ORIGINAL

# BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

## DOCKET NO. 070098-EI
## FLORIDA POWER & LIGHT COMPANY

## IN RE: FLORIDA POWER & LIGHT COMPANY'S PETITION TO DETERMINE NEED FOR FPL GLADES POWER PARK UNITS 1 AND 2 ELECTRICAL POWER PLANT

## REBUTTAL TESTIMONY & EXHIBIT OF:

## JUDAH L. ROSE

**BEFORE THE PUBLIC SERVICE COMMISSION**

**FLORIDA POWER & LIGHT COMPANY**

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**MARCH 30, 2007**

**Q. Please state your name and business address.**

A. My name is Judah L. Rose. I am a Managing Director of ICF International ("ICF"). My business address is 9300 Lee Highway, Fairfax, Va. 22031.

Q. **Please briefly describe your educational background and professional experience.**

A. After receiving a degree in economics from the Massachusetts Institute of Technology (MIT) and a Masters Degree in Public Policy from the John F. Kennedy School of Government at Harvard University, I joined ICF International in 1982. I have been working at ICF International since then and now direct ICF's wholesale power practice. I have also been a member of the Board of Directors of ICF International and am one of three people in a firm of over 1,500 people to have been given the title Distinguished Consultant.

**Q. Have you worked with public sector clients on electric power issues?**

A. Yes. ICF has been the principal power consultant to the U.S. Environmental Protection Agency (EPA) continuously for over 25 years, and analyzed all the major policy initiatives involving regional controls on power plant emissions such as $SO_2$, $NO_x$, and Hg. ICF also has extensive experience in analyzing the

impact of $CO_2$ regulations on the power sector including conducting the electric sector analysis for the Regional Greenhouse Gas Initiative (RGGI) in the Northeast and MidAtlantic.

**Q. Do you have other public sector clients?**

A. Yes. ICF has worked with the Federal Energy Regulatory Commission (FERC), U.S. Department of Energy (DOE), Environment Canada, and the European Union. We have also worked with state entities including those in Ohio, New Jersey, California, South Carolina, New York, Connecticut, Kentucky, and Michigan.

**Q. Do you have private sector clients?**

A. Yes. ICF provides assistance to electric utilities, financial institutions, power marketers, fuel companies, and independent power producers. ICF also works with Regional Transmission Organizations (RTOs).

**Q. What type of work do you typically do?**

A. I have extensive experience in assessing the effects of market and regulatory trends on the wholesale power generation sector. This work regularly addresses capacity expansion, market prices for power, and fuel and environmental controls.

**Q. Are there other relevant aspects of your experience?**

A. Yes. I have authored numerous articles in industry journals and spoken at scores of conferences. For additional details, please see my resume which is labeled Document No. JLR-1.

**Q. Have you testified before other state regulators and legislators?**

A. Yes. I have testified before state regulators and legislators in Florida, New Jersey, Ohio, California, North Carolina, Oklahoma, Louisiana, New York, Pennsylvania, Indiana, Kentucky, and Minnesota.

**Q. On whose behalf are you testifying?**

A. I am testifying on behalf of Florida Power & Light Company ("FPL").

**Q. What is the purpose of your rebuttal testimony?**

A. The purpose of my testimony is threefold: first, to rebut Mr. David Schlissel's supplemental testimony on the magnitude of his suggested $CO_2$ price forecast; second, to demonstrate that the $CO_2$ allowance price forecasts used by FPL in their costing calculations for FGPP were reasonable; and third, to demonstrate that there is a direct linkage between the stringency of $CO_2$ policy and the impact on gas prices.

**Q. Are you sponsoring any exhibits to your rebuttal testimony?**

A. Yes. I am sponsoring an exhibit consisting of one document, JLR-1, which is attached to my rebuttal testimony.

**Q. Can you summarize your testimony?**

A. Yes. My testimony centers on seven main points:

First, I believe it is reasonable and prudent to take plausible $CO_2$ allowance prices into account when planning future generation and that the allowance prices used by FPL in their planning process meet these criteria.

Second, while I believe that there is uncertainty involved in forecasting $CO_2$ prices, reasonable parameters can be defined to develop plausible ranges of potential prices.

Third, the $CO_2$ prices that Mr. Schlissel suggests be used to evaluate the economics of building FGPP, and his high case in particular, are extreme and represent a view unsupported by any analysis conducted by Mr. Schlissel and Synapse. I say this because of a variety of policy and technology options that I believe are likely to be employed that will reduce the cost of $CO_2$ allowances. These include the use of offsets and international allowance trading and the deployment of new low emitting technologies including nuclear, coal with carbon capture and sequestration (CCS), and renewables such as wind and biomass.

Fourth, as has been stated in previous testimony by Rene Silva (pg 34), the economics of building gas versus coal will largely hinge on the relative fuel price versus the relative cost of environmental regulation – most notably $CO_2$. Both of these issues are highly uncertain, but plausible, integrally related scenarios can be developed and appropriately weighted.

Fifth, even if one assumes that allowance prices could potentially reach $50/ton from a fundamental perspective, I do not believe that many countries,

including the U.S., would tolerate the impact that such an allowance price would have on the broader economy.

Sixth, not only does Mr. Schlissel's $50/ton $CO_2$ price represent an extreme view, but there is no evidence that he has effectively or systematically modeled $CO_2$ prices using industry-accepted modeling techniques.

And seventh, Mr. Schlissel's characterization of EIA and MIT analyses are incomplete and selective.

**Q. Do you believe it is reasonable and prudent to take $CO_2$ allowance prices into account when planning future generation?**

A. Yes. Although nothing is certain of course, there is increasing momentum in the U.S. that points to the fact that $CO_2$ will most likely be regulated in the mid to long-term. This is evident in the six legislative initiatives that have been introduced in the 110th Congress.

**Q. Will potential $CO_2$ emission reduction requirements tend to favor new natural gas power plants over new coal power plants, all else being equal?**

A. Yes. This is because coal power plant emissions of $CO_2$ are higher per unit of fuel input and electrical output compared to gas plants, and this issue is not in dispute. What is in dispute is the extent new gas plants will be favored.

**Q. Are there aspects of $CO_2$ emission regulations that tend to mitigate the effect on coal power plants?**

A. Yes. The principal mitigants are:

- Natural gas demand is expected to increase due to $CO_2$ emission regulations and as a result, natural gas prices are expected to be higher than otherwise would be the case. This natural gas price increase is expected to be substantial and must be accounted for in any analysis of a policy to control $CO_2$. This increase in gas prices at least partially rebalances the cost comparison in favor of coal plants, especially high efficiency coal plants, to say nothing of the reliability benefits associated with fuel diversity.
- Coal demand is expected to decrease, especially from older existing plants. As a result, coal prices would be lower than if $CO_2$ reduction regulations did not exist, also partly readjusting the balance. While this effect is likely to be smaller than the gas price increase, it should be considered.
- Allocations of $CO_2$ emission allowances or permits from the government can be extremely valuable in a marketized version of $CO_2$ control. The U.S. DOE considers the technology being proposed by FPL as a clean coal technology. This is because it uses advanced technology to increase thermal efficiency and could be favored by the provision of extra $CO_2$ emission allowance allocations. This can also partially redress the balance between new coal and gas plants in the favor of coal. As an example, with regards to clean coal technology, the Feinstein Bill to control $CO_2$ emissions S. 317 orders the EPA to create a definition of 'qualifying advanced clean coal technology'

within 18 months of enactment. It must reflect advances in available technology, taking into consideration net thermal efficiency, measures to capture and sequester carbon dioxide, and output-based emission rates for $CO_2$, $SO_2$, $NO_X$, PM, and Hg. In another example, in Europe, $CO_2$ emission allowance allocations are being used to cushion the effect on various sectors in accordance with national policy. A fair consideration of the decision to build new coal plants like the one being proposed by FPL must at least give qualitative consideration to this potential.

