**BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION**

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| **In re: Petition for rate increase by Florida Power & Light Company** | **Docket No: 20250011-EI**<br><br>**Filed: June 10, 2025** |

**FLORIDA ENERGY FOR INNOVATION ASSOCIATION'S NOTICE OF FILING REDACTED PREFILED TESTIMONY AND EXHIBITS OF MOHAMED AHMED, Ph.D.**

Enclosed for filing is the prefiled Direct Testimony and Exhibits of Dr. Mohamed Ahmed that has been redacted today by Florida Power & Light ("FPL") in connection with FPL's Notice of Intent to Request Confidential Classification filed in this docket on June 9, 2025. An unredacted version of Dr. Ahmed's testimony and exhibits was uploaded to FPL's confidential data room on June 9, 2025, available to all parties who have entered agreements to access information which FPL designates as confidential.

FEIA understands that FPL will file a formal Request for Confidential Classification of the redacted information. FEIA reserves the right to respond to that filing at the appropriate time.

Respectfully submitted this 10th day of June, 2025.

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**CERTIFICATE OF SERVICE**

I HEREBY CERTIFY that a true and correct copy of the foregoing has been furnished by e-mail this 10th day of June, 2025 the following:

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**BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION**

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| In re: Petition for rate increase by Florida Power & Light Company. ______________________________/ | Docket No.: 20250011-EI<br>Dated: June 9, 2025 |

**DIRECT TESTIMONY**

**OF**

## MOHAMED AHMED, Ph.D.

**on behalf of Intervenor,**

**Florida Energy for Innovation Association, Inc.**

**Q. PLEASE STATE YOUR FULL NAME.**

A. Mohamed Ahmed.

**Q. BY WHOM ARE YOU EMPLOYED?**

A. I am employed by Electric Power Engineers, LLC, where I serve as the Senior Director of Energy Market Analysis and Project Finance. In this role, I lead initiatives in market price forecasting, energy storage analysis, revenue forecasting, and financial feasibility assessments for utility-scale energy projects, with a focus on renewable generation and transmission planning across North America, particularly in ERCOT markets. I also manage engineering teams and provide technical expertise in areas such as congestion analysis, locational marginal price (LMP) forecasting, and sub-synchronous oscillation studies.

**Q. WHAT IS YOUR EDUCATIONAL AND EMPLOYMENT BACKGROUND?**

A. I hold a PhD in Electrical and Computer Engineering from the University of Waterloo (2012), a Master of Science in Electrical Power and Machines from Ain Shams University (2005), and a Bachelor of Science in Electrical Power and Machines from Ain Shams University (1999).

With over 25 years of experience in the electrical power system industry, I have developed expertise in energy market analysis, project finance, transmission and distribution systems, and renewable energy integration across North America and the Middle East. My career includes leadership roles in electricity market design, system operations, and project management. I have led initiatives in market price forecasting, congestion analysis, energy storage, and financial feasibility studies, primarily for ERCOT and other ISOs like CAISO, SPP, and MISO. Key past roles include senior positions at the Independent Electricity System Operator (IESO), where I designed market power mitigation frameworks and led capacity auction development, and at SNC-Lavalin, where I managed renewable energy projects and interconnection analyses. I also conducted research at IBM on weather impacts on transmission reliability and led a MITACS-Accelerate project on smart distribution networks. My technical skills include tools like PSS/E, MATLAB, GAMS, and SCADA, complemented by numerous peer-reviewed publications, a patent in decentralized Volt/VAR control, and presentations at conferences like IEEE PES General Meeting and CIGRE. My current Curriculum Vitae is attached as Exhibit MA-1.

**Q. ON WHOSE BEHALF ARE YOU SUBMITTING TESTIMONY TODAY?**

A. I am testifying on behalf of the Florida Energy for Innovation Association ("FEIA"), an alliance of data center providers and groups committed to advancing Florida's position as a competitive and innovation-driven data center market. FEIA is an intervenor in this proceeding.

**Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?**

A. I have been retained by FEIA to review the testimony in this case and provide my expert testimony and analysis concerning the Large Load Contract Service ("LLCS") Tariff and associated Rate Schedules LLCS-1 and LLCS-2 proposed by Florida Power and Light ("FPL"). In particular, my testimony addresses a novel rate element that FPL proposes to include in the LLCS Tariff, which FPL calls an Incremental Generation Charge ("IGC").

**Q. PLEASE SUMMARIZE YOUR TESTIMONY**

A. My testimony shows that the proposed IGC is a rate element that the Commission has not previously approved and has far-reaching policy implications for the State of Florida with respect to the data center industry. Inclusion of the IGC in the LLCS Tariff single handedly drives the rate that data centers would have to pay for electric service up by more than 65% to prohibitive levels (Exhibit MH-2).

My testimony further shows that empirical support for the IGC is lacking. I explain that FPL has not provided the Commission a full cost-of-service study supporting the LLCS Rate Schedule or the IGC, nor has it provided evidence of having evaluated alternative resource options. Moreover, my testimony shows that FPL has overstated the costs of serving data center loads by relying on a simplified revenue requirement model that fails to account for the significant system benefits data centers provide – such as flat, high-load-factor demand, improved asset utilization, and support for existing baseload generation like nuclear. I also provide a detailed analysis of the anomalous assumptions underlying FPL's proposed IGC, including its oversized battery design, failure to incorporate offsetting revenues, and unrealistic cost escalation modeling. In doing so, I quantify how FPL's methodology leads to a significant overstatement of costs and demonstrate that key assumptions used to calculate the IGC are technically and economically unsound.

## I. OVERVIEW OF PROPOSED FPL RATES AND IGC

**Q. YOU PREVIOUSLY TESTIFIED THAT INCLUSION OF THE IGC ELEMENT DRIVES THE RATE THAT DATA CENTERS WOULD HAVE TO PAY FOR ELECTRIC SERVICE TO PROHIBITIVE LEVELS ON WHAT DO YOU BASE THAT STATEMENT?**

A. My statement is based on my experience as an electric utility consultant and my review of the findings of FEIA Witnesses Loomis and Rizer.

**Q. PLEASE EXPLAIN YOUR UNDERSTANDING OF THE IGC?**

A. The IGC is a new rate element that, as far as I can tell, has never been approved by the Commission for FPL or any other electric utility in Florida. Its supposed purpose is to capture the cost of new generation buildout that would be required to satisfy the load for the new LLCS customers ( i.e., customers with a load of 25 MW or more and a load factor of 85% or more).

**Q. ARE YOU ABLE TO DETERMINE WHAT GENERATION ASSETS FPL PROPOSES TO DEPLOY TO SERVE DATA CENTER'S INCREMENTAL GENERATION REQUIREMENTS?**

A. According to FPL's response to FIPUG's First Set of Interrogatories (No. 20), FPL is assuming that the incremental costs to serve data center loads are primarily battery storage, transmission upgrades, and fixed operations and maintenance (O&M) of these assets.

**Q. HAS FPL INVESTIGATED ANY OTHER RESOURCE BLENDS?**

A. FPL has not shown any documentation or other evidence that it investigated any other asset types or combinations of resources to serve data center loads.

**Q. HAS FPL CONDUCTED A CAPACITY EXPANSION OR RELIABILITY ASSESSMENT OF PROPOSED BATTERY STORAGE ADDITIONS?**

A. FPL has not provided relevant technical studies to substantiate its proposed battery storage solution as the most cost-effective option for meeting data center energy demands. Furthermore, FPL has provided no public reliability assessments to confirm the solution's viability for grid stability or voltage support. While a confidential document was provided outlining the revenue requirements for this battery storage system, it fails to justify its cost-competitiveness for customers across all rate classes. This lack of transparency raises concerns about potential cost burdens on ratepayers and risks to grid reliability, underscoring the need for regulatory oversight and public disclosure.

**Q. HAS FPL OBTAINED A POSITIVE DETERMINATION OF NEED FOR THE PROPOSED BATTERY STORAGE ADDITIONS UNDER SECTION 403.519, FLORIDA STATUTES FROM THE COMMISSION?**

A. Not to my knowledge. It is my understanding that battery storage additions and solar projects with a capacity of less than 75 MW are not required to obtain a need determination from the Commission. Nor do they trigger the Commission's Bid Rule—R. 25-22.082, FAC—which mandates requests for proposals to ensure that utilities are considering all available options for generating capacity.

**Q. WHY SHOULD THAT CONCERN THE COMMISSION?**

A. Since battery storage additions are not subject to Commission scrutiny under the need determination process or the Bid Rule, it is important for the Commission to understand that, excluding hydrogen, battery storage is the highest cost energy resource available in today's market on a Levelized Cost of Energy ("LCOE") basis. The June 2024 Lazard Levelized Cost of Energy Analysis is a comparative LCOE analysis for various generation technologies on a $/MWh basis and is well regarded in the industry as a reliable assessment of cost-competitiveness of different energy sources. The June 2024 Lazard Report gives a range of Levelized Cost of Storage (LCOS) for a Utility-Scale 100 MW 2-hour battery as low as $141/MWh, assuming full Investment Tax Credit ("ITC") and subsidies which include a 10% Energy Community adder, and as high as $322/MWh with no ITC or subsidies.

