Indianapolis Power & Light Company
2019 IRP Public Advisory Meeting #2
March 26, 2019

Meeting Summary

Welcome & Opening Remarks
Lisa Krueger, President AES US SBU
(Slide 3)

Lisa Krueger is the President of the AES US SBU, which includes IPL & DP&L, as well as AES Generation across the nation. Lisa appreciated the participants that participated in the previous meeting and are here today. She also welcomed any new participants joining today. She emphasized that the purpose of gathering today is to work towards determining how IPL will serve the future energy needs of our customers.

Ms. Krueger shared that since the first meeting in January, IPL has been working on a lot of activities. The team has explored more into our model and met with stakeholders like the Indiana Utility Regulatory Commission (IURC) staff, the Office of Utility Consumer Counselor (OUCC) staff, and the Citizens Action Coalition (CAC) to discuss the model and provide continued supportive and collaborative interaction. The dialogue and engagement will help the team move towards the IRP filing in November, so the feedback and comments are very valuable throughout the process this year.

Meeting Objectives & Agenda
Stewart Ramsay, Meeting Facilitator
(Slide 4 – 5)

Mr. Stewart Ramsay introduced himself and emphasized the importance of converting dialogue into a conversation and encouraged participants of the meeting to ask questions. Mr. Ramsay's role is to ensure questions get answered and to keep track of time during the meeting to make sure we stick to the agenda timing allotments. In addition to the agenda mentioned, after the Sierra Club presentation, Ray Wilson from the Hoosier Interfaith Power & Light will make a statement to the group.

Meeting 1 Recap
Patrick Maguire, Director of Resource Planning
(Slide 6 – 7)

Mr. Patrick Maguire, the Director of Resource Planning, started with a quick review of Meeting 1 topics. In the January meeting, IPL reviewed the 2016 IRP, defined capacity terms, discussed the IPL existing resource mix and presented the Ascend Analytics model. design and explained that we went through the IRP cycle 2016, and talked about timeline, capacity, existing resource, for each unit, existing capacity we fulfilled and different technology. For this IRP, Mr. Maguire wants the group to understand the model and how it provides powerful tools for analysis. For example, generic new supply side resources will be discussed today. The factors like capacity factor, capacity credit, capital cost and other introductory information were discussed in the first meeting.

Today, in the second meeting, we are going to discuss specific technologies and key underlying assumptions used in the model. IPL has a meeting scheduled in May that will allow for a follow up and recap of all the assumption discussed today. After the meeting in May, IPL will work on modeling throughout the summer and then will regroup with everyone at the next meeting in the late summer time frame. After that, an IRP review of results will likely be held in late September or early October.

Stakeholder Presentation: Sierra Club, Beyond Coal Campaign
Matt Skuya-Boss, Lead Organizer
(Slide 8)

Mr. Matt Skuya-Boss, lead organizer of the Sierra Club, is looking to engage all the participants in a collaborative process as they look forward to the energy future friendly Indianapolis. He started by raising the question: Should Indianapolis be the last major American city powered by coal?

To avoid the worst climate change, the UN and the Intergovernmental Panel on Climate Change (IPCC) states that strict action must be taken to rapidly eliminate greenhouse gas pollution. The span of seven (7) extreme-heat days is the norm currently in Indiana, and according to the Purdue Climate Change report released last year, it will be as many as thirty-eight (38) to fifty-one (51) extreme hot days annually. The IPL portfolio is predominantly fossil fuel driven and the Petersburg coal plant is one of the worst greenhouse gas polluters in the States. IPL must ensure that the utility reduces carbon pollution, and this cannot happen without the Petersburg coal plant moving towards swift retirement in the next decade. AES, the parent company, has made a carbon intensity reduction commitment by 50% by 2022 and 70% by 2030.

The public is also demanding action to combat climate change. Indiana cities' mayors have also made a commitment to the Paris Agreement to curb greenhouse gas pollution. The Yale Climate Study also points to where the public stands with regards to issues such as climate change, global warming and greenhouse gas emissions.

We should be looking at carbon prices to make sure that the cost of burning fossil fuel is going to be on the rise. And locally, we have seen the city of Indianapolis, just this year, adopt a plan which calls for 100% renewable energy community wise by 2050. The city also received the Bloomberg Climate Challenge grant.

Mr. Skuya-Boss also mentioned that NIPSCO will be having 75% renewable capacity within next 10 years, and it's going to save $4 billion for their customers.

Recommendations:

- IPL should commit to retire the Petersburg plant by no later than 2028; Retire all units by 2024, Units 1 & 2 by 2024 and the rest by 2028. Retirement of all units no later than 2028.
- IPL should commit to conduct an all-source RFP for any capacity additions
- IPL should utilize NIPSCO data in making assumptions about costs of renewable energy
- IPL should assume public demand for reducing greenhouse gas emissions will continue to increase.

