April 28, 2017

Dr. Brad Borum, Director of Research, Policy and Planning
bborum@urc.in.gov
Indiana Utility Regulatory Commission
101 W. Washington Street, Suite 1500 E
Indianapolis, IN 46204

Electronically delivered

Dear Dr. Borum,

IPL appreciates the opportunity to respond to the comments submitted by interested parties regarding its 2016 Integrated Resource Plan (IRP). The attached response document addressed key topics raised.

We look forward to reviewing the IURC report related to the 2016 IRPs. Please let me know if you have any questions in the meantime. I may be reached at Joan.soller@aes.com or 317.261.5403.

Sincerely,

Joan M. Soller, PE
Director, Resource Planning

Indianapolis Power & Light Company Reply to Stakeholder Comments on the 2016 Integrated Resource Plan
April 28, 2017

Introduction

Indianapolis Power & Light Company ("IPL") submitted its 2016 Integrated Resource Plan ("IRP") on November 1, 2016. The Indiana Office of Utility Consumer Counselor ("OUCC"), Indiana Coal Council ("ICC), Midwest Energy Efficiency Alliance ("MEEA") and Citizens Action Coalition, Earthjustice, Indiana Distributed Energy Alliance, Sierra Club, and Valley Watch ("Commenters"), submitted comments to the Indiana Utility Regulatory Commission ("IURC") regarding IPL's 2016 IRP.

This document includes IPL's responses to these stakeholder comments.

OUCC

IPL appreciates the OUCC engaging in its 2016 public advisory process including meeting participation, submitting comments and recognition about the effective use of IPL's website to engage people in the IRP process.

The OUCC suggested further clarification through Commission guidance on the meaning of the requirement that DSM plans be "consistent with" the utility's most recent IRP. To the extent that the OUCC implies this means "equal to", IPL disagrees. IPL's view is the words "consistent with" are not terms of art but are used in the statute in their plain ordinary sense.

IPL recognizes the variability in Indiana utility methods of modeling DSM in the IRPs mentioned by the OUCC. IPL welcomes stakeholder discussions about this topic. Since the inclusion of DSM as a selectable resource is relatively new in Indiana, the utilities using different DSM modeling approaches may be educational. The OUCC suggested that each utility model DSM the same way. While this may lead to some uniformity, dictating a specific method is not necessary.

The OUCC suggested IPL provide a unit by unit analysis of costs of future potential environmental regulations in its IRP. IPL included this level of detail in the model inputs as shown in input spreadsheets. IPL will consider describing this in the narrative with a simple reference table where applicable in subsequent IRPs. In parallel with the 2016 IRP, IPL presented detailed unit by unit analysis including potential future regulation impacts in other proceedings before the IURC using the same assumptions as those modeled in the IRP. Stakeholders may review this analysis in Cause No. 44794.

ICC

The ICC supported IPL's short-term Petersburg compliance plans and approach to coal forecasting; however, ICC disagreed with IPL's annual escalation rate of 2.5% on a real basis after 2025 for coal costs which it believes are too high. IPL did utilize one coal forecast, but evaluated its portfolios across a range of coal prices utilizing stochastic analyses. IPL plans to

meet with an ICC technical representative in April to discuss their comments. IPL is open to considering additional coal price forecasts in future IRPs.

MEEA

IPL appreciates MEEA's review of IPL's IRP. As MEEA acknowledges, IPL solicited and considered stakeholder input throughout the IRP process. IPL is pleased that MEEA recognized its efforts to represent DSM as a selectable resource in the IRP model. Please see IPL's responses to MEEA's key points below.

Modeling of DSM at the Measure rather than at the Program Level (p. 2)

MEAA endorsed IPL's decision to model DSM as bundles of Measures in cost tiers. IPL gave considerable thought as to whether to model DSM in the IRP model at the Measure or Program level as discussed in the first public advisory meeting and with the IPL DSM Oversight Board. The decision was eventually made that development of bundles (with similar load shapes) at the measure level was the most logical and efficient approach for modeling purposes. IPL is appreciative of the fact that MEAA acknowledged the benefits of this approach. This comment also points out that there are alternative approaches to modeling DSM as a resource in the IRP as evidenced by the fact IPL and MEEA favored modeling at the Measure level, while the Commenters seems to advocate modeling DSM in the IRP at the Program level (CAC et al Report at page 38). IPL remains open to considering alternative approaches to representing DSM in future IRPs.

The measure bundles that were selected by the IRP modeling were inputs to the DSM Request for Proposal (RFP) that IPL issued subsequent to completion of the IRP. The purpose of the RFP process was to select a vendor(s) to deliver IPL DSM programs in the 2018-2020 timeframe. While the Measure bundles in the RFP provided the bidders a starting point for DSM program development, the bidders were encouraged to identify and propose innovative programs (not limited to IRP selected measures) that would be achievable in the IPL service territory. Thus, the IRP modeling allows the development of innovative DSM programs.

Inclusion of savings potential of opt-out customers (p. 2)

MEEA suggested that IPL include the energy efficiency potential of the opt-out customers in the IRP modeling. Inclusion of the energy efficiency potential for previously opted-out customers in the IRP would likely overstate the amount of DSM that would be achievable by IPL's programs. Overstating the amount of potential savings would have the effect of IPL not planning for a high enough future load forecast, potentially resulting in a shortfall in supply resources. As a practical matter, after four rounds of opt-out, only three customers out of 118 have chosen to opt back in. If an opt-in trend by customers develops, IPL would make the necessary adjustments to our DSM programs to accommodate the increase in customer participation.