Likewise, Utility-Scale 100 MW 4-hour battery LCOS is as low as $124/MWh and as high as $296/MWh. These costs are significantly higher than other resources available to FPL, particularly resources they already have in their 10-Year Site Plan. In my opinion, this alone should cause the Commission to pause before approving the IGC as proposed.

**Q. HAS FPL PROVIDED APPROPRIATE JUSTIFICATION FOR USING BATTERY STORAGE TO SERVE DATA CENTER LOAD?**

A. FPL has not submitted resource adequacy studies, comparative cost analyses, or load modeling to demonstrate that short-duration batteries are suitable for serving high-load customers. Without such analysis, FPL's use of battery storage as the sole basis for the IGC lacks support and appears arbitrary. FPL has only provided a revenue requirement model for an IGC based on battery additions.

**Q. IS IT REASONABLE FOR FPL TO MAKE THAT ASSUMPTION?**

A. No. Data centers operate with extremely high load factors and consistent, around-the-clock demand. These loads are best served by base load generation resources such as natural gas combined cycle, coal, and nuclear—not by battery storage, particularly short-duration 2-hour batteries, which are typically used for peak shaving and ancillary services. FPL has not demonstrated that its proposed resource mix is adequate or cost-effective for serving this type of high-load, high-availability customer. Nor has it provided sufficient analysis to justify why batteries are the appropriate choice for meeting base load obligations.

**Q. EARLIER YOU TESTIFIED ABOUT THE COST RANGE OF BATTERY STORAGE WITH AND WITHOUT THE FEDERAL INVESTMENT TAX CREDIT ("ITC"). WHAT IS THE ITC AND WHY IS IT SO IMPORTANT TO FPL'S CHOICE TO RELY ON BATTERIES IN THE IGC?**

A. The ITC is a federal incentive that allows energy developers to offset a portion of capital investment costs for qualifying technologies, including battery storage. The ITC dramatically reduces the Levelized Cost of Storage (LCOS), making batteries appear more economical than they otherwise would be. According to FPL's own 2025 Integrated Resource Plan (IRP), "FPL's resource planning work continues to factor in tax credits for new utility-owned batteries, solar, and hydrogen. The Investment Tax Credit (ITC) effectively lowers the capital cost for a new battery." (FPL 2025 10 Year Site Plan, p. 82). In other words, FPL is explicitly relying on the presence of these federal tax credits to justify battery investments that underpin the proposed IGC.

**Q. WHY SHOULD THE COMMISSION BE CONCERNED ABOUT RELYING ON TECHNOLOGY WHOSE COST EFFECTIVENESS IS DEPENDENT ON FEDERAL SUBSIDIES?**

A. The Commission should be concerned because federal tax credits, such as the ITC, are subject to political risk. They may be reduced, restructured, or eliminated depending on federal fiscal policy, changes in IRS guidance or broader political shifts. FPL's 2025 Integrated Resource Plan (IRP) explicitly identifies these tax incentives as key drivers of battery economics. If the credits cited were to lapse, the entire cost structure for battery deployment would shift, exposing the general body of rate payers to significant risk. If these incentives disappear, the financial rationale for battery-heavy solutions would no longer be supportable.

**Q. HAS FPL PROVIDED AN ANALYSIS SHOWING THE SENSITIVITY OF THE IGC TO LOSS OR REDUCTION OF THESE TAX CREDITS?**

A. No. Despite highlighting the importance of the Inflation Reduction Act of 2022 ("IRA") incentives in its 2025 IRP, FPL has not submitted any sensitivity analyses that show how IGC-related costs would change under scenarios in which the ITC or related adders are unavailable or limited. This omission represents a material gap in FPL's planning approach. FPL's cost justification is built on an assumed continuation of favorable federal tax policy, yet they have not shown how costs and impacts on ratepayers would change without these benefits.

**Q. WHAT RECOMMENDATION DO YOU HAVE FOR THE COMMISSION IN REGARD TO THESE FEDERAL INCENTIVE RISKS?**

A. Given the significant uncertainty surrounding the continued availability of federal tax credits such as the ITC, I recommend that the Commission approve an amended version of the IGC consistent with the recommendations of FEIA Witness Loomis. The economics of FPL's battery-heavy resource selection hinge on external policy decisions well outside of FPL's jurisdiction or control. It would be imprudent to establish a new tariff structure on such an unstable foundation without the modifications laid out in FEIA Witness Loomis' testimony.

**Q. DID FPL INCLUDE DATA CENTER LOADS IN ITS RESOURCE PLANNING FOR THE 10-YEAR SITE PLAN?**

A. No. According to Witness Cohen's Testimony, "FPL currently does not have agreements to serve any customers of this size in 2026 or 2027. As such, FPL did not include any customers, costs, or revenues associated with Rate Schedules LLCS-1 or LLCS-2 in either its 2026 or 2027 forecasts used in this proceeding." [Cohen, Page 23, Lines 7-10]

## II. BENEFITS OF DATA CENTERS TO THE GRID

**Q. IN DEVELOPING THE LLCS-1 AND LLCS-2 RATE SCHEDULES,**

**INCLUDING THE IGC, HAS FPL CONSIDERED THAT DATA CENTERS PROVIDE BENEFITS TO ITS GRID?**

A. No. FPL appears to have focused solely on the costs associated with serving data centers without adequately accounting for their operational and system benefits.

**Q. WHAT BENEFITS DO DATA CENTERS PROVIDE TO FPL'S GRID?**

A. Data centers with high load factors support efficient transmission planning, enhance utilization of fixed assets, and reduce per-unit infrastructure costs for all ratepayers.

The JLARC Virginia Data Center Study (2024) confirms that these consistent loads exhibit minimal variation of ±2.5% throughout the day and no more than ±6.5% annually, demonstrating a highly predictable and stable pattern of electricity usage. Electrical infrastructure must be sized for peak demand even though the grid often operates at significantly lower levels. This leads to underutilization and reduced efficiency of electrical transmission and generation infrastructure. The consistent load profiles of data centers flatten the systemwide load profile which facilitates higher asset utilization and better return on investment for FPL.

For example, based on 2023 data from FPL's Ten-Year Site Plan, the addition of 3,000 MW of new data center load operating at an 85% load factor (consistent with the LLCS eligibility threshold) would increase FPL's systemwide load factor by approximately 2.6% on an absolute basis—or a 4.6% relative increase. This increase in load factor enhances the efficiency of FPL's existing transmission and generation infrastructure, enabling greater electricity delivery without the need for new capital investment (Exhibit MH-3).

**Q. HAVE OTHER UTILITIES RECOGNIZED AND QUANTIFIED THE SYSTEM-LEVEL VALUE OF NEW DATA CENTER LOAD?**

A. Yes they have. For example:

- Idaho Power entered into a special contract with Brisbie LLC's data center in Kuna, Idaho. Before finalizing the agreement, Idaho Power conducted a "no-harm" present value revenue requirement (PVRR) analysis to confirm that other customers would not be negatively impacted (Case No. IPC-E-21-42). The Idaho Public Utilities Commission approved the agreement in May 2023, partially because Idaho Power incorporated the associated load and generation into its Integrated Resource Plan (IRP) to quantify broader grid benefits.
- Similarly, Xcel Energy's 2019 agreement with a Google-affiliated data center in Minnesota was approved after Xcel demonstrated that projected revenues would exceed the cost of incremental generation and capacity. This reinforced the principle that new large loads, when properly planned and priced, can benefit the entire customer base without shifting costs.

These examples demonstrate a key best practice: when data center loads are properly planned for and modeled, they enhance grid efficiency and can reduce system costs. FPL has not conducted such an analysis in its resource planning. Despite proposing a significant rate structure for data centers under the LLCS tariff, FPL has neither incorporated these loads nor evaluated the associated resource needs in its IRP.

**Q. HOW DO THESE BENEFITS PROVIDE TANGIBLE BENEFITS TO FPL'S GENERAL BODY OF RATEPAYERS?**

A. Because the majority of utility system costs are fixed, driven by capital investment rather than energy volume, spreading these costs over a greater number of kilowatt-hours (kWh) reduces the per-unit cost of electricity. Provided that data centers pay appropriate interconnection and transmission charges, this improved asset utilization benefits the general body of ratepayers by reducing the cost burden per customer. In short, data center integration can support lower long-term rates for all customer classes, including residential consumers, by improving cost recovery efficiency.

As data centers are large, predictable electricity users, their consistent demand helps utilities recover fixed infrastructure costs (like transmission upgrades and power plants) over a larger base. The addition of data centers to a utility's service area has a positive impact on the overall customer base. The addition spreads infrastructure costs across more megawatt-hours, reducing pressure on residential and small business rates. The result of the above is a lower per-unit cost of electricity for all ratepayers.

As examples, utilities such as Idaho Power and Xcel Energy have conducted detailed modeling to assess the impacts of proposed data center additions on system and customer costs. In both cases, the analysis confirmed that, when properly structured, large data center loads improve cost recovery without shifting burdens to existing customers. Regulatory commissions in those states approved the data center agreements based on these transparent, data-driven evaluations — reinforcing the principle that strategic load growth can produce systemwide ratepayer benefits.