In his concluding remarks, he again emphasized the public demands to reduce the carbon footprint. Since, IPL is the only utility in Indianapolis, it has the power and the responsibility to at least see how they can spark this change.

Stakeholder Presentation: Hoosier Interfaith Power & Light
Ray Wilson, P.E., Vice Chair

Mr. Ray Wilson represents Hoosier Interfaith Power & Light and expressed that their aim is to promote energy conservation, efficiency and use of renewable energy as a faith response to climate change.

The UN inter-governmental panel on climate change, charged with assessing the plans for climate change, reported that we must limit global warming to 1 and ½ degree Celsius above pre-industrial levels. To do that, there must be social and technological change on a scale for which there has no documented historical precedent. Emissions must fall rapidly between now and 2030 to prevent catastrophic climate change.

This IRP cannot be business as usual. There must be a start with the end in mind and then work backwards. First, we need to stop burning coal as soon as possible and then we need to stop burning gas for generating electricity. We need to stop burning natural gas to heat our homes and our water. We need someone from Systems Gas to be in this room because in the next 20 years, they have to stop promoting gas. We have to stop running our cars on gasoline and convert them to electric.

Recently published articles describe that solar and wind are less expensive to produce electricity than running a coal power plant with the least effect toward global warming. By 2050 many states and cities plan to be carbon neutral and only using renewable source of energy. For instance, New Mexico will be using 50% renewable energy by 2030, 80% by 2040 and 100% by 2045.

Detailed Load Forecast – Base, High & Low Peaks and Energy
Erik Miller, Senior Research Analyst
(Slide 9 – 25)

Mr. Erik Miller discussed the following outline that describes the data input for the IPL load forecast, peak & energy. The data inputs for the residential, commercial and industrial models are the following:

- Historical sales and customer data are included since 2010.
- End Use: EIA Regional End Use Saturations and Efficiency Trends from annual energy output.
- Economics: Moody's Q4 2018 Forecast is purchased from Moody's with a bunch of different scenarios.
- IPL Price Forecast.
- Weather: 20-years trend offer the change in temperature in the form of Cooling Degree Day (CDD) which increase by 0.6% and Heating Degree Day (HDD) which decrease by 0.3% as progressing average of 20 years.
- Future DSM is going to be decided in Integrated Resource Planning (IRP).

Residential Model
Bottom-up analysis is applied in using EIA data for looking into saturation and efficiency of house appliances and layering in the real income, household size, real price and the HDD or CDD and we get three (3) variables XHeat, XCool and XOther to forecast the average use.

Residential End Use Trend
This helps us to evaluate the annual kWh usage for heating, cooling, water heating, appliance, lighting and miscellaneous (plug load devices such as computer). After 2005 the kWh for lighting started to decline. The load for the miscellaneous started to increase due to more plug load of devices.

Participants had the following questions/comments, with answers provided after:

- Should electric utilities think about the trend towards electrification, and how that is going to cause increases in load?
    - It is a possibility, and IPL has discussed internally, but it is not included in this presentation. IPL hired MCR to provide an EV and PV forecast. They will present at the May meeting.
- A participant noted that we must be serious about this plan as we are talking about 20 years. By 2035, customers will not heat water unless there is a heat pump water heater.
- How much credence does IPL give to the IPCC report, as we have 12 years to resolve climate change? How seriously does the corporation take it beyond economic responsibility to your stakeholder? Is there discussion where you take the existence of the society in your forecasting model?
    - We made commitment in terms of our carbon reduction profile so, here in IPL, we also have commitment to our stakeholders in terms of making sure we meet the IPL customers need in reasonable cost and reliable manner. The part of our process for being here today is to make sure we take feedback of our stakeholders into account.

Residential Economic Driver
The driving variables are household income and multi-family housing stock growth. Indianapolis household income is increasing by 2% and the household size is decreasing by 0.37%. Multi-family housing growth increased by 8.3 % due an increase in apartments and residents moving downtown.

Residential Forecast
The average use is increasing by 0.4% per year, the number of customers is increasing by 0.8 % per year, and the sales are increasing by 1.2% per year.

A Participant had the following question/comment, with an answer provided after:

- What kind of data does IPL get from Moody's? What kind of additional data can IPL get from Moody's? Moody's produces forecasts for these types of economic drivers on a routine basis and they have history of doing so. Is there any kind of data that characterizes an error term associated with these variables? How right Moody's has been about those variables in the past?
    - Erik Miller noted that this sort of data is not something IPL current receives from

Moody's. IPL will review and see if it's possible and get back to the participant.

Commercial Model
The Commercial model is like the Residential Model created by end use data from the bottom-up analysis. The saturation, efficiency and intensity are layered with employment, gross domestic product (GDP), real price and cooling degree days (CDD) or heating degree days (HDD) to get the three (3) variables XCool, XHeat and XOther. This can help us to show the trend for the variables and help us to forecast the trend.

