IMPA
INDIANA MUNICIPAL POWER AGENCY

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Dr. Bradley K. Borum
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Indiana Utility Regulatory Commission
PNC Center
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Dear Dr. Borum,

Thank you for your May 20, 2016 draft comments on Indiana Municipal Power Agency's 2015 Integrated Resource Plan. IMPA appreciates the opportunity to review your comments and provide feedback prior to the final report. Attached are responses to various questions and comments included in your report.

Once again, thank you for the opportunity to review your comments and provide clarifying information to you. We look forward to working with you and your staff as we develop future IRPs.

Thank You,

Doug Buresh P.E.
Sr. VP, Planning and Operations
Indiana Municipal Power Agency

The Load Forecast

1. **On pages 5-33, IMPA states that its forecast model excluded 24 months of data in 2009 and 2010 to better analyze the base trends and growth by removing the effects of much of the severe recession. The director would appreciate IMPA's thoughts on the following commentary:**

   IMPA uses an auto-regressive approach (Auto-Regressive Integrated Moving Average (ARIMA) that is based on historical patterns of the load rather than a forecasting method that utilizes a relationship between energy use and/or demand based on a set of explanatory variables. IMPA recognized its ARIMA model, because it is based on trends, was not useful for adjusting for the effects of a recession (or any other extraordinary event) to attempt to explain pre- and post-recession use of electricity. That is, a recession wreaks havoc on an ARIMA forecasted result because there is no corresponding downturn in a specific driver(s) to correlate with the downturn in load caused by the recession. Similarly, the addition or subtraction of members can render an ARIMA method problematic.

   An ARIMA model has value as a short-term forecasting method in which the values are relatively stable and linear but not when there is dramatic instability such as that caused by the recession. Creating a dummy variable for a selected period(s) of history, especially recent history, is concerning.

   IMPA's choice of the ARIMA model might be convenient due to IMPA's structure. In some sense IMPA's relationship with its members in preparing load forecasts has similarities to the preparation of load forecasts by the MISO and PJM. However, the MISO and PJM rely heavily on the load forecasts of member utilities and IMPA does not have that input from its member systems. It should be noted that MISO lists this as an unacceptable approach in its forecasting methodologies whitepaper. In addition to IMPA's comments on the characterization of IMPA's load forecasting approach, the director would appreciate IMPA's thoughts on potential improvements in the load forecasting process.

   <u>IMPA Response:</u> IMPA appreciates the Director's comments on its load forecasting process and would like to offer further explanation of the methodology. The forecasting models do, in fact, include explanatory variables such as Indiana Real Per Capita Income, U.S. Unemployment, cooling degree days, and heating degree days (IRP Report page 5-34, Appendix D page 54). Therefore, the models utilize both the ARIMA as well as econometric functions. While the economic variables may have explained most, if not all of the recessionary load impacts, the recessionary period did cause issues with the ARIMA function of the model. Therefore, as described in the report (IRP Report page 5-33), this period was excluded to allow both functions to perform properly. No "dummy" variables were included in the models as IMPA is in agreement with the Director that creating dummy variables could introduce an unintended bias. It is noteworthy that the Great Recession (December 2007 – June 2009) was the worst global

recession since World War II. In IMPA's opinion, the rapid loss and subsequent partial recovery of the electric load was such an unusual occurrence that this period is a statistical outlier and should be excluded from the load history.

Regarding the addition or subtraction of members, IMPA members are contractually obligated to purchase all of their power requirements from IMPA through a long term contract which encompasses the entire IRP forecast period. Thus, the loss of a member load is a highly unlikely event. When a new member joins IMPA, historical data is obtained to allow IMPA to model the member's load as if it had been part of IMPA for the entire period modeled. Therefore, new members do not create issues for the ARIMA model. IMPA responds to requests when in- or out-of-state non-IMPA electric municipalities look to replace their expiring contracts. Given the eligible non-IMPA electric municipalities vary in size from very small to large, IMPA captures the possibility of obtaining new members through its economic growth scenario driver (IRP Report page 10-66) and through its stochastic demand uncertainty (IRP Report page 14-119 and 15-141).