**Q. ARE THERE OTHER TECHNICAL SYSTEMWIDE BENEFITS THAT DATA CENTERS PROVIDE?**

A. Yes. Nuclear power plants, which provide stable, cost-effective baseload power are not well-suited to respond to load variations. The high load factor and flat profile of data centers are ideal loads for nuclear power plants. The load profile that data centers maintain can offer FPL additional justification for extending their existing nuclear fleet. FPL's current nuclear fleet consists of four units located at two sites within the FPL service territory. In its 10-Year Site Plan, FPL states that in 2023 these plants provided 28,766 GWh of carbon free energy to the FPL system, representing roughly 20% of FPL's fleet-wide generated energy in said year.

FPL also noted that it is in the process of securing Subsequent License Renewals (SLRs) for all four units, assuming the continued operation of Turkey Point Units 3 and 4 through 2052 and 2053, and St. Lucie Units 1 and 2 through 2056 and 2063. A large stable load, such as those from data centers, would provide FPL significant additional justification for the relicensing of these units. Additionally, should FPL pursue additional nuclear powered generation facilities, these loads will help to absorb the continuous output, minimize curtailment, improve operational efficiency, and support faster return on investment for FPL.

## <u>III. ANALYSIS OF FPL'S SUPPORT FOR THE CREATION AND LEVEL OF THE IGC</u>

**Q. HAS FPL CONDUCTED A FULL COST-OF-SERVICE STUDY TO SUPPORT THE LLCS RATE SCHEDULES OR THE IGC?**

A. No. FPL has not submitted a cost-of-service study to support the LLCS Rate Schedules or IGC.

**Q. HOW DOES FPL USUALLY ESTABLISH RATES FOR OTHER CUSTOMER CLASSES?**

A. FPL generally uses a cost-of-service study to determine the costs each customer class imposes on the system, and from there derives the appropriate revenue requirements and rates. This includes load research, demand profiles, allocation of fixed and variable costs, rate base contributions, and usage patterns. None of these standard elements have been publicly disclosed with respect to the LLCS Tariff or the IGC.

**Q. ARE COST-OF-SERVICE STUDIES A STANDARD TOOL IN UTILITY RATE DESIGN?**

A. Yes. A properly conducted cost-of-service study is the foundation of fair, equitable, and defensible ratemaking. It provides the analytical basis to determine how much each class should pay in proportion to the costs it imposes on the system. Without it, rates cannot be aligned with cost causation, and subsidies are likely to result.

For example, in Minimum Filing Requirement (MFR) Schedule E, FPL presents highly detailed cost-of-service studies for all customer classes except for LLCS, including fully allocated costs, functionalization of expenses, rate base assignments, and parity calculations.

Yet, despite proposing a completely new LLCS customer class with significantly higher rates, FPL has not performed or submitted any such parity or detailed cost analysis for LLCS customers. This inconsistency raises concerns about whether the LLCS charges are based on sound cost allocation principles grounded in cost causation were instead structured to meet a targeted financial result.

**Q. IN RESPONSE TO DISCOVERY, FPL PROVIDED A CONFIDENTIAL LARGE LOAD MODEL STYLED "2025 FPL EDM LARGE LOAD – CONFIDENTIAL.XLSX." DOES THIS MODEL CONSTITUTE A COST-OF-SERVICE STUDY?**

A. No. FPL's confidential model is not a comprehensive cost-of-service study. Instead, it functions as a revenue requirement model designed to estimate the return needed on proposed battery storage investments. Importantly, it does not account for the revenue or system-wide benefits associated with those batteries, both of which are essential to proper resource planning assessment and an understanding of the net impacts on FPL and its customers.

**Q. DO YOU HAVE CONCERNS REGARDING THE DESIGN AND COST ALLOCATION IN FPL'S CONFIDENTIAL MODEL?**

A. Yes. In reviewing FPL's Confidential Large Load Model, it appears that based upon our calculations that FPL proposes to deploy 6.1 GW of 2-hour battery energy storage systems (BESS) to serve 3.0 GW of data center load at [redacted] to support data center growth. This plan raises concerns about potential over- specification, deviation from industry standards, and unequitable cost allocation across customer classes. Key issues of concern include:

1. <u>Potential Over-Specification</u>: FPL's proposal to install 6.1 GW of battery capacity per 3 GW of load, a 2:1 battery-to-load ratio, exceeds typical data center peak load requirements, creating a surplus capacity of many hours. This potential over-specification benefits the broader FPL grid by enabling the storage of solar energy well beyond what is needed to serve data center loads. That excess stored energy would likely be dispatched to serve other customers on the system, while the full cost of the battery infrastructure is recovered through LLCS rates—thereby inflating the costs borne by data center customers without a commensurate benefit.

   FPL has not provided detailed load modeling to justify its proposed 2:1 battery-to-load ratio versus a leaner design (e.g., 1.5 MW battery per MW load or 1 MW battery per MW load). A 25% reduction in the battery-to-load ratio would result in a corresponding 25% reduction in the IGC, which would materially lower the resulting LLCS rates. I am not proposing any specific ratio, but rather stating that there is not enough evidence to support this choice. This should be supported by sufficient and appropriate analysis.

2. <u>2-Hour vs 4-Hour Battery Implementation</u>: The 2-hour batteries proposed by FPL are suited for peak shaving but fall short of the 4-hour battery standard used in leading data center markets, like

Virginia, where there is an abundance of large-scale facilities with high, flat, and consistent load profiles.

It is difficult to assess the relative benefits of 2-hour versus 4-hour batteries because FPL's revenue requirement model excludes any consideration of additional revenue streams. While 4-hour batteries involve higher upfront capital costs compared to 2-hour batteries, they offer approximately twice the usable energy output, resulting in a significantly higher capacity factor. This increased throughput allows fixed costs to be spread over more discharged energy, ultimately reducing the levelized cost of storage (measured in $/MWh) over the asset's lifetime. As a result, 4-hour batteries are often more cost-effective in long-term applications, particularly in markets with sustained, high-load conditions.

3. <u>Cost Allocation</u>: Under FPL's proposed LLCS Tariff, data center customers would be required to bear the full cost of battery storage infrastructure, despite the fact that these batteries provide systemwide benefits—such as enhanced grid stability and solar energy shifting—that accrue to all customer classes. The utilization of these batteries will only be directly tied to the data center load for a small portion of the year when there is insufficient capacity to serve the data center loads. At all other times the batteries will be supporting other grid functions including peak shaving, stability and voltage support, and energy arbitrage.

It is not reasonable or equitable to assign 100% of the cost to data center customers when the majority of the operational value will accrue to the grid as a whole.

FPL substantiates the grid benefits for storage in its 10-year site plan by stating that,

> "As a complement to FPL's planned solar additions, FPL is planning to deploy 7,603 MW of battery storage, which provides cost-effective capacity, regardless of the time of day or the weather conditions. These additions enable solar energy produced during the day to be stored and delivered even when the sun is not shining. Storage acts as a key resource that improves system reliability and resource adequacy by addressing the evening peak cost-effectively."

(FPL 2025 Ten Year Site Plan, Page 5.)

Clearly batteries have been identified as a critical benefit to the overall grid, not just data centers.

There is insufficient information provided by FPL to demonstrate that a battery-led solution is the most appropriate or cost-effective way to serve incremental data center load – or how such a solution benefits the overall grid. Yet, FPL proposes to assign the entire cost of this infrastructure solely to the data center class. A comprehensive, systemwide planning analysis is needed to evaluate all available options and determine the most efficient and equitable approach—one that fully accounts for both the specific needs of data centers and the broader system benefits such investments provide.

**Q. WITHOUT DISCUSSING FPL'S CONFIDENTIAL LARGE LOAD MODEL, CAN YOU SUMMARIZE YOUR CONCERNS REGARDING OVER-SPECIFICATION AS IT RELATES TO THE IGC ?**

A. Yes. By "over-specification" I mean design requirements or features that are more extensive or complex than what is actually necessary to serve data center load. For example, in its response to FIPUG's First Set of Interrogatories, Number 20 (which is not confidential) FPL advises that "[t]he Incremental Generation Charge is based on the annual revenue requirement for the projected addition of 6,100 MW of battery capacity to serve an additional 3 GW of load." This "2X" battery capacity (i.e., 6.1 GW of battery capacity to serve 3 GW of load) exceeds typical data center peak load requirements, creating surplus capacity in many hours. This potential over-specification benefits the broader FPL grid by enabling the storage of solar energy far beyond what is needed to serve data center loads. That excess stored energy would likely be dispatched to serve other customers on the system, while the full cost of the battery infrastructure is recovered through LLCS rates. In my opinion, this would inflate the costs borne by data center customers without a commensurate benefit.

**Q. ARE YOU ABLE TO QUANTIFY OR PROVIDE EXAMPLES FROM OTHER MARKETS TO ASSESS WHETHER FPL'S PROPOSED COST RECOVERY IS APPROPRIATE?**

A. Under the proposed LLCS Tariff, FPL would collect IGC payments of approximately $6.7B per 1,000 MW over 20 years, equating to $28.07/kW-month. When comparing this to capacity cost recovery mechanisms in other markets, the proposed IGC is significantly higher.

For example:

- Entergy Louisiana implements their version of the IGC called the "Additional Facilities Charge" (AFC), at $9.16 per kW or 67% lower than the IGC proposed by FPL (Exhibit MH-D).
- Indiana Michigan Power Company applies a transmission-interconnected demand charge of $10.96 per kW-month, which remains significantly lower than FPL's proposed IGC (Indiana Utility Regulatory Commission Case No. 46097).
- When comparing these proposed costs to the 2024 Lazard Report, the most expensive storage cost assumption for a 2-hour Utility Standalone battery is $16.9/kW-month assuming no subsidies or tax credits. This suggests that it is more expensive for FPL to build these and get its rate of return than industry standard cost comparisons.