It is also likely that customers that have opted out are undertaking significant efforts to be more energy efficient. To the extent this is occurring it is being captured in IPL's load forecast modeling. To also include energy efficiency undertaken by opt-out customers in the Market Potential Study would potentially be double counting this energy efficiency.

Represent the Technical Potential as an input to the IRP modeling (p. 3)

MEEA also suggests that IPL include the Technical Potential rather than the Maximum Achievable Potential ("MAP") in the IRP for modeling purposes. IPL respectfully disagrees. The primary objective of the Market Potential Study is to identify the level of DSM that might be undertaken by our customers. IPL intentionally chose to input the MAP in the IRP modeling rather than the lower Realistic Achievable Potential ("RAP") so as to not limit the amount of DSM that was available for the IRP model to select. By doing so IPL gave the IRP model the opportunity to select all achievable DSM, which effectively does not constrain the DSM selection process.

IPL disagrees with MEEA's opinion that not inputting Technical Potential is a "flawed" approach. IPL screens both supply and demand resources to include practical options for the model to select. (For example, see the description of why hydroelectric facilities are not modeled in the 2016 IPL IRP.) If IPL included the entire Technical Potential in the IRP for possible selection as suggested by MEEA, the results would almost certainly overstate the amount of DSM that is achievable by IPL customers. This would also likely result in a shortfall of supply resources due to a deflated IPL load forecast. Since Technical Potential exceeds Economic Potential, this approach would also create a false expectation among stakeholders regarding the amount of DSM that would be appropriate for IPL to undertake or achieve.

IPL does agree that at the program level certain less economic measures may be bundled with more economic measures to provide customers with DSM program offerings that are more desirable to customers and provide more comprehensive savings while remaining economic overall.

Savings Levels (pp. 3-4)

MEEA suggested that higher savings levels may be achievable. IPL would like to emphasize that after opt-outs are considered, the IRP selected energy efficiency amounts are more than 1% per year, rather than the approximately 0.80% indicated in Figure 1 in MEEA's comments. In addition, there are significant amounts of "organic" efficiency improvements that are occurring in the IPL service territory and that are reflected in the IPL load forecasts. Finally, for reasons previously discussed, it is more appropriate to discuss DSM achievement net of opt-out customers.

Commenters - Citizens Action Coalition, Earthjustice, Indiana Distributed Energy Alliance, Sierra Club, and Valley Watch.

Overall feedback

IPL was surprised and disappointed with the tone of the comments submitted by the joint Commenters which seemed more like what one could expect in a docketed and contested proceeding than a collaborative process as described in the IURC's IRP Director's reports from 2014-2016. IPL was transparent and open throughout the IRP public advisory process, conducted four public meetings as well as an additional call for any interested parties to ask questions. The Commenters did not engage their consultants until very late in this process which limited the effectiveness of their review. It appears the consultants may not have reviewed the meeting presentation materials and summary notes which may have helped to improve their understanding of the IRP modeling and outcomes. As an example, the consultants suggest more granular information be presented early in the process. IPL offered to provide information multiple times in stakeholder forums; however, no stakeholders accepted this offer. IPL welcomes early discussions of scenarios and assumptions with stakeholders to shape subsequent IRPs. In addition, the Commenters criticized IPL's non-technical and executive summaries but did not offer suggested examples of these documents that are acceptable to them. IPL would be pleased to review suggested examples to continue to improve effective communication of the technical IRP content.

IPL met all requirements of IRP

IPL strongly disagrees with the Commenters' contention that IPL did not fully comply with the IAC requirements in this IRP. IPL fulfilled all requirements of the IRP as shown in the Rule Reference Table listed on pages xvi and xvii in Volume 1. There are 83 cited requirements. IPL is unclear why the CAC et al consultants listed only 17 requirements and disagrees with the assessment that IPL only met two of those requirements. The Commenters may not agree with the results of the IRP modeling, but that does not mean that IPL did not comply with the IRP Rule.

The IPL IRP includes the documentation provided in all three volumes and electronic files submitted to the IURC. This includes attachments and five public advisory meeting materials provided to stakeholders throughout the 2016 IRP process. For example, the ABB report, Attachment 2.1 and 2.2 respectively, are a part of the IRP, not supplemental to the IRP as inferred by the Commenters. IPL's vendors worked closely with IPL staff to align work products as much as possible.

Scenario development and comparison to Base Case

The Commenters take issue with the development of the candidate portfolios and the comparison of all scenarios to the Base Case. They believe that this comparison gives the Base Case a "baked in" advantage over all of the other portfolios. IPL does not agree with this statement and used the Base Case as a means to compare how the portfolios perform under a common set of assumptions to levelize results. This results in an "apples to apples" approach.