Regarding MISO and PJM requirements, PJM creates its own forecast and does not require the load serving utilities to provide a forecast. As for MISO, IMPA is the load serving entity solely responsible for serving its member's load in the footprint. IMPA consults the members to obtain information on potential load changes but it would not be prudent to have each member provide their own forecast. IMPA is continually evaluating its forecasting methodology and looking for additional data sources.

2. **IMPA's historical energy requirements include EE reductions from 2011 through 2014.**

   Apparently, IMPA added the energy from these programs back into the historical energy in an attempt to analyze naturally occurring load growth.

   a. **This seems contradictory. Would IMPA please address this seeming inconsistency?**

      IMPA Response: In statistics, the development of the models often requires an adjustment to the data. IMPA adjusts its historical loads to account for load variations not attributable to the explanatory economic variables. In response to Question 1, IMPA described how adjustments were made to account for new member loads as well as the load anomaly attributable to the Great Recession.

      Energy efficiency requires a similar adjustment. Since the energy efficiency reductions attributable to IMPA's EE program are driven by program incentives rather than explanatory economic variables, the energy efficiency reduction is added back to the IMPA historical load. The inclusion of energy efficiency provides a consistent historical database for developing the "gross" load forecast. After the gross load forecast is generated, the historical energy efficiency reductions are subtracted from the gross load

forecast resulting in the "net" or final load forecast which does not include the historic energy efficiency.

b. **Because IMPA is no longer implementing significant EE programs, concern about double-counting past energy and peak reductions due to DSM might not be a major concern for the forecast of future load. The concern for double-counting of past DSM may occur if historical use is not adjusted due to the amount that past DSM programs have reduced the naturally occurring load requirements; also the lack of adjustment might feed forward into lower forecasts. The director recognizes that accurately measuring the changing effects of EE (a.k.a. "roll off") is daunting and there is no universally accepted approach. However, is IMPA putting its thumb on the scale to try to offset its other thumb on the scale that resulted from the change in load levels due to DSM?**

IMPA Response: In response to Question 2a, IMPA described how energy efficiency is added to the historical loads solely for the purpose of developing the statistical variables, after which the energy efficiency is removed to create the final load forecast. No double-counting occurs. The Director's concern about double-counting and IMPA putting its thumb on the scale is precisely the reason IMPA employs this technique. By developing its load forecast using an adjusted database, IMPA removes any downward bias and double-counting that could be introduced using a historical database which is not adjusted for the energy efficiency reductions.

c. **Although some legitimate concerns exist for potential double-counting, there are a couple of considerations. First, the higher efficiency buildings and devices that were incentivized by the DSM programs are still in place. These prior DSM initiatives will result in less energy use in the future. Second, DSM programs tend to have spillover effects beyond the program itself, and those effects are also still present. Thus it is possible to miss some of the effects of past DSM on future requirements, depending on how firmly you push down on the scales.**

IMPA Response: As described in response to Question 2b, the technique employed by IMPA avoids the issue of double-counting; however, IMPA agrees that it is possible to miss some of the effects of organically occurring energy efficiency on future requirements. In future load forecasts, IMPA will continue to investigate ways to assess the impact of organically occurring energy efficiency as well as free riders.

3. **Is it accurate to say that IMPA used only one base load forecast for all of its scenarios? At least, no other forecasts are discussed in the load forecast chapter. Appendix D, page IX, Figure 2 shows potential energy forecast and the net energy forecast.**

IMPA Response: It is accurate to say that a single base forecast is used as the underlying forecast for all of the scenarios; however, only the Status Quo scenario uses the forecast as is. The remaining scenarios (Retrenchment, Global Economy, Shifting Gears, and Green Revolution) use a load forecast that is adjusted for economic growth and load factor (IRP Report page 10-66).