Commercial End Use Trend
This helps us to explain the End Use of kWh used for heating, cooling, ventilation, lighting, water heating, refrigerator, cooking and others (office equipment). Due to more office equipment installed since 2005, it is observed that the lighting use has decreased, and the other variables have increased.

Commercial Economic Drivers
The two major variables for commercial economic drivers are non-manufacturing employment and non-manufacturing GDP. The GDP is directly correlated to the sales forecast. The bottom-up approach uses the end use data as a primary driver for the load forecast. Additionally, weighted economics variables are used. GDP is weighted at 20% and employment is weighted at 80 %. Employment is expected to increase by 0.8% and the GDP is expected to increase by 1.87%. The weighted economic variable increases by 1.04%.

Industrial Model
The Energy Information Admiration (EIA) does not analyze the data for industrial customers because their energy usage is not homogenous; it is rather heterogeneous. The industrial sector customers differ from one another widely, so the end use data is not utilized. The economic variable is used to see the trend of sales of industrial customers. As customers are added to the IPL service territory or moving out of the service territory, these adjustments are made outside the model.

Industrial Economic Drivers
The manufacturing employment variable is decreasing by 0.53% per year and manufacturing GDP is increasing by 1.57% per year due to automation in manufacturing. The economic weighting for each variable is: employment 90% and GDP is 10%.

A Participant had the following question/comment, with an answer provided after:

- What percentage of IPL load is in the industrial sector?
    - Erik Miller noted that this percentage is noted in the next slide, slide 21.

Class Sales Forecast
All the data is compiled and segregated in three (3) main sales class types to get the overall IPL sales forecast. The large commercial & industrial customers (large C&I) consist of 49%-45% of sales in the forecast from 2019 to 2039. The small commercial & industrial customers (small C&I) consist of 14% - 13 % of sales in the forecast from 2019 to 2039. The residential customers consist of 38% - 42% of sales in the forecast from 2019 to 2039. The average annual growth rate forecast for the residential sector is 1.2%, small C&I is 0.2 % and large C&I is 0.3 %.

Participants had the following questions/comments, with an answer provided after:

- Is there is a difference between large and small based on what rate the customer is on?
    - Yes, that is correct. Erik Miller noted that IPL uses the commercial model to forecast rate code SL customer, which includes large customers. For the breakdown by classification, this group of IPL customers moves to the Large C&I sector data.
    - In the next IRP meeting, IPL will further explain and breakout by the model for further review.

Peak Model
The Peak model resembles the other models and the forecast is assumed through the peak days and the temperature. The trends in this model are forecasted by the three (3) variables PKCool, XHeat and XOther.

IRP Energy & Peak Forecast
The average annual growth rate for energy is 0.4% and the average annual peak growth rate is 0.8%. EV and PV are not included in this forecast because this analysis is being worked on by IPL vendor MCR and the results will be including at the next IRP meeting in May.

The high and low forecast are developed by alternate Moody's economic scenario and standard deviation in the Itron model and these can be verified by the PowerSimm Model. The load forecast will be added to PowerSimm and then PowerSimm will bring in modeling changes based on the events in the past and forecast the future load based on historical data in the model.

BREAK
(Slide 26)

IPL Demand Side Management (DSM) Market Potential Study (MPS) and End Use Results
Jeffrey Huber, GDS Associates
Jacob Thomas, GDS Associates
(Slide 27 – 64)

Mr. Jeffery Huber presented on the Market Potential Study (MPS) and End Use Analysis for IPL completed by GDS. Mr. Jacob Thomas was available via phone/Skype to support this presentation. The GDS Team performed the end use analysis through primary and secondary research which includes survey research and onsite visits. With that collected information, the GDS team built an energy stimulation model that also includes data from the Commercial Building Energy Consumption Survey (CBECS).

Participants had the following questions and comments, with answers provided after:

- Do you have demographic data?
    - Yes, there is limited demographic data from the mail/online survey. For example, some high-level detail on building type, education level, etc.
- I ask because low income people and people of color are mostly impacted by the energy division, so it would be good to know census track data.
    - For income, the potential study did separate income status, but used the more, broad census data.

- Could you share the data that respondents noted in the survey report?
    - It would not be from the survey report, but we did look at the public use micro-dataset for Marion County from the American housing community survey form to understand household size.
    - In the self-report survey, GDS did ask the respondents if they qualified for income-based programs like SNAP.
- Are you showing the differences in the types of the homes for residential customers, like if the customer is a homeowner versus a renter? Also, what is the length of time someone is either in their own home or in an apartment? Is this noted for the current time period and then projected out into the future time period for the IRP?
    - The MPS study did capture if the home is single family or multi-family and if the resident owns or rents. In terms of the projection, there is more multi-family in new construction.
- Need to know the length of time of a homeowner is in the home. To know how they benefit from any kinds of programs.
    - From the forecasting perspective, the data from the IPL end use analysis done in 2018 is used for the current state, but then the projection forward is uses Moody's data and forecasting approach noted in Erik Miller's presentation.
- So, we are trying to understand in the IPL territory has more homeowners versus renters.
    - That would be a separate analysis that would need to be done.

