses. This allows a number of combinations of fuel and environmental compliance costs to serve as possible future scenarios with which to view the economics of Turkey Point 6 & 7. These scenarios provide a wide range of possible fuel and environmental compliance "futures" with which to address uncertainty.

Furthermore, FPL annually updates these projections of fuel costs and environmental compliance costs, along with a number of other assumptions such as the load forecast, for its economic analyses. Witness Cooper apparently fails to recognize that FPL is not relying on its 2007 analysis. Rather, FPL continues to analyze the feasibility of these units each year. In 2009, FPL's economic analyses utilized a number of updated assumptions for load, fuel costs, and environmental compliance costs.

The Commission also recognizes that uncertainty exists in forecasts utilized in economic analyses, and that many of these assumptions will change each year, when it required that an annual feasibility analysis for the new nuclear units be filed with the Commission.

Consequently, there appears to be no disagreement among Witness Cooper, the Commission, and FPL in regard to the fact that the future is uncertain or that assumptions used in economic analyses change.

However, as evidenced by Witness Cooper's testimony, there does appear to be disagreement at least between Witness Cooper and FPL regarding: (i) whether these assumptions will continue to change in the future (FPL believes they will continue to change, but Witness Cooper seems to believe that some selected current forecasted values will not change), and (ii) in what directions those assumptions will move. I'll return to these issues later in my testimony. I'll now turn my attention to the four assumptions that Witness Cooper is most concerned about.

Q. Would you please discuss the first assumption that Witness Cooper has concerns about: the load forecast that FPL used in its 2009 economic analyses?

A. Yes. The January 2009 load forecast used in FPL's 2009 economic analyses of both the nuclear uprates and Turkey Point 6 & 7 is an updated forecast. It is significantly different from the load forecasts used in prior nuclear feasibility analyses. The 2009 updated forecast shows a significant drop in projected load growth, particularly in the near-term. For example, as shown in Exhibit SRS – 1 in my direct testimony, the forecasted Summer peak load for the year 2020 dropped from 30,910 MW in the 2008 forecast to 27,715 MW in the 2009 forecast, for a drop of 3,195 MW.

However, Witness Cooper refers to projected load for the year 2017 in his testimony so I'll focus on that year. The projected decrease in Summer peak load for 2017 from the 2008 load forecast (28,621 MW) to the 2009 load forecast (25,401 MW) is similar, 3,220 MW. Therefore, for the discussion that follows, I'll assume that the drop in projected Summer peak load is approximately 3,200 MW.

Q. Witness Cooper asked on page 9, lines 21 – 22, of his testimony: *"Is this dramatic shift in demand fully reflected in the 2009 Economic Analysis?"*

A. I note that Witness Cooper's testimony did not answer his own question, so I will do so. The answer is yes. FPL fully accounted for the change in forecasted demand and for the accompanying changes in forecasted annual energy to be served. This same updated load forecast was used in analyzing both the new nuclear units and the combined cycle capacity to which the new nuclear units were compared.

Had he taken the time to examine Table ES.1 in the Executive Summary sections of FPL's 2008 and 2009 Site Plans, Witness Cooper would have learned how FPL's resource plans have changed due in large part to this decrease in forecasted load. I'll summarize those changes by discussing the major changes in FPL's resource plan from the 2008 Site Plan to the 2009 Site Plan. (A number of smaller changes, such as MW ratings to existing units, also occurred, but these changes were relatively minor.)

For the years 2009 through 2017 (the years addressed in both the 2008 and 2009 Site Plans), the major differences are:

- In the 2008 Site Plan, FPL projected the addition of 3 new greenfield combined cycle (CC) units, each with 1,219 MW (Summer) capacity, that would add approximately 3,660 MW of total capacity.
- In the 2009 Site Plan, FPL removed these 3 greenfield CC units and added the conversions/modernizations at its existing Cape Canaveral and Riviera sites. The addition of two new CC units (approximately 2,430 MW in total from the new units), and the removal of approximately 1,350 MW of existing generating unit capacity at those two existing sites as part of the conversion process, results in a net gain of approximately 1,080 MW (= 2,430 – 1,350) from these conversions.
- In addition, FPL's 2009 Site Plan shows the temporary removal of approximately 2,400 MW of existing generating unit capacity that will be placed into Inactive Reserve status in the first few years of the ten-year reporting period, and then returning to active status in the future as needed to meet reserve margin requirements. The 2009 Site Plan projected that about 1,600 MW of this capacity would be returned to active service by 2017. This results in a net reduction in active generating capacity by 2017 of 800 MW.

- Therefore, FPL's 2009 Site Plan shows a net capacity increase of approximately 280 MW (= 1,080 – 800) by 2017.
- Consequently, FPL's 2009 Site Plan, compared to the 2008 Site Plan, shows a decrease in new net capacity additions of approximately 3,380 MW (= 3,660 – 280) by 2017.

The decrease in FPL's forecasted load of approximately 3,200 MW equates to a decrease in the amount of new generation resources needed of about 3,840 MW due to the 20% reserve margin criterion. Thus FPL's projection of resource needs by 2017 dropped by approximately 3,840 MW. A comparison of the 2008 and 2009 Site Plans shows a reduction in planned new net capacity by 2017 of approximately 3,380 MW to address the reduction in projected resource needs. This is a clear indication that FPL has adjusted its resource plan to address the lower load forecast.

Q. Is the load forecast likely to change after 2009?

A. Yes. FPL's official load forecast is typically reviewed and revised from one year to another to reflect the best information available. Therefore, it is likely that new load forecasts will be developed each year. If so, those new load forecasts will be used in FPL's annual resource planning work, including the annual economic analyses of new nuclear capacity. However, what neither FPL nor Witness Cooper knows with certainty is what the magnitudes and directions of changes will be in future load forecasts compared to the 2009 forecast.

Q. **Suppose that the new nuclear units are built and FPL's load in the future is actually smaller than is currently projected. Omitting any consideration of economics, would FPL's customers still benefit from having Turkey Point 6 & 7 on the system?**

A. Yes. There would still continue to be numerous benefits to FPL's customers. Turkey Point 6 & 7 would add 2,200 MW of baseload capacity and energy that are projected to operate at projected capacity factors in the 90% range using no fossil fuel and operating with no air emissions. Furthermore, the units are projected to do this for at least 40 years. Economic considerations aside, this resource would bring at least the following benefits to the FPL system: (i) significant increases in system fuel diversity; (ii) significant decreases in system emissions, including CO_2; and (iii) significant additional flexibility for FPL's future resource planning and system operations.

Q. **How would Turkey Point 6 & 7 result in significant additional flexibility for FPL's resource planning and system operations if the load was smaller than currently projected?**

A. If future loads were to be smaller than currently projected at the time Turkey Point 6 & 7 come on-line, a number of options would open up for FPL. These options would become available because the large amount of capacity offered by Turkey Point 6 & 7, combined with lower load, would enable FPL to more easily meet its reserve margin requirements for the purpose of maintaining system reliability, thus freeing up possible courses of action. These potential courses of action include, but are not necessarily limited to, the following: (i) taking additional existing units out-of-service and converting the sites with new, highly efficient generating units (as is being currently done at FPL's existing Cape Canaveral and Riviera sites), thus continuing to modernize FPL's fossil fueled generating fleet; (ii) taking additional older existing units out-of-service either temporarily (Inactive Reserve) or permanently (unit retirement); and (iii) having the potential for more time for both planned and unplanned maintenance outages for existing generating units if such action is desired to gain greater long-term reliability and operational cost savings.

On the other hand, if FPL's load is actually larger than currently projected, the benefits of Turkey Point 6 & 7 would likely be larger than the currently projected benefits shown in FPL's 2009 economic analyses.

Q. Would you please discuss the second assumption that Witness Cooper is concerned about, accounting for efficiency and renewables in its economic analyses?

A. Yes. Witness Cooper contends that FPL's economic analyses should account for larger contributions from energy efficiency and renewables. He bases this contention on two points (paraphrasing): (i) proposed federal legislation may direct utilities to move in the direction of more efficiency and renewables; and (ii) efficiency and renewables should be incorporated anyway once they are either 'understood' to be superior options, or once advancements reach the point where they will become superior options.

Q. What does Witness Cooper contend should be assumed regarding proposed federal legislation when conducting economic analyses of new nuclear units?

A. Witness Cooper discusses proposed federal legislation in various places in his testimony including beginning on page 15, line 22, through page 16, line 4: *"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 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% of their generation from renewables, with as much as 8 percent of that total coming from efficiency."* Witness Cooper contends that current economic analyses of new nuclear units should incorporate these aspects of the proposed legislation as if the proposed legislation were already established law. However, Witness Cooper chooses not to discuss how the currently proposed legislation addresses new nuclear units in the renewables section of the legislation. FPL Witness Reed does discuss the "nuclear neutral" aspect of the proposed legislation in his rebuttal testimony.

The proposed federal legislation that Witness Cooper discusses appears to be HR 2454 that very narrowly passed the U.S. House of Representatives a short while ago. This legislation, at least in the current form that barely passed one body of Congress, was not even proposed several months ago when FPL's economic analyses were conducted. More importantly, this legislation has not yet passed the U.S. Senate, much less been signed into law. In other words, this legislation is still only proposed legislation.

Moreover, I would expect that if this legislation actually passes both houses of Congress, numerous changes in the legislation are likely, so that the final version may be significantly different than the version that narrowly passed the House. In addition, if some form of the legislation is passed and signed into law, it is likely that legal challenges will occur that could result in changes to the law itself and/or in changes to rules and regulations that seek to direct activities of utilities and other entities.

Witness Cooper expresses many times in his testimony that he believes that the future is uncertain. However, he contends that this proposed legislation – which has proven to be quite contentious - should be treated as a 'certainty' in regard to assumptions that are used today in economic analyses of resource options. His contention shows that he is willing to waive his core belief of great uncertainty when it suits him - when he believes it helps bolster an argument against continued evaluation of new nuclear units in Florida - and assume that a proposed legislative bill accurately reflects what the future will hold.

Q. Why does FPL include environmental compliance costs for CO_2 in its analyses if there is currently no law addressing these emissions?