**Q. What are the factors that tend to limit future long-term $CO_2$ emission allowance prices separate from limiting the stringency of the policy?**

A. There are numerous options for reducing $CO_2$ and other greenhouse gas (GHG) emissions ($CH_4$, $N_2O$, PFC, HFC and $SF_6$) which are believed to contribute to climate change. These various measures of reducing GHG emissions form a supply curve of mitigation options. In order for $CO_2$ prices to be extremely high, not only does the demand for $CO_2$ reductions have to be high (i.e., the program is very stringent), but the supply of reductions has to be severely limited. The $CO_2$ reduction options that should be addressed in an analysis of $CO_2$ emission allowance prices include a combination of on-system reductions specific to the power system and off-system reductions, or offsets, which occur outside the power sector. On-system reductions include measures such as fuel switching, unit redispatch, technology and efficiency improvements at existing units as well as the deployment of carbon capture

and sequestration, nuclear power and renewables. The deployment and adoption of energy efficiency measures can also play a role. Off-system reductions include such measures as $CO_2$ offsets from forestry and other sources, and non-$CO_2$ greenhouse gas (GHG) reductions from other sectors. These include both reductions that occur domestically in the U.S., as well as those that occur abroad, particularly in developing countries. Taken as a whole, these mitigating options are significant and, depending on the way in which $CO_2$ regulation is implemented and coupled with other market forces, could significantly offset any direct cost differential between a gas-fired plant and a coal-fired plant imposed by $CO_2$ regulation.

**Q. Can you elaborate on the on-system reductions in more detail?**

A. Yes. On-system reductions, as mentioned above include a portfolio of measures and actions that the power system, in aggregate, can undertake to reduce $CO_2$ emissions. These measures can impact the dispatch and, in some cases, the fuel choices of existing units as well as decisions regarding what type of new capacity is added to the system in the future to meet load growth and peak demand plus reserve margin requirements. In forecasting $CO_2$ allowance prices, new build options and their cost and performance characterizations play an important role in determining the cost of complying with future carbon constraints. Assumptions regarding the ability of existing units to retrofit with controls can also play a role.

**Q. Is it reasonable to believe that carbon capture and sequestration (CCS) will play a role in mitigating rapid growth in $CO_2$ costs?**

A. Yes. Numerous parties have discussed the importance of CCS in meeting future energy needs in the U.S. and the world and are encouraging research and development of CCS options. A recent study by MIT called "The Future of Coal" concluded that CCS is "the critical enabling technology that would reduce $CO_2$ emissions significantly while also allowing coal to meet the world's pressing energy needs." (Executive Summary, p.x) President Bush has stated that CCS is a top priority and supports the FutureGen project to develop a low- to zero-emissions coal plant early in the next decade. Two bills have been introduced this Congressional session with goals of providing financial support to facilities that capture carbon emissions and improving carbon capture and sequestration research, development and demonstration (S. 155 and S. 962).

There is a large effort underway, both in the private and public sectors, to evaluate the technologies and resources necessary for CCS to work. The U.S. Department of Energy's National Energy Technology Laboratory (NETL) is working on several fronts to bring CCS to commercialization. These include: developing a network of regional partnerships to determine approaches for CCS; funding several technology research projects to assess the potential for different capture options; and researching measurement, monitoring and verification approaches for the $CO_2$ once it is stored.

Utilities are also conducting analysis of CCS. AEP recently announced that it will be conducting tests of two capture options over the next two years with the intention of installing a commercial scale capture operation sometime in the period after 2011.

**Q. Do these CCS tests include both new PC as well as IGCC plants?**

A. Yes. The two AEP tests, for example, will both be on conventional pulverized coal units. The MIT study states that in terms of future CCS potential there is no clear preference for IGCC versus other new coal plants. The MIT study states that even though IGCC is currently the leading electricity generation candidate for carbon capture, CCS has not yet been proven on this technology. Further R&D may show that another technology is more cost effective or more efficient at capturing $CO_2$; an even more likely finding is that a variety of technologies will need to be deployed to suit the wide variety of coal types used for electricity generation. (Executive Summary, p. xiii). The MIT study also notes the trade-off between the cost to produce electricity before a carbon regulation is implemented and the cost after the start of the program; depending on the timing of the CCS retrofit and magnitude of that carbon cost, it may be difficult to tell which plant type (IGCC or PC) will actually have a lower net present value, when incorporating CCS. (Executive Summary, p. xiv)

**Q. Does the MIT study indicate any factors with potential to alter the cost of retrofitting CCS on existing plants?**

A. Yes. According to the study, the largest source of efficiency loss observed with $CO_2$ capture on a pulverized coal plant and therefore the largest cost increase comes from recovering the $CO_2$. The efficiency loss associated with this process could potentially be reduced by one-half with a more efficient capture technology, resulting in a decrease in costs per ton of $CO_2$ of 25%. (p. 28)

**Q. Can you elaborate on the off-system reductions in more detail?**

A, Yes. Off-system reductions, or offsets, represent the ability to reduce $CO_2$ or $CO_2$ equivalent emissions from the six greenhouse gases identified under the Kyoto Protocol ($CO_2$, $CH_4$, $N_2O$, PFC, HFC and $SF_6$) outside of the GHG regulated sector. One of course has to be convinced these offsets represent reductions that are equivalent to reduced on-system emissions; measurement and verification protocol are currently being developed to assure that these off-system reductions are real and quantifiable. The Kyoto Protocol has set up flexibility mechanisms such as the Clean Development Mechanism (CDM) and Joint Implementation (JI) mechanisms to assure that compliance with a $CO_2$ cap can be met through the investment in, and purchase of, low cost GHG abatement options.

Offsets exist both domestically and internationally. ICF has been at the forefront of developing the inventory and cost of these potential reductions

through the development of both domestic marginal abatement cost curves (MACCs) for the U.S. EPA and international MACCs for the International Energy Agency (IEA), and we incorporate these MACC curves in our analyses.

**Q Can you explain why you think the $CO_2$ allowance price forecasts developed by Synapse are unreasonable?**

A. Yes. I believe that the $CO_2$ price forecasts developed by Synapse are unreasonable because Synapse has not conducted any modeling in order to forecast $CO_2$ allowance prices. In developing prices they have relied indirectly upon studies conducted by others, giving no explanation of how they arrived at the specific $CO_2$ price forecasts represented.

**Q. What is wrong with relying on other studies?**

A. There are several problems. First, the studies in some cases analyze the same program with very different results. An expert opinion should not give equal weight to contradictory inputs or methodologies. Second, the studies are of different vintages and some are likely out-of-date. Mr. Schlissel elsewhere emphasizes in his testimony recent developments and should not ignore recent information here. Third, the studies in some cases have clear and obvious methodological flaws which Mr. Schlissel ignores. These studies should not be included. Fourth, Synapse selectively used certain scenarios from studies, ignoring or rejecting others with no explanation. Fifth, there are certain aspects of these studies that are not apparent to outsiders without full and complete access to the models, data, results, limitations, etc. This would not

be a problem if Synapse and Mr. Schlissel did their own analysis and presented the results of their own studies.