The IPL Residential survey results informed and updated the market and efficiency share of the equipment seen in the IPL territory. This data also informs the unit energy consumption variable for the IPL load forecast.

The IPL Commercial survey results updated the end use intensity and saturation. The results also noted distribution of customers by the building type. It also provided an understanding about customers' energy efficiency behavior.

Research Design- Small Commercial and Industrial End Use Analysis

The Residential End Use Analysis through self-reported surveys was conducted through online/mail, samples stratified by average use, data element, miscellaneous end uses, hours of use, willingness to participate in a site visit and demographics. The site visits are conducted to accurately verify the reporting for the end use analysis and to recognize the plug load.

Based on the home type (single family detached 75%, multifamily 15%, mobile/manufactured home 2%, town home 7%), the usage of electricity for heating home is 35% for heating water is 40%. The majority of Indianapolis homes have central air conditioning. Some homes have heat pumps and less have room air conditioning units.

The comparison between the gas heat and electric heat helps us to understand the end use profile for the average annual kWh per home. Electric home heating is used 49% as compared to gas heating which is 6% and electric water heating is 12% as compared to gas heating which is 8%.

Lighting energy usage per room differs between interior and exterior uses. Dining Room and

Closet spaces consume the lowest energy. The classification based on the bulb type is presented in the presentation. The reported average number of bulbs is twenty (20) bulbs per home. The on-site residential work indicated that forty-one (41) bulbs per home.

Participants had the following questions and comments, with answers provided after:

- A participant noted surprise at the presented result that most bulbs in storage are incandescent light bulbs. Folks assume that a CFL or an LED would replace burned out incandescent bulbs.
    - Mr. Huber noted that the difference in 51% versus 60% is not very significant. There is a lot at play here. For example, people may have bought the incandescent bulbs some time again and end up not using them because they purchase a rebated bulb through an energy efficiency program. Also, some homeowners may have kept the incandescent type bulb for a specific indoor or outdoor fixture that they later no longer have.
- Another participant added that low income families cannot afford energy efficient bulbs, so they buy cheap incandescent bulbs. Also, some people do not like the shape of energy efficient bulbs.
    - This was a common complaint for the CFLs, less for the LED bulbs. Low Income would have a different saturation by bulb type.
- Have you looked at the frequency of use versus distribution by bulb type? While I have large number of incandescent bulbs, they tend to be in areas with less hours of use.
    - GDS did not do logging or metering for the end use analysis study. Studies do show that LEDs tend to be in fixtures with higher hours of use and that lower hours of use, say in a closet, are the last bulbs to be changes out to a more efficient bulb type.

Research Design- Small Commercial and Industrial End Use Analysis

Seventy (70) on-site surveys were conducted for small commercial & industrial IPL customers to identify end-use saturation by end use type. The main component considered for the segmentation was the building type. GDS used data collected by IPL, information from a third-party database and the data collected during the end use analysis study to better understand business end uses by building type.

Participants had the following questions and comments, with answers provided after:

- Do you have data on the small commercial customers whether they own their building or not?
    - GDS did collect if the business owns the building or leases the space.
- Is the segmentation “lodging” hotels?
    - Yes, lodging is hotels.
- What about online retail and the impact of its growth?
    - GDS disaggregated the database.
    - Like the response in the residential presentation, the data collected in this analysis from 2018 is used as the starting point in the forecast and then the EIA data is used to project forward.
- One participant requested a further analysis on the segmentation based on census track, zip code data.
    - IPL acknowledged the request in the meeting and will address the participant’s

request at a later date.

Small Commercial & Industrial Segmentation and End Use Profiles
The commercial sites with gas heating have the end use profile of miscellaneous 34%, heating 2%, cooling 7%, ventilation 16%, electric water heating 1%, cooking 3%, refrigeration 155, lighting 13% and office 9%. The commercial sites with electric heating have the end use profile of miscellaneous 33%, heating 5%, cooling 7%, electric water heating 1%, cooking 2%, refrigeration 15%, lighting 13% and office 9%. For lighting in the commercial sector, 52% of lighting is T5/T8 bulbs and 20% is LED bulbs.

Research Design- Large Commercial and Industrial End Use Analysis
For large commercial & industrial customers, GDS completed a smaller number of on-site surveys. There are less of these types of customers and they are harder to recruit to participate. The facilities tend to be larger and take a longer amount of time to complete the on-site survey. GDS completed forty-five (45) on-site surveys, one survey was at a customer site who has opted-out of the IPL energy efficiency programs.