A. There are two reasons for this. First, it has become increasingly likely over the last couple of years that some form of federal CO_2 regulation will occur. Second, despite Witness Cooper's statement on page 15, lines 2 -3 that: *"To my knowledge, the state of Florida has not put a price on carbon, nor is it contemplating doing so"*, the state of Florida has taken steps to develop a recommendation regarding CO_2 regulation.

Therefore, with the likely outcome of CO_2 regulation, FPL has included a range of environmental compliance costs for CO_2 in all of its resource planning work during the last few years to ensure that CO_2 compliance costs are addressed.

However, the details of how compliance would actually "work" have varied greatly in the numerous pieces of legislation that have been proposed or considered. For this reason, FPL believes it is premature to attempt to incorporate a wide variety of potential other impacts, such as those discussed by Witness Cooper, at this time in its resource planning analyses. If/when CO_2 compliance legislation is signed into law – and the many and varied facets of the law are then known – FPL will incorporate these facets into its resource planning work, including future economic analyses of new nuclear units. Until that time, FPL believes it is wise to use a basic approach of examining a variety of CO_2 compliance costs.

Q. You stated earlier that you believe Witness Cooper suggests that greater contributions from energy efficiency and renewables should have been accounted for in any case in FPL's economic analyses of new nuclear units. Would you please discuss?

A. Yes. On page 19, lines 9 – 11, Witness Cooper says the following about energy efficiency: *"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."* Then, in regard to renewables, he states the following beginning on page 18, line 22, through page 19, line 2: *"...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."* On line 5 of that same page, Witness Cooper points out which type of technologies he has in mind when he mentions the: *"...availability and cost of renewables..."*

In other words, Witness Cooper believes that efficiency and renewables <u>might</u> be viewed as being superior alternatives to new nuclear if: (i) people can be convinced that efficiency is economical; and (ii) there are technological breakthroughs for renewable energy options.

Q. What is your reaction?

A. In regard to the concept of having to convince people that efficiency is economical, this strikes me as a very strange concept. One can accurately compare the economics of two resource options if one will simply ensure that all of the costs associated with each resource option are accounted for in the analyses. The only time this becomes a problem is if an incomplete, and therefore inaccurate, analytical approach is used in an attempt to show that someone's preferred option is better than would actually be the case if a complete and accurate analysis was conducted.

Witness Cooper bases his case regarding the economics of efficiency and renewables on *such an incomplete analytical approach* – a screening curve approach that only looks at levelized cents/kwh costs of resource options. With such an incomplete – and inaccurate - approach to evaluating the economics of resource options, it is no wonder that he perceives that there is a real problem with convincing people efficiency is the economic choice. (I will further discuss the problems inherent with a screening curve approach to analyzing resource options in section III of my testimony.)

Now, in regard to expecting, or hoping for, technological breakthroughs that <u>may</u> result in renewable options potentially becoming superior to new nuclear capacity, Witness Cooper is again choosing to drop his core belief of great uncertainty. He proposes that FPL should stop an on-going evaluation of one resource option – new nuclear units – with tremendous potential, based only on the hope that renewable technology development <u>may</u> produce a better option. Once again, Witness Cooper is willing to suspend his concerns about uncertainty if he believes this will help him in his argument against continuing the evaluation of new nuclear units in Florida.

FPL is a very strong proponent of renewable energy, believes it has an important role to play in FPL's future plans and operations, and intends to pursue renewable energy options vigorously. However, because of the very view that Witness Cooper repeatedly claims to have – uncertainty regarding the future – FPL also strongly believes that the on-going evaluation of new nuclear units should continue. With tremendous uncertainty in the future, one should pursue all promising options.

Q. Returning to Witness Cooper's concerns regarding efficiency and renewables, does FPL's 2009 economic analysis for this docket incorporate efficiency and renewables?

A. Yes. One of the reasons that FPL's 2009 load forecast has dropped so much is that it accounts for an additional 895 MW of energy efficiency that is projected to result from updated federal appliance efficiency and lighting standards. In addition, the 2009 economic analysis includes a projection of all achievable, cost-effective FPL DSM that had been identified at the time the economic analysis was conducted.

Regarding renewable energy, the 2009 economic analysis included the impact of several new, large-scale renewable energy projects by FPL. These projects include: (i) the DeSoto Next Generation Solar Energy Center (a 25 MW photovoltaic (PV) facility; (ii) the Space Coast Next Generation Solar Energy Center (a 10 MW PV facility); and (iii) the Martin Next Generation Solar Energy Center (a 75 MW solar thermal facility).

As FPL's resource planning work continues from year-to-year, updated assumptions for energy efficiency and renewables will be incorporated into FPL's economic analyses as appropriate.

Q. Would you please discuss the third assumption, or set of assumptions, that Witness Cooper is concerned about: projected costs for natural gas and CO_2 compliance cost?

A. Yes. Witness Cooper's basic position in this docket is that the projected costs for natural gas and environmental compliance costs for CO_2 that were used in FPL's 2009 economic analyses are too high.

He first refers to FPL's response to a Staff interrogatory (Interrogatory 45) asking for an explanation of why the economic advantage of nuclear compared to natural gas-fired combined cycle units has increased in the 2009 economic analysis compared to the 2008 analysis. FPL's response was that the primary reasons are higher projected natural gas costs and CO_2 compliance costs than were projected in 2008. Witness Cooper then discusses why he believes FPL's projected values for natural gas and CO_2 should have been lower.

Q. What does Witness Cooper offer in support of his view that FPL's projected natural gas prices are too high?

A. He offers the following statement on page 12, lines 15 – 17 in terms of 'qualitative' support: *"There is increasing optimism about natural gas resources. There are efficiency programs targeted at natural gas consumption in the climate change legislation moving through Congress, which may free up supply and put downward pressures on price."* In terms of 'quantitative' support, he offers the following Q & A exchange on page 13, lines 5 – 7: *"Q. Please provide empirical evidence to support your concerns about the natural gas projections employed by FPL. A. The evidence relies on futures prices."*

Q. What is your reaction to these qualitative and quantitative statements that Witness Cooper believes support his belief that future natural gas costs in Florida will be significantly lower than projected in FPL's 2009 economic analyses for this docket?

A. First, in regard to his qualitative statement, he again suspends his concern regarding uncertainty about the future and pins his case on the same proposed, contentious legislation which, if enacted, *"…may…put downward pressure on prices."* Suffice it to say that the pending legislation may not pass in its current form and, even if it did, it may not put downward pressure on gas prices.

Second, in regard to his quantitative statement that supposedly provides *"empirical evidence"* that natural gas prices will be lower in the future (presumably for the 40-plus years starting in 2018 in which Turkey Point 6 & 7 will operate), he offers what appears to be a single natural gas futures price forecast of recent vintage. Witness Cooper ignores the fact that futures prices change constantly. By so doing, he once again suspends his concern about uncertainty regarding the future when it suits him. He chooses instead to attempt to make a case that this single futures price forecast is an accurate indicator of natural gas commodity prices for the next 50 years.

Third, Witness Cooper's discussion is solely about natural gas <u>commodity</u> prices. He does not address increases in projected firm gas transportation costs that have occurred since 2007. These fixed costs are separate from gas commodity prices in FPL's analyses, but are a substantial portion of annual total gas costs for a new gas-fired unit.

Witness Cooper may not recognize the significant contribution that firm gas transportation costs make in analyses involving combined cycle units. Even relatively small increases in firm gas transportation costs on a $/mmBTU basis will result in significant increased annual costs for combined cycle units. For example, a $0.10/mmBTU increase in firm gas transportation costs equates to an increase in <u>annual</u> costs of approximately $15,000,000 for the combined cycle capacity to which Turkey Point 6 & 7 is compared in the economic analyses. Therefore, increasing firm gas transportation costs, not mentioned by Witness Cooper, clearly enhances the economic feasibility of new nuclear capacity compared to new gas-fired combined cycle capacity.

Q. Have others commented on projected natural gas commodity prices in Florida recently and what was their view?

A. Yes. In docket (Docket No. 090172-EI) regarding the EnergySecure natural gas pipeline, Witness Benjamin Schlessinger provided testimony on behalf of the Florida Gas Transmission Company (FGT). In his testimony, Witness Schlessinger states on page 7, lines 20 – 23: *"FPL may have severely understated future natural gas prices because depletion of gas resources and diversion of LNG supplies away to higher-paying markets in Europe and Asia – these kinds of factors may cause Henry Hub gas prices to rise in real dollar terms, plus more for inflation."*

The forecast that Witness Schlessinger is discussing is the same natural gas commodity price forecast that is used in the 'Medium Gas Cost' forecast in FPL's 2009 nuclear cost recovery docket. Although FPL does not agree with Witness Schlessigner's assertion, it is clear that Witness Schlessinger and Witness Cooper each look at the same FPL gas commodity price forecast and come to completely opposite conclusions about what actual future gas commodity prices will really be. I conclude that Witness Cooper's original statement that the future is very uncertain is correct, but also conclude that Witness Cooper's subsequent claim that his selected single futures market forecast correctly predicts natural gas commodity prices for the next 50 years is less than convincing.

FPL believes that there is significant uncertainty regarding what future fuel costs will be and that this uncertainty is heightened by the unpredictability of future environmental compliance costs. Consequently, FPL's 2009 economic analyses for both the nuclear uprates and the Turkey Point 6 & 7 units continue to use a scenario approach in which 3 fuel cost forecasts and 4 environmental compliance costs forecasts are utilized. The intent is to recognize the uncertainty in both projections and to try to ensure that a wide variety of potential outcomes are represented in the analyses. And, as stated before, FPL updates its fuel cost forecasts each year and these updates are used in the nuclear economic analyses.

Q. In regard to projected CO_2 compliance costs, what does Witness Cooper have to say about the values used in FPL's 2009 economic analyses?

A. Starting on page 14, line 23, and continuing on to page 15, line 1, Witness Cooper makes the following statement: *"The companies have put a high price on carbon in their economic analyses."* He then explains that pending federal legislation, HR 2454, 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. What is your reaction to these statements?

A. I have two reactions. My first reaction is in regard to Witness Cooper's contention that FPL should have incorporated the "*...an elaborate scheme of allowances...*", in addition to "*... policies other than putting a price on carbon...*" from HR 2454 in FPL's economic analysis. This simply does not make sense. The current version of the proposed bill did not even exist when FPL performed its analyses. Furthermore, this bill is still only pending legislation, the legislation is quite contentious, and the details of the legislation are almost certain to continue to change if some version of the legislation is to become law.