**Q. Can you provide examples of flaws in the studies that should have caused them to be given significantly less weight?**

A. Yes. Examples of significant problems include:

- EPA Analysis of S. 843 – This analysis used offset curves only and did not include $CO_2$ costs in plant dispatch and operation.
- MIT was not an energy sector specific model. The Emissions Prediction and Policy Analysis Model is a multi-regional general equilibrium model of the world economy. The version of the model used in their analysis did not have the capability to represent policies that discriminate among economic sectors, so MIT approximated the S. 139 as applying to the entire United States economy, rather than only applying it to the specific affected sectors. The MIT study explains this probably causes a slight overestimation of $CO_2$ prices, yet this point is ignored by Mr. Schlissel.
- Tellus and EIA use the National Energy Modeling System (NEMS), developed by EIA, but with contradictory results. While the electric sector representation in NEMS is reasonable from a national perspective, it lacks detail at the regional level. For example, NEMS lacks transmission transfer capabilities and treats each NERC region as one large market. There is a general lack of granularity at the more disaggregated regional level. The contradictory results, as filed by Mr.

Schlissel in exhibit DAS-3, are the result of widely divergent input assumptions. Mr. Schlissel makes no determination as to which set of assumptions are more or less plausible and therefore which outcome should be given greater weight.

- It is important to note that the model developed and used by ICF – the Integrated Planning Model (IPM®) has undergone a rigorous peer review process and is regularly used for financial due diligence and regulatory analysis.

**Q. Can you provide examples of studies of the same program which are widely divergent?**

A. Yes. Mr. Schlissel identifies three studies each (MIT, EIA, Tellus) of the two versions of the McCain Lieberman bill (S139 and SA 2028) with widely different results. Nonetheless, he gives equal weight to each. The Tellus results are much lower for the same program compared to EIA and Mr. Schlissel provides no view as to which is correct.

**Q. How does Mr. Schlissel handle multiple results in the same study?**

A. He excludes results from some of the studies without explanation. For example, the MIT study was conducted with and without offsets and with different baseline growth assumptions, but it is unclear which version of the analysis he is presenting. Understanding the amount of offsets and their cost is critical to understanding the relative impact of on-system reductions versus the amount of reductions coming from outside the system. These factors

together determine the effective stringency of a $CO_2$ policy and determine the directionality and order of magnitude of the allowance price forecast.

Additionally, Mr. Schlissel does not explain why one scenario from a study was accepted and plotted while other scenarios were rejected. For example, in presenting the EIA analysis of S. 139, Mr. Schlissel showed only one set of results (the analysis of S. 139 with *AEO2003* reference case assumptions) from a study that included eight sensitivity analyses. Among the sensitivities left out is an analysis of the bill using *AEO2003* high technology assumptions (earlier availability, lower cost, and higher efficiencies for advanced technologies), which results in $CO_2$ allowance prices that are 25% lower in 2010 and 29% lower in 2025.

**Q. Do any or all of the analyses address the effects of $CO_2$ on gas and coal prices?**

A. Mr. Schlissel provides $CO_2$ prices but not fuel prices, and the numerous studies he relied upon have different treatment ranging from no treatment to more nuanced treatment. While Mr. Schlissel seems to acknowledge that gas prices are important in evaluating power sector economics, he gives no weight to the fact that $CO_2$ policy would have a direct impact on the price of natural gas. I believe this is a key flaw in his understanding of how $CO_2$ prices are determined and the feedback that $CO_2$ has on fuel prices in general and gas prices in particular.

**Q. Do any or all of the analyses address the effects of new technologies in mitigating the growth in $CO_2$ allowance price projections that were developed?**

A. All studies implicitly had to make assumptions in this regard even if that assumption was no technological improvement. Some of the studies conducted by EIA for example did explicitly include an advanced technology scenario that resulted in lower $CO_2$ prices – and it is interesting to note that Mr. Schlissel explicitly chose not to represent those lower $CO_2$ prices in his presentation of the different analyses or to take them into account when he interpolated between the price points of the various analyses. Mr. Schlissel himself does not provide a view regarding the issue of technology development in mitigating $CO_2$ prices other than to say it is a contributing factor.

**Q. Do any or all of the analyses address the effects of alternative emission allowance allocation programs?**

A. Mr. Schlissel does not address this important issue and treatment of this issue varies across the studies. None address the issue of clean coal technology allowance bonuses.

**Q. Does Mr. Schlissel contradict Synapse and his own testimony by giving equal weight to the High $CO_2$ Case?**

A. Yes, in his corrected direct testimony, Exhibit DAS-3, pg 53 of 63, Mr. Schlissel says "the most likely scenario (will be) closer to (though not equal to) low-case scenarios than the high case scenario...". He states that after

2030 allowance prices could be higher in response to more stringent emissions caps to achieve atmospheric stabilization. This notwithstanding, he gives added weight to the high $CO_2$ case in his supplemental testimony where he concludes that the proposed new coal plant has costs above new gas plants. I discuss this contradiction later in my testimony.

**Q. Do you find Mr. Schlissel's $CO_2$ scenarios reasonable?**

A. No, for all the reasons I describe above. I especially take issue with his higher $CO_2$ estimates which reach $40 to $50/ton $CO_2$. These scenarios represent extreme views and should be given a very low weight by decisions makers. It is important to note the extreme implications of a $50/ton $CO_2$ price on the power sector specifically and the U.S. economy in general. These implications include:

- Very large increases in natural gas prices of $2/MMBtu in real 2006 dollars. Natural gas is a crucial fuel for home heating and industrial activity, including power generation.
- Very large decreases in coal use of 40 percent with adverse consequences for coal using and producing areas.
- Average power sector costs increase 3¢/kWh in 2006 dollars versus U.S. average rates of approximately 7¢/kWh.
- If $50/ton $CO_2$ is applied nationwide, this is equivalent to adding $357 billion in costs in today's dollars. On a net present value basis, this equals roughly $3.6 trillion dollars. Total wealth of U.S. households

(real estate, stocks, bonds, bank deposits) is $45 trillion, and hence, such a program equals a burden 8 percent of total U.S. wealth.

- U.S. power sector $CO_2$ emissions by 2030 decrease 47 percent from base line. China alone is increasing its $CO_2$ emissions by over 10 percent per year and is poised to overtake the U.S. this year as the world's largest carbon emitter and is not subject to controls as are many other countries. The $50/ton price is associated with small effects in terms of $CO_2$ controls, but huge economic effects, and hence, is extreme.

Current $CO_2$ prices in Europe are $6/ton. Thus, there is no history to support $50/ton, adding to the implausibility and the inappropriateness of such an extreme price forecast.

**Q. How do you forecast $CO_2$ emission prices?**

A. ICF explicitly takes into account up-to-date policy, market and technical information and integrates these factors in our sophisticated modeling framework – the Integrated Planning Model (IPM®) that has been used by multiple utilities as well as by the US EPA and others. When conducting this type of analysis, we take into account the fundamental supply and demand of $CO_2$ reduction options including on-system reductions, offsets and alternative technologies. This allows us to provide decision makers a coherent integrated and documented view upon which to base decisions. Further, since it is our analysis, we are in a position to fully present it in forums such as this proceeding.

**Q. Did you model the $CO_2$ allowance prices used by FPL in their analysis?**

A. Yes. ICF developed these $CO_2$ allowance price streams by conducting rigorous, bottom-up analyses of the cost of meeting specific $CO_2$ cap limits using our IPM® model. We specifically developed the following scenarios:

- Mild $CO_2$ – representative of the Senator Bingaman's Policy (S.A. 868) as proposed in 2005.
- Stringent $CO_2$ – representative of the Senators McCain and Lieberman's (S. 1151) policy as introduced in 2006.
- Moderate $CO_2$ – representative of a weighted price stream that used the Bingaman and McCain-Lieberman policies as noted above plus an analysis ICF conducted of Senator Carper's policy introduced in 2006.