Large Commercial & Industrial Segmentation and End Use Profiles
The industrial customers are largely manufacturing, while less are non-manufacturing. Within the non-manufacturing customers, their end use profile break outs include industry types such as wholesale trade, accommodation & found services, agricultural, construction, education, health care, transport & warehouse, retail trade, etc. For lighting in the industrial sector, 40% of lighting is T5/T8 bulbs and 43% are LED bulbs.

A Participant had the following question/comment, with an answer provided after:

- What percentage of IPL customers in industrial and commercial sectors are opted-out of IPL DSM programs?
    - IPL would like to revise the estimate stated during the meeting. The team reviewed and updated the statistics based on the current IPL database. The current IPL opt-out estimate is 115 customers are opted-out which is 87% of eligible sales and 3 million MWhs per year.

IPL DSM Market Potential study (MPS) Preliminary Result
Erik Miller, IPL Senior Research Analyst, presented to the group the important detail on slide 43. Mr. Miller wants the IRP stakeholder group to understand that the MPS results presented today are only a part of the realistic achievable potential. This is not the amount of DSM the IRP selected or the amount IPL will file with the Commission. Mr. Miller notes on slide 44 where we are in the process. The IPL IRP team still needs to create IRP inputs from the Achievable Potential from the Market Potential Study. These inputs will go into the model and will be selected as part of the resource selection in IPL IRP resource modeling. After those modeling results, IPL will take that information to vendors via a request for proposals (RFP) process to then create a plan to file with the Commission for program approval to implement a 2021-2023 DSM Program Plan.

Potential Study Methodology
Mr. Huber from GDS Associates describes to the group how the characterization of DSM measures is created. The data sources used for the study include:

- The current catalog of IPL DSM measures.

- The Indiana Technical Resource Manual (TRM), the Illinois TRM and the Michigan Energy Measures Database.
- IPL evaluated program results.
- Regional and national cost databases.
- Building energy modeling.
- IPL market data and survey data

- Model Assumptions
  - Presented and reviewed with IPL and the IPL DSM Oversight Board (IPL OSB) for comment and review.

Methodology Approach

Mr. Huber describes the study approach on slide 47. Once the measure characterization is completed, the team identifies the technical potential, then the economic screen for the economic potential with cost-effective measures and lastly the achievable potential considers some market barriers.

Slides 48, 49, 50 and 51 highlight the process and calculations that GDS steps through to get to the potential results. The process includes utilizing remaining factors, adoption rates, etc.

Residential Potential Result

The technical potential is almost 3,000,000 MWh. This is a lot of savings. Jeffrey noted that this is cumulative number over the 20 years and this is 45% of forecasted residential sales. Again, this is a theoretical number in the sense that is capturing 100% of the savings. It would be extremely aggressive. This is technical potential, that may or may not be utility driven. The economic potential is about 85% of the technical potential.

Participants had the following questions/comments, with answers provided after:

- You mentioned that renters are the large component and they have perhaps limited ability to affect some of these targets. How does your achievable potential address that?
  - In the willingness to participate research, it is shown that renters have a slightly lower willingness to participate sentiment. For the long-term adoption rate, the multi-family building sector is slightly smaller. One way to get around this is to target the business owner of the multi-family building to participant in the program.
- Does this figure of 3,000,000 MWh of savings take into account electrification in 2021 to 2039, including electric vehicle charging stations?
  - This potential study does not take into account future electrification. It does not include charging stations. IPL is completing a separate analysis on EVs with the consultant MCR.

Realistic Achievable Potential (RAP) is approximately 1,250,000 MWh (cumulative, 2021 – 2023). Slide 54 shows these numbers in a staked bar chart. Slide 55 shows the same information in a pie chart. On an annual basis, the savings by end type are presented on slide 56 and noted the savings by % of total residential sales.

A Participant had the following question/comment, with an answer provided after:

- What is plug load?
    - Plug load are electric uses from the Alexas, iPads, etc. of the world that are not easily capture in the other end use categories.

Commercial & Industrial Potential Result

Mr. Huber notes these slides present the same information as the residential sector, but with the C&I results. A reminder, the results that are presented are gross savings, not net savings. Net to gross ratios are not yet considered. Slides 58, 59, 60 & 61 follow the same presentation structure.

Realistic Achievable Potential (RAP) for C&I sector is approximately 1,478,000 MWh (cumulative, 2021 – 2023).

Demand Response potential includes direct load control like switches on equipment and smart thermostat controls to switch ACs to reduce load at the time of the peak. GDS also looked at curtailable agreements in the C&I sector. The RAP is for DR is presented on slide 63.