The Commenters believe that TVA's methodology is superior because they compare five distinct portfolios against five different scenarios. The result is a 5x5 "matrix" of results comparing all of the results against each other. Figure 1 below contains results from TVA's 2015 IRP.[1]

Figure 1. **Excerpt from TVA's 2015 IRP – Scoring Metric Comparisons**

		Scenario					
	Alternative Strategy	1 Current Outlook	2 Stagnant Economy	3 Growth Economy	4 De-Carbonized Future	5 Distributed Marketplace	Average
PVRR ($ billion)	A	132.7	125.9	139.5	131.7	120.4	130.0
	B	132.7	126.0	139.5	131.7	120.4	130.1
	C	133.4	126.5	140.8	131.9	121.1	130.7
	D	134.4	127.9	141.3	133.6	122.8	132.0
	E	136.2	129.4	140.8	132.8	123.5	132.5

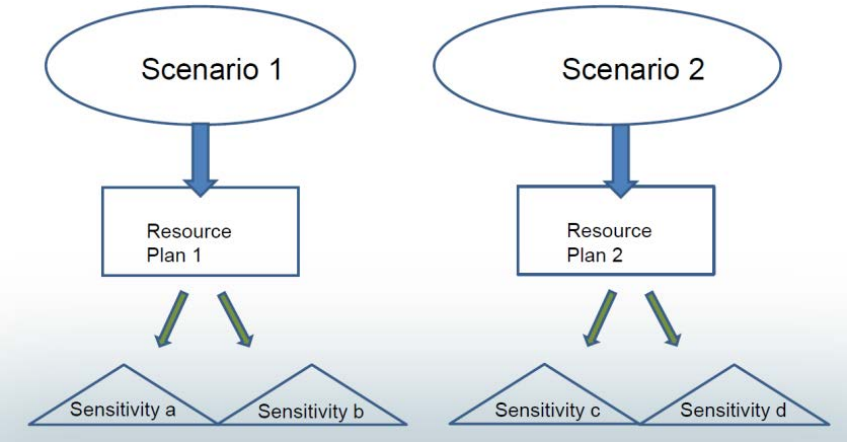
Source: TVA 2015 IRP

The primary difference in approach appears to be how scenarios and sensitivities are defined in the context of Integrated Resource Planning. In the first stakeholder meeting for this IRP on April 11, 2016, IPL defined scenarios and sensitivities and how they will be used in the 2016 IRP. Figure 2 below shows a slide from that stakeholder meeting. [2] IPL defined scenarios openly through the public stakeholder process, and those scenarios and underlying assumptions were used to create a different portfolio specific to each scenario.

[1] Figure 7.3 on page 93 of TVA's 2015 IRP https://www.tva.com/file_source/TVA/Site%20Content/Environment/Environmental%20Stewardship/IRP/Documents/2015_irp.pdf

[2] https://www.iplpower.com/Our_Company/About_IPL/IRP_2016/IPL_2016_IRP_Public_Advisory_Meeting_1_Presentation_4-11-16/. See slide 67.

Figure 2 – **Scenarios and Sensitivities**



IPL considers the "Scenarios" in TVA's IRP to be sensitivities, where each portfolio was modeled against the same set of assumptions that were deterministically varied (i.e. one or more variables were changed by a fixed and known amount). IPL chose in this IRP cycle to conduct the sensitivity analysis through a stochastic simulation, although both a deterministic and stochastic sensitivity analysis could be conducted, which was the case in the TVA 2015 IRP.

IPL is open to including a comparison of each portfolio against the other scenarios in its next IRP. It is important to note, however, that this type of analysis does not lend well to choosing a single preferred resource portfolio and should not replace a complete and robust sensitivity analysis. TVA did not choose a single portfolio or strategy in their 2015 IRP – they instead established "guideline ranges for key resource types (owned or contracted) that make up the target power supply mix". The Commenters criticize IPL for reaching a similar conclusion in this IRP with the Hybrid Portfolio, but the Commenters also would like the same analysis as TVA. Additionally, in the end, TVA relies on the "Current Outlook" scenario, which is described in a similar nature as a Base Case, as a basis to develop their final recommendation.

IPL encourages stakeholders to make any suggestions early in the next public IRP process as to how portfolios are developed and analyzed. If stakeholders prefer less reliance on the Capacity Expansion model to develop the portfolios and prefer more fixed portfolios based on specific strategies or resource decisions, IPL may accommodate assuming that all subjective assumptions are clearly defined and established up front. IPL is also open to a deterministic sensitivity analysis for key variables, but IPL does not believe it should replace a full stochastic analysis of each candidate portfolio.

IPL believes that a stochastic analysis is an important piece of analyzing all candidate portfolios regardless of how they are developed. In the 2016 IRP, IPL conducted a stochastic sensitivity analysis, as all six portfolios were run against the same set of 50 iterations of power prices, gas

prices, load, and other variables. The Commenters criticize the number of iterations used in this analysis, and we address that specifically later, but they make no mention of the results from that analysis or the underlying assumptions that went into it. A stochastic sensitivity analysis is more thorough than a deterministic sensitivity analysis because stochastic analysis is less subjective. As we described in the June 2016 public meeting, a deterministic sensitivity analysis might be more transparent on the surface, but it still requires subjective determination of the specific variables or group of variables you want to change, the direction and magnitude of the change, and the correlation between all of the variables. A stochastic sensitivity analysis, on the other hand, is more robust and can show how a portfolio performs against a full range of simulations, rather than the handful that the modeler chooses for a deterministic analysis.

Preferred resource portfolio defined

The Commenters claim IPL chose a preferred reference case that was not fully modeled. IPL disagrees with this statement because IPL selected the Base Case as the preferred resource portfolio.