Witness Cooper has once again decided to suspend his belief that the future is uncertain and assume that a bill currently pending, and almost certain to undergo changes if it does become law, accurately represents the future of CO_2 compliance costs.

If/when a bill that regulates CO_2 emissions is signed into law, then FPL will develop a strategy for complying with whatever "*...elaborate scheme of allowances...*" and other "*...policies...*" that the law requires. However, FPL does not believe that it is productive to attempt to include in its resource analyses numerous potential aspects of a myriad of competing bills (and a myriad of interpretations of each bill) when addressing prospective CO_2 compliance costs in its analyses. Such an approach may give one a false sense of precision. However, this approach ignores the range of uncertainty that will continue to exist until legislation is signed into law and the accompanying implementing regulations are determined. Therefore, until these occur, it is far more productive to recognize the uncertainty that exists regarding CO_2 regulation and to address it by a wide range of CO_2 compliance costs.

Second, I note that Witness Cooper is providing testimony in this docket on behalf of SACE, and in the current DSM goals docket (Docket No. 080407 – EG), SACE is represented by other witnesses including Witness William Steinhurst.

SACE witness Cooper's contention in this docket that FPL's compliance costs for CO2 are too high contrasts strongly with SACE witness Steinhurst's testimony in the DSM goals docket. On page 22, lines 13 – 14, of Witness Steinhurst's testimony in the DSM goals docket, Witness Steinhurst makes the following comment regarding projected CO_2 compliance costs of FPL: *"I consider those values to be at the extreme low end of the reasonable range of estimates..."*

It is clear that these two witnesses for SACE do not agree with each other regarding projected compliance costs for CO_2. It is also evident that SACE has taken one position – projected CO_2 costs should be higher – when higher costs are beneficial to one objective (justifying more energy efficiency in the

DSM goals docket), yet has taken the opposite position – projected CO_2 cost should be lower – when lower costs are beneficial to another objective (stopping development of new nuclear units in Florida in this docket).

Q. The fourth of Witness Cooper's concerns about assumptions was that FPL used a low cost estimate for new nuclear units. Would you care to comment?

A. Yes. FPL witnesses Reed and Scroggs discuss one aspect of Witness Cooper's concern in this area: why it is appropriate for FPL to continue to utilize the same non-binding capital cost estimate range of $3,108/kw to $4,540/kw in 2007$ in FPL's ongoing economic analyses. I will discuss another aspect of Witness Cooper's concern regarding nuclear capital costs.

This concern involves what he calls the '$1/kw factor'. Witness Cooper states on page 34, lines 9 – 12: *"The $1/kw factor has changed significantly between 2007 and 2009, as shown in Exhibit MNC – 13. The decline in the implicit $1/kw factor accounts for between one-tenth and one-quarter of the increase in the breakeven capital figure."* He attempts to show this in Exhibit MNC – 13.

In other words, Witness Cooper believes that FPL has changed the $1/kw factor for some reason and the result of that change is that the breakeven capital costs for the new nuclear units have increased in the 2009 analysis by 10% to 25%.

Q. Is Witness Cooper correct in his assertions? If not, please explain.

A. Witness Cooper is not correct. Let's start by first discussing what the $1/kw factor is. It is a calculated factor that equates what $1/kw of overnight capital cost equates to in cumulative present value of revenue requirements (CPVRR) for the capital costs for 2,200 MW of new nuclear capacity (i.e., Turkey Point 6 & 7). The factor was developed to assist in the calculation of capital breakeven costs in the last step of FPL's economic analysis of new nuclear units.

For example, if one were to look at Exhibit SRS – 5 of my direct testimony in this docket, the values in columns (5) and (6) can be used to show how the $1/kw factor is applied. Let's look at the last row of column (5) where we see the cost differential between the Plan with Nuclear and the Plan without Nuclear – CC is $9,909 million CPVRR in 2009$. The question is what overnight construction cost (in terms of $/kw) for 2,200 MW of new nuclear capacity will make the capital cost of new nuclear generation equal to $9,909 CPVRR, which, in turn, will result in the two resource plans having identical (breakeven) CPVRR costs.

The actual factor FPL is applying in column (6) is approximately $0.5282/kw of overnight capital cost per $1 million CPVRR in 2009$. Therefore, when the $9,909 million CPVRR cost differential in column (5) is multiplied by the $0.5282 value, the result is $5,234/kw of overnight capital costs for new nuclear generation. This overnight capital cost will result in the two resource plans, the Resource Plan with Nuclear and the Resource Plan without Nuclear – CC, breaking even for this fuel and environmental compliance cost scenario.

Witness Cooper's approach in his Exhibit MNC – 13 is to use the inverse of this factor, 1/0.5282 = 1.893. He shows this value on what appears to be the 6^{th} column of his exhibit. The exhibit also derives the inverse of the factor FPL used in its 2007 need filing (which was approximately 0.5068), 1/0.5068 = 1.973. To this point there is no problem in Witness Cooper's approach.

However, he does create a problem in his last column of the exhibit. In this column, entitled *"Factor Change as % of Break even change"*, he appears to attempt the following calculation (he supplies no explanation or formulae): divide the percentage difference in his $1/kw factors by the percentage difference in the breakeven costs. The result of his dividing a percentage by a percentage is shown in this last column – a series of values ranging from approximately 10 to 27. He interprets these results to mean that the change in his $1/kw factors from 1.973 to 1.893 *"... accounts for between one-tenth and one-quarter of the increase in the breakeven capital figure."*

In other words, Witness Cooper believes this slight factor change somehow has driven up the breakeven cost by 10% to 25%. This interpretation of his calculation results is incorrect. The breakeven costs for nuclear have not increased by 10% to 25% due to this slight change in the factor.

Q. What is the actual impact of the change in the $1/kw factor?

A. The $1/kw factor has changed by only 4%. This can be derived simply by computing the percentage change in Witness Cooper's factors: (1.973/1.893) - 1 = 0.042, or 4%. Therefore, if the only change in the economic analysis from 2007 to 2009 was this slight change in the $/kw factors, the most that the breakeven costs would have increased is 4%.

Q. Why did the $1/kw factor change and is the real impact of the change a 4% increase in breakeven costs?

A. The factor changed slightly because the discount rate changed from the 2007 analysis to the 2009 analysis. This change in the discount rate automatically results in a change in the $/kw value that equates to $1 million in CPVRR cost for 2,200 MW of new nuclear.

However, it is worth noting that the change in the discount rate was applied also to the calculation of costs for the combined cycle units. Therefore, the actual impact of the change in the $1/kw factor on the breakeven capital costs for nuclear is likely less than 4%.

Q. Was there any other concern regarding FPL's economic analyses that Witness Cooper has that you wish to address?

A. Yes. On page 35, lines 7 – 20, Witness Cooper discusses (paraphrasing) that FPL's economic analyses may have assumed that any excess capacity on the system (presumably resulting from the large 1,100 MW nuclear units) would be used to make potential 'off-system' sales that could result in the nuclear units appearing more cost-effective than they should versus the *"small"* (page 35, line 3) combined cycle units.

Q. Did FPL's economic analyses utilize such an approach?

A. No. In FPL's economic analyses of both the nuclear and combined cycle units, the only assumption for sales (other than to native load customers) was that existing sales contracts would be served. The assumptions for these contracts were identical in the calculations for both the Resource Plan with Nuclear and the Resource Plan without Nuclear - CC. There were no other potential (i.e., not under current contract) sales assumed in the analyses.

Furthermore, even if FPL had assumed that excess capacity could be used for potential sales, nuclear might have been disadvantaged by this assumption. This is because the combined cycle units are 1,219 MW, significantly larger than the 1,100 MW nuclear units, a fact that has been part of each of FPL's economic analyses of new nuclear units including the 2007 need filing.

III. Witness Cooper's "Economic Analyses"

Q. Did Witness Cooper provide a meaningful, comprehensive economic analysis that showed what the system economic impacts would be if the

new nuclear units, Turkey Point 6 & 7, were not added to the FPL system?

A. No.

Q. Did Witness Cooper provide any economic analysis at all?

A. No. The entire extent of his "economic analysis" was to state that (paraphrasing) it costs less on a cents/kwh basis to either produce a kwh with other generating options, or to save a kwh through energy efficiency, than to generate a kwh with a new nuclear unit.

For example, Witness Cooper makes the following statement on page 20, lines 8 - 11 of his testimony: *"As shown in Exhibit MNC – 6, paged 1 and 2, in half a dozen studies the cost of alternatives that included renewables and/or efficiency, every analyst found several non-fossil resources less costly than nuclear."* An examination of MNC – 6, pages 1 and 2, present a series of comparisons of a number of resource options that were performed by various parties. (It does not appear that Witness Cooper performed any of these comparisons.) No information is provided on the exhibit's pages to indicate what type of economic analysis was performed. Some "cost" was developed for nuclear and this cost value was assigned a value of 100%. Then values for all other resource options were developed and compared, in percentage terms, to nuclear.

Despite the lack of information on this slide, it appears safe to assume from Witness Cooper's testimony that the cost values used were levelized cost values on a cents/kwh basis. On page 33, line 7, Witness Cooper discussed how resource options can be compared: *"The typical methodology is a levelized cost comparison of the different alternatives."* On lines 12 -13 of the same page, he states: *"Generally, analysts calculate the projected cost per kilowatt-hour."*

Unfortunately, this is the full extent of Witness Cooper's "economic analysis" that supposedly supports his recommendation that Florida cease its on-going evaluation of new nuclear units.

Q. Does Witness Cooper at least provide the information used to develop these cents per kwh values so that one could determine key aspects of the calculation including, but not limited to: what costs were included in the calculations, what costs were excluded in the calculations, the vintage of assumptions, the source of the assumptions, what years the calculations addressed, what year or years the costs were levelized to, and how the calculations were performed?

A. No.

Q. Besides the fact that no explanation or detail is provided for these calculations, what is your reaction to Witness Cooper's use of a cents/kwh approach for attempting to judge the economics of competing resource options?