**Q. IS FPL MAKING CORRECT REVENUE REQUIREMENT ASSUMPTIONS IN ITS IGC CALCULATIONS?**

A. No. FPL appears to be using a simplified approach to the calculation by taking the highest annual revenue requirement (the "peak" year) over the 20-year period and assuming that same revenue requirement for every year over the life of project. There is no normalization across the years, even though revenue requirements are significantly lower in other years, ranging from $28.07 / kW-month to $9.81/ kW-month or a 65% delta. This results in revenue requirements that exceed what would be produced under a levelized or time-weighted average, leading to an unjustified increase in charges. This overstates the IGC requirement relative to the assets' actual long-term costs.

In most cases, utility revenue requirements are front-loaded due to depreciation and interest, then decline over time. A proper analysis would levelize the revenue requirement over the useful life of the asset or use a net present value approach to ensure that customers are not overcharged. FPL's approach ignores this time-value component entirely, violating basic principles of cost recovery and fairness.

Furthermore, aside from relying on peak-year revenue requirements, FPL also calculates all revenue recovery based on a 2:1 battery-to-load ratio—effectively doubling the infrastructure assumed necessary to serve the data center load. This over-specification inflates the capital cost basis used in the IGC calculations, leading to significantly higher revenue requirement when compared to a more appropriately sized system. By assuming both the highest annual cost and an unnecessarily large battery deployment, FPL compounds the overstatement and shifts an excessive cost burden onto data center customers.

**Q. HAS FPL PROVIDED ANY JUSTIFICATION FOR WHY IT CHOSE THE HIGHEST YEAR OF REVENUE REQUIREMENT AS ITS BASIS FOR THE GENERATION OVER-SPECIFICATION?**

A. No. FPL has not provided adequate justification for using the peak annual cost as **the** basis for all 20 years. There is no explanation of why a levelized cost recovery approach was not used, nor any sensitivity analysis showing the impact of using more accurate annual revenue projections. This omission further undermines the credibility and reasonableness of the proposed IGC. Likewise, FPL has not submitted any technical or economic rationale to support its decision to base revenue requirements on a 2:1 battery-to-load ratio, which significantly inflates the capital cost assumptions and further distorts the total cost to be recovered.

## IV. ANALYSIS OF OVER-RECOVERY IN FPL'S IGC MODEL

**Q. BASED ON THE ABOVE, IS FPL'S PROPOSED IGC SUPPORTED BY THE INFORMATION PROVIDED IN ITS REVENUE REQUIREMENT MODEL?**

A. No. FPL's proposed IGC is materially overstated based on the financial modeling information provided by FPL itself. As I mentioned, the proposed IGC of $28.07/kW-month (4.52 cents/kWh at an 85% Load Factor [LF]) is calculated using FPL's peak-year revenue requirement rather than a levelized approach that reflects cost behavior over time.

**Q. WHAT IS THE FINANCIAL IMPACT OF FPL USING THE PEAK-YEAR REVENUE REQUIREMENT INSTEAD OF A LEVELIZED APPROACH?**

A. FPL's projections indicate a total capital investment (CapEx) of approximately [redacted], including [redacted] for battery storage, [redacted] for transmission infrastructure, and nearly [redacted] in fixed operation and maintenance (O&M) costs. These figures support the development and operation of 6.1 GW of capacity to serve an expected 3 GW of contracted LLCS load over a 20-year period.

FPL's total revenue requirement associated with this investment—incorporating all cost categories, including depreciation, return on equity, income taxes, insurance, and the effects of the federal Investment Tax Credit (ITC)—is shown as $12.87 billion on a nominal basis. When discounted using FPL's own weighted average cost of capital (WACC) of 8.81%, the present value of the revenue requirement is approximately $6.51 billion, also referred to in FPL's model as the Cumulative Present Value Revenue Requirement (CPVRR).

However, FPL calculates its proposed IGC of $28.07 per kW per month based on the peak year revenue requirement and then applies that rate uniformly across the full 20-year contract term. This results in a total customer payment stream of $20.2 billion in nominal dollars, or $8.99 billion on a present value basis.

This leads to an excess recovery of $7.35 billion in nominal terms — or $2.48 billion even after applying FPL's own discount rate. This present-value overcollection—nearly 38%—is driven entirely by FPL's use of peak-year pricing rather than a levelized cost approach.

In short, FPL has designed the IGC around the peak cost year, rather than aligning charges with the actual cost trajectory over time. As a result, LLCS customers would be required to pay significantly more than is necessary to recover the costs of serving them, even under FPL's own assumptions. This overcollection is inconsistent with cost-of-service principles and raises concerns about the fairness and reasonableness of the proposed tariff.

**Q. WHAT IS THE FINANCIAL IMPACT OF FPL'S OVER-SPECIFICATION OF BATTERY CAPACITY RELATIVE TO THE ACTUAL LOAD IT NEEDS TO SERVE?**

A. FPL's proposed 6.1 GW buildout—double the 3 GW contracted load — greatly inflates infrastructure costs and FPL's stated revenue requirement. When scaled to a 3 GW buildout:

- Battery storage costs fall from [redacted] to [redacted]
- Transmission costs decline from [redacted] to [redacted]
- Fixed O&M drops from [redacted] to [redacted]

If FPL scales its infrastructure to the available 3 GW in the LLCS-1 territory, total capital investment drops from [redacted] to [redacted]. FPL's model shows this adjustment results in the following:

- The total nominal revenue requirement falls from $12.87 billion to $6.36 billion,
- The discounted revenue requirement drops from $6.51 billion to $3.27 billion (using 8.81% WACC).

Under this correction alone, the IGC would drop significantly—reflecting **nearly** a 50% reduction in customer cost obligations—driven by a proportional reduction in FPL's capital investment. Even at this lower IGC, FPL would still fully recover its revenue requirement, including a regulated return on equity.

**Q. WHAT IS THE COMBINED FINANCIAL IMPACT WHEN BOTH THE PEAK-YEAR REVENUE ASSUMPTION AND CAPACITY OVER-SPECIFICATION ARE CORRECTED?**

A. When both modeling flaws are corrected, the cumulative financial effect is dramatic. Using a levelized cost structure based on a 3 GW buildout, the corrected IGC is $10.20/kW-month (1.64 cents/kWh at 85% LF). This translates to:

- Nominal customer payments: ~$7.70 billion over 20 years
- Discounted customer payments: ~$3.27 billion

Compared to FPL's original $8.99 billion discounted payment projection, this correction results in a reduction of $5.72 billion in present-value customer obligations — a nearly 64% reduction. It also lowers the all-in electricity rate from 10.16 cents/kWh to approximately 7.28 cents/kWh.

The two tables below show the impact of making the Peak Year Levelization Adjustment and Battery Over-specification Adjustment on the IGC and FPL's NPV Revenue Requirement.

**1) Impact of Assumption on FPL's IGC**

| **Scenario Description** | **IGC Rate** ($/kW-month) | **Effective IGC Rate** (¢/kWh at 85% Load Factor) | **IGC Reduction** (from Original Proposal) |
|---|---|---|---|
| **FPL Original Proposal** (Peak-Year, 6.1 GW) | $28.07 | 4.52¢ | – |
| **Peak-Year Correction Only** (Levelized, 6.1 GW) | $20.33 | 3.27¢ | 27.6% reduction |
| **Both Corrections Applied** (Levelized, 3 GW) | $10.20 | 1.64¢ | 63.6% reduction |

**2) Impact of Assumptions on FPL's NPV Costs and Revenue Requirements**

| Scenario Description | FPL Revenue Requirement (NPV, $B) | IGC Customer Payments (NPV, $B) | Overpayment (%) |
|---|---|---|---|
| **FPL Original Proposal** (Peak-Year, 6.1 GW) | $6.51 | $8.99 | +38% above NPV requirement |
| **Peak-Year Correction Only** (Levelized, 6.1 GW) | $6.51 | $6.51 | 0% — aligns with cost recovery |
| **Both Corrections Applied** (Levelized, 3 GW) | $3.27 | $3.27 | 0% — aligns with cost recovery |

**Q. WHY IS IT IMPORTANT FOR THE COMMISSION TO CONSIDER THESE CORRECTIONS IN EVALUATING THE PROPOSED IGC?**

A. These corrections are essential to preserve the integrity of cost-of-service ratemaking. If left uncorrected, FPL's current IGC structure would enable recovery of infrastructure costs far in excess of what is required to serve the LLCS load. It would also shift unjustified financial burdens onto data center customers through excessive and front-loaded charges. In contrast, a levelized approach using accurate load planning reduces overcollection while still allowing FPL to fully recover all costs, including an approved return on equity.

Importantly, all figures cited in this analysis—including revenue requirements and present-value estimates—are based on FPL's own modeling inputs and assumed WACC of 8.81%. The Commission has an opportunity and obligation to ensure that infrastructure costs are prudently planned and that large-load customers are treated equitably. Correcting these two modeling anomalies aligns the IGC with foundational principles of utility ratemaking and supports the Commission's duty to approve just and reasonable rates.