IPL clearly stated its preferred resource portfolio based upon the six PVRR results and other metrics of the portfolios modeled was the Base Case at the final public advisory meeting and in Volume 1 of its 2016 IRP, in the Executive Summary on page 7, the Results section on page 207, and Attachment 1.2, Meeting #4, page 22. This aligns with the Commenters' understanding that the preferred resource portfolio should be selected from candidate portfolios based on IAC 170-4-7-8 3c. "From its candidate resource portfolios, a utility shall select a preferred resource portfolio and include in the IRP the following:…"

As indicated in Volume 1, page 208, continued discussions led IPL to consider that the future may indicate a hybrid of multiple portfolios. This does not change IPL's short-term action plan. IPL described a Hybrid Portfolio to explain its thought process as part of this IRP exercise. IPL merely indicated that subsequent IRPs may indicate varying results from a qualitative perspective. Had IPL calculated a projected PVRR for this hypothetical portfolio, IPL would have been criticized for including information in the IRP that was not reviewed in the stakeholder process.

The potential hybrid portfolio includes more environmentally friendly resources such as DSM, energy storage, CHP and renewables and utilizing coal at a lower capacity factor than the Base Case. IPL is perplexed as to why the Commenters would not agree with this strategy in principle and welcomes further discussions in subsequent IRPs.

Short term implications of modeled portfolios

Within the first five years of the IRP study period (2017-2021), the model determines how IPL's portfolio should best respond to differing scenario assumptions in order to provide reliable, reasonable least cost electricity.

While there are small variances in DSM selected by the model among the scenarios in the first five years, only two portfolios resulting from the scenario analyses differ significantly from the Base Case: the Recession Economy and the Strengthened Environmental. In the Recession Economy scenario, the assumptions of an abrupt decline in retail load due to economic factors, low market prices and natural gas prices caused the model to refuel Pete units 1 – 4 from coal to natural gas in 2018. IPL is not experiencing the recession load forecast assumptions that were modeled.

In the Strengthened Environmental scenario, the assumptions of high costs for environmental compliance at the Petersburg units and the addition of a 20% renewable energy standard caused the model to select retiring Pete 1 and refueling Pete units 2-4 to natural gas in 2018. The model also selected adding 500 MW of wind and 280 MW of solar in 2020. IPL is not experiencing the assumptions modeled in this scenario.

IPL recognizes changes in assumptions will be evaluated in the next IRP prior to any significant resource investments. In addition, should the underlying assumptions of the Strengthened Environmental or Recession Economy scenarios come to fruition, IPL will assess their impacts and determine if resource changes are warranted. IPL recognizes that DSM modifications are among the quickest to implement.

Suggested Changes in next IRP

The Commenters recommended that for the next IRP, IPL provide evidence that the peak output of wind farms indeed does correlate with IPL's minimum loads. Figure 3 shows the hourly average IPL load and the hourly average capacity factors for IPL's wind units by season in 2016.

Figure 3 – **Representative alignment between IPL load and wind production**

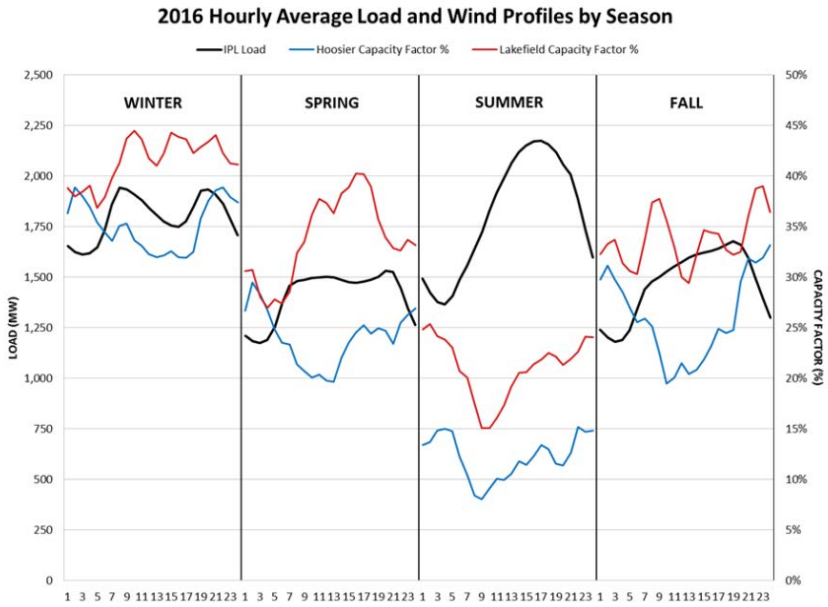


Figure 3 also shows that for each season in 2016, the capacity factors for IPL's wind projects are often the highest late at night, which coincides with low loads. The 2016 data also shows that IPL's wind units experience their lowest average capacity factors on summer days when IPL's load tends to be the highest. Hoosier Wind Farm's average capacity factors range from less than 10% to 15% in the summer and Lakefield's average capacity factors range from 15% to about 25% in the summer. However, as shown in Figure 3, the capacity factors for the wind units increase in the spring and fall seasons when load is generally lower.

Technical appendix

The Commenters suggest a large technical appendix and voluminous supporting electronic files be filed subsequently with the IRP. IPL disagrees. IPL recognizes the complexity of the IRP modeling inputs, outputs and process as well as large amounts of related data. Requiring all of this data to be formally filed with the IURC is nether necessary or practical. IPL shared approximately 486 individual files comprising over 840 MB of data to stakeholders through the discovery process using a secure web portal. In addition to concerns about filing additional confidential or proprietary information, IPL understands the IURC document filing system includes a limit of 25 MB. Furthermore, the IURC may or may not have designed its systems to manage the level of data which would be filed. The only stakeholders to review this data were the consultants hired by the Commenters. The burden of the additional efforts to pre-file this information is not justified.