A. I found it both informative and disappointing.

Q. How was it informative and disappointing?

A. The informative portion was the statement on lines 12 – 13 on page 33: *"Generally, analysts calculate the projected cost per kilowatt-hour."* Note that he said "analysts" use this method. He did not say that 'utility resource planners', or 'Commissions', - both parties that seek to evaluate resource options with a complete accounting of all of the cost impacts on a specific utility system from competing resource options - use this approach to make resource option decisions. The reason that parties seeking economic analyses with a complete accounting of all system cost impacts do not use a levelized cents/kwh approach is that it is fundamentally flawed when used in an attempt to compare a variety of resource options <u>because this approach does not account for a variety of system costs</u>.

Therefore, the 'analysts' Witness Cooper is referring to are individuals and organizations who are <u>not</u> interested in a full accounting of costs, especially system costs, when evaluating resource options. The fact that such individuals and organizations either do not recognize the problems inherent in a levelized cents/kwh approach, or recognize this but choose anyway to use this approach because it gives them the 'answer' they seek, is disappointing.

Q. Have the flaws inherent in this analytical approach been discussed previously in Commission dockets?

A. Yes. Most recently, I submitted rebuttal testimony in the DSM goals docket, Docket No. 080407 – EG, that discussed the fundamental flaws in using this approach for the purpose Witness Cooper attempts to use it for – an economic comparison of very different resource options.

That discussion appears in Exhibit SRS – 6 to this rebuttal testimony. The discussion explains the fundamental flaws inherent in using a typical 'screening curve', or levelized cents/kwh, approach when attempting to evaluate a variety of resource options. The discussion also presents an example of the projected levelized cents/kwh value approach applied to a combined cycle unit. The levelized value that is derived from a typical screening curve analysis is provided first. That value is 6.8 cents/kwh, a value that falls within the range of approximately 6 to 13 cents/kwh for this type of generating unit in Witness Cooper's Exhibit MNC – 6, page 3 of 4.

The discussion then shows what happens when one slightly modifies the original screening curve calculation so that only two of the flaws inherent in a typical screening curve approach are addressed. The result is a dramatic decrease in the levelized cents/kwh value for a combined cycle unit from 6.8 to 1.2 cents/kwh. In summary, this discussion points out the fact that typical screening curve analyses use very incomplete information, thus guaranteeing that comparative evaluations of a variety of resource options will produce inaccurate and misleading results.

Q. In summary, how should one view any economic analysis based only on a screening curve analysis?

A. When a person attempts to justify a resource option selection solely with a screening curve analysis, the individual attempting to use such an analysis as justification either does not understand how utility systems work, or knows better but is trying to seek a decision from the Commission that would be based on very incomplete information.

The Commission, and any other interested party, should view a screening curve analysis as an approach that utilizes only an incomplete subset of information, and which, therefore, provides incorrect analysis results. Therefore, resource decisions should not be based upon this analytical approach because a full accounting of system cost impacts has not been presented.

It is for these reasons that FPL does not make resource decisions, nor seek Commission approval for resource additions, based solely on screening curve analyses. FPL's resource planning analyses are designed to capture all relevant, quantifiable costs and system cost impacts on FPL's system in its analyses of competing resource options. FPL utilized this comprehensive analytical approach in the analyses presented in this docket.

Q. Did Witness Cooper offer any other perspective on the economics of new nuclear units that you'd like to discuss?

A. Yes. On Witness Cooper's testimony starting on page 35, lines 22 – 23, and concluding on page 36, line 1, he states: *"The economic advantage claimed for nuclear is actually quite small, when compared to the total costs of the system."* He then attempts to show this through a calculation in his Exhibit MNC – 14 in which he attempts to compare the total system CPVRR costs with the two new nuclear units versus the system CPVRR costs with two combined cycle units. He summarizes the conclusion of his analysis on page 38, lines 8 – 9, of his testimony where he reports the results as: *"...an economic analysis that gives nuclear a slight, 4 – 5 percent, cost advantage."*

Q. What is your reaction to this?

A. Witness Cooper appears to be mixing assumptions and data from FPL's 2007 and 2009 analyses in his calculation. At best, I find that to be a questionable approach. But let's ignore that and see what the point of his analysis appears to be. He appears to be trying to make a point that a CPVRR cost advantage of 4% to 5% is small when comparing Supply options on a very large utility system such as FPL's.

On a system the size of FPL's, I find that cost advantage to be fairly large in comparison to what FPL typically sees in resource option evaluations. In comparisons of Supply options on our system, we often see cost advantages closer to 1% to 2%. Using an analogy of DSM analyses versus Supply options, achieving a benefit-to-cost ratio of 4% to 5%, or as it is usually presented, 1.04 to 1.05, represents a clear economic choice (assuming the analysis accounts for all DSM-related costs).

Witness Cooper's choice of this metric – savings as a percent of total system costs – is a bit unusual and is misleading for a utility the size of FPL. For example, in all of FPL's nuclear economic analyses since the 2007 need filing, the projected fuel savings from 2021 –on (after both nuclear units are in-service) is at least $1 billion <u>per year</u> in nominal dollars. This annual savings value is an enormous number. The use of Witness Cooper's metric would result in this amount of savings appearing as a smaller % savings value for FPL's system than it would for a utility system half of FPL's size. From this perspective, Witness Cooper's metric is definitely misleading. One billion dollars per year of fuel savings for FPL's customers is an enormous savings no matter how large the utility system is.

IV. Witness Cooper's "Diversity Analysis"

Q. Witness Cooper discusses *"diversity"* on page 32 of his testimony. He also provides Exhibit MNC – 12, *"Diversity of Resource Under Various Technology Scenarios"* in which he attempts to examine diversity for three resource plans. Did you review this discussion and exhibit?

A. Yes. The Herfindahl-Hirschman Index (HHI), as described by Witness Cooper on page 32, lines 7 -9, is: *"...used frequently in economics to evaluate the* *concentration of markets. In fact, the Merger Guidelines of the Department of Justice and the Federal Trade Commission are written in terms of the HHI."* I was curious to see how Witness Cooper attempted to apply this index to utility resource planning and to see what the results of his calculation would indicate.

Q. Would you provide your understanding of how the HHI index works?

A. Yes. Witness Cooper's testimony on page 32 provides the calculation formula that is used to calculate the HHI value. The HHI represents a measure of "market concentration" or market "diversity". From examining the calculation formula, the lower the HHI value is, the better. In other words, the lower the HHI value is, the more diverse the market is.

The calculation methodology can derive a lower HHI value in at least two different ways. For example, assume that an HHI calculation has five market categories that are included in the analysis. The calculated HHI value gets lower as the percentages assumed for each of the five categories approach equilibrium (i.e, as the percentages assumed for each of the five categories approaches 20%, thus indicating an equal distribution among the five categories). This is the first way in which an HHI value can be lowered. If each of the five categories does have a 20% share value, the calculated HHI value is 2,000.

The second way in which an HHI value can be lowered is to introduce more categories to which a non-zero percentage is assigned. Let us assume that our example now has 10 categories and that each category is assigned a 10% percentage. The resulting HHI value now drops to 1,000.

Q. Would you now explain how Witness Cooper applied this calculation methodology in his Exhibit MNC – 12?

A. Yes. Witness Cooper's first column provides a listing of five "resources" which are actually fuel/energy types (coal, nuclear, etc.) The 2nd through the 4th columns are directed at FPL (with his 5th through the 7th columns directed at Progress). In regard to the three columns that are directed at FPL, the 2nd and 3rd columns utilize selected data from FPL's 2007 need filing for Turkey Point 6 & 7. The 4th column contains assumed data for a hypothetical resource plan scenario of Witness Cooper's choosing.

In the 2nd column, he appears to extract projected FPL system fuel mix percentage values for the year 2018 from two different scenarios of fuel cost and environmental compliance costs. Then he averages the two values to derive an average fuel mix value. (Witness Cooper provides virtually no explanation of his calculations or assumptions, but one can match his values in the 2nd column using the approach described above.) The values in the 2nd column are from FPL's Resource Plan without Nuclear – CC in the 2007 need filing.

The values in the 3rd column appear to be calculated in the same manner, but the values are from FPL's Resource Plan with Nuclear in the 2007 need filing. Therefore, one of Witness Cooper's column headings is mislabeled. The column heading for his 2nd column is *"FPL No Nuclear"*. This is descriptive enough (but it would have been clearer if he had simply labeled it as FPL's "Resource Plan without Nuclear – CC".) However, the column heading for his 3rd column is *"Gas"*. This is not only unclear, it is in error. The values shown utilize data from FPL's "Resource Plan with Nuclear" and the column heading should reflect that.

The HHI value for the Resource Plan with Nuclear is 5,385 which is lower than the HHI value for the Resource Plan without Nuclear – CC which is 5,782. Therefore, one would conclude that the Resource Plan with Nuclear is better from a fuel diversity perspective than the Resource Plan without Nuclear – CC. (However, this outcome can be seen clearly from just examining the fuel mix values used by Witness Cooper as inputs.)

In his 4th column, Witness Cooper creates another resource plan to which he attributes additional efficiency and renewables. It is not clear what he means by "efficiency" but for purposes of this discussion, I'll assume he means DSM energy efficiency programs and/or appliance and lighting standards. It is also unclear how much energy efficiency and renewables he is assuming are in this resource plan he has created. In his testimony on page 32, lines 18 – 19, he states: *"Efficiency is assumed to be 12% of the total resource, while incremental renewables are set at 3 percent."* Thus it appears that he is assuming a total 15% contribution from 12% efficiency and 3% renewables. However, in his 4th column, the values shown are 8% for efficiency and about 7% for renewables (which he places in the "Other" category). Perhaps the text of his testimony simply does not match the values in the exhibit, or he may have performed a calculation (that he neglects to show) that results in the efficiency and renewable percentages being different than those in the text of his testimony.

Presumably due to the addition of efficiency and renewables, Witness Cooper adjusts the percentages for all other fuel mix categories (again with no explanation of how he does so.) The HHI value he derives from this new resource plan for FPL is 4,290, lower than either of the other two resource plans. His conclusion, stated on page 32, lines 19 – 20, is that: *"...the efficiency and renewable mix is more diverse than either the nuclear or gas scenarios..."*.

Q. What is your reaction to the analysis presented in Witness Cooper's exhibit and the conclusion that Witness Cooper draws from the results?

A. I believe that his analysis is flawed and, therefore, his conclusion is meaningless. In his calculation, Witness Cooper made at least three errors.