It is important to note that $CO_2$ prices, like any allowance price under a cap and trade policy, are representative of the marginal cost of imposing emissions limits. In the case of $CO_2$, meeting those emission limits can mean a variety of responses as noted earlier including fuel switching away from more carbon intensive fuels, shifting dispatch away from less efficient generation sources, building more efficient generation such as ultra-super critical pulverized coal, and building less carbon-intensive, but generally more expensive generation sources such as renewables.

**Q. Is this approach consistent with your firm's historical role in assessing the impacts of air emission regulations?**

A. Yes. ICF has a long history of forecasting emission allowance prices and the impact of air regulations on the power and other sectors. This capability has been built over the past three decades through the Firm's continuous support for the U.S. EPA Office of Air and Radiation, as well as our work with a wide range of utilities, merchant generators, power marketers, environmental groups, fuel companies, and public agencies across the country and internationally. Our analysis is based on the same framework that we use for our power market evaluation, providing internal analytical consistency. As noted, ICF has been the leading consultant to the US Environmental Protection Agency and to commercial industry on the economic and environmental impacts of the Clean Air Act Amendments (CAAA) and other environmental policies for over 30 years. We evaluated the costs of compliance with the acid rain regulations (Title IV) of the CAAA of 1978 and 1990, focusing on forecasted effects on utility $SO_2$ emissions, utility costs, electricity rate increases, and regional coal markets.

Prior to the CAAA, ICF evaluated all of the major legislative proposals from industry and environmental groups, appraising the emissions, costs, and coal market impacts of various proposed and final revisions to the CAAA. We have assessed impacts of $SO_2$ emissions trading on utility compliance costs and regional coal markets under an acid rain control program. We continue to

support EPA's air regulatory analyses. We were the lead analysts supporting the Clean Air Power Initiative (CAPI); provided analytic and other support for the SIP Call process; provided carbon related analysis, and currently support ongoing multi-pollutant and related analyses including the Clear Skies Act, Senator Carper's Clean Air Planning Act, the Clean Air Interstate Rule (CAIR) and Clean Air Mercury Rule (CAMR) regulations and mercury maximum achievable control technology (MACT) proposals. In addition, ICF has been one of the world's leading firms in the development and application of GHG estimation protocols. We have provided technical knowledge of GHG and other emissions sources in energy production operations to a wide range of clients including the Federal Government, the Intergovernmental Panel on Climate Change, Environment Canada, the UN, World Bank, and a number of public and private organizations across the U.S. and in Europe. We are increasingly working with states and regions to analyze the impacts of regional emissions caps, including the Regional Greenhouse Gas Initiative (RGGI), and the states of New York and Connecticut.

**Q. Are there any errors in Mr. Schlissel's supplemental direct testimony that are pertinent to your rebuttal?**

A. Yes. In Table 1 of his supplemental direct testimony, Mr. Schlissel makes two errors in replicating summary results originally provided in Mr. Silva's direct testimony. Table 1 shows the summary results of the cost differential analysis described in Mr. Silva's direct testimony and notes the errors made by Mr. Schlissel in his representation of the same results. A negative value in

the table indicates that the Plan with Coal is less costly than the Plan without Coal.

**Table 1. Cost Differentials of FPL Scenarios (Millions, 2006$)**

| Fuel Cost Forecasts | Environmental Compliance Cost Forecasts | | | |
|---|---|---|---|---|
| | A – No $CO_2$ | B – Low $CO_2$ | C – Mid$CO_2$ | D – High $CO_2$ |
| High Differential | (2,792) | (2,045) | (1,127) | (666)* |
| Shocked Differential | (873) | (113) | 804 | 1,278 |
| Medium Differential | (219) | 537 | 1,466 | 1,930 |
| Low Differential | 1,912^ | 2,670 | 3,604 | 4,037 |

* In his Supplemental Direct Testimony, Mr. Schlissel entered an incorrect value of 1,912.
^ In his Supplemental Direct Testimony, Mr. Schlissel entered an incorrect value of (1,912).

**Q. Can you please explain why Mr. Schlissel's conclusions from the results shown in Table 1 are unreasonable?**

A. In his examination of the results in Table 1, Mr. Schlissel states that the cases under Environmental Cost A "are not reasonable and should not be considered." Similarly, he describes the Low $CO_2$ cost forecast in column B as an "unreasonable assumption over such a long period of time." He then concludes that "just one out of eight scenarios … suggest[s] that FGPP would be the lower cost capacity addition to FPL's system," referring to the case combining $CO_2$ Cost Forecast C and the High Differential Fuel Forecast.

I would first point out that correcting the error in Mr. Schlissel's Table 1, even under his unduly narrow approach, results in 2 of the 8 scenarios showing FGPP as the lower cost option relative to new gas capacity.

More importantly, however, is that Mr. Schlissel fails to evaluate the potential for each of the scenarios with an integrated view of fuel and $CO_2$ markets and therefore is too broad in his determination of which scenarios he considers reasonable. As discussed earlier, ICF regularly analyzes the interactions of fuel markets and environmental regulations. In those analyses, it quickly becomes apparent that as environmental costs for coal-fired plants increase relative to those for gas-fired plants, as they would under any sort of $CO_2$ regulation, the demand for gas-fired generation and therefore for natural gas itself increases. At the same time, coal prices tend to decrease, broadening the differential between gas and coal prices.[1] Therefore, the Fuel Cost Forecasts with lower differentials between gas and solid fuel costs are unlikely under the Mid and High Environmental Cost Forecasts.

By narrowing Mr. Schlissel's subset of 8 cases further by removing the Low and Medium Differential Fuel Cost Forecasts, 2 of 4 cases show FGPP as the lower cost option for FPL's system, with the upside of the project roughly equivalent to the downside. Based on this subset of cases in Table 1, the

[1] Mr. Yupp describes the relationship between environmental cost and gas prices the same way in his testimony.

upper bound of the potential cost of FGPP over natural gas generation is $1.278 billion, as compared to Mr. Schlissel's conclusion of $4.037 billion.

**Q. Would higher $CO_2$ costs than those included in the analysis in Table 1, such as the Synapse Mid and High Cases proposed by Mr. Schlissel, increase the potential cost of FGPP relative to the costs presented in Table 1?**

A. Not necessarily. First, as discussed earlier, I believe the higher $CO_2$ costs proposed by Synapse are unreasonable for a number of reasons. But even if $CO_2$ costs did rise above those assumed in the High Environmental Cost Forecast reflected in Table 1, natural gas prices would likely rise as well, thereby offsetting some of the additional cost incurred by FGPP relative to a gas-fired generator. Depending on the relative stringency and the reaction of gas prices, FGPP may or may not remain the lower cost option for FPL's customers.

**Q. So Mr. Schlissel's conclusion that the cost to FPL's customers "would rise significantly above $4.037 billion" under Synapse's Mid and High $CO_2$ Price Forecasts is unreasonable?**

A. Yes, for a couple of reasons. First, Mr. Schlissel uses the highest cost in Table 1 as a basis for his comparison even though, as noted above, the combination of a High $CO_2$ cost and low fuel price differential is very unlikely. I would argue that the Shocked or High Differential costs would serve as the starting point for such a comparison. Second, the higher $CO_2$

costs assumed in the Synapse cases would drive up gas prices, offsetting some of the added cost to FGPP of the higher $CO_2$ cost.