IPL recognizes there were iterations of data shared and reviewed due in part to overly broad requests and the newness of this level of review on the part of all parties engaged. IPL was as responsive as possible given this volume of data as well as holiday work schedules. Contrary to the consultants' implications, IPL offered teleconferences prior to their accepting this offer in February. In fact, IPL met telephonically in late October. The request to provide written questions prior to the last call was intended to ensure IPL had the proper staff in attendance and to assist Commenters to meet its submission deadlines as indicated by email which included IURC and OUCC representatives.

The IRP is already a very large document with many attachments. Similar to a docketed proceeding, it includes narratives, attachments and work papers. The discovery process is intended to provide stakeholders with additional information as needed.

Please see the joint utility comments in the pending IRP rulemaking related to this topic as well.

Future Modeling of Distributed Generation Scenarios

The Commenters suggested on page 13 that the way IPL modeled distributed generation was flawed because wholesale power prices were not adjusted with the addition of distributed CHP, wind, and solar. IPL modeled distributed generation (DG) more extensively in this IRP than previous IRPs and expects refinements and improvements in subsequent IRPs. IPL does not consider the opportunities for improvement as flaws. IPL will investigate ways to incorporate DG resources into market price forecasts, which could impact the commitment and dispatch of existing or planning thermal generation. The ABB fundamental forecast does incorporate an assumed amount of DG and energy efficiency for the MISO region, but the DG resources modeled in this IRP were assumed to be in the IPL service territory. Wide spread regional or national high adoption may impact future power market prices, but it is uncertain what the price impact would be within the MISO market. A future "High Adoption of DG" scenario could include the assumption that trends within the IPL service territory are reflective of regional cost and adoption trends, and therefore MISO-wide assumptions for DG build-out may be incorporated in the fundamental forecasts. IPL will investigate ways to coordinate with forecast vendors to see what options are available to model potential DG impacts more broadly in the future.

Higher reserve margin in early years

The Commenters stated that IPL used an incorrect reserve margin which they stated caused the IRP results to be flawed (p. 27). IPL used a minimum of 15% to align with the most recent MISO Planning Reserve Margin Requirement (PRMR). In the Base Case model runs, IPL's vendor inadvertently used a 22% reserve margin for 2017-2022 rather than 15%. IPL regrets this oversight. Following the submission of the Commenters' 2016 IRP Report, IPL's vendor re-

ran the Base Case model with the reserve margin changed to 15 percent for 2017-2022 and the results for existing generation and the amount of new DSM did not change as shown in Figure 4 which mirrors Figure 8.3 in Volume 1 of IPL's IRP. Therefore, the results of the IRP remain valid.

Figure 4 – **Revised Base Case results with 15% reserve margin for all years**

Year	Final Base Case
2017	DSM*- 58 MW
2018	DSM - 17 MW Retrofit P1-4
2019	DSM - 16 MW
2020	DSM - 12 MW
2021	DSM - 15 MW
2022	DSM - 10 MW
2023	Retire HS GT 1&2 DSM - 10 MW
2024	DSM -11 MW
2025	DSM - 10 MW
2026	DSM - 9 MW

Year	Final Base Case
2027	DSM - 4 MW
2028	DSM - 4 MW
2029	DSM - 1 MW
2030	Retire HS 5&6 DSM - 2 MW
2031	DSM - 3 MW
2032	Retire Pete 1 DSM - 9 MW
2033	Retire HS7 DSM - 9 MW Wind 250 MW Market 50 MW PV 90 MW Battery-50 100 MW
2034	Retire Pete 2 DSM - 2 MW H-Class CC 450 MW Wind 250 MW
2035	DSM - 2 MW Wind 250 MW Battery-50 250 MW Market 150 MW
2036	DSM - 2 MW Wind 250 MW Battery-50 150 MW PV 10 MW

**DSM Includes 58.1 MW of Demand Response*

Portfolio development process

The Commenters questioned the development of IPL's scenarios and resource portfolio development. IPL believes the Commenters' consultants did not understand some details of the portfolio development process such as the evolution of the Base Case and the catalyst for the Quick Transition portfolio. As mentioned in introductory comments, it seems they did not review the materials from the public advisory meetings which explain both items.

As shown in Attachment 1.2, Meeting #3 slide deck, page 8, the initial and final Base Cases were clearly compared.[3] IPL did not intend to bias any results through this evolution, rather, the need to consider grid reliability impacts became apparent when larger amounts of intermittent resource were chosen than any previous IRP. The IRP modeling process is iterative and multi-faceted. More than previous IRPs, resource selections were limited based on transmission reliability requirements. Capacity planning and transmission planning models are independent tools. As IPL identified in Section 10, exploring ways to improve the understanding of transmission constraints is an area of improvement in subsequent IRPs. IPL is also open to improving the narrative descriptions of transmission constraints. In order to better understand the wind limitations in the Base Case, please see the section below.

Regarding the development of the Quick Transition portfolio, it was developed based upon stakeholder input in the public advisory meetings. In fact, IPL created a Quick Transition portfolio following initial exercises and small group discussions with all of the Petersburg coal units retiring by 2030 and included changes requested by stakeholder to retire the Petersburg units in 2022. It does not make sense to use the capacity expansion model selection tools to accomplish this task.