**Q. ARE THERE MORE APPROPRIATE MODELS USED IN OTHER STATES TO RECOVER INFRASTRUCTURE COSTS FROM LARGE-LOAD CUSTOMERS?**

A. Yes. Entergy Louisiana's Incremental Generation Charge (referred to as an Additional Facilities Charge (AFC)), which applies to Meta's data center in that state, provides a useful comparison. Under their AFC structure, the charge is amortized over a fixed period (typically 10 years), allowing for a declining recovery schedule that aligns with the useful life of the asset. After that amortization period, the charge is substantially reduced, reflecting that the utility has recovered its initial capital outlay.

**Q. WHAT IS THE CONSEQUENCE OF FPL'S FLAWED APPROACH FOR DATA CENTER CUSTOMERS?**

A. FPL's methodology for calculating the IGC leads to a substantial overcharge, placing an excessive and unjustified burden on data center customers. These customers may end up financing long-term grid assets that benefit FPL's broader system, while bearing inflated annual costs that do not reflect their actual cost of service.

**Q. WHAT IS YOUR RECOMMENDATION TO THE COMMISSION IN LIGHT OF YOUR FINDINGS?**

A. Based on my analysis, I recommend that the Commission amend the LLCS Tariff and the proposed Incremental Generation Charge in their current form. The proposed structure is not supported by a cost-of-service study, relies on inflated and unsubstantiated assumptions such as peak-year pricing and excessive infrastructure sizing, and fails to account for the significant systemwide benefits that data centers provide. These deficiencies result in a rate structure that is inconsistent with foundational ratemaking principles, particularly cost causation, customer fairness, and non-discriminatory rates. I support the suggested LLCS Tariff modifications outlined in FEIA Witness Loomis' testimony, which offer a more equitable, technically sound, and economically justified alternative to the current proposal.

**Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?**

A. Yes.

# MOHAMED AHMED, PH.D.

**Senior Director**

Energy Market Analysis and Project Finance, EPE

## AREAS OF EXPERTISE

- Electricity market design & forecasting (LMPs, PCA/NCA, MPM, ICA)
- Transmission & distribution planning, congestion and curtailment analysis
- Battery storage economics & BESS scheduling
- Project finance, revenue forecasting, and return on investment analysis
- Regulatory filings, policy analysis, and stakeholder engagement
- Renewable integration, smart grid operation, and market simulation

## PROFESSIONAL SUMMARY

Dr. Mohamed Ahmed has more than 25 years of hands-on experience in R&D, conceptual and detailed engineering, electricity markets, electricity market design, engineering, and project management all in the Electrical Power System (Transmission and Distribution) business. Dr. Ahmed has extensive experience with the safe, efficient, and effective operation of the power system and system dispatch operations within North America and the Middle East. Dr. Ahmed was responsible for providing the leadership and direction to ensure that the necessary staff, policies, and procedures are in place and a culture of reliability and compliance with NERC and NPCC are developed and implemented to provide safe, secure, and economic local and regional transmission system operation.

## EDUCATION

**Ph.D., Electrical and Computer Engineering**

University of Waterloo, 2012

**M.Sc., Electrical Power & Machines**

Ain Shams University, 2005

**B.Sc., Electrical Power & Machines**

Ain Shams University, 1999

## PROFESSIONAL EXPERIENCE

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**Senior Director, Energy Market Analysis and Project Finance, EPE, Vancouver, BC, Canada, Jan. 2023 – Present**

- Market Price Forecasting: predict future energy prices (LMPs) with deep insights on curtailments, congestion analysis, identification of frequently binding constraints, ERCOT-wide LMP forecasting with bus shift factors, ERCOT heat maps for LMPs on all nodes, financial transmission rights, and environmental analysis.
- Market Policy Analysis: understanding of the various market policies, regulations, and incentives that impact energy markets and the ability to assess their impact on energy projects. This includes the ability to develop and use sophisticated models for market simulation and analysis, as well as in-depth technical knowledge of energy markets and a deep understanding of market operations and regulations.
- Energy Storage Analysis: understanding of energy storage technologies and the ability to assess the economics and feasibility of energy storage projects, including LMP studies for BESS and BESS schedule optimization.
- Revenue Forecast Analysis: estimating the expected revenue for a project over a specified period of time. The analysis takes into consideration the pricing structure, relevant market factors, and other assumptions to provide an estimate of the revenue potential.
- Financial Analysis: performing financial analysis, including project feasibility and return on investment analysis, and the ability to assess and quantify project risks.
- Generation & Transmission Planning Analysis: Support in running EMT studies for Sub-synchronous Oscillations studies (SSO), performed Reactive Power Studies.
- Lead and managed an Engineering team and acted as the technical expert in matters related to renewable generation and energy storage.

**Senior Specialist Market Power Mitigation, Energy Market Design, Market Renewal Program, IESO, Mississauga, ON, Canada, Jan. 2020 – Jan. 2023**

Design Duties:

- Demonstrated ability to learn new concepts quickly and contributed to the MPM design document as well as the ex-ante design in DAM and PD.
- Participated in finalizing the MRP Detailed Design (DD), and publish version 1.0, then I helped in the reply to all the comments from stakeholders, and prepared the updated DD documents version 2.0

- Communicated all the MPM design features to the Calculation Engine team and Settlement team.
- Managed to reply to all the comments from ABB (HAPG) on the detailed design chapter and close all pending action items on time.
- Prepared several memos, excel sheets, and examples to close the gaps moving from the Detailed Design to the details of the solution-oriented topics and implementation.
- Drafted the MPM sections in the PD Calc. Engine, and developed a condensed plan with timelines to achieve this task and get the deliverables in timely manner.
- Designed the ex-ante MPM in the PD Calculation Engine,
- Developed the methodology for identifying the Potential Constrained Areas (PCAs) in Ontario, this included comprehensive analysis for the congestions in the Province and applied various statistical analyses (e.g. Temporal Correlation and Cumulative Distribution Function)
- Prepared a proposal for the Adjust Reference Level methodology, which considers different aspects of constraints (no restrictions on MPs offers, limit the number of laminations to 20, and not to pump the offers up when mitigated), the proposal has been approved and communicated to HAPG.
- Reviewed ABB's functional specification document for MPM, DSO and NCUC.
- Prepared and presented MRP MPM training to MRP Academy, EPRI, and Control Room.

<u>Stakeholder Interaction Duties:</u>

- Assigned to prepare some replies for the Stakeholder feedback questions on the Detailed Design Documents.

<u>Regulatory Framework Duties:</u>

- Drafted Market Manuals and Market Rules for Constrained Area Designations & Price Impact Test
- Participated in drafting the Market Rules for the Calculation Engines: Day-ahead Market, Pre-Dispatch Market, and Real-Time Market.
- Participated in preparing the description of the processes, process diagrams, details of the tasks of each process for the new added processes or modified ones.

<u>Implementation Duties:</u>

- Prepared the Functional Specification Documents of the Energy Market Design with ABB (HAPG), this document spells out all the details and requirements of the Market Design.

- Performed analyses for the Potential Constrained Areas (PCA), Narrow Constrained Areas (NCA), and to do this task, MATLAB, Excel, SCADA and PSSE is used to do the analyses.
- Developed a draft testbed for the Calc. Engine on GAMS, which can be used after some modifications to benchmark against ABB Calc. Engine, and also can be used to test any new design features before implement them.
- Participated in the interactions with the Settlement team, and collaborated in many topics, and drafted some business requirements needed for the EMFC (Enhanced for Mitigation) data sets.

Mentor/Leadership Duties:

- Took a lead role in IESO interactions with ABB (HAPG) and continue to champion IESO's interests through those conversations.
- Took a mentorship role to develop a prototyping engine in GAMS to replica the calculation engine to be used in testing the new MRP design features.

**Senior Specialist Forward Markets & Adequacy, Capacity Market Renewal Program, IESO, Mississauga, ON, Canada, Jan. 2019 – Apr. 2020**

Design Duties:

- Prepared the scope of the Incremental Capacity Auction Market, and prepared the High-Level Design document for the Market Design.
- Supported the HLD team to reply to the internal comments, update the HLD and publish it to stakeholders in March 2019, received the Stakeholders feedback, and replied to their comments and concerns.
- Investigated the other options to meet our resource requirement and adequacy needs, outside the Capacity Auction.
- Drafted all the work-plans for the assigned tasks within Stream-5 (Auction Mechanics and Locational Considerations).
- Interacted with IESO consultant "Brattle Group" on weekly basis to specify the design details of Ontario Incremental Capacity Auction including the seasonality characteristics (i.e. seasonal demand curve, seasonal auction, and seasonal target capacity)
- Finalized the needed detailed design decisions for the ICA, Declining Offers, Optimum Split of the Annual Revenue Requirement, Locational Considerations (Zonal Minimum and Zonal Maximum)

- Explained the decisions related to the HLD, as per the detailed design document, also looking after the how to implement the HLD decisions (e.g. Annual Offers, Locational Clearing, Price Separation, etc.)
- Develop, populate, and test base cases with respect to: Energy adequacy, Capacity adequacy, and Transmission adequacy
- Drafted the rationale document which explain the details of the IESO decisions, those decisions included how to deal with minimum constraints either hard constraints or demand curves, the price setting mechanisms, locational pricing, maximum constraints modeling, handling multiple offers and declining offers.