a. **Is the net energy forecast the forecast IMPA used as the base forecast in the IRP? Is the difference between the two forecasts the level of historic EE for the years 2011-2014? Why is the difference constant over the forecast period? Should not the effects of EE measures installed for the period 2011-2014 decrease and, eventually, disappear over time?**

   IMPA Response: Yes, the net energy forecast represents expected loads (net of energy efficiency reductions). The "potential" energy forecast assumes load growth with no EE programs. For energy efficiency installed for the period 2011-2014, IMPA assumes the effects of the measures will not disappear over time. For example, if an incentive measure was to replace inefficient lights in a factory, then even after the light bulbs eventually burn out, the factory will replace them with similar (or better) energy efficient light bulbs.

b. **Given the relatively small changes in the anticipated forecasts, having a single forecast might be appropriate IF the forecast was sufficiently credible under a range of uncertainties. However, because the trending analysis (ARIMA) may be problematic (including the possibility of adding or subtracting members or a corporate decision to embark on significant DSM to influence future resource requirements or comply with environmental requirements), would IMPA agree that having different forecasts to more fully assess potential risks could provide some important insights?**

   IMPA Response: In response to Questions 1 and 2, IMPA described how its forecast is not problematic as historical adjustments were made to create a consistent database. In response to Question 3, IMPA described how the scenarios (Retrenchment, Global Economy, Shifting Gears, and Green Revolution) provided IMPA with four additional load forecasts that were dramatically different from the base (Status Quo) forecast; both much higher and much lower. To fully assess the potential risks of load uncertainty, each plan was subjected to fifty (50) unique stochastic load forecasts in which the long-term growth, monthly peak, monthly energy, hourly shape, and load factor varied greatly from the base forecast (IRP Report page 15-141). IMPA believes its efforts to address and quantify load uncertainty are exemplary and set a standard for industry best practice.

4. **Missing.**

5. **The load forecast model uses heating degree days (HDDs), cooling degree days (CDDs), Indiana real per capita income, U.S. unemployment, peak days, and off-peak days.**

    a. **How does this model capture the effects of improving efficiency over time?**

    IMPA Response: *IMPA used its scenario process to address improving efficiency over time by adjusting the load factors. For example, the Green Revolution scenario improves the load factor by 3% by 2030 due to residential rooftop solar, batteries, and energy efficiency.*

6. **Regarding the generated load forecasts for each of IMPA's five load zones.**

    a. **Would IMPA please clarify how these were done? Then, is it correct to say that these were done in the same basis as power is generated into MISO and PJM?**

    IMPA Response: *The IMPA load zone forecasts represent the IMPA loads in each of the five transmission providers that serve IMPA members. Forecasting the five zones provides IMPA with the load data necessary to calculate the costs and local effects due to: Locational Marginal Prices (LMPs), Network Integration Transmission Service (NITS), Capacity Markets, Reserve Requirements, etc. between the different RTOs and zones within them. IMPA used the same forecasting method for each load zone (IRP Report Appendix D). Consistent with the load forecast, IMPA's generating resources are modeled in the transmission zone in which they reside and are priced at localized LMPs determined from analysis of historic congestion and loss trends.*

7. **IMPA, on page 5-36, discussed methodology used to weather normalize the load data.**

    a. **Is our characterization correct that, in essence, IMPA is back-casting to find load under normal weather with the assumption that nothing else changes?**

    b. **This is probably a reasonable practice, but is this characterization accurate?**

    IMPA Response for a & b: Correct, IMPA back-casts with normal weather to evaluate the performance of the models.

8. **Given the low projected demand and energy sales growth rates, it is not surprising that IMPA's resource requirements have not experienced significant changes.**

    IMPA's analysis of potential retirements due to potential environmental regulations, age, and operational characteristics seems well-reasoned. Historically, IMPA have been very proactive

in taking advantage of relatively low market rates from MISO and PJM while searching for opportunities to partner with other power suppliers as a means of reducing financial and reliability risks (page 2-15). It is, then, commendable that IMPA is considering 300 MW participation in a 500 MW combined cycled facility (by 2021 and 2022) in anticipation of the expiration of a Purchased Power Agreement (100 MW) in 2020 and the retirements of Whitewater Valley Stations 1 and 2 in 2022 (page 1-13 and the table on 1-14).