As with the Synapse $CO_2$ forecasts themselves, Synapse does not appear to have done any analysis to support Mr. Schlissel's claim that costs would rise "significantly" and certainly not as compared to the $4.037 billion value.

In fact, Mr. Schlissel concedes in his recent deposition that while he understands that $CO_2$ regulations have the effect of increasing natural gas prices, no specific gas price forecast or price response was assumed in his studies. By not taking a position on this effect, he did not adequately consider the impacts to natural gas prices that would result from higher $CO_2$ prices.

**Q. Does this conclude your testimony?**

A. Yes.

**JUDAH L. ROSE**

## EDUCATION

1982 M.P.P., John F. Kennedy School of Government, **Harvard University**

1979 S.B., Economics, **Massachusetts Institute of Technology**

## EXPERIENCE

Judah L. Rose joined ICF in 1982 and currently serves as a Managing Director of ICF International. Mr. Rose has more than 25 years of experience in the energy industry, with emphasis on electric power, generation and transmission. Mr. Rose directs ICF International's wholesale power Line of Business (including assistance to electric utilities, financial institutions, law firms, government agencies, fuel companies, and IPPs). Mr. Rose is one of ICF's Distinguished Consultants, an honorary title given to three of ICF's 1,800 employees, and has served on the Board of Directors of ICF International as the Management Shareholder Representative. Mr. Rose co-manages ICF's IPM© (Integrated Power Model). Mr. Rose has supported the financing of tens of billion dollars of new and existing power plants and is a frequent counselor to the financial community on power issues. Mr. Rose has also served as lead negotiator, and he frequently provides expert testimony and litigation support in power-related court cases. Mr. Rose received a M.P.P. from the John F. Kennedy School of Government, Harvard University, and an S.B. in Economics from the Massachusetts Institute of Technology.

Mr. Rose has publicly testified in scores of state and other legal proceedings, addressed approximately 100 major energy conferences, authored numerous articles published in Public Utilities Fortnightly, the Electricity Journal, Project Finance International, and written numerous company studies on power, coal, and gas related issues, and managed large consulting projects. Mr. Rose has also appeared in TV interviews. Details are provided below.

## PRESS INTERVIEWS

**TV:** "The Most With Allison Stewart," MSNBC, "Blackouts in NY and St. Louis & ongoing Energy Challenges in the Nation," July 25, 2006
CNBC Wake-Up Call, August 15, 2003
Wall Street Journal Report, July 25, 1999
Back to Business, CNBC, September 7, 1999

**Journals:** Electricity Journal
Energy Buyer Magazine
Public Utilities Fortnightly
Power Markets Week

**Magazine:** Business Week

Power Economics
Costco Connection

**Newspapers:** Denver Post
Rocky Mountain News
Financial Times Energy
LA Times
Arkansas Democratic Gazette
Galveston Daily News
The Times-Picayune
Pittsburgh Post-Gazette
Power Markets Week

**Wires:** Bridge News
Associated Press
Dow Jones Newswires

**TESTIMONY**

Confidential Expert Report, Nuclear Power Siting, December 2006, South Carolina.

Electric Utility Power Hedging, on behalf of Duke Energy Indiana, Cause No. 38707-FAC6851, February 9, 2007.

CPCN for Cliffside Coal Plant, on behalf of Duke Carolinas, Docket No. E7, SUB790, December 2006.

IGCC Coal Plant, Testimony on behalf of Duke Energy Indiana, Cause No. 43114, October 2006.

Expert Report, Chapter 11, Case No. 01-16034 (AJG) and Adv. Proc. No. 04-2933 (AJG), November 6, 2006.

Market Power and the PSEG Exelon Merger on Behalf of the NJBPU Staff, NJBPU, BPU Docket No. EM05020106, OAL Docket No. PUC-1874-05, Supplemental Testimony March 20, 2006.

Market Power and the PSEG Exelon Merger on Behalf of the NJBPU Staff, NJBPU, BPU Docket No. EM05020106, OAL Docket No. PUC-1874-05, Surrebuttal Testimony December 27, 2005.

Market Power and the PSEG Exelon Merger on Behalf of the NJBPU Staff, NJBPU, BPU Docket No. EM05020106, OAL Docket No. PUC-1874-05, November 14, 2005.

Brazilian Power Purchase Agreement, confidential international arbitration, October 2005.

Cost of Service and Fuel Clause Issues, Rebuttal Testimony on behalf of Public Service of New Mexico, Docket No. EL05-151, November 2005.

Cost of Service and Peak Demand, FERC, Testimony on behalf of Public Service of New Mexico, September 19, 2005, Docket No. EL05-19.

Cost of Service and Fuel Clause Issues, Testimony on behalf of Public Service of New Mexico, FERC Docket No. EL05-151-000, September 15, 2005.

Prudence of Acquisition of Power Plant, Testimony on behalf of Redbud, September 12, 2005, No. PUD 200500151.

Proposed Fuel Cost Adjustment Clause, FERC, Docket Nos. EL05-19-002 and ER05-168-001 (Consolidated), August 22, 2005.

Market Power and the PSEG Exelon Merger on Behalf of the NJBPU, FERC, Docket EC05-43-000, May 27, 2005.

New Air Emission Regulations and Investment in Coal Power Plants, rebuttal testimony on behalf of PSI, April 18, 2005, Causes 42622 and 42718.

Rebuttal Report: Damages due to Rejection of Tolling Agreement Including Discounting, February 9, 2005, CONFIDENTIAL.

New Air Emission Regulations and Investment in Coal Power Plants, supplemental testimony on behalf of PSI, January 21, 2005, Causes 42622 and 42718.

Damages Due to Rejection of Tolling Agreement Including Discounting, January 10, 2005, CONFIDENTIAL.

Discount rates that should be used in estimating the damages to GTN of Mirant's bankruptcy and subsequent abrogation of the gas transportation agreements Mirant had entered into with GTN, December 15, 2004. CONFIDENTIAL

New Air Emission Regulations and Investment in Coal Power Plants, testimony on behalf of PSI, November 2004, Causes 42622 and 42718.

Rebuttal Testimony of Judah Rose on behalf of PSI, Cause No. 42469, August 23, 2004.

Rebuttal Testimony of Judah Rose on behalf of the Hopi Tribe, Case No. A.02-05-046, June 4, 2004.

Supplemental Testimony "Retail Generation Rates, Cost Recovery Associated with the Midwest Independent Transmission System Operator, Accounting Procedures for Transmission and Distribution System, Case No. 03-93-EL-ATA, 03-2079, EL-AAM, 03-2081, EL-AAM, 03-2080, EL-ATA for Cincinnati Gas & Electric, May 20, 2004.

"Application of Southern California Edison Company (U338-E) Regarding the Future Disposition of the Mohave Generating Station," May 14, 2004.

"Appropriate Rate of Return on Equity (ROE) TransAlta Should be Authorized For its Capital Investment Related to VAR Support From the Centralia Coal-Fired Power Plant", for TransAlta, April 30, 2004, FERC Docket No. ER04-810-000.

"Retail Generation Rates, Cost Recovery Associated with the Midwest Independent Transmission System Operator, Accounting Procedures for Transmission and Distribution System, Case No. 03-93-EL-ATA, 03-2079, EL-AAM, 03-2081, EL-AAM, 03-2080, EL-ATA for Cincinnati Gas & Electric, April 15, 2004.

"Application of Southern California Edison Company (U338-E) Regarding the Future Disposition of the Mohave Generating Station," May 14, 2004.

"Appropriate rate of return on equity (ROE) TransAlta should be authorized for its capital investment related to VAR support from the Centralia coal-fired power plant", for TransAlta, April 30, 2004.