Participants had the following questions/comments, with answers provided after:

- How are savings generated from people's normal behavior figured into this study? For example, when the study shows that AC units are out of date from the modern standard, when customer replace the unit they will have to replace with a more efficient because that is only what is available in the market today.
    - Mr. Huber notes that it is taken into account in two places. In the forecast, the assumptions for naturally occurring efficiency behavior is included. For the GDS model, when equipment is compared in the study it is compared to the federal standard. The naturally occurring savings are not part of the analysis for the market potential study. The study includes savings only for the savings from a piece of equipment that is installed above the federal standard.
- Do these slides reflect any changes from the OSB changes?
    - No, not yet. IPL is meeting with the OSB later this week to address the comments.

MPS Preliminary Results and Next Steps

Mr. Miller noted that the next steps for the MPS are to review results further with IPL DSM OSB members in April and then finalize results. After results are finalized, the IRP bundles will be created. These bundles then get selected alongside the supply side resources in the IRP resource modeling. In Stakeholder Meeting #3, IPL will present the bundling and modeling approach for DSM and then final DSM bundle selections will be presented in Stakeholder Meeting #4 with the other resource selections from the IRP model. Then after filing the IRP report, IPL will issue an RFP for DSM implementation and then a filing in Spring of 2020 for DSM programs for 2021 – 2023.

LUNCH
(Slide 65)

Commodity Prices and Modeling
Patrick Maguire, Director of Resource Planning
(Slide 66 – 89)

The commodity forward curves. These curves include peak power prices, delivered gas prices to the units, delivered coal prices to the Petersburgh plant, oil price for the remaining IPL diesel units left, emissions prices and capacity prices for MISO Zone 6. All variables are useful to review when we are looking at IPL's load obligation, what is the IPL position, long or short.

IPL is using Wood Mackenzie as the forward forecast curves vendor. The cases provided by the Wood Mackenzie are the following:

- Federal Carbon Case (Carbon tax starting 2028).
- Federal Carbon Case + High Gas Sensitivity.
- No Carbon Case.
- No Carbon + Low Gas Sensitivity.

IPL is also working with Wood Mackenzie to develop two more sensitivities.

- Carbon Case + Low Gas Sensitivity.
- No Carbon Case + High Gas Sensitivity.

Forward Curve Notes

PowerSimm is a market simulation model. IPL will input these curves into the model and then dispatch and commit our units against these curves. Our model is not creating power prices. The prices create monthly hour shapes. The on off peak prices will match Wood Mackenzie.

Deterministically, you put in one forward curve for gas and power prices. Stochastically, there is a few different approaches based on the variable. Not every variable is a Wood Mackenzie curve, some are IPL sourced. For the natural gas price delivered at address is taken from Wood Mackenzie every month and the daily price shapes are created in the PowerSimm with both highest and lowest curves. For the coal prices, IPL is using IPL sourced coal curves for delivery into Petersburg. Fuel Oil delivered prices are taken from Wood Mackenzie. A carbon emission curve is sourced by Wood Mackenzie, while the SO_2 and NO_x curves are based on internal forward curves from brokers. Capacity will be valued at the estimated bilateral price for the MISO Zone 6.

A Participant had the following questions/comments, with answers provided after:

- How far out do you lock in a price for gas and coal?
    - For Coal, IPL contracts four (4) to five (5) years in general. For Natural Gas, it is more short term.

MISO Capacity Price Forecast

The MISO capacity market is a residual market for the remaining capacity. Entities like IPL are not looking to the MISO capacity market for a price signal to build capacity. As a load serving entity, IPL is required to serve our load with our generation. This generally leads to low prices in

MISO. There is uncertainty within the capacity price and bilateral transaction prices. These low prices are not predicted to continue forever, so you could see capacity prices increase and in volatility. Another consideration that makes modeling tricky is that the bilateral market is only liquid for a year, not five or ten. Therefore, IPL has constructed bounds on what the bilateral capacity price could be. IPL is indexing this to the cost of new entry for a new combustion turbine (CONE). This is the ceiling. The most likely price or Mode is a percentage of CONE. Slide 70 and 71 present this information.

Participants had the following questions/comments, with answers provided after:

- Could you compare DP&L data from PJM to the IPL data?
    - These are two different markets with two capacity different markets.
- How to understand the reasonableness of the model? Can the model pick resources at these prices?
    - The IPL model can purchase capacity at these prices but will be constrained with how much it can purchase.
- Are you looking at any other environmental assumptions other than air emissions?
    - Yes, IPL is looking at other environmental assumptions.
- How did you decide on 25% of CONE as the Mode value?
    - That's the highest auction clearing price. IPL has seen the bilateral market trade higher than that.
- On a short-term basis or long-term basis?
    - On a short-term basis.
- How transparent are the bilateral prices to you, and what data are you relying on?
    - The bilateral prices are what IPL has purchased or sold at.
- What is the rational for looking at this variable stochastically?
    - Mr. Maguire notes that there may still be uncertainty into the future on the outcome of the capacity market in 2030 or beyond and the uncertainty in market rules and increases over time.
    - The stochastic method and the triangular distribution covers the uncertainty adequately and appropriately.
- The participant noted some skepticism and interest in comparing the deterministic result from this variable and the stochastic result.
- Why is CONE based on a new combustion turbine and would it change if it was based on solar?
    - The new combustion turbine is considered the cheapest form of capacity as a proxy by MISO. Some ISOs have evaluated changing that. Therefore, it could change over time.
- What would it take to have that change happen?
    - It would take a market rule change at MISO and their approval from FERC. The cost of new entry by zone is filed each year by MISO to FERC. No ISOs have changed the proxy.