Stakeholder Interaction Duties:

- Participate in the Stakeholder engagement processes, attending Stakeholder meetings and webinars.
- Interacted with Stakeholders and answered all questions and addressed their concerns about ICA design features.

Implementation Duties:

- Prepared the Business Requirement Document (BRD) and work closely with Business Analysts (BAs) to draft the Market Design Requirements.
- Reviewed the Market Manuals and Market Rules for the new Transitional Capacity Auction (TCA).
- Led the TCA team, to design, implement, test all auction design features for Phases 2a and Phase 2b.

Mentor/Leadership Duties:

- Led the interactions with our vendor "Accenture" on a day-to-day basis, interactions can be summarized in the following points:
    - Explain all the design requirements needed for the auction engine.
    - Help the vendor in implementing the design requirements
    - Build Test Cases which can confirm the BRD.
    - Answer all design related question from the Vendor.
    - Develop Ad-hoc scenarios as needed by TCA team.
- Led the interactions with our consultant “Brattle Group” on a weekly basis, interactions can be summarized in the following points:

- Discuss the new design features of Ontario and getting the consultant feedback on how other jurisdictions implementing their Capacity Auctions
- Prepare and review materiality reports to endure the implement-ability of the new design features.
- Worked closely with the Brattle to develop a pricing mechanism for the zones with minimum procurement limit.

- Mentor the testing team to develop UAT and SIT test cases to test the auction engine, and to make sure it meets IESO BRD.
- Mentor a team to draft the internal manual and rational document which captures the details of the IESO design decisions.

**Senior Planning Engineer, Grid Solutions Department, Clean Power, SNC-Lavalin, Toronto, ON, Canada, Jan. 2016 – Dec. 2019**

Technical/Leadership Duties:

- Leading a team that is responsible for the Performance Based Maintenance Contract (PBMC) for wind generation on the distribution and the utility scale levels in North America.
- Leading a team for Renewable Energy Projects, starting from Scoping, Pre-Feasibility, Feasibility, Detailed Design, Engineering, Procurement, and Construction Management.
- Managed and over-sight of retained electrical engineering consultants, provide over-sight of retained electrical engineering consultants for the production of relevant electrical studies and design packages for the following components of renewable energy projects: Initial/conceptual electrical design (single line), Interconnection requests for submission to ISO/RTO's, evaluation of ability to meet interconnection standards (e.g. reactive power, voltage control, frequency control)
- Evaluation of transmission system interconnection capacity for potential renewable projects, evaluation of congestion and curtailment risk (SCED analysis)
- Led the technical and economic evaluation of transmission projects, responsible for the identification of competitive (FERC 1000) and merchant transmission projects in several independent system operators in the US including CAISO, SPP, and MISO.
- Responsible for assignments involving transmission and distribution system planning, generation and load connection assessment, long-term transmission visioning, grounding, transient and lightning studies.

- Responsible for delivering technical work involving the development of long-term transmission plans and transmission feasibility studies, the integration of renewable energy resources in North American transmission systems.
- Performed power system studies for HV/EHV Power projects using state of the art Engineering Software: Insulation Coordination, Load Flow, Voltage Stability, Short Circuit, Lightning and Switching transients, Circuit breaker Transient Recovery Voltage, Power Transformer inrush EMTP studies, Lightning Shielding of substations from direct strokes, Grounding Studies, Rigid & Flexible bus design Calculations, and Power Cable Sizing.
- Managed the team's service portfolio and track transmission developments in PJM, NYISO, ISO-NE, SPP and MISO to advise Generation clients on all transmission and interconnection related issues.
    - Analyses of transmission load flow and Location Marginal Price (LMP)
    - Analyses of congestion and basis risks for potential and existing projects with a long-term view while tracking the regional transmission planning and development
    - Develop strategies to select new project sites and evaluate opportunities with transmission-related work to ensure each project has sufficient transmission availability for project competitiveness
    - Technical and competitive insight throughout development, interconnection, and operation phases of projects.
    - Interconnection process for wind, solar and battery energy storage projects
- Took responsibility for the timely completion of projects assigned while meeting all project quality and budget objectives.
- Provided excellent customer service by setting examples in timeliness, quality and efficiency of services rendered.
- Contribute to development of the team's short-term and long-term business plan including, but not limited to, annual operating budgets, annual targets, identifying growth areas, new initiatives, key customer segments, new service offerings and enhancing existing service offerings to align with market needs
- Work closely with business development and lead efforts towards continued growth, including opportunity identification, pipeline management, proposal development and submittal, and play a significant role during negotiation and establishment of contracts
- Actively manage the relationships and act as liaison with select key customer accounts in the renewable industry

- Actively participate in industry forums, such as conferences, workshops and publications to promote SNC-Lavalin's vision as well as to stay informed and lead the market of Resource Integration

Management Duties:

- Operations: Responsible for development and execution of all relevant activities related to resources, projects and clients.
- Product Development: Direct and contribute to the development of the Line-of-Business (LOB) products by: strengthening existing products/services, identifying new products/services, defining the vision, strategy, and roadmap for growth of each product, product pricing/profitability analysis.
- Business Development and Sales: work closely with the Executive Team to execute on growth and revenue goals for SNC-Lavalin by executing on the following: Lead and write proposals, identify potential new business and RFPs, Develop LOB yearly budget and pipeline management, LOB market research and business cases, and including identifying new potential clients and markets.
- Finance: Develop analytics and metrics to ensure financial revenue and profitability goals are met. This includes but is not limited to successful budget development and continuous tracking, LOB revenue & profitability goals, ensuring staff productivity and profitability goals are met
- Resource planning including justifying and leading the hiring process
    - Assign, monitor and coordinate the workload of the resources
    - Provide staffing forecasts and participate in all hiring activities.

**Engineer/Technical Officer, System Performance Department, IESO, Mississauga, ON, Canada, Sep. 2014 – Dec. 2015**

- Developing and maintaining power system models used in power flow, short circuit, transient and dynamic stability analysis of the IESO controlled grid.
- Assess the impact on the reliability of taking an equipment out-of-service.
- Receive assignments from the Supervisor in general terms on specific problems related to assigned areas of work and obtain the necessary data for problem-solving.
- Safeguard the confidentiality of Market Participant data.
- Using PSS/E and DSA tools to perform tests to validate market participant models and data.

- Resolving model and data related power system operation issues, developing and implementing solutions.
- Providing technical support to the On-Line Limits Derivation (OLLD) Project (WINTOP) on network modeling and tools.
- Maintaining on-line network models in support of EMS and on-line dynamic security assessment applications.
- Developing software to facilitate system data collection to automate the power system analysis process.
- Lead studies to identify future system conditions based on currently contracted amounts of ancillary services (black start, regulation, voltage control) and Must Run resources.
- Determine if existing resources under contract are sufficient to meet identified requirements, and provide information for the contracting process as needed.
- Consult/lead/participate in special studies as required.
- Interfacing with Market Participants to gather equipment model and data for their registered facilities.
- Providing model and data support for the development of market rules, policies, and procedures.
- Participating in developing and delivering training to IESO staff on issues pertaining to models and data.

**Senior Research Scientist, IBM, Research, and Development Department, first accepted project, the Southern Ontario Smart Computing Innovation Platform (SOSCIP), Project title: "Weather Forecasting Effect in Reliability Evaluation of Electrical Transmission & Distribution Systems," Waterloo, ON, Canada, Sep. 2012 – Sep. 2014**

- Review reliability evaluation techniques, factors that influence power system reliability, and the basic concepts of weather modeling;
- Examine the existing weather models and extend them to reflect the effect of continuously changing stress created by weather in reliability assessment of transmission system using the IBM forecasting weather data;
- Use IBM weather forecasting tool "Deep Thunder" to forecast weather in Southern Ontario.
- Develop a series of multi-state weather models to be used to predict the system failure rate, outage duration, and unavailability and develop an outage forecast model.

- Introduce an approach to incorporate the reliability indices into a series of weather specific indices using IBM Info-Sphere Streams that extract online real-time data from NOAA website.
- Use Agile Cloud computing to illustrate the application of weather modeling on practical transmission and distribution systems.
- Present a series of sensitivity studies for the various percentages of failures occurring in adverse and extreme weather conditions.

**Project Leader, MITACS – Accelerate (Hydro-One, Ryerson University, University of Waterloo), "Decentralized Operation of Smart Distribution Networks based on a Multi-Agent Framework," Centre of Urban Energy (CUE), Toronto, ON, Canada, May 2011 – Apr. 2012**

- Propose a multi-agent system for energy resource scheduling of an islanded power system with distributed resources and energy storage elements.
- Develop a model that consists of integrated micro-grids, lumped loads, and a variety of storage devices.
- Apply the distributed intelligent multi-agent technology to make the power system more reliable and efficient, and capable of exploiting and integrating alternative sources of energy.
- Implement the developed models in one of the existing Ontario distribution systems owned by Hydro One.
- Recommendation for proper implementation of the proposed multi-agent system to the project manager.