IMPA Response: *IMPA appreciates the Director's comments.*

RESOURCE PLANNING

1. **It is gratifying that IMPA's resource planning allowed all IMPA-owned units to be considered for retirement in the capacity expansion modeling analysis rather than relying on somewhat arbitrary assumptions such as the age of the units. IMPA assumes, for purposes of the IRP, that the diesel units at Rensselaer will retire at the end of 2016, but a final decision has not been made as of this IRP. (page 6-41)**

   IMPA Response: *IMPA appreciates the Director's comments.*

   a. **Is it correct to assume that the City of Rensselaer and IMPA agreed to the parameters for evaluating the retirement of the units?**

      IMPA Response: *The units in question, #5, #6, #10 and #11 are very small and very old. #5 and #6 are over 60 years old and #10 and #11 are over 45 years old. Total capacity of the four units is 7 MW. #5 has already been retired in place due to environmental restriction. The market based nature of the contract with the city makes it cost neutral for IMPA whether the units are in service or not. IMPA has consistently assumed in the last three IRPs that these four units would be retired by 2015 or 2016. Over the years, IMPA has had discussions with the city of the status of the older units. For purposes of the IRP it was assumed they closed. However, in the end, it is the City of Rensselaer's choice to keep the units open or not.*

   b. **Did MISO express any concerns about the retirements?**

      IMPA Response: *No discussions were held with MISO regarding the retirement of these units. The units are behind the meter and per the 16/17 PRA auction, represent just .003% of MISO's offered ICAP.*

2. **IMPA's resource planning seems to give reasonable treatment to renewable resources. The current plan assumes 50 MW of solar park development over the next five years in addition to the existing 13 MW. (page 6-13)**

Comment:
It is gratifying that IMPA allowed the resource planning model to add renewable energy additions if the model found them to be the most cost-effective resource alternative.

IMPA Response: *IMPA appreciates the Director's comments.*

3. **Although IMPA mentioned that EE and demand response was included in the expansion analysis and that pricing of EE and demand response was based on IMPA experience and supplemented with research from ACEEE, nothing more was detailed in IMPA's analysis (page 6-43).**

   Would IMPA please provide additional detail to better explain what was done?

   IMPA Response: *See response below for an explanation of the EE modeling.*

4. **Pages 13-105-107 discuss DSM options. Utilizing IMPA's experience with EE programs, the cost characteristics, hourly patterns, load factors, and coincidence factors were modeled.**

   A critical step in modeling EE is to develop hourly EE patterns. The hourly patterns vary by type of measure, time of day, day of week, and month. The hourly patterns of the various measures are aggregated into a single 8,760 hourly "per unit" pattern.

   It is recognized that there is a finite amount of less expensive EE that can be obtained in any year, after which the next set of measures becomes more expensive. As a result, IMPA developed an EE Investment Hierarchy.

   An aggregate EE hourly pattern is created from a variety of residential, commercial, and industrial measures. The aggregate EE represents the types of EE measure we know and serves as a proxy for new measures that will undoubtedly be developed in the future.

   The aggregate EE is broken into three investment levels, which are progressively more expensive. The three levels contain 10 blocks, and each block is equivalent to 0.42% of IMPA's load. If all 10 blocks were chosen, that would add 4.2% of EE in that year. IMPA felt it was important to make available large amounts of EE, albeit at a higher price, to provide a DSM choice in carbon scenarios where avoided cost will be high. A fixed component was added to each block to account for indirect expenses such as administration, marketing, and Evaluation, Measurement, and Verification (EM&V).

   The description if good, but it still needs more detail to understand what was done. For example, what measures where included in developing the aggregate per unit efficiency pattern? How were the three investment levels determined? Is each block within an investment level identical? Are the blocks across the three investment

levels identical except for costs? How did the costs of each block change over the forecast period? How is technological change accounted for?