The first error was not ensuring that his resource plan creation was comparable, at least in terms of system reliability, to the two FPL resource plans. The two FPL resource plans were created by FPL to have comparable system reliability. However, there is no information given to show that Witness Cooper even considered system reliability when he created his resource plan; i.e., the third resource plan shown in his exhibit.

Therefore, the comparison Witness Cooper attempts to make may well be an "apples-to-oranges" comparison in which his resource plan creation does not offer comparable system reliability. If that is the case, then any "diversity" analysis is meaningless. In addition, Witness Cooper provides no information regarding the economic impacts, particularly the impact on electric rates, of his resource plan if it were to be implemented on the FPL system. Witness Cooper's sole focus is on system fuel diversity, not on whether his resource plan creation has serious adverse economic or system reliability impacts.

This may be because Witness Cooper believes that his earlier – and fundamentally flawed – screening curve analysis results "prove" these resources are economic. Regardless of Witness Cooper's reasons, it is necessary - at a minimum - to ensure that resource plans being compared provide the FPL system with comparable system reliability.

This fundamental error renders the analysis meaningless even if the calculation methodology had been without error. However, that is not the case.

In regard to the calculation methodology, it is important to remember that the values he starts his calculations with are projected fuel mix percentages for a given year. These values represent the relative percentages of different types of fuel that will be used to serve the <u>annual total kwh used by FPL's customers</u>. This annual total of kwh used by FPL's customers is a value after the impact of all of FPL's DSM programs (i.e., efficiency) have been taken into account. In other words, the 2nd and 3rd columns show the fuel usage after efficiency has been accounted for.

Witness Cooper's second mistake is to account for incremental efficiency as if it were a new fuel resource, and assigning it as a new category. Incremental efficiency should have been accounted for by reducing the amount of kwh served by the utility system, just as efficiency was accounted for in the two FPL resource plans. (Strangely enough, Witness Cooper actually takes the correct approach in his handling of additional renewable energy when he places it in the existing "Other" category.)

This mistake of how he accounts for additional efficiency not only results in incorrect fuel mix percentage values for all of the actual fuel categories, it artificially lowers the calculated HHI value due to the introduction of another non-zero category (as was discussed earlier) for his resource plan creation that was not accounted for in the same manner in the two FPL resource plans.

His third mistake is to assume that additional efficiency and renewables will lower the fuel mix percentages <u>for all fuel types</u> on the FPL system, including nuclear and coal. On FPL's system, natural gas and oil are the fuels "at the margin" in FPL's operation. Nuclear and coal are baseload energy sources that would see negligible (if any) impact from additional efficiency or renewables that might be added to FPL's system. The fuel use impact of additional efficiency or renewables would be on the marginal fuels, gas and oil, and primarily on gas.

In other words, the same amount of nuclear and coal fuel will continue to be used. Therefore, as Witness Cooper was adjusting fuel mix values due to the assumed addition of efficiency and renewables, the fuel mix percentages for nuclear and coal should have <u>increased, not decreased</u>, because the same amount of nuclear and coal fuel would be divided by a smaller total amount of total system fuel used.

Q. Would you discuss how the HHI calculation might have looked if these three errors had been corrected?

A. Yes. Witness Cooper's failure to create a new resource plan that ensures the same system reliability as the two FPL resource plans presents a serious problem. However, we can overcome this problem for the purpose of this explanation by doing two things. We first ignore Witness Cooper's flawed resource plan, then we use the two FPL resource plans, the Resource Plan with Nuclear and the Resource Plan without Nuclear – CC, as starting points. Then we'll add the same amount of efficiency and renewables to both resource plans. Because the two FPL resource plans already have comparable system reliability, and identical efficiency and renewable resources will be added to both plans, the resulting resource plans will at least have comparable system reliability.

Using that approach to correct for Witness Cooper's first error, Exhibit SRS – 7 shows an alternate HHI calculation. In page 1 of 2 of this exhibit, there are two rows of calculations. The first row uses the Resource Plan without Nuclear - CC as the starting point. The second row uses the Resource Plan with Nuclear as the starting point. Calculations are then made in each row from these two starting points.

The second error (adding a new category for "Efficiency") is corrected by first removing that extra category, then by adding a new column titled "Amount of Fuel". The reduction in system fuel usage from additional efficiency and renewables is addressed in this new column. The third error (assuming that all fuel categories are affected by additional efficiency and renewables on FPL's system) is corrected by the simple recognition of the fact that, on FPL's system, the impact of these additional resources will primarily be a reduction in natural gas usage, not a reduction in the use of all fuels types. For simplicity's sake in this example, we'll assume all of the reduction will be from natural gas usage.

In the first row, calculation (1) is merely a duplicate of Witness Cooper's calculation for FPL's Resource Plan without Nuclear - CC and the HHI value of 5,782 matches the value he derived. Calculation (2) then assumes that FPL serves 8% less energy due to additional energy efficiency and that this reduction results solely in a reduction in gas usage. (This can be seen by comparing the "Amount of Fuel" column values in calculations (1) and (2).) The values in the "Resulting Fuel Mix Percentage" column for gas decline, but increase for all other fuels. This is because the amount of energy produced the other fuel types is unchanged, but their percentages are now calculated from a smaller total fuel use value. The result of calculation (2) is that the HHI value has been lowered to 5,514 due to the additional efficiency.

Calculation (3) now adds in a contribution of 7% of annual energy coming from renewables. This is seen by an increase in the "Amount of Fuel" column of 7% in the "Other" fuel type, and a further decrease of 7% in the "Gas" fuel type. The HHI value now drops further to a value of 4,548.

Q. What conclusion do you draw from these calculations so far?

A. The conclusion so far is that if one starts from a resource plan that does not include the new nuclear units, the addition of 8% efficiency and 7% renewables can lower the HHI index. The value calculated for this resource plan is 4,548. The question is what will be the HHI value if the same additions of efficiency and renewables are added to a comparable resource plan that features two new nuclear units?

To answer that question, we return to Exhibit SRS – 7, page 1 of 2, and calculation (4). This calculation is for the Resource Plan with Nuclear and the same HHI value of 5,385 is derived that was shown in Witness Cooper's exhibit.

Calculations (5) and (6) now account for the identical amounts of additional efficiency (8%) and renewables (7%), and account for them in the same way, as was done in calculations (2) and (3). The resulting HHI index of 4,210 is lower than the 4,548 value for the Resource Plan without Nuclear – CC. (In addition, the 4,210 value for the Resource Plan with Nuclear is also lower than the 4,290 value Witness Cooper derived for his resource plan creation, a resource plan that is likely not even be a comparable plan in regard to system reliability.)

Q. How would the results have changed if, in row 2, 15% more nuclear had been added in place of the 15% total for efficiency and renewables?

A. This scenario is examined on Exhibit SRS – 7, page 2 of 2. On this page, calculations (1) through (4) are unchanged, but calculations (5) and (6) have changed due to the assumption of additional nuclear replacing the incremental efficiency and renewables. In this scenario, the HHI value for the Resource Plan with Nuclear in calculation (6) would have increased slightly from 4,210 to 4,359, but would still be lower than the calculation (3) value of 4,548.

Q. What do you conclude from these HHI calculations?

A. In summary, I believe that although the HHI approach is one way to attempt to measure diversity on a utility system, I don't believe it is a particularly meaningful approach to use. Its narrow focus on "diversity" tends to divert attention from a comprehensive analysis that address all impacts that a resource option has on a utility system including system economics, system reliability, etc. Therefore, I currently do not see that an HHI index analysis provides much meaningful information that would not already be available from a more comprehensive analytical approach such as that used by FPL.

Nevertheless, Witness Cooper chose to use the HHI approach. After reviewing the results of that approach, once several errors in his calculation methodology had been corrected, I find no merit to his suggestion that new nuclear capacity cannot improve system fuel diversity. As these calculations show, greater diversity can be achieved by pursuing a variety of resource options: new nuclear, efficiency, and renewables. FPL is pursuing all of these resource options.

Q. Does this conclude your rebuttal testimony?

A. Yes.

The information presented on the following pages was originally presented in the rebuttal testimony of Steven R. Sim in the FPSC's Docket No. 080407 – EG. The subject matter presented here from that docket – the fact that a typical screening curve approach that develops levelized cents/kwh cost values for individual resource options is a fundamentally flawed way in which to attempt to compare a variety of different resource options – is also a subject in this nuclear cost recovery docket (Docket No. 090009 – EI).

V. NRDC-SACE's "Economic Analysis"

Q. Did any of the NRDC-SACE witnesses provide a meaningful, comprehensive economic analysis that showed what the results would be for any Florida utility system if it were to adopt their recommended approach to goals setting?

A. No.

Q. Did they provide any economic analysis at all?

A. No. The entire extent of their "economic analysis" was to state in various testimonies that (paraphrasing) it costs less on a cents/kWh basis to save a kWh through DSM than to generate a kWh with a new power plant. Witness Wilson's testimony includes an Exhibit JDW-3, page 9 of 15 that shows the *"levelized cost of new energy resources in cents per kWh"* to be in the 2 to 4 cents/kWh range for energy efficiency and in the 7.3 to 10 cents per kWh range for a combined cycle unit. (Other Supply options are addressed as well.) Witness Mosenthal quotes this same price range of 2 to 4 cents per kWh for DSM on page 34, lines 2 – 3 of his testimony. Witness Steinhurst's testimony states that *"the cost of saved energy for those leading DSM programs is on the order of $0.02 – 0.03/kWh"* on page 30, lines 1 – 2. Neither Witness Mosenthal nor Witness Steinhurst state whether the values they quote are levelized values or represent some other type of value.

Unfortunately, this is the full extent of NRDC-SACE's "economic analysis" that is provided to support their recommendation of how DSM goals should be set for Florida.

Q. Did their testimonies at least provide the information used to develop these cents per kWh values so that one could determine key aspects of the calculation including, but not limited to: which DSM programs were examined, what costs were included in the calculations, what costs were excluded in the calculations, the vintage of assumptions, what years the calculation addressed, what year or years the costs were levelized to, and how the calculations were performed?

A. No.

Q. Besides the fact that no explanation or detail is provided for these calculations, what is your reaction to NRDC-SACE's use of a cents/kWh approach for comparing resource options?