## PUBLICATIONS AND PRESENTATIONS

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**Journal Papers:**

1. N. Padmanabhan, K. Bhattacharya, **M. H. Ahmed**, "Procurement of Energy, Primary Regulation, and Secondary Regulation Reserves in Battery Energy Storage Systems Integrated Real-Time Electricity Markets", IEEE Systems Journal, Volume: 16, Issue: 4, December 2022
2. H. Ahmed, **M. H. Ahmed**, M. M. Salama, "A Linearized Multi-Objective Energy Management Framework for Reconfigurable Smart Distribution Systems Considering BESSs", IEEE Systems Journal, Volume: 16, Issue: 1, March 2022

3. H. Ahmed, A. Awad, **M. H. Ahmed**, M. M. Salama, “Mitigating voltage-sag and voltage-deviation problems in distribution networks using battery energy storage systems”, Electric Power Systems Research, Volume 184, July 2020, 106294

4. Ameena Al-Sumaiti, **M. H. Ahmed**, Sergio Rivera, Mohamed El Moursi, Magdy Salama, Tareefa Alsumaiti, “A Stochastic PV Model for Power System Planning Applications”, IET Renewable Power Generation, Volume 13, Issue 16, 09 December 2019, p. 3168 – 3179

5. M.F Shaaban, **M. H. Ahmed**, M. M. Salama, Ashkan Rahimi-Kian, “Optimization unit for real-time applications in unbalanced smart distribution networks”, Journal of advanced research, Volume 20, Pages 51-60, Elsevier, November 2019.

6. M. Othman, H. Ahmed, **M. H. Ahmed**, M. M. Salama, “A Techno-economic Approach for Increasing the Connectivity of Photovoltaic Distributed Generators”, IEEE Transactions on Sustainable Energy, published September 2019 “early access”, volume: 11, issue: 3, July 2020, Page(s): 1848 - 1857

7. N. Padmanabhan, **M. H. Ahmed**, K. Bhattacharya, “Battery Energy Storage Systems in Energy and Reserve Markets”, IEEE Transactions on Power Systems, date of publication: August 2019, volume: 35, issue: 1, Jan. 2020, Page(s): 215 - 226

8. M. Othman, **M. H. Ahmed**, M. M. Salama, “A Coordinated Real-Time Voltage Control Approach for Increasing the Penetration of Distributed Generation”, IEEE Systems Journal, published April 2019, volume: 14, issue: 1, March 2020, Page(s): 699 - 707

9. M. Othman, **M. H. Ahmed**, M. M. Salama, “A novel smart meter technique for voltage and current estimation in active distribution networks”, International Journal of Electrical Power & Energy Systems, Elsevier, Volume 104, January 2019, Pages 301-310

10. N. Padmanabhan, **M. H. Ahmed**, K. Bhattacharya, “Simultaneous Procurement of Demand Response Provisions in Energy and Spinning Reserve Markets,” IEEE Transactions on Power Systems, Volume: 33, Issue: 5, Sept. 2018, Page(s): 4667 - 4682

11. A. S. Awad, **M. H. Ahmed**, T. H. El-Fouly, and M. M. Salama, "The impact of wind farm location and control strategy on wind generation penetration and market prices," Renewable energy, vol. 106, pp. 354-364, 2017.

12. A. Almutairi, **M. H. Ahmed**, and M. M. Salama, “Probabilistic Generating Capacity Adequacy Evaluation: Research Roadmap,” Electric Power Systems Research, vol. 129, December 2015, pp. 83–93.

13. Ameena Saad Al-Sumaiti**, M.H. Ahmed**, M. M. Salama, "Residential Load Management under Stochastic Weather Condition in Developing Countries," Electric Power Components and Systems, vol. 42, pp. 1452-1473, 2014.

14. Nazila Rajaei, **M.H. Ahmed**, M. M. Salama, "Fault Current Management Using Inverter-Based Distributed Generators," IEEE Transactions on Smart Grid, Vol. 5, No. 5, September 2014, pp. 2183 - 2193.
15. Ameena Saad Al-Sumaiti, **M.H. Ahmed**, M. M. Salama, "Smart Home Activities: A Literature Review," *Electric Power Components and Systems*, 42(3–4):294–305, 2014
16. A. Almutairi, **M. H. Ahmed**, and M. M. Salama, "Evaluation of the Generating Capacity Adequacy of the Saudi Arabian Central Operating Area," Electric Power Components and Systems, vol. 42, pp. 83-90, 2014.
17. **M. H. Ahmed**, K. Bhattacharya, M. M. Salama, "Probabilistic Distribution Load Flow with Different Wind Turbine Models," IEEE Transactions on Power Systems, Vol. 28, No. 2, May 2013, pp. 1540-1549.
18. **M. H. Ahmed**, K. Bhattacharya, M. M. Salama, "Stochastic Unit Commitment with Wind Generation Penetration," *Electric Power Components and Systems*, No. 12, Vol. 40, pp. 1405-1422, August 2012.

**Patents:**

1. M. El-Khatib, **M. H. Ahmed**, M.M.A. Salama, R. El Shatshat, "Decentralized Volt/VAR Control for Advanced Distribution Automation Systems," Nov. 2012, US20140148966 A1

**Conference Papers:**

1. Imtiaz Ahmed Khan, Kshirasagar Naik, **M. H. Ahmed**, Mustafa Al-tekreeti, "Ranking of Routes for Electrical Transmission Lines Using GIS and Fuzzy Logic", IEEE PES General Meeting, August 3 – 6, 2020, Location: Virtual Event
2. Haytham Ahmed, **M. H. Ahmed**, Magdy Salama, "Network Reconfiguration for the Optimal Operation of Smart Distribution Systems", IEEE PES General Meeting, August 4-8 2019, Atlanta, GA, USA.
3. M. Othman, **M. H. Ahmed**, M. M. A. Salama, "A Probabilistic Economic Assessment Approach for Active Power Curtailment of Photovoltaic Based Distributed Generators," accepted to IEEE PES General Meeting, will be held on August 5-9, 2018 in Portland, OR, USA.
4. Sherin Helal, M.F. Shaaban, **M. H. Ahmed**, M.M.A. Salama, "Optimal Scheduling of Battery Energy Storage Systems in Unbalanced Distribution Networks," 2018 IEEE Canadian Conference on Electrical and Computer Engineering (CCECE).
5. Mahmoud M. Othman, **M. H. Ahmed**, M. M. A. Salama, "A Novel Real-Time Estimation Technique for Active Unbalanced Distribution Networks Using Smart Meters," 2018 IEEE Canadian Conference on Electrical and Computer Engineering (CCECE).

6. **M. H. Ahmed**, Mohamed Arif, Mohamed Al-Ghawzi, Willy Kotigua, "Quantifying the Value of Pumped Storage Hydro (PSH) in the Saudi Electric Grid," Saudi Arabia Smart Grid (SASG) Conference, December 2016, Jeddah, KSA.

7. Nazila Rajaei, **M.H. Ahmed**, M.M.A. Salama, "A Novel Newton-Raphson Algorithm for Power Flow Analysis in the Presence of Constant Current Sources," 2016 IEEE PES Transmission & Distribution Conference & Exposition Proceedings, 03 May - 05 May 2016, Dallas Convention Center, 650 S. Griffin St., Dallas, TX, USA.

8. Nazila Rajaei, **M.H. Ahmed**, M.M.A. Salama, "Comparison of the Effects of IBDGs and Synchronous DGs in Fault Condition," the 42nd Association of Egyptian American Scholars (AEAS) Annual Conference, Dec. 27 – Dec. 29, 2015, Ain Shams University, Cairo, Egypt.

9. M.F. Shaaban, **M. H. Ahmed**, T.H.M. EL-Fouly, M.M.A. Salama, "Impact of Integrating PEV and Renewable Sources on Power System Reliability Assessment," the International Conference on Electric Power and Energy Conversion Systems, American University of Sharjah, UAE – November 24–26, 2015, Sharjah, UAE.

10. M. El-Khatib, **M. H. Ahmed**, R. El Shashat, M.M.A. Salama, "Autonomous Decentralized Distribution System Restoration Algorithm," the 2015 International Symposium on Smart Electric Distribution Systems and Technologies (EDST 2015) - CIGRE SC C6 Colloquium, Vienna, September 8th to September 11th, 2015.

11. Abdulaziz Almutairi, **M. H. Ahmed**, M. M. A. Salama, "System Adequacy Assessment with Wind Power Generation using Monte Carlo Markov Chain Method," accepted for presentation at International Science And Technology Conference (ISTEC), September 2nd to September 4th, 2015 at St. Petersburg, Russia.

12. **M. H. Ahmed**, M. El-Khatib, R. El Shashat, M.M.A. Salama, "Transformer Health Index Estimation Using Orthogonal Wavelet Network," the 2015 IEEE Electrical Power & Energy Conference (EPEC2015), London, Ontario, Canada, October 26 -28, 2015.

13. Abdulaziz Almutairi, **M. H. Ahmed**, M. M. A. Salama, "Inclusion of Wind Generation Modeling into the Conventional Generation Adequacy Evaluation," Electrical Power and Energy Conference (EPEC), 2014 IEEE, 122-127, 14th Electrical Power and Energy Conference, November 2014.

14. Nazila Rajaei, **M.H. Ahmed**, M.M.A. Salama, "Analysis of Fault Current Contribution from Inverter-Based Distributed Generation," IEEE PES General Meeting, Washington DC, July 2014.

15. Ahmed Samir, **M.H. Ahmed**, T. El-Fouly, M.M.A. Salama, "A Probabilistic Approach to Assess Wind Generation Penetration and Market Prices," IEEE CCECE 2014: Symposium on CUE-ORF-RE workshop, May 2014.