"Retail Generation Rates, Cost Recovery Associated with the Midwest Independent Transmission System Operator, Accounting Procedures for Transmission and Distribution System, Case No. 03-93-EL-ATA, 03-2079, EL-AAM, 03-2081, EL-AAM, 03-2080, EL-ATA for Cincinnati Gas & Electric, April 15, 2004.

"Valuation of Selected MIRMA Coal Plants, Acceptance and Rejection of Leases and Potential Prejudice to Leasors" Federal Bankruptcy Court, Dallas, TX, March 24, 2004 CONFIDENTIAL.

"Certificate of Purchase as of yet Undetermined Generation Facility", Cause No. 42469 for PSI, March 23, 2004.

"Ohio Edison's Sammis Power Plant BACT Remedy Case", In the United States District Court of Ohio, Southern Division, March 8, 2004.

"Valuation of Power Contract," January 2004, confidential arbitration.

"In the matter of the Application of the Union Light Heat & Power Company for a Certificate of Public Convenience and Necessity to Acquire Certain Generation Resources, etc.", before the Kentucky Public Service Commission, July 21, 2003.

"In the Supreme Court of British Columbia", July 8, 2003. CONFIDENTIAL

"The Future of the Mohave Power Plant – Rebuttal Testimony", California P.U.C., May 20, 2003.

"Affidavit in Support of the Debtors' Motion", NRG Bankruptcy, May 14, 2003. CONFIDENTIAL

"IPP Power Purchase Agreement," confidential arbitration, April 2003.

"The Future of the Mohave Power Plant", California P.U.C., March 2003.

"Power Supply in the Pacific Northwest," contract arbitration, December 5, 2002. CONFIDENTIAL

"Power Purchase Agreement Valuation", Confidential Arbitration, October 2002.

"Cause No. 42145 - rebuttal testimony on behalf of PSI. Filed on 8/23/02."

"Cause No. 42200 - in support of PSI's petition for authority to recover through retail rates on a timely basis. Filed on 7/30/02."

"Cause No. 42196 - in support of PSI's petition for interim purchased power contract. Filed on 4/26/02."

"Cause No. 42145 - in support of PSI's petition for authority to acquire the Madison and Henry County plants. Filed on 3/1/2002."

"Analysis of an IGCC Coal Power Plant", Minnesota state senate committees, January 22, 2002

"Analysis of an IGCC Coal Power Plant", Minnesota state house of representative committees, January 15, 2002

"Interim Pricing Report on New York State's Independent System Operator", New York State Public Service Commission (NYSPSC), January 5, 2001

" The need for new capacity in Indiana and the IRP process", Indiana Utility Regulatory Commission, October 26, 2000

"Damage estimates for power curtailment for a Cogen power plant in Nevada", August 2000. CONFIDENTIAL

"Valuation of a power plant in Arizona", arbitration, July 2000. CONFIDENTIAL

Application of FirstEnergy Corporation for approval of an electric Transition Plan and for authorization to recover transition revenues, Before PUCO, Case No. 99-1212-EL-ETP, October 4, 1999 and April 2000.

"Issues Related to Acquisition of an Oil/Gas Steam Power plant in New York", September 1999 Affidavit to Hennepin County District Court, Minnesota

"Wholesale Power Prices, A Cost Plus All Requirements Contract and Damages", July 1999. Testimony to U.S. Bankruptcy Court.

"Power Prices." Testimony in confidential contract arbitration, July 1998.

"Horizontal Market Power in Generation." Testimony to New Jersey Board of Public Utilities, May 22, 1998.

"Basic Generation Services and Determining Market Prices." Testimony to the New Jersey Board of Public Utilities, May 12, 1998.

"Generation Reliability." Testimony to New Jersey Board of Public Utilities, May 4, 1998.

"Future Rate Paths and Financial Feasibility of Project Financing." Testimony to U.S. Bankruptcy Court, April 1998.

"Stranded Costs of PSE&G." Testimony to New Jersey Board of Public Utilities, February 1998.

"Application of PECO Energy Company for Approval of its Restructuring Plan Under Section 2806 of the Public Utility Code." Rebuttal Testimony filed July 1997.

"Future Wholesale Electricity Prices, Fuel Markets, Coal Transportation and the Cajun Bankruptcy." Testimony to Louisiana Public Service Commission, December 1996.

"Curtailment of the Saguaro QF, Power Contracting and Southwest Power Markets." Testimony on a contract arbitration, Las Vegas, Nevada, June 1996.

"Future Rate Paths and the Cajun Bankruptcy." Testimony to the U.S. Bankruptcy Court, June 1997.

"Fuel Prices and Coal Transportation." Testimony to the U.S. Bankruptcy Court, June 1997.

"Demand for Gas Pipeline Capacity in Florida from Electric Utilities." Testimony to Florida Public Service Commission, May 1993.

"The Case for Fuel Flexibility in the Florida Electric Generation Industry." Testimony to the Florida Department of Environmental Regulation (DER), Hearings on Fuel Diversity and Environmental Protection, December 1992.

**SELECTED SPEAKING ENGAGEMENTS**

Rose, J.L., AESP, NEEC Conference, Rising Prices and Failing Infrastructure: A Bleak or Optimistic Future, Marlborough, MA, October 23, 2006.

Rose, J.L., Infocast Gas Storage Conference, "Estimating the Growth Potential for Gas-Fired Electric Generation," Houston, TX, March 22, 2006.

Rose, J.L., "Power Market Trends Impacting the Value of Power Assets," Infocast Conference, Powering Up for a New Era of Power Generation M&A, February 23, 2006.

Rose, J.L., "The Challenge Posed by Rising Fuel and Power Costs", Lehman Brothers, November 2, 2005.

Rose, J.L., "Modeling the Vulnerability of the Power Sector", EUCI – Securing the Nation's Energy Infrastructure, September 19, 2005

Rose, J.L., "Fuel Diversity in the Northeast, Energy Bar Association, Northeast Chapter Meeting, New York, NY, June 9, 2005.

Rose, J.L., "2005 Macquarie Utility Sector Conference", Macquarie Utility Sector Conference, Vail, CO, February 28, 2005.

Rose, J.L., "The Outlook for North American Natural Gas and Power Markets", The Institute for Energy Law, Program on Oil and Gas Law, Houston, TX, February 18, 2005.

Rose, J.L. "Assessing the Salability of Merchant Assets – What's on the Horizon?", Infocast – The Market for Power Assets, Phoenix, AZ, February 10, 2005.

Rose, J.L. "Market Based Approaches to Transmission – Longer-Term Role", National Group of Municipal Bond Investors, New York, NY, December 10, 2004.

Rose, J.L. "Supply & Demand Fundamentals – What is Short-Term Outlook and the Long-Term Demand? Platt's Power Marketing Conference, Houston, TX, October 11, 2004.

Rose, J.L. "Assessing the Salability of Merchant Assets – When Will We Hit Bottom?, Infocast's Buying, Selling, and Investing in Energy Assets Conference, Houston, TX, June 24, 2004.

Rose, J. L. "After the Blackout – Questions That Every Regulator Should be Asking," NARUC Webinar Conference, Fairfax, VA, November 6, 2003.

Rose, J. L., "Supply and Demand in U.S. Wholesale Power Markets," Lehman Brothers Global Credit Conference, New York, NY, November 5, 2003.

Rose, J.L., "Assessing the Salability of Merchant Assets – When Will We Hit Bottom?", Infocast's Opportunities in Energy Asset Acquisition, San Francisco, CA, October 9, 2003.