IMPA Response: In lieu of attempting to model the many existing as well as yet-to-be-defined future EE offerings, IMPA chose to representatively model EE blocks that could be selected as resource options by the expansion model. This dynamic approach allowed IMPA to consider the sizing and timing of demand-side resources in the same fashion as the model considered supply-side resources, avoiding the DSM screening models which rely heavily on static avoided costs. The basis for the creation of the costs and load shapes of the blocks was IMPA's actual EE results observed during the Energizing Indiana (EI) program.

A key aspect when modeling DSM is that consistency exists between the market price formation model (Horizons Interactive) and the optimization model (CEM). As explained in the IRP Report (page 10-59), IMPA essentially performed a NERC-Wide IRP for each scenario (Status Quo, Retrenchment, Global Economy, Shifting Gears, and Green Revolution). For states with an energy efficiency resource standard (EERS), the long-term targets were met and for states without an EERS the model made an economic choice when to add energy efficiency. IMPA utilized ACEEE data to determine the target for each state (IRP Report page 11-90).

To develop the load shape, data from all five EI programs was used to compile an 8760 hourly load shape for the EE block. The programs were, Residential Lighting, C&I rebates, Home Energy Audits, Schools and Low Income Weatherization. All blocks utilized the same load shape, with the cost of the blocks being the differentiating characteristic. The cost of the blocks was divided into three levels in order to represent the increasing cost of EE programs as more difficult and expensive programs are implemented. As with other supply-side resource types, the cost of the EE programs escalated through the expansion period. As with competing supply-side resources, there was no attempt to model technological improvements.

5. **IMPA makes no assumptions as to future environmental rules or laws. For purposes of this analysis, it is assumed that all future resource options comply with the existing environmental rules in place at the time of installation. (page 7-50)**

   It is s not clear what these two sentences are saying. IMPA says it makes no assumptions about future environmental rules or laws but then goes on to reference all future resource options comply with the existing environmental rules in place at the time of installation. Does this mean IMPA assumes only those environmental rules that exist today are to be met by future resource options? How does IMPA define an existing environmental rule? Is a rule that is proposed today an existing rule or a proposed rule? Or must the rule be settled law and regulation?

IMPA Response: *These statements simply mean that if a resource can be built now under existing laws and regulations, it can be built in the future. IMPA is making no assumption about future laws that would make a technology illegal or incapable of being constructed. An existing environmental rule is a rule that is in effect, or a finalized rule that will go into effect in the study period. It is NOT an unapproved proposed rule, a theoretical rule, or a rule/idea supported by special interest groups. That said, in three of the expansion scenarios and 30 of the 50 stochastic runs, some form of carbon legislation rules were assumed to be in effect.*

RISK ANALYSIS

1. **IMPA identified five distinct themes that are expected to have the greatest impact on the future energy business environment over the next 20 years: (a) Status quo; (b) Retrenchment; (c) global economy; (d) shifting gears; and (e) green revolution. (page 10-60)**

   On page 10-60, is it accurate to say that the three scenarios (global economy, shifting gears, and green revolution) were developed to address the ramifications of the CPP rule?

   IMPA Response: *As discussed in Section 10, IMPA developed five different scenarios. These five different visions of the future represent much more than just carbon legislation, but major deviations in U.S. and International economic and political results and policies. Of the five scenarios, three did include CO_2 legislation under different forms; mass based, rate based and CO_2 tax. Along with these however, each scenario included different economic conditions, environmental policies, commodity prices, load growth etc. as shown in the matrix on pages 10-66 and 10-67.*

2. **IMPA focuses on levelized average system rates in the vast majority of risk metrics presented. IMPA presented one graph with levelized PVRR for the five plans. The levelized value is the mean value of the 50 stochastic draws. IMPA seems to recognize that a difference exists in how plans perform when measured on ASR versus present value revenue requirement.**

   It would have been helpful if IMPA presented a figure similar to Figure 107 on page 15-162 with the horizontal axis being PVRR instead of levelized ASR. This raises an important issue for all utilities to more fully understand the risks and uncertainties they face--specifically, whether a utility, especially a wholesale provider, should focus on rates or revenue requirement when trying to evaluate resource options. Regardless, should all the information be presented so that it can be more completely addressed by policymakers? IMPA's thoughts on this matter would be appreciated.