Transmission Impacts

The Commenters suggested IPL more clearly describe the transmission import limitations and impacts on the resource planning process. IPL recognized the complexity and overlap between resource planning and transmission planning in this IRP more than any previous IRP due to the increasing cost competiveness of intermittent resources compared to traditional supply side resources. In response to informal discovery, the Commenters suggested it may be helpful for IPL to explain how various resources impact system stability. IPL agrees and plans to incorporate additional materials in public meetings and in the IRP narrative about this topic in subsequent IRPs.

The NERC standards system stability requirements are voluminous and dynamic. IPL described the criteria at a high level and avoided disclosing Critical Electric Infrastructure Information (CEII) in accordance with the NERC Critical Infrastructure Protection (CIP) requirements. IPL offered to conduct a teleconference to describe transmission requirements and impacts more fully with the Commenters, but they chose not to accept this offer. By honoring an approximate 2,000 MW transmission import limit, IPL is safeguarding reliability in this IRP, not biasing any specific resources.

IPL modeled a 1,200 MW *minimum* requirement for natural gas to be connected to its 138 kV transmission system. The description on page 169 describing a 600 MW minimum immediately

[3] IPL Public Advisory Meeting #3 Materials https://www.iplpower.com/Our_Company/About_IPL/IRP_2016/

followed a description of the Harding Street and Georgetown units remaining in service. Together, the capacity of these units is approximately 600 MW. In hindsight, a simple insertion of the word "additional" in the sentence from page 169 as shown below may have helped to avoid confusion.

> "IPL does not retire Harding Street 7 or the Georgetown natural gas units in 2030, because IPL needs a minimum of 600 MW of ***additional*** natural gas on its 138 kV system to retain system reliability." (pg. 169, Volume 1, IPL's IRP)

"Biases" against renewables

Commenters questioned IPL's modeling of the first feasible years for the addition of wind and solar resources, and the inclusion of IPL's experience and business development expertise. The Commenters also suggested that IPL assumed it must develop the resources rather than rely on third parties to do so on page 34 of its Report.

First of all, the header 'ABB Midwest Fall 2015 Reference Case' on Confidential Attachment 5.1 refers to the original data table and source for the data. IPL provided input through an iterative process to the Earliest Feasible Year of Installation', as well as specific solar, wind, energy storage and CHP information. Additionally, as explained in each IRP public advisory stakeholder meeting[4], the model does not assume that IPL is the one to construct and own these projects. IPL's modeling decisions reflect the fact that projects cannot be brought online right away. Instead, the model is agnostic to ownership. It is possible for either IPL or a third party to construct and own the renewable energy projects.

IPL's modeled first feasible dates to add wind or solar reflect that the steps to start and complete a project take time, whether or not the project is owned by IPL. As shown in Figure 5, a project development construction schedule for self-built or third party secured project can take between two and three years. Additionally, the regulatory filing development, proceeding, and approval process can take a year or more, and the MISO Generator Interconnection Queue process takes two years on average.

[4] Meeting #3 Notes Summary at https://www.iplpower.com/Our_Company/About_IPL/IRP_2016/Presentation_PDFs/2016_IPL_IRP_Meeting_3_Notes_Summary_and_Stakeholder_Questions_with_IPL_Responses_9-06/

Figure 5 –**Illustrative Project Development Schedule for Construction or PPA**

Item	Duration (Days)	Cumulative Days	Example
Resource Plan Identified	0	0	1/1/2017
Internal Company Approvals	30	30	1/31/2017
RFP Developed	90	120	5/1/2017
RFP Issued	7	127	5/8/2017
Nonbinding Notice of Intent to Respond Due	28	155	6/5/2017
Proposals Due	45	200	7/20/2017
Evaluation, Clarification, Initial Due Diligence	30	230	8/19/2017
Notification of Bidders of Short List	5	235	8/24/2017
Evaluation, Clarification, Additional Diligence and Negotiations	60	295	10/23/2017
Board Approvals by Utility and Developer	30	325	11/22/2017
Submission to IURC for Approval	7	332	11/29/2017
IURC Review Complete	270 to 365	602 to 697	8/26/2018
Final, Non-Appealable Order	30	632 to 727	9/25/2018
Commercial Operation Date "COD" (existing project-PPA)	0	632 to 727	9/25/2018
COD (self-build project)	275	907 to 1002	6/27/2019

The schedule above does not show other items that could extend the project development timeline, such as city or county permits, MISO interconnection process of ~2 years, MISO retirement analysis of a minimum of 26 weeks, financing, avian take permits for wind projects, stakeholder engagement, etc.

The Commenters indicated that they have not seen other IRPs incorporate the impact of FERC Order No. 827 for reactive power or FERC Docket RM 16-6-000 for frequency response into their wind cost assumptions. IPL strived to use the most up-to-date wind costs and uncertainties when developing its IRP. Resource Planning includes consideration for all types of resources needed to continue to serve our customers reliably for every hour of every day. Choosing the

right technology mix of those resources must include known and probable risks including changes in public policy, such as FERC and NERC directives that are likely to add costs to specific projects using specific technologies. It is normal for any two utilities to have differing assessments of the impacts of impending rule and policy changes. IPL is diligent in its efforts to engage with regulators and policy makers and has prudently included costs associated with the interconnection of wind resources.