Rose, J.L., "Asset Valuation in Today's Market", Infocast's Project Finance Tutorial, New York, NY, October 8, 2003.

Rose, J.L., "Forensic Evaluation of Problem Projects", Infocast's Project Finance Workouts: Dealing With Distressed Energy Projects, September 17, 2003.

Rose, J.L., National Management Emergency Association, Seattle, WA, September 8, 2003.

Rose, J.L., "Assessing the Salability of Merchant Assets – When Will We Hit Bottom?", Infocast's Buying, Selling & Investing in Energy Assets, Chicago, IL, July 24, 2003.

Rose, J.L., CSFB Leveraged Finance Independent Power Producers and Utilities Conference, New York, NY, "Spark Spread Outlook", July 17, 2003.

Rose, J.L., Multi-Housing Laundry Association, Washington, D. C., "Trends in U.S. Energy and Economy", June 24, 2003.

Rose, J.L., "Power Markets: Prices, SMD, Transmission Access, and Trading", Bechtel Management Seminar, Frederick, MD, June 10, 2003.

Rose, J.L., Platt's Global Power Market Conference, New Orleans, LA, "The Outlook for Recovery," March 31, 2003.

Rose, J.L., "Electricity Transmission and Grid Security", Energy Security Conference, Crystal City, VA, March 25, 2003.

Rose, J.L., "Assessing the Salability of Merchant Assets – When Will We Hit Bottom?, Infocast's Buying, Selling & Investing in Energy Assets, New York City, February 27, 2003.

Rose, J.L., Panel Discussion, "Forensic Evaluation of Problem Projects", Infocast Conference, NY, February 24, 2003.

Rose, J.L., PSEG Off-Site Meeting Panel Discussion, February 6, 2003 (April 13, 2003).

Rose, J.L., "The Merchant Power Market—Where Do We Go From Here?" Center for Business Intelligence's Financing U.S. Power Projects, November 18-19, 2002.

Rose, J.L., "Assessing U.S. Regional And The Potential for Additional Coal-Fired Generation in Each Region," Infocast's Building New Coal-Fired Generation Conference, October 8, 2002.

Rose, J.L., "Predicting the Price of Power for Asset Valuation in the Merchant Power Financings, "Infocast's Product Structuring in the Real World Conference, September 25, 2002.

Rose, J.L., "PJM Price Outlook," Platt's Annual PJM Regional Conference, September 24, 2002.

Rose, J.L., "Why Investors Are Zeroing in on Upgrading Our Antiquated Power Grid Rather Than Exotic & Complicated Technologies," New York Venture Group's Investing in the Power Industry—Targeting The Newest Trends Conference, July 31, 2002.

Rose, J.L., Panel Participant in the Salomon Smith Barney Power and Energy Merchant Conference 2002, May 15, 2002.

Rose, J.L., "Locational Market Price (LMP) Forecasting in Plant Financing Decisions," Structured Finance Institute, April 8-9, 2002.

Rose, J.L., "PJM Transmission and Generation Forecast", Financial Times Energy Conference, November 6, 2001.

Rose, J.L., "U.S. Power Sector Trends", Credit Suisse First Boston's Power Generation Supply Chain Conference, Web Presented Conference, September 12, 2002.

Rose, J.L., "Dealing with Inter-Regional Power Transmission Issues", Infocast's Ohio Power Game Conference, September 6, 2001

Rose, J.L., "Where's the Next California", Credit Suisse First Boston's Global Project Finance Capital Markets Conference, New York NY, June 27 2001

Rose, J.L, "U.S. Energy Issues: What MLA Members Need to Know," Multi-housing Laundry Association, Boca Raton Florida, June 25, 2001

Rose, J.L., "How the California Meltdown Affects Power Development", Infocast's Power Development and Finance Conference 2001, Washington D.C., June 12, 2001

Rose, J.L., "Forecasting 2001 Electricity Prices" presentation and workshop, What to Expect in western Power Markets this Summer 2001 Conference, Denver, Colorado, May 2, 2001

Rose, J.L., "Power Crisis in the West" Generation Panel Presentation, San Diego, California, February 12, 2001

Rose, J.L., " An Analysis of the Causes leading to the Summer Price Spikes of 1999 & 2000" Conference Chair, Infocast Managing Summer Price Volatility, Houston, Texas, January 30, 2001.

Rose, J. L., " An Analysis of the Power Markets, summer 2000" Generation Panel Presentation, Financial Times Power Mart 2000 conference, Houston, Texas, October 18, 2000

Rose, J.L., "An Analysis of the Merchant Power Market, Summer 2000" presentation, Conference Chair, Merchant Power Finance Conference, Atlanta, Georgia, September 11 to 15, 2000

Rose, J.L., "Understanding Capacity Value and Pricing Firmness" presentation, Conference Chair, Merchant Plant Development and Finance Conference, Houston, Texas, March 30, 2000.

Rose, J.L., "Implementing NYPP's Congestion Pricing and Transmission Congestion Contract (TCC)", Infocast Congestion Pricing and Forecasting Conference, Washington D.C., November 19, 1999.

Rose, J.L., "Understanding Generation" Pre-Conference Workshop, Powermart, Houston, Texas, October 26-28, 1999.

Rose, J.L., "Understanding Capacity Value and Pricing Firmness" presentation, Conference Chair Merchant Plant Development and Finance Conference, Houston, Texas, September 29, 1999.

Rose, J.L., "Comparative Market Outlook for Merchant Assets" presentation, Merchant Power Conference, New York, New York, September 24, 1999.

Rose, J.L., "Transmission, Congestion, and Capacity Pricing" presentation, Transmission The Future of Electric Transmission Conference, Washington, DC, September 13, 1999.

Rose, J.L., "Effects of Market Power on Power Prices in Competitive Energy Markets" Keynote Address, The Impact of Market Power in Competitive Energy Markets Conference, Washington, DC, July 14, 1999.

Rose, J.L., "Peak Price Volatility in ECAR and the Midwest, Futures Contracts: Liquidity, Arbitrage Opportunity" presentation at ECAR Power Markets Conference, Columbus, Ohio, June 9, 1999.

Rose, J.L., "Transmission Solutions to Market Power" presentation, Do Companies in the Energy Industry Have Too Much Market Power? Conference, Washington, DC, May 24, 1999.

Rose, J.L., "Repowering Existing Power Plants and Its Impact on Market Prices" presentation, Exploiting the Full Energy Value-Chain Conference, Chicago, Illinois, May 17, 1999.

Rose, J.L., "Transmission and Retail Issues in the Electric Industry" Session Speaker, Gas Mart/Power 99 Conference, Dallas, Texas, May 10, 1999.

Rose, J.L., "Peak Price Volatility in the Rockies and Southwest" presentation at Repowering the Rockies and the Southwest Conference, Denver, Colorado, May 5, 1999.

Rose, J.L., "Understanding Generation" presentation and Program Chairman at Buying & Selling Power Assets: The Great Generation Sell-Off Conference, Houston, Texas, April 20, 1999.

Rose, J.L., "Buying Generation Assets in PJM" presentation at Mid-Atlantic Power Summit, Philadelphia, Pennsylvania, April 12, 1999.

Rose, J.L., "Evaluating Your Generation Options in Situations With Insufficient Transmission," presentation at Congestion Management conference, Washington, D.C., March 25, 1999.

Rose, J.L., "Will Capacity Prices Drive Future Power Prices?" presentation at Merchant Plant Development conference, Chicago, Illinois, March 23, 1999.