Assumptions for Replacement Resources
Patrick Maguire, Director of Resource Planning
(Slide 72 - 88)

Mr. Maguire discussed that in the first 2019 IRP meeting, IPL discussed what technologies will be analyzed for future capacity and energy addition to the IPL fleet. Natural gas, wind, utility

scale solar, and commercial and residential solar and energy storage are considered as resources to provide energy and capacity for IPL.

Slide 74 denotes the key variables considered when IPL is reviewing potential supply side resource additions in the Ascend model:

- Capital cost: the cost to construct and is represented in $/kW.
- Operating Cost
- Operating Characteristic
    - Heat Rate
    - MW limits
    - Ramp rates
    - Capacity Factor/ Profile (wind and solar)

Slide 75 describes the methodology used to come up with generic resource cost by technology type and how it was calculated. IPL evaluated publicly available data and data from third-party vendors and IPL created an average from the National Renewable Energy Lab (NREL) mid case, HIS Markit, Wood Mackenzie and Bloomberg New Energy Finance. IPL also benchmarked off the Lazard LCOE and NIPSCO RFP results.

A Participant had the following question/comment, with an answer provided after:

- Is IPL using the national or regional Lazard's Levelized Cost of Energy (LCOE)?
    - IPL is not using the Lazard costs directly, but as a benchmark to the cost assumption. Lazard provides a range and review that it matches regionally to us.
- The NIPSCO IRP information was for MISO Zone 6. Is that not correct?
    - Yes, that's correct.

The confidential data resources are available with a signed non-disclosure agreement and this data is collected from IHSMarkit, Bloomberg New Energy Finance (BNEF) and Wood Mackenzie.

Natural Gas

Slide 78 describes the capital cost of natural gas in real 2018 $/kW is $967, the fixed O&M is $14.22 and variable O&M is $3.04. The lines are not marked because it is from the confidential vendors.

Wind

The location for a new wind asset has a profile that matches a wind plant in Northwestern Indiana and IPL assumes the annual capacity factor is 42%. The profile source is the NREL wind toolkit. IPL has pulled 2009-2012 stimulated wind data to source the profile as well. The generic project size for modeling is 50 MW ICAP. The capacity credit is 7.8% (3.9 MW per 50 MW project). Slide 80 denotes the capital costs for wind. The costs are going down in real terms over time.

Solar

The location for a new solar asset has a profile that matches a solar plant in Central Indiana with an annual capacity factor of 23% and single axis tracking. The profile source for the solar resource is IPL Rate Renewable Energy Production (REP) projects. IPL is using hourly data from 2016-2018. The size of the project is 25 MW for utility scale. The solar capacity factor for

the ground fixed is tilt 17.8%, tracking is 21.2% and the commercial rooftop is 13.6%. The solar capacity credit changes as more solar is added to MISO system. The shifting net peak load is represented by the "Duck curve". The installed solar forecast is from Wood Mackenzie.

Participants had the following question/comment, with an answer provided after:

- What is not clear is how IPL's current solar capacity interacts with the IPL energy storage facility at Harding Street?
    - IPL's battery is not configured to interact with the current solar.
- When solar is coupled with storage does it change the presented curve?
    - Yes, it does, but you have to account for the cost of adding the storage to the solar as well.
- What is the current and future saturation of solar energy assumed by Wood Mackenzie?
    - Unfortunately, I cannot share that information because it is confidential from Wood Mackenzie but will available with the confidential data release on April 9th.

Storage
Slide 87 notes the generic storage unit for energy arbitrage. Storage, even more than the other technologies, expects to see sharp declines year over year as we continue through time.

Participants had the following question/comment, with an answer provided after:

- The Participant commented on the weather impacts and the solar cost decrease. It seems to me, that IPL should be a partner with the community to further the transition to the new sources of energy. IPL should reconsider priorities in what we've had in public policy. The public policy is tangential the technical issues we are addressing today. IPL could consider more solar would make it easier to convert the Petersburg Plant
    - Patrick noted his thanks for the comment and that the public policy perspective is different from what we are working on here in the IRP.
- How many storage units are you considering buying or building? What is the impact on the environment based on the types of storage you select?
    - IPL does have storage as an option in the model to select.
    - Stewart noted that the answer to the second question depends on the type of battery.
    - Patrick notes that it is assumed that the battery is a lithium ion battery.
- Please consider looking on how the battery impacts the community and environment.