A. I was both surprised and disappointed in their "economic analysis." I was surprised because the testimonies of the NRDC-SACE witnesses repeatedly attempt to make the case that the RIM test; i.e., a cost-effectiveness test that measures the impacts to the utility system's cents/kWh electric rate of competing resource options, is not the appropriate test to use in judging DSM options that compete with Supply options. Nevertheless, all three of these NRDC-SACE witnesses have attempted to compare competing resource options on a cents/kWh basis and state that the results of this electric rate comparison should be used to justify the selection of DSM options.

Therefore, despite their protestations to the contrary, it is obvious that the NRDC-SACE witnesses really believe that a comparison of resource options that is based on an electric rate comparison is the correct way by which to conduct economic analyses of competing resource options. On that basic point the NRDC-SACE and I are in complete agreement.

However, I was also disappointed because NRDC-SACE's witnesses have selected an analytical approach that is fundamentally flawed for the analysis they are trying to use it for: an economic comparison of two very different resource options.

Q. Why is their analytical approach fundamentally flawed when used to compare two resource options that are as different as a DSM measure and a Supply option?

A. The problems in using this analytical approach for comparing two widely dissimilar resource options such as DSM and a Supply option have been previously discussed in prior Commission proceedings. However, if NRDC-SACE (and GDS) truly believe that this is a "best practice" analytical approach, it is probably worthwhile to discuss this issue again in depth.

Let's start by focusing on Witness Wilson's levelized cost values. (Although it is reasonable to assume that the cents/kWh values used by witnesses

Mosenthal and Steinhurst are also levelized cost values, their failure to adequately describe what these values represent leaves one unsure.)

The analytical approach behind the levelized cost values presented by Witness Wilson is generally referred to as a "screening curve" analysis. In a screening curve analysis, one looks at a resource option, assumes that it operates at a given capacity factor or a range of capacity factors, and then calculates the present value costs of operating only this individual resource option over a number of years. These costs are then typically presented in terms of a levelized (or constant) $/MWh, or the equivalent levelized cents/kWh, value over the years addressed in the analysis.

By using this analytical approach to compare two very dissimilar resource options - a DSM measure versus a Supply option (for example, a baseload generating unit such as a combined cycle or nuclear unit) - NRDC-SACE (and GDS) is making a classic error that I have seen beginning resource planners and inexperienced analysts make of trying to utilize a screening curve approach to analyze two resource options that impact the utility system in very different ways.

The usefulness of a screening curve analysis is actually very limited. It can be used in a meaningful way to compare the economics of two competing resource options that are identical or very comparable in at least the following four (4) key characteristics: (i) capacity (MW); (ii) annual capacity factors;

(iii) the percentage of the option's capacity (MW) that can be considered as firm capacity at the utility's system peak hours; and (iv) the projected life of the option. If two resource options are identical or very comparable in at least these four key characteristics, then a screening curve analysis can be meaningful and one could "screen out" the less attractive of the two almost identical options. (This leads to the common terminology of this type of analysis as a "screening curve" analysis.)

However, a screening curve analytical approach that attempts to compare resource options that are not identical or even closely comparable in at least these four characteristics will produce incomplete results that are of little value. Indeed, the less comparable these characteristics are for the resource options being analyzed, the less meaningful are the results. Because a DSM measure and a combined cycle unit are about as different in terms of resource options as one can get, a screening curve approach attempting to analyze these types of resource options provides meaningless results.

The reason is because a typical screening curve analysis does not address the numerous economic impacts that these resource options will have <u>on the utility system as a whole</u>. Instead, a screening curve approach merely looks at the cost of operating the individual option itself. One can think of a screening curve analysis as examining the costs of a resource option if it were placed out in an open field by itself and operated without its operation having any impact on the utility system. The numerous impacts an individual resource option has on the utility system – for example, how it impacts the operation of all the other generating units on the system – is typically ignored in a screening curve approach.

However, the system impacts of any resource option are very large and can result in significant system cost savings that should be credited back to the resource option in order to have a complete picture. Any analytical approach, such as a screening curve approach, that ignores system cost impacts can only provide an incomplete, and therefore incorrect, result.

Q. Can you provide an example of a system cost impact that is not captured in a screening curve analysis for a single new resource option?

A. Yes. Let's assume that the resource option in question is a combined cycle unit. In a screening curve analysis, one assumes that this generating unit will operate at a particular capacity factor (or range of capacity factors). For purposes of this discussion, we'll assume the generating unit operates 90% of the hours in a year. Then, using the generating unit's capacity and heat rate, plus the projected cost of the fuel the generating unit would burn, the annual fuel cost of operating the generating unit for 90% of the hours in a year is calculated. This calculation is then repeated for each year addressed in the screening curve analysis.

In a screening curve analysis, the unit's annual fuel costs – which will be very large for a baseload generating unit – are added to all of the other costs (capital, O&M, etc.) of building and operating this individual generating unit. The present value total of these costs is then used to develop a levelized $/MWh or cents/kWh cost for this generating unit.

However, the screening curve analysis approach does not take into account the fact that this new baseload generating unit would not operate on a utility system at 90% of the hours in a year if it was not cheaper to operate this new unit than to operate other existing generating units on the system. In other words, for every hour the new baseload generating unit operates, the MWh it produces displace more expensive MWh that would have been produced by the utility's existing generating units. Whatever the annual fuel cost is of operating this new generating unit 90% of the hours in a year, the utility will save an even greater amount of system fuel costs saved by reducing the operation of one or more existing units during these hours.

For example, let's say that the new generating unit's annual fuel cost would be $100 million per year, but that the operation of this new unit will also result in a savings of $110 million in fuel costs from reduced operation of the system's more expensive existing units. A typical screening curve analysis will include the $100 million cost value for the individual unit, but ignore the $110 million in system fuel savings that will also occur.

For this reason a typical screening curve analysis approach utilizes an incomplete set of information and, therefore, is an incorrect way to thoroughly analyze resource options. A complete analytical approach would take into account the total system fuel cost impact of a net system fuel savings of $10 million (= $110 million in system fuel savings - $100 million in unit fuel cost) instead of only the fuel expense of the individual combined cycle unit. Consequently, a typical screening curve analysis will grossly overstate the actual net system fuel cost of the new generating unit.

In similar fashion, other system cost impacts, such as environmental compliance costs and variable O&M, are not accounted for in typical screening curve analyses because this approach does not take into account the fact that the new generating unit will reduce the operating hours of the utility's existing generating units. Nor does a screening curve approach account for the impact the resource option will have in regard to meeting the utility's future resource needs. Therefore, the screening curve approach utilizes incomplete information for a number of cost categories, thus providing incorrect results.

Q. The discussion above showed how a screening curve analytical approach utilizes incomplete information and leads to incomplete system cost results for a single new resource option. Is the screening curve approach

become even more problematic when attempting to compare two or more different types of resource options?

A. Yes. This can be shown by a qualitative discussion that looks at several different types of resource options. Let's assume that a screening curve approach is used in an attempt to economically compare a few different resource options, three utility generating options and one DSM option:

- Combined cycle option A (1,000 MW)
- Combined cycle option B (1,000 MW)
- Combined cycle option C (500 MW)
- DSM option (100 MW)

Let's assume that the first comparison attempted is of two virtually identical combined cycle (CC) units, CC options A and B, in which the four key characteristics of the two CC units are identical. But let's assume that the capital cost of CC option A is lower by $1 million than the capital cost of CC option B.

In this comparison, even though a screening curve analysis will not provide an accurate system net cost value as per the above discussion, because the impacts to the operation of existing generating units on the system will be identical from two CC units that are the same in regard to capacity (1,000 MW), capacity factor (due to an assumption of identical heat rates and other factors that drive capacity factor), the amount of firm capacity (1,000 MW) each unit will provide, and the life of the two units, a screening curve analysis will give a meaningful comparison of the two options. (In other words, even though the results will not be accurate from a system cost perspective for either of the two options, the results will be "off" by the same amount and in the same direction.) As would be expected, the screening curve results will show that CC option A results in a slightly lower $/MWh value for CC option A compared to CC option B due to its $1 million lower capital costs.

As this example shows, a screening curve analytical approach can produce meaningful results in a case in which the four above-mentioned characteristics of resource options are identical or very comparable. However, as the on-going discussion will show, once these factors for competing resource options are no longer comparable, a typical screening curve approach cannot produce meaningful results.

Q. Why would a screening curve approach break down if one attempted to compare otherwise identical generating units that differ only by their size such as CC option A (1,000 MW) and CC option C (500 MW)?

A. Now at least one of the four key characteristics of resource options that must be identical or very comparable in order for a screening curve approach to provide meaningful results differ significantly between CC option A and CC option C. This is the capacity of the two options: 1,000 MW for CC option A and 500 MW for option C. Even if one were to assume that all other assumptions for the two units were identical (capacity factor, percentage of capacity that is firm capacity, life of the units, heat rate, capital cost per kW, etc.), the significant difference in capacity offered by the two options would cause a screening curve approach to yield incomplete, and therefore incorrect, results.

The capacity difference between these options would result in at least two system impacts that would not be captured by a screening curve approach. The first of these is the impact of each of the two CC options on the utility's future resource needs. The 1,000 MW of CC option A will address the utility's future resource needs twice as much as will the 500 MW of CC option C. Therefore, CC option A will avoid/defer future resource additions to a greater extent that will CC option C. This will show up in a system cost analysis in the form of different system capital, fuel, O&M, environmental compliance, etc. costs beginning at some point in the future when the utility begins to have resource needs.

In addition, even prior to that point in the future when new resources are needed, the 500 MW greater capacity of CC option A will result in different system fuel cost, variable O&M, and environmental compliance cost impacts as the operation of the utility's existing generating units are reduced to a greater extent than with CC option C.

None of these system economic impacts that are driven by the difference in the capacity of two competing resource options are typically captured in a screening curve approach. The earlier discussion pointed out that a screening curve approach applied to even a single new resource option will omit a variety of significant system cost information that is necessary to develop a complete cost perspective of the one resource option. Now we see that an attempt to use a screening curve approach to compare the economics of two resource options that differ significantly in only their capacity will omit an even greater amount of important system cost information. Therefore, the use of a screening curve approach is definitely flawed when used to compare two new resource options that differ in just one of the four key characteristics listed above.