The trend in policy and regulations is to demand additional equipment to be installed by all new generation, including wind. Given that FERC released Order No. 827 on June 16, 2016 and RM-16-000 on February 18, 2016, previously published IRPs would not have had a chance to incorporate the potential impact of the FERC rules. IPL recognizes FERC stated in its November 17, 2016 Notice of Proposed Rule (NOPR) RM-16-6-000 for primary frequency response[5] that battery storage paired with wind is not necessary to comply with this NOPR. This occurred after IPL filed its 2016 IRP. That statement is conditioned however on the premise that the requirements for Primary Frequency Response (PFR) can be met in another manner. One challenge for the provision of PFR, now proposed as a condition of interconnection, is that response is only part of the problem. To provide PFR consistent with NERC's guidelines includes standards for both response and the duration of that response. To conform this will require some capital allocation either for additional controls, equipment such as batteries or other options. IPL choice to include batteries as the solution is not dependent upon any specific wind technology and is representative of a cost adder needed to perform the necessary functionality.

Model did not limit replacement of Petersburg coal units to just batteries

Commenters assert that the model may only select batteries to replace Pete coal units in 2017 and 2018. This assertion is not correct as demonstrated in the Recession Economy and the Strengthened Environmental scenarios where refueling to natural gas one or more Pete units could be economic. As explained above, adding renewables in 2017 or 2018 would not be feasible because there is not sufficient time to obtain necessary approvals and procure these resources as a replacement for the Pete units. Additionally, if IPL did attempt to replace Pete units with renewables, the timeline shown in the above chart would need to be extended 26 weeks, because per MISO tariff, an owner notify MISO of the intention to retire resources a minimum of 26 weeks in advance for MISO to analyze potential impacts.

[5] FERC 18 CFR Part 35, Docket No. RM 16-6-000 (Issued November 17, 2016) https://www.ferc.gov/whats-new/comm-meet/2016/111716/E-3.pdf

Modeling of DSM

The Commenters had several recommendations on methodologies and approaches to modeling DSM in a Market Potential Study and IRP. IPL acknowledges that this is a complex process and that there is not one correct methodology or approach. IPL is open to collaboration with stakeholders on ways to revise and improve DSM modeling in the future given due consideration to the time and budget needed to undertake the alternative approaches.

1. The Commenters indicated that the avoided costs assumptions are inconsistent and not well documented. (p. 23). IPL only used one capacity price forecast. Upon review of its Confidential Attachment 5.3, IPL realized this work paper may have been confusing. To clarify the confusion over the avoided cost that was used in the analysis, IPL updated and is providing it with this submission to the IURC and interested parties with whom it has an executed NDA. This updated work paper is titled Revised Confidential Attachment 5.3.

   By way of explanation, the spreadsheet tab entitled "Capacity Prices – Ref Case" contains the Midwest Fall 2015 Reference Case which was used as the starting point for the avoided costs. The "IPL Worksheet" tab illustrates the adjustment IPL made to the years 2016 and 2017 based its own short-term bilateral transactions in the MISO zone 6 for Indiana. Finally, the "MPS Avoided Costs" tab provides the worksheet that AEG used to adjust the avoided costs into real 2016 dollars for the MPS. Note that the row (referenced by the Commenters) entitled – "Avoided Capacity Cost (Row 3 in tab, "MPS Avoided Costs") is the sum of the "Avoided Generation Capacity Cost" and the "Avoided T&D Capacity Cost" rows. This summation is shown in red font in the Revised Confidential Attachment 5.3 file. The amounts in this aggregated row were used as an input in AEG's LoadMAP tool to evaluate the DSM measures in the MPS.

2. The Commenters recommend using 0.25% decrements to develop proxy avoided costs; however, the methodology to do so is not clear (p. 24).

   IPL believes the methodology it used to screen and identify DSM measures in the MPS process was reasonable and aligns with the Capacity Expansion model inputs used to select DSM or an alternate resource. IPL is open to discussing alternatives with stakeholders for subsequent IRPs.

3. The Commenters stated "IPL appears to have modeled its own IRP and DSM efforts in the same manner as Tennessee Valley Authority's." (p. 19)

   IPL's approach to modeling DSM in the IRP varied from TVA's approach. IPL conducted a Market Potential Study to develop DSM bundles and load shapes using a bottom ups approach. TVA did not complete a MPS and used more general load shapes to represent types of DSM.

4. The report that is referenced in FN 9 ("US Experience with Efficiency as a Transmission and Distribution System Resource") describes an approach to utilize DSM to enhance system reliability and mitigate transmission and distribution investment. (p. 19)

   IPL included avoided T&D costs in the Market Potential Study cost and benefit analysis that was used to screen DSM measures, acknowledging that DSM does provide value to the T&D system. The fact that IPL is a highly compact and interconnected distribution system with the ability to switch loads and manage circuit loads effectively does limit the value provided by focused DSM programs. Should IPL have circuits that in certain situations may benefit from localized DSM provided load relief, it may utilize its Air Conditioning Load Management (ACLM) program to do so. IPL's ACLM switches are mapped by circuit and may be utilized on a circuit by circuit basis to mitigate loading issues, although to this point IPL has not utilized the ACLM switches in this manner. IPL may consider localized DSM efforts in the next IRP.