BREAK
(Slide 89)

Scenario Analysis Framework & Proposed Scenarios
Patrick Maguire, Director of Resource Planning
(Slide 90 – 100)

Mr. Maguire noted that IPL is using scenarios to generate a set of different optimized portfolios. IPL is net long capacity with the existing resource mix and the age-based retirement dates over the thirty (30) year planning period. The 2019 IRP scenario modeling framework is designed to evaluate accelerated retirements in conjunction with portfolio optimization via capacity expansion modeling.

Scenario Drivers
IPL is starting with the Reference Case as the Wood Mackenzie No Carbon Case. Through this scenario analysis, IPL can isolate the impact of the carbon tax and can also combine different drivers/parameters to see impacts.

Slide 92 lays out the inputs by Scenario for modeling.

Participants had the following questions/comments, with answers provided after:

- The rationale behind the Scenario C is unrealistic to me.
    - Mr. Maguire restates the participants thoughts and continues a dialogue back and forth. Mr. Maguire notes that these perspectives are fair and valid, and IPL is open to combining the drivers in ways stakeholders are interested in seeing.
    - IPL will present the final scenarios in the May meeting and those can include an additional scenario from this participant and/or other participants as well.
- Do you have thoughts on why you are not varying the capital costs? Why did IPL choose to leave those all as Base?
    - The main rationale for not varying the capital costs in the scenarios is that the band of range in cost is tighter than it was in the past. IPL sees this as less of driver of uncertainty and less of an impact in the next ten or twenty years. Some of the other fundamental shifts weigh heavier than the capital cost driver.

Proposed Scenario Framework
IPL is proposing this framework because IPL wants to systematically look at various retirement combinations for the Petersburg plant. These are just scenarios we want to look at. Stakeholders made requests for this type of modeling. Furthermore, when you let the model pick the retirement date for a unit or multiple units, the model is blind to how costs shift if only one unit is retired. Essentially, the outputs are shaped by what the inputs are. IPL wants to take into account the age of the units, overhaul schedules, and the age-based retirement dates.

Participants had the following questions/comments, with answers provided after:

- I am curious as to the rationale for each one of these retirements. Do these retirements take into account the need for additional environmental equipment? For example, if you need equipment on Pete 1 and 4, then you would put it higher in the analysis if IPL would retire two units.
    - The current environmental controls are considered in the modeling. Furthermore, the environmental analysis is ongoing. In additional to maintenance schedules for the units and the systems needed to run the plant, which ones are still needed, if some units retire and not all.
- Are these retirements or converting to natural gas? Also, have you accessed the external threats to continuing to have fossil fuels and the societal resistance to this usage, like what is happening in Evansville and around the country.
    - IPL is starting with a retirement analysis. IPL will model conversion to natural gas as sensitivity for the Petersburg units. The second question is a big question. IPL will show in the scorecard for the IRP the emissions by scenario and embedded in that data is the impact on the surrounding communities.

Slides 94 – 98 show visually the different Scenarios and when the model would optimally fill the

shortfall with new resources selected by the model.

Participants had the following questions/comments, with answers provided after:

- Can we see that how much CO_2 would be emitted under each scenario?
  - The amount of CO_2 emitted under each scenario will be in the metrics/scorecard of the IRP.
- How much time is required to put into a new unit (let's say it is a combined cycle plant) to replace capacity?
  - For development it may be shorter, say two (2) to five (5) years. For construction of the new combined cycle plan it would be longer, say four (4) to eight (8) years.

Slide 99 shows that the modeling would provide twenty-five (25) different portfolios.

Role of Stochastics
The modeling will be completed in phases.
Phase I - Deterministic scenario analysis and portfolio construction.

Phase II - Stochastic capacity expansion helps us understand future uncertainty and risk.

Goal - Stochastic ranges help to understand the full range of uncertainty.

Result – A broad range of scenarios an resource portfolios are the foundation for eventually selected a robust and flexible preferred portfolio. .

Final Q&A, Concluding Remarks & Next Steps
Stewart Ramsay, Meeting Facilitator
Patrick Maguire, Director of Resource Planning
(Slide 101 – 102)

Stewart asked meeting participants if it was a meaningful time spent in the meeting today. Participants responded with the following remarks to conclude the meeting:

- One participant commented that there are many improvements from the last IRP and the team has come up with a lot of good things. She is excited to see what they come up with.
- One participant appreciated the IRP process, especially how inclusive and transparent it is and that it considers many different voices.
- One participant appreciates that the IRP gives the public a great opportunity to have input into IPL's plans. He comments that the technical issues covered in these last two IRP meetings are inseparable from public policy and that future IRPs should take this into account.

Meeting adjourned.