Q. The previous examples discussed only Supply options. Do similar problems exist if one were to attempt to compare DSM options to supply side options using a screening curve approach?

A. Yes. All of the problems inherent in using a screening curve approach that omits the system cost impacts discussed above are equally applicable whether Supply or DSM options are being addressed.

In this example, the system impacts of the lower amount of DSM (100 MW) on future resource needs would not be captured in a typical screening curve analysis. This would lead to the same type of incomplete and incorrect analysis discussed previously. Even if one were to adjust the 100 MW of demand reduction from DSM to account for the fact that 100 MW of DSM would be equivalent to 120 MW of supply side capacity (if the utility had a 20% reserve margin criterion), 120 MW of one option will be at a disadvantage compared to larger resource options in terms of avoiding/deferring future resource needs of the utility.

In addition, DSM options vary widely in terms of their actual contribution during system peak hours. Many DSM programs reliably reduce demand during the summer and winter peak hours such as load control, building envelope, heating/ventilation/air conditioning (HVAC) programs to name a few. However, other DSM programs may contribute little or no demand reduction at the summer peak hour, at the winter peak hour, or at either peak hour. A streetlight program would be an example of such a program.

Presentations of screening curve analyses of DSM options, such as in Witness Wilson's exhibit, typically lump a wide variety of DSM options together regardless of the capability of these DSM options to lower peak hour demand. This form of presentation further clouds one's understanding of what DSM options are actually being addressed and does not allow an observer to fully understand the breadth of the system impacts that are not being captured in a screening curve analysis.

Q. Please summarize why a comprehensive economic analysis that includes system cost impacts of resource options, such as the analytical process

FPL utilized, is superior to the NRDC-SACE screening curve "economic analysis" approach?

A. There are a large number of cost impacts to consider if one is attempting to provide a complete analysis of competing resource options. Some of these cost impacts are driven solely from the operation of the resource option itself while other cost impacts are utility system impacts driven by integrating and operating a resource option with the utility's existing generating units.

A screening curve approach typically addresses only the costs of operating the individual unit itself. As discussed above, this approach omits all of the system cost impacts that are crucial to capturing the complete costs of a resource option.

In contrast, a system economic approach – such as that utilized by FPL in the analyses presented in this docket - not only captures all of the costs of operating the individual resource option, but also captures the system costs and cost savings of operating the entire FPL system with the resource option.

Q. Can you provide a quantitative example of how the cents per kWh results of a typical screening curve approach might change if one were to account for even one or two system impacts that are typically omitted by this analytical approach?

A. Yes. Staff Interrogatory Number 57 in this docket requested the results of a screening curve analysis of the 2019 combined cycle unit used in FPL's DSM screening analyses. FPL provided these results, along with a condensed version of the qualifiers discussed at length above that explain the significant limitations of using this levelized cost value when comparing a combined cycle unit to very dissimilar resource options.

The levelized cost value FPL provided in response to Staff's request is \$162/MWh assuming a 90% capacity factor with costs levelized in 2019\$. This value is equivalent to a levelized 16.2 cents/kWh in 2019\$. (Screening curve analyses are often presented in levelized \$/MWh values for either the in-service year of the unit or for the year in which the analysis was performed.) As previously mentioned, NRDC-SACE provides no information regarding what year \$ their levelized values are in. Let's give them the benefit of the doubt and assume that they at least tried to put the values for the resource options (which would almost certainly have different in-service years) on a common year basis. This is most commonly done through levelizing costs to the year in which the analysis was done. Therefore, let's convert the \$162/MWh value in 2019\$ to an equivalent 2009\$ value.

Exhibit SRS-14 provides the summary page of that analysis. The levelized value for this same unit at a 90% capacity factor now becomes \$69/MWh in 2009\$. This value is highlighted in the box on the left-hand side of the page. This exhibit shows that FPL accounted for all projected costs of building and operating this <u>individual unit</u> over the projected 25-year life of the unit. The calculation does not account for offsetting system cost impacts as is typical in screening curve analysis. Because NRDC-SACE presented their values in terms of cents/kWh, I'll do so as well. The $69/MWh value translates to 6.9 cents/kWh. (NRDC-SACE's value for a CC unit was in the 7.3 to 10.0 cents/kWh range.)

Exhibit SRS-15 now takes a more realistic, but still highly conservative assumption (in order to make the math easier to follow and to be consistent with the system fuel cost savings example discussed above). In Exhibit SRS–15, the impacts of only two of the many system impacts have been included: system fuel savings and system environmental compliance cost savings.

The conservative assumption used is that both the system fuel cost savings and the system environmental compliance cost savings will be 10% of the combined cycle unit's costs in those categories. For example, the fuel cost value for this individual unit for the year 2019 in Exhibit SRS–14 is $865,447 (in $000). The new assumption used in developing Exhibit SRS-15 is that the system would actually realize a saving of 1.10 x $865,447 ($000) = $951,992 ($000) from reduced operation of the other units on the system.

Consequently, a net system fuel savings of $86,545 ($000) (= $951,992 - $865,447) would occur. This value shows up as a negative value, ($86,545) ($000), in Exhibit SRS–15 for the 2019 fuel cost value to denote this savings.

A similar calculation is made for all years for the fuel costs and the environmental compliance costs.

Even with this conservative assumption for FPL's system, the screening curve's levelized cost value for the combined cycle unit at a 90% capacity factor has now dropped from $69/MWh or 6.9 cents/kWh to $12/MWh or 1.2 cents/kWh.

Therefore, even by making a simple adjustment to a screening curve analysis to account for only two of many system impacts of adding a combined cycle to a utility system such as FPL's, the levelized cost projection from the screening curve analysis is dramatically lowered from 6.9 cents/kWh to 1.2 cents/kWh. And, as discussed previously, there are a number of other system impacts that still not accounted for in this example.

The moral of the story is that, by leaving out system cost impacts, typical screening curve analyses are based on very incomplete information and can provide very misleading results as demonstrated by this example. This points out how meaningless the cents per kWh values are that NRDC-SACE presented as its "economic analysis."

Screening Curve Results for 2019 CC Unit: With No System Impacts (2009$)

Unit 1
Combined Cycle

Discount Factor:	0.088869
Base (MW) (blended summer/winter)	1,219
Heat Rate	6,582
Fixed O&M ($/kW-yr)	6.65
Capital Replace ($/kW-yr)	10.93
VOM ($/MWh)	1.36
Gas Transportation ($/kW-yr)	132.12
in-service year	2019
book life	25
costs in entered in year $s	2019

Combined Cycle

Capacity Factor (%)	Levelized $/kW	Levelized $/MWh
0	131	-
5	154	352
10	177	202
15	200	152
20	223	127
25	246	112
30	269	103
35	292	95
40	316	90
45	339	86
50	362	83
55	385	80
60	408	78
65	431	76
70	454	74
75	477	73
80	500	71
85	523	70
90	546	69
95	569	68
100	592	66

Nominal
$ each year

Natural Gas
1

	Fixed Costs				Variable Costs					
Year	Capital $000	Fixed O&M $000	Capital Repl $000	Gas Transportation $000	NOx Emission $000	SO2 Emission $000	CO2 Emission $000	Fuel Costs $000	Variable O&M $000	Total $000
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
2009	0	0	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0	0	0
2015	0	0	0	0	0	0	0	0	0	0
2016	0	0	0	0	0	0	0	0	0	0
2017	0	0	0	0	0	0	0	0	0	0
2018	0	0	0	0	0	0	0	0	0	0
2019	258,093	8,106	13,319	161,056	694	610	103,768	865,447	14,556	1,425,649
2020	248,821	8,309	13,652	161,056	760	667	112,272	912,227	14,920	1,472,683
2021	238,528	8,516	13,994	161,056	832	731	121,135	930,501	15,293	1,490,586
2022	228,618	8,729	14,343	161,056	911	800	136,580	949,141	15,675	1,515,855
2023	219,061	8,947	14,702	161,056	998	877	146,358	968,154	16,067	1,536,221
2024	209,831	9,171	15,070	161,056	1,093	960	163,062	987,547	16,469	1,564,259
2025	200,889	9,400	15,446	161,056	1,198	1,052	180,509	1,007,328	16,881	1,593,760
2026	192,194	9,635	15,832	161,056	1,022	1,028	191,875	1,027,505	17,303	1,617,450
2027	183,630	9,876	16,228	161,056	872	1,005	210,720	1,048,085	17,735	1,649,207
2028	175,085	10,123	16,634	161,056	745	982	230,387	1,069,076	18,179	1,682,266
2029	166,541	10,376	17,050	161,056	636	960	258,285	1,090,487	18,633	1,724,024
2030	157,997	10,636	17,476	161,056	543	939	279,871	1,112,327	19,099	1,759,943
2031	149,455	10,902	17,913	161,056	407	911	304,610	1,134,603	19,576	1,799,433
2032	140,914	11,174	18,361	161,056	264	881	331,183	1,157,325	20,066	1,841,223
2033	132,374	11,454	18,820	161,056	113	849	359,684	1,180,501	20,567	1,885,418
2034	123,939	11,740	19,290	161,056	0	815	390,214	1,204,140	21,082	1,932,276
2035	115,716	12,033	19,773	161,056	0	778	422,875	1,228,252	21,609	1,982,091
2036	107,598	12,334	20,267	161,056	0	740	457,776	1,252,847	22,149	2,034,765
2037	99,481	12,643	20,774	161,056	0	698	495,030	1,277,933	22,703	2,090,316
2038	91,365	12,959	21,293	161,056	0	655	534,754	1,303,521	23,270	2,148,872
2039	83,933	13,283	21,825	161,056	0	608	577,072	1,329,621	23,852	2,211,249
2040	77,866	13,615	22,371	161,056	0	559	622,110	1,356,242	24,448	2,278,268
2041	72,484	13,955	22,930	161,056	0	507	670,002	1,383,396	25,059	2,349,390
2042	67,102	14,304	23,503	161,056	0	453	720,887	1,411,093	25,686	2,424,085
2043	61,722	14,661	24,091	161,056	0	395	774,909	1,439,344	26,328	2,502,507
2044	0	0	0	0	0	0	0	0	0	0
2045	0	0	0	0	0	0	0	0	0	0
2046	0	0	0	0	0	0	0	0	0	0
2047	0	0	0	0	0	0	0	0	0	0
2048	0	0	0	0	0	0	0	0	0	0
2049	0	0	0	0	0	0	0	0	0	0
2050	0	0	0	0	0	0	0	0	0	0
2051	0	0	0	0	0	0	0	0	0	0
NPV 2009	861,387	45,969	75,534	742,016	3,007	3,758	1,132,607	4,845,589	82,548	7,792,416
	65	3	6	56	0	0	86	368	6	592