16. M. El-Khatib, **M. H. Ahmed**, R. El Shashat, M.M.A. Salama, “Optimal Real-Time Coordinated Voltage and Reactive Power Control in Smart Grids,” IEEE CCECE 2014: Symposium on CUE-ORF-RE workshop, May 2014.
17. Abdulaziz Almutairi, **M. H. Ahmed**, M. M. A. Salama, “Different Representation Models For Integrating Wind Energy Into Generating Capacity Adequacy Assessment,” 2013 CIGRÉ Canada Conference, Westin Calgary, Calgary, Alberta Canada, September 9-11, 2013.
18. **M. H. Ahmed**, K. Bhattacharya, M.M.A. Salama, “Evaluation of the Environmental Impact of Wind Generation Penetration,” IEEE PES General Meeting 2012– California, San Diego. July 22 -26, 2012.
19. Y. Chow, **M. H. Ahmed**, M.M.A. Salama, “Accurate Inductance of an Air Core Solenoid in a Rapidly Convergent Series Form,” INDUCTICA 2012 Conference, Berlin Germany, June 2012.
20. Y. Chow, **M. H. Ahmed**, M.M.A. Salama, “Simple and Exact Inductance Formula of a Circular Loop” INDUCTICA 2012 Conference, Berlin Germany, June 2012.
21. **M. H. Ahmed**, K. Bhattacharya, M.M.A. Salama, “Renewable Energy Environmental Effects,” ICGST International Conference on Recent Advances in Energy and Power Systems, Alexandria, Egypt, April 2012.
22. **M. H. Ahmed**, K. Bhattacharya, M.M.A. Salama, “Operations Analysis of Wind Penetration into Distribution Systems Using PDLF” Middle East - Innovative Smart Grid Technologies – ME (ISGT) – Saudi Arabia – Jeddah – December 17 – 20, 2011.
23. **M. H. Ahmed**, K. Bhattacharya, M.M.A. Salama, “Analysis of Uncertainty Model to Incorporate Wind Penetration in LMP-Based Energy Markets” International Conference on Electric Power and Energy Conversion Systems, American University of Sharjah, UAE – November 15 -17, 2011.
24. **M. H. Ahmed**, K. Bhattacharya, M.M.A. Salama, “Stochastic Analysis of Wind Penetration Impact on Electricity Market Prices” IEEE PES General Meeting 2011 – Michigan, Detroit. July 26 -28, 2011.
25. **M. H. Ahmed**, H.M. Mashaly, A.A. Abaas, M.A. El-Sharkawy,"Impacts of Using Compact Fluorescent Lamp on Power Quality," ICEEC-2004 "International Conference on Electrical, Electronic, and Computer Engineering," Faculty of Engineering, Ain Shams University.
26. **M. H. Ahmed**, H.M. Mashaly, A.A. Abaas, M.A. El-Sharkawy, "Experimental Implementation of Harmonics Identification Scheme," MEPCON-2005 "Middle East Power System Conference," Faculty of Engineering, Suez Canal University.
27. **M. H. Ahmed**, H.M. Mashaly, A.A. Abaas, M.A. El-Sharkawy,"Passive and Adaptive Filter Design and Experimental Implementation," MEPCON-2005 "Middle East Power System Conference," Faculty of Engineering, Suez Canal University.

**Exhibit MH-2: GSLD-3 Current & GSLD-3, LLCS-1 Proposed Rates**

| | **GSLD-3 Current Rates** (Cents / Kwh) | **GSLD-3 Proposed Rates** (Cents / Kwh) | **~ Change** | **% Change** |
|---|---|---|---|---|
| **Base Bill** | 3.00 | 3.92 | 0.93 | 31% |
| **Rate before Taxes and Fees** | 5.98** | 6.89** | 0.91 | 15% |
| **Total Rate Incl Taxes and Fees** | 6.14 | 7.08 | 0.94 | 15% |

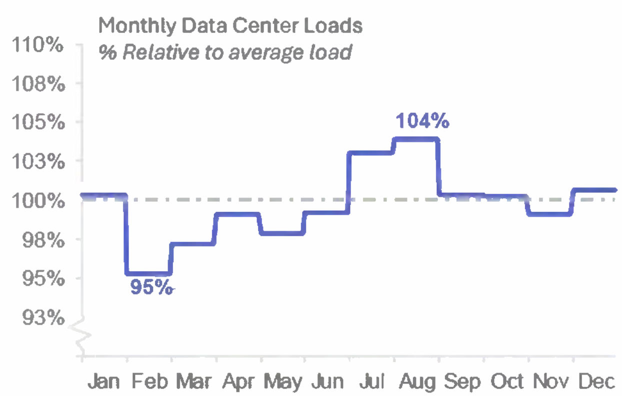
| | **GSLD-3 Current Rates** (Cents / Kwh) | **LLCS-1 Proposed Rates*** (Cents / Kwh) | **~ Change** | **% Change** |
|---|---|---|---|---|
| **Base Bill** | 3.00 | 7.13 | 4.13 | 138% |
| **Rate before Taxes and Fees** | 5.98 | 10.16 | 4.10 | 69% |
| **Total Rate Incl Taxes and Fees** | 6.14 | 10.43 | 4.29 | 69% |

*Base Bill Include Incremental Gen Charge

| ****Schedule A-2: 2026 Projected Test Year Page 11 of 12** | **GSLD-3 Current** | **GSLD-3 Proposed** |
|---|---|---|
| **Typical Kwh** | 3,285,000 Kwh | 3,285,000 Kwh |
| **Cost (Pre GRT/ RAF)** | $196,576 | $226,437 |
| **Rate (Pre GRT/ RAF)** | **5.98 cents / Kwh** | **6.89 cents / Kwh** |
| **Cost Including GRT/ RAF** | $ 201,792 | $232,445 |
| **Rate Including GRT/ RAF** | 6.14 cents / Kwh | 7.08 cents / Kwh |

**Exhibit MH-3: Data Center Load Profiles and FPL Load Factor Increase**

| | FPL Load Data Before Interconnection | | | | FPL Load Data After Interconnection of 3 GW at 85% Load Factor | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | Net Energy Load (GWh) | Average GW | Peak GW | Load Factor | Net Energy Load (GWh) | Average GW | Peak GW | Load Factor | **Load Factor Increase** | **Relative Load Factor Increase** |
| **2022** | 140,916 | 16.04 | 26.42 | 60.7% | 163,315 | 18.59 | 29.42 | 63.2% | **2.5%** | **4.1%** |
| **2023** | 143,756 | 16.36 | 28.46 | 57.5% | 166,155 | 18.91 | 31.46 | 60.1% | **2.6%** | **4.6%** |
| **2024** | 140,464 | 15.99 | 27.73 | 57.7% | 162,863 | 18.54 | 30.73 | 60.3% | **2.7%** | **4.6%** |



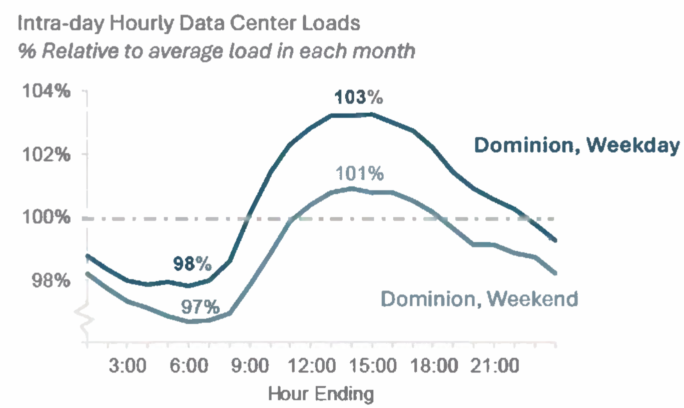



**Exhibit MH-4: Entergy Louisiana Additional Facilities Charge Structure**

| Recovery Period Years | Monthly % of Costs During Recovery Term | Monthly % of Costs Post Recovery Term |
|---|---|---|
| **1** | 8.93% | 0.18% |
| **2** | 4.75% | 0.18% |
| **3** | 3.37% | 0.18% |
| **4** | 2.67% | 0.18% |
| **5** | 2.26% | 0.18% |
| **6** | 1.99% | 0.18% |
| **7** | 1.79% | 0.18% |
| **8** | 1.65% | 0.18% |
| **9** | 1.54% | 0.18% |
| **10** | 1.45% | 0.18% |

| | Entergy Louisiana – Additional Facilities Charge (10 Year Recovery) | FPL – LLCS-1 Incremental Generation Charge |
|---|---|---|
| **Payment Years 1-10** | $ 1,130 per kW * 1,000,000 kW * 1.45% * 12 Months * 10 Years = **$ 1.96 Billion** | $ 28.07 / Kw * 1,000,000 kW * 12 Months * 10 Years = **$ 3.36 Billion** |
| **Payment Years 11-20** | $ 1,130 per kW * 1,000,000 kW * 0.18% * 12 Months * 10 Years = **$ 244.1 Million** | $ 28.07 / Kw * 1,000 MW * 12 Months * 10 Years = **$ 3.36 Billion** |
| **Total Payment Over 20 Years** | **$ 2.2 Billion** | **$ 6.7 Billion** |
| **Effective Cost per Kw over 20 Years** | **$ 9.16 / kW - month** | **$ 28.07 / kW - month** |

* $1,130 per kW is assumed battery storage cost – per FPL model