   IMPA Response: *While IMPA does compare the present value of revenue requirements (PVRR) ranking against the average system rate (ASR) ranking via a trade-off diagram (IRP Report page 15-163), IMPA steadfastly believes member rates are the most relevant*

indicator of a plan's performance. Any optimized plan that serves less load will likely have a lower PVRR; however, the rate impact of the plan could be detrimental to the customers in general. It is imperative that the criterion for the selection of IMPA's preferred plan is consistent with the expectations of its members and their customers as well as with broader audiences such as the state of Indiana's economic development and job creation efforts. For example, IMPA could increase spending on energy efficiency programs which would potentially lower PVRR, but raise rates. The non-participants would see a higher monthly bill due to the rate increase and any potential new customer may view the higher rate as a deterrent in the site selection process.

In its IRP process, IMPA considers the sizing and timing of demand-side resources in the same fashion as the model considered supply-side resources. By using the ASR selection criterion, IMPA can be assured the selected plan results in a fair and equitable rate for all customers.

3. **IMPA's IRP demonstrates that Plan 02 is always to the left of and above Plan 01, but yet IMPA chose Plan 01 as the preferred plan in Chapter 16.**

   Please explain the rationale for selecting Plan 01. Given the risk metrics presented in the earlier pages, would IMPA agree that this was not necessarily a slam dunk decision? The intent of these questions is to better understand how IMPA uses the information presented in the various risk metrics to inform its decisions. (pg 15-162)

   IMPA Response: Yes, Plans 01 and 02 are very similar and the results were nearly identical. The only difference in the two was the retirement of the Whitewater Valley Station (WWVS) power plant in 2022 in Plan01. In Plan02, WWVS remains in service throughout the study period. From an IRP standpoint, this decision is far enough out that it doesn't affect IMPA in the near term. Plan01 was chosen in the IRP because of various uncertainties around the future life of the WWVS facility. By 2022 the plant will be 50-65 years old depending on the unit. In the coming years, a more thorough evaluation of the long term outlook for WWVS will be undertaken.

4. **IMPA seems to have conducted a reasonable review of potential risk metrics, but it is not clear how these various measures were considered and used.**

   Is it accurate to say that other risk metrics were considered by IMPA but were not presented? If yes, what were those risk measures and why were they ultimately not presented?

   IMPA presented all of the risk metrics it extracted from the model runs in the filed IRP. These included:

   - *Stochastic risk profiles*

- *Tornado charts with detailed metrics of 10 independent variables*
- *Stochastic mean comparisons*
- *Risk profile comparisons*
- *Trade off diagram between PVRR and ASR*
- *Efficient frontier of ASR vs Standard Deviation*
- *Comparison of levelized ASR*
- *Comparison of levelized PVRR*
- *Risk Confidence bands around ASR*
- *Several charts detailing CO_2 and natural gas risk*

IMPA believes its efforts to address and quantify risk are advanced and comprehensive. For example, extracting tornado charts from a stochastic process is an innovative approach given the difficulty of isolating the impact of the independent drivers from the random variables.

To the Director's question, IMPA considers each of the risk metrics when reviewing a resource plan. For example, Plan 05 had the most expensive ASR risk profile (IRP Report page 15-162), but had the lowest CO_2 emissions (IRP Report page 15-168). So as IMPA looks to strike a balance between rates and carbon emissions, these two risk metrics provide valuable information. IMPA understands the future is uncertain, so careful study of the various risk metrics assists IMPA in understanding the risks of any plan it decides to pursue.