Screening Curve Results for 2019 CC Unit: With Only Two System Impacts (2009$)

Unit 1
Combined Cycle

Discount Factor:	0.088869
Base (MW) (blended summer/winter)	1,219
Heat Rate	6,582
Fixed O&M ($/kW-yr)	6.65
Capital Replace ($/kW-yr)	10.93
VOM ($/MWh)	1.36
Gas Transportation ($/kW-yr)	132.12
in-service year	2019
book life	25
costs in entered in year $s	2019

Combined Cycle

Capacity Factor (%)	**Levelized $/KW**	**Levelized $/MWh**
0	131	-
5	129	295
10	127	145
15	125	95
20	123	70
25	121	55
30	119	45
35	117	38
40	115	33
45	113	29
50	111	25
55	110	23
60	108	20
65	106	19
70	104	17
75	102	15
80	100	14
85	98	13
90	96	12
95	94	11
100	92	10

Nominal
$ each year

Natural Gas
1

	Fixed Costs				Variable Costs					
Year	**Capital $000**	**Fixed O&M $000**	**Capital Repl $000**	**Gas Transportation $000**	**NOx Emission $000**	**SO2 Emission $000**	**CO2 Emission $000**	**Fuel Costs $000**	**Variable O&M $000**	**Total $000**
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
2009	0	0	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0	0	0
2015	0	0	0	0	0	0	0	0	0	0
2016	0	0	0	0	0	0	0	0	0	0
2017	0	0	0	0	0	0	0	0	0	0
2018	0	0	0	0	0	0	0	0	0	0
2019	258,093	8,106	13,319	161,056	(69)	(61)	(10,377)	(86,545)	14,556	358,079
2020	248,821	8,309	13,652	161,056	(76)	(67)	(11,227)	(91,223)	14,920	344,165
2021	238,528	8,516	13,994	161,056	(83)	(73)	(12,114)	(93,050)	15,293	332,067
2022	228,618	8,729	14,343	161,056	(91)	(80)	(13,658)	(94,914)	15,675	319,679
2023	219,061	8,947	14,702	161,056	(100)	(88)	(14,636)	(96,815)	16,067	308,195
2024	209,831	9,171	15,070	161,056	(109)	(96)	(16,306)	(98,755)	16,469	296,330
2025	200,889	9,400	15,446	161,056	(120)	(105)	(18,051)	(100,733)	16,881	284,664
2026	192,194	9,635	15,832	161,056	(102)	(103)	(19,187)	(102,750)	17,303	273,878
2027	183,630	9,876	16,228	161,056	(87)	(101)	(21,072)	(104,808)	17,735	262,457
2028	175,085	10,123	16,634	161,056	(74)	(98)	(23,039)	(106,908)	18,179	250,957
2029	166,541	10,376	17,050	161,056	(64)	(96)	(25,829)	(109,049)	18,633	238,619
2030	157,997	10,636	17,476	161,056	(54)	(94)	(27,987)	(111,233)	19,099	226,896
2031	149,455	10,902	17,913	161,056	(41)	(91)	(30,461)	(113,460)	19,576	214,849
2032	140,914	11,174	18,361	161,056	(26)	(88)	(33,118)	(115,732)	20,066	202,605
2033	132,374	11,454	18,820	161,056	(11)	(85)	(35,968)	(118,050)	20,567	190,156
2034	123,939	11,740	19,290	161,056	0	(81)	(39,021)	(120,414)	21,082	177,590
2035	115,716	12,033	19,773	161,056	0	(78)	(42,287)	(122,825)	21,609	164,996
2036	107,598	12,334	20,267	161,056	0	(74)	(45,778)	(125,285)	22,149	152,267
2037	99,481	12,643	20,774	161,056	0	(70)	(49,503)	(127,793)	22,703	139,289
2038	91,365	12,959	21,293	161,056	0	(65)	(53,475)	(130,352)	23,270	126,050
2039	83,933	13,283	21,825	161,056	0	(61)	(57,707)	(132,962)	23,852	113,218
2040	77,866	13,615	22,371	161,056	0	(56)	(62,211)	(135,624)	24,448	101,465
2041	72,484	13,955	22,930	161,056	0	(51)	(67,000)	(138,340)	25,059	90,094
2042	67,102	14,304	23,503	161,056	0	(45)	(72,089)	(141,109)	25,686	78,408
2043	61,722	14,661	24,091	161,056	0	(39)	(77,491)	(143,934)	26,328	66,394
2044	0	0	0	0	0	0	0	0	0	0
2045	0	0	0	0	0	0	0	0	0	0
2046	0	0	0	0	0	0	0	0	0	0
2047	0	0	0	0	0	0	0	0	0	0
2048	0	0	0	0	0	0	0	0	0	0
2049	0	0	0	0	0	0	0	0	0	0
2050	0	0	0	0	0	0	0	0	0	0
2051	0	0	0	0	0	0	0	0	0	0
NPV 2009	861,387	45,969	75,534	742,016	(301)	(376)	(113,261)	(484,559)	82,548	1,208,958
	65	3	6	56	(0)	(0)	(9)	(37)	6	92

An Alternate Calculation for Dr. Cooper's "Diversity of Resources" Analysis: Calculation # 1

(1) FPL without Nuclear Plan

Fuel Type	Amount of Fuel	Resulting Fuel Mix Percentage	HHI Calculation
Coal	6.95	7%	0.005
Gas	73.7	74%	0.543
Oil	1.75	2%	0.000
Nuclear	17.3	17%	0.030
Other	0.3	0%	0.000
	100	100%	0.578
HHI =			**5,782**

(2) FPL without Nuclear Plan and 8% less GWh

Fuel Type	Amount of Fuel	Resulting Fuel Mix Percentage	HHI Calculation
Coal	6.95	8%	0.006
Gas	65.7	71%	0.510
Oil	1.75	2%	0.000
Nuclear	17.3	19%	0.035
Other	0.3	0%	0.000
	92	100%	0.551
			5,514

(3) FPL without Nuclear Plan, 8% less GWh, and 7% more Renewables

Fuel Type	Amount of Fuel	Resulting Fuel Mix Percentage	HHI Calculation
Coal	6.95	8%	0.006
Gas	58.7	64%	0.407
Oil	1.75	2%	0.000
Nuclear	17.3	19%	0.035
Other	7.3	8%	0.006
	92	100%	0.455
			4,548

(4) FPL with Nuclear Plan

Fuel Type	Amount of Fuel	Resulting Fuel Mix Percentage	HHI Calculation
Coal	6.95	7%	0.005
Gas	70	70%	0.490
Oil	1.95	2%	0.000
Nuclear	20.8	21%	0.043
Other	0.3	0%	0.000
	100	100%	0.538
HHI =			**5,385**

(5) FPL with Nuclear Plan and 8% less GWh

Fuel Type	Amount of Fuel	Resulting Fuel Mix Percentage	HHI Calculation
Coal	6.95	8%	0.006
Gas	62	67%	0.454
Oil	1.95	2%	0.000
Nuclear	20.8	23%	0.051
Other	0.3	0%	0.000
	92	100%	0.511
			5,114

(6) FPL with Nuclear Plan, 8% less GWh, and 7% more Renewables

Fuel Type	Amount of Fuel	Resulting Fuel Mix Percentage	HHI Calculation
Coal	6.95	8%	0.006
Gas	55	60%	0.357
Oil	1.95	2%	0.000
Nuclear	20.8	23%	0.051
Other	7.3	8%	0.006
	92	100%	0.421
			4,210

An Alternate Calculation for Dr. Cooper's "Diversity of Resources" Analysis: Calculation # 2

(1) FPL without Nuclear Plan

Fuel Type	Amount of Fuel	Resulting Fuel Mix Percentage	HHI Calculation
Coal	6.95	7%	0.005
Gas	73.7	74%	0.543
Oil	1.75	2%	0.000
Nuclear	17.3	17%	0.030
Other	0.3	0%	0.000
	100	100%	0.578
HHI =			**5,782**

(2) FPL without Nuclear Plan and 8% less GWh

Fuel Type	Amount of Fuel	Resulting Fuel Mix Percentage	HHI Calculation
Coal	6.95	8%	0.006
Gas	65.7	71%	0.510
Oil	1.75	2%	0.000
Nuclear	17.3	19%	0.035
Other	0.3	0%	0.000
	92	100%	0.551
			5,514

(3) FPL without Nuclear Plan, 8% less GWh, and 7% more Renewables

Fuel Type	Amount of Fuel	Resulting Fuel Mix Percentage	HHI Calculation
Coal	6.95	8%	0.006
Gas	58.7	64%	0.407
Oil	1.75	2%	0.000
Nuclear	17.3	19%	0.035
Other	7.3	8%	0.006
	92	100%	0.455
			4,548

(4) FPL with Nuclear Plan

Fuel Type	Amount of Fuel	Resulting Fuel Mix Percentage	HHI Calculation
Coal	6.95	7%	0.005
Gas	70	70%	0.490
Oil	1.95	2%	0.000
Nuclear	20.8	21%	0.043
Other	0.3	0%	0.000
	100	100%	0.538
HHI =			**5,385**

(5) FPL with Nuclear Plan and 8% more Nuclear

Fuel Type	Amount of Fuel	Resulting Fuel Mix Percentage	HHI Calculation
Coal	6.95	7%	0.005
Gas	62	62%	0.384
Oil	1.95	2%	0.000
Nuclear	28.8	29%	0.083
Other	0.3	0%	0.000
	100	100%	0.473
			4,726

(6) FPL with Nuclear Plan and 15% more Nuclear

Fuel Type	Amount of Fuel	Resulting Fuel Mix Percentage	HHI Calculation
Coal	6.95	7%	0.005
Gas	55	55%	0.303
Oil	1.95	2%	0.000
Nuclear	35.8	36%	0.128
Other	0.3	0%	0.000
	100	100%	0.436
			4,359