Rose, J.L., "Capacity Value – Pricing Firmness," presentation at Market Price Forecasting conference, Atlanta, Georgia, February 25, 1999

Rose, J.L., "Developing Reasonable Expectations About Financing New Merchant Plants That Have Less Competitive Advantage Than Current Projects," presentation at Project Finance International's Financing Power Projects in the USA conference, New York, New York, February 11, 1999.

Rose, J.L., "Transmission and Capacity Pricing and Constraints," presentation at Power Fair 99, Houston, Texas, February 4, 1999.

Rose, J.L., "Peak Price Volatility: Comparing ERCOT With Other Regions," presentation at Megawatt Daily's Trading Power in ERCOT conference, Houston, Texas, January 13, 1999.

Rose, J.L., "The Outlook for Midwest Power Markets," presentation to The Institute for Regulatory Policy Studies at Illinois State University, Springfield, Illinois, November 19, 1998.

Rose, J.L., "Developing Pricing Strategies for Generation Assets," presentation at Wholesale Power in the West conference, Las Vegas, Nevada, November 12, 1998.

Rose, J.L., "Understanding Electricity Generation and Deregulated Wholesale Power Prices," a full-day pre-conference workshop at Power Mart 98, Houston, Texas, October 26, 1998.

Rose, J.L., "The Impact of Power Generation Upgrades, Merchant Plant Developments, New Transmission Projects and Upgrades on Power Prices," presentation at Profiting in the New York Power Market conference, New York, NY, October 22, 1998.

Rose, J.L., "Capacity Value – Pricing Firmness," presentation to Edison Electric Institute Economics Committee, Charlotte, NC, October 8, 1998.

Rose, J.L., "Locational Marginal Pricing and Futures Trading," presentation at Megawatt Daily's Electricity Regulation conference, Washington, D.C., October 7, 1998.

Rose, J.L., Chairman's opening speech and "The Move Toward a Decentralized Approach: How Will Nodal Pricing Impact Power Markets?" at Congestion Pricing and Tariffs conference, Washington, D.C., September 25, 1998.

Rose, J.L., "The Generation Market in MAPP/MAIN: An Overview," presentation at Megawatt Daily's MAIN/MAPP – The New Dynamics conference, Minneapolis, Minnesota, September 16, 1998.

Rose, J.L., "Capacity Value – Pricing Firmness," presentation at Market Price Forecasting conference, Baltimore, Maryland, August 24, 1998.

Rose, J.L., "ICF Kaiser's Wholesale Power Market Model," presentation at Market Price Forecasting conference, New York, New York, August 6, 1998.

Rose, J.L., Campbell, R., Kathan, David, "Valuing Assets and Companies in M&A Transactions," full-day workshop at Utility Mergers & Acquisitions conference, Washington, D.C., July 15, 1998.

Rose, J.L., "Must-Run Nuclear Generation's Impact on Price Forecasting and Operations," presentation at The Energy Institute's conference entitled "Buying and Selling Electricity in the Wholesale Power Market," Las Vegas, Nevada, June 25, 1998.

Rose, J.L., "The Generation Market in PJM," presentation at Megawatt Daily's PJM Power Markets conference, Philadelphia, Pennsylvania, June 17, 1998.

Rose, J.L., "Market Evaluation of Electric Generating Assets in the Northeast," presentation at McGraw-Hill's conference: Electric Asset Sales in the Northeast, Boston, Massachusetts, June 15, 1998.

Rose, J.L., "Overview of SERC Power," opening speech presented at Megawatt Daily's SERC Power Markets conference, Atlanta, Georgia, May 20, 1998.

Rose, J.L., "Future Price Forecasting," presentation at The Southeast Energy Buyers Summit, Atlanta, Georgia, May 7, 1998.

Rose, J.L., "Practical Risk Management in the Power Industry," presentation at Power Fair, Toronto, Canada, April 16, 1998.

Rose, J.L., "The Wholesale Power Market in ERCOT: Transmission Issues," presentation at Megawatt Daily's ERCOT Power Markets conference, Houston, Texas, April 1, 1998.

Rose, J.L., "New Generation Projects and Merchant Capacity Coming On-Line," presentation at Northeast Wholesale Power Market conference, New York, New York, March 18, 1998.

Rose, J.L., "Projecting Market Prices in a Deregulated Electricity Market," presentation at conference: Market Price Forecasting, San Francisco, California, March 9, 1998.

Rose, J.L., "Handling of Transmission Rights," presentation at conference: Congestion Pricing & Tariffs, Washington, D.C., January 23, 1998.

Rose, J.L., "Understanding Wholesale Markets and Power Marketing," presentation at The Power Marketing Association Annual Meeting, Washington, D.C., November 11, 1997.

Rose, J.L., "Determining the Electricity Forward Curve," presentation at seminar: Pricing, Hedging, Trading, and Risk Management of Electricity Derivatives, New York, New York, October 23, 1997.

Rose, J.L., "Market Price Forecasting In A Deregulated Market," presentation at conference: Market Price Forecasting, Washington, D.C., October 23, 1997,

Rose, J.L., "Credit Risk Versus Commodity Risk," presentation at conference: Developing & Financing Merchant Power Plants in the New U.S. Market, New York, New York, September 16, 1997.

**SELECTED PUBLICATIONS**

Rose, J.L., "Should Environmental Restrictions be Eased to Allow for the Construction of More Power Plants?, The Costco Connection, April 2001.

Rose, J.L., "Deregulation in the US Generation Sector: A Mid-Course Appraisal", Power Economics, October 2000.

Rose, J. L., "Price Spike Reality: Debunking the Myth of Failed Markets", *Public Utilities Fortnightly,* November 1, 2000.

Rose, J.L., "Missed Opportunity: What's Right and Wrong in the FERC Staff Report on the Midwest Price Spikes," *Public Utilities Fortnightly,* November 15, 1998.

Rose, J.L., "Why the June Price Spike Was Not a Fluke," *The Electricity Journal*, November 1998.

Rose, J.L., S. Muthiah, and J. Spencer, "Will Wall Street Rescue the Competitive Wholesale Power Market?" *Project Finance International*, May 1998.

Rose, J.L., "Last Summer's "Pure" Capacity Prices – A Harbinger of Things to Come," *Public Utilities Fortnightly,* December 1, 1997.

Rose, J.L., D. Kathan, and J. Spencer "Electricity Deregulation in the New England States," *Energy Buyer*, Volume 1, Issue 10, June-July 1997.

Rose, J.L., S. Muthiah, and M. Fusco, "Financial Engineering in the Power Sector," *The Electricity Journal,* Jan/Feb 1997.

Rose, J.L, S. Muthiah, and M. Fusco, "Is Competition Lacking in Generation? (And Why it Should Not Matter)," *Public Utilities Fortnightly,* January 1, 1997.

Mann, C. and J.L. Rose, "Price Risk Management: Electric Power vs. Natural Gas," *Public Utilities Fortnightly,* February 1996.

Rose, J.L. and C. Mann, "Unbundling the Electric Capacity Price in a Deregulated Commodity Market," *Public Utilities Fortnightly,* December 1995.

Booth, William and J.L. Rose, "FERC's Hourly System Lambda Data as Interim Bulk Power Price Information," *Public Utilities Fortnightly,* May 1, 1995.

Rose, J.L. and M. Frevert, "Natural Gas: The Power Generation Fuel for the 1990s." Published by Enron.

## EMPLOYMENT HISTORY

| | | |
|---|---|---|
| ICF Resources Incorporated | Managing Director | 1999-Present |
| | Vice President | 1996-1999 |
| | Project Manager | 1993-1996 |
| | Senior Associate | 1986-1993 |
| | Associate | 1982-1986 |