5. The Commenters also stated that "…more useful, interpretable results would be achieved by testing generic "portfolio" efficiency bundles with increasing savings over a range of potential cost for each savings level… it assumes perfectly known information about cost and availability of energy efficiency reaching out twenty years into the future." (p. 38).

   IPL created 56 bundles of DSM measures with similar load shapes at different cost tiers. This approach is reasonable. The additional "range of potential cost" analysis discussed by the Commenters was not suggested by any stakeholder during the IRP stakeholder process. The development and modeling of additional high cost and low cost bundles and associated load shapes would be very burdensome and impractical. A sensitivity analysis may be a more efficient means to assess DSM cost variations, which IPL will consider in the next IRP. IPL does not believe that modeling varying DSM costs would have materially changed the modeling results for the period beyond 2020, particularly given that DSM was the primary resource addition in those years.

   IPL does acknowledge that twenty years is a long period to forecast DSM costs and that costs will likely be different the more distant that we get from present day information. It is also uncertain what future DSM programs will look like, but the measure bundles serve as reasonable proxies for some future DSM world. One of the positive attributes about DSM as a resource is that short term modifications can be readily made to the DSM plan based on changing technology, market and cost considerations. Additionally, in just three years, IPL will refresh its IRP, and will have the benefit of three additional years of program implementation.

6. The Commenters stated "The study appears to assume that 100 percent of each measure's incremental cost is paid as an incentive." (p. 39)

   For most programs, IPL/AEG used approximately 70% of the incremental measure cost as the incentive cost. This accounts for both incentivized and direct install measures.

Programs that deviated from this methodology include: Peer Comparison (costs are all administrative), Appliance Recycling, Strategic Energy Management, Retro-commissioning, and Demand Response.

7. The Commenters noted that IPL's rate of return was applied to DSM "capital costs". (pp. 41-42)

   The Commenters observation is correct; a rate of return was inadvertently applied in the model to the portion of IPL DSM costs that were characterized as "Capacity Costs". This does not impact the amount of DSM selected by the model, based on the fact that only a portion of the DSM costs were capitalized. To the extent that costs were capitalized over the life of the measure, the Net Present Value (NPV) of the discounted cash flows, that is, the DSM costs are essentially the same as the raw cost inputs. IPL will investigate ways to avoid this occurrence in subsequent IRPs

Risk analysis

The Commenters criticized the stochastic risk analysis because of the number of iterations IPL conducted. The Commenters described the Latin Hypercube sampling process like a decision tree – that is, if there are ten draws on natural gas, then extending from that are ten draws for coal prices, and each of the ten natural gas draws must be combined with all ten draws for coal prices, requiring 100 "draws" or endpoints. Adding additional variables would require an exponential increase in the number of required endpoints. This does not accurately describe the Latin Hypercube sampling process. Latin Hypercube sampling is a stratified Monte Carlo sampling program that can be thought of as a "smart" Monte Carlo sampling. Instead of drawing each sample from the entire distribution, the sample space is divided into equal probability ranges and then a sample is taken from each range.

In IPL's 2016 IRP, there were 50 draws for 10 variables <u>every month</u> through the study period. For example, for January 2017, there were 50 different draws for natural gas that were selected via Latin Hypercube sampling, which partitioned the cumulative probability function into a set of 50 distinct bins. Draws were then randomly chosen, and if there was already a selection in that bin, that draw was thrown out and a new draw was conducted. This process is more likely to result in a proper sampling of the entire probability distribution, which can only be done via Monte Carlo sampling with more iterations. Draws for the other variables were conducted <u>simultaneously</u> within the framework of the defined assumptions for the probability distribution types (i.e. normal, log-normal, uniform), volatilities, and correlations.

The Commenters are correct that at times, "tens of thousands" of modeling iterations or draws are used in Monte Carlo sampling. This is possible for a relatively simple optimization problem with one or two uncertainties or variables. But the IRP modeling problem is much more complex, involving a 20-year, 8760 unit commitment and dispatch model. The fundamentals

underlying the model – power prices, gas prices, carbon prices, etc. – are highly variable and include aspects of seasonality, mean reversion, and correlations between variables, all of which needs to be accounted for. As IPL identified in response to discovery from the Commenters, the 50 iteration, 20-year hourly market price development run used for each of the six portfolios took nine days to complete. Conducting "tens of thousands" of iterations would be prohibitively time consuming and unnecessary.

For the next IRP, IPL will review the appropriate number of sampling draws based on the tradeoff of model robustness, model limitations, and time limitations. Given the concerns of the Commenters that some of this material would not be as useful for a non-technical audience, IPL is open to hosting a technical workshop via in-person meeting or WebEx with stakeholders interested in detailed stochastic modeling assumptions.

ABB Forecast

The Commenters stated that the ABB forecast did not include energy efficiency or renewable resources. This is incorrect. The ABB forecasts do include EE and renewables. While the Commenters did not inquire about this in discovery or in teleconferences, on page 2-8 of Attachment 2.1, ABB stated that proposed resources are included along with load forecasts in the Eastern Interconnect which include energy efficiency impacts. Resources were not defined as thermal only. IPL will work to improve the narrative description of the forecast development process in subsequent IRPs while still trying to balance the overall length and readability with the Commenters' interest in additional details.

Conclusion

IPL appreciates the efforts and inputs to the process from reviewers and encourages stakeholders and their consultants to engage in the IRP process earlier. IPL looks forward to the IURC comments in the Director's report and welcomes further discussion with stakeholders about these topics.