# IPL 2016 IRP Public Advisory Meeting #5

January 13, 2017

***WebEx Meeting Only***

# Welcome & Agenda

Joan Soller, Director of Resource Planning

# What Will Be Covered Today

- Review of IRP Development Process
- Final IRP Model Results
- Next Steps
- Stakeholder Questions

# Active cases before the Commission

- Cause No. 42170, ECR-28
- Cause No. 38703, FAC-114
- Cause No. 44576, Rates (under appeal)
- Cause No. 44893, Rates
- Cause No. 44794, SO2, NAAQs and CCR
- CN 44885 Consumer Affairs Division Decision Item

# Review of IRP Development Process

Megan Ottesen, Regulatory Analyst

# IRP Process

- IPL hosted four public advisory meetings before filing the 2016 IRP
  - Introduction to IRP Process: April 11, 2016
  - Scenarios & Metrics Discussion: June 14, 2016
  - Preliminary Results: August 16, 2016
  - Presentation of Final Results: September 16, 2016
- IPL filed the 2016 IRP on November 1, 2016

For meeting materials, see IPL's IRP webpage at: https://www.iplpower.com/irp/

# Report Structure

- Section 1: Introduction
- Section 2: Operating and Planning with MISO
- Section 3: Distribution and Smart Grid
- Section 4: Load Research, Forecast and Load Forecasting Methodology
- Section 5: Resource Options
- Section 6: Risks and Environmental Considerations
- Section 7: Resource Portfolio Modeling
- Section 8: Model Results
- Section 9: Conclusions and Recommendations
- Section 10: Attachments

# IPL's IRP Objective

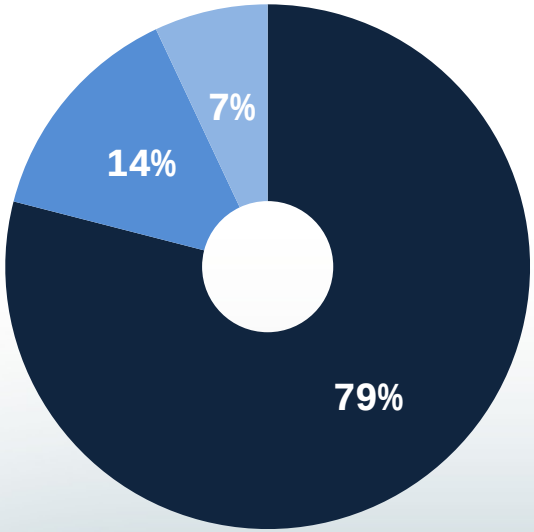
- To identify a portfolio to provide:
  - safe
  - reliable
  - reasonable least cost energy service
  - to IPL customers from 2017-2036
  - measured in terms of Present Value Revenue Requirement (PVRR)
  - giving due consideration to potential risks and stakeholder input.

# How does IPL select future resources?

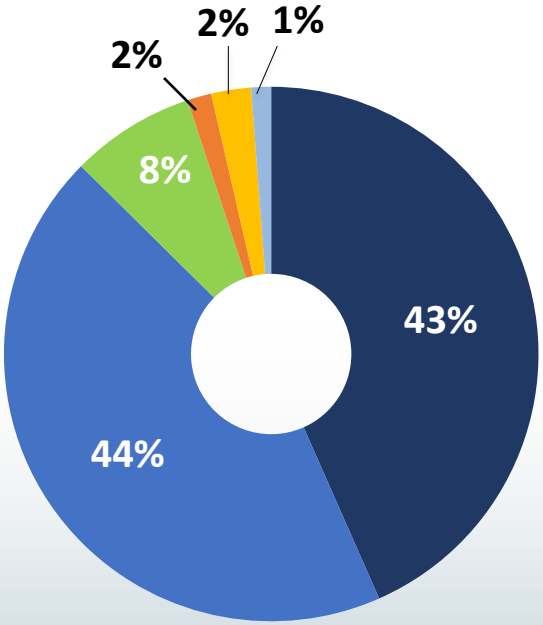
- An Integrated Resource Plan is developed based on:
  - Load (demand) forecast
  - for a 20 year period
  - utilizing existing and future supply and demand side resources
  - following an analysis of multiple potential future scenarios.

# IPL's resource mix has changed and will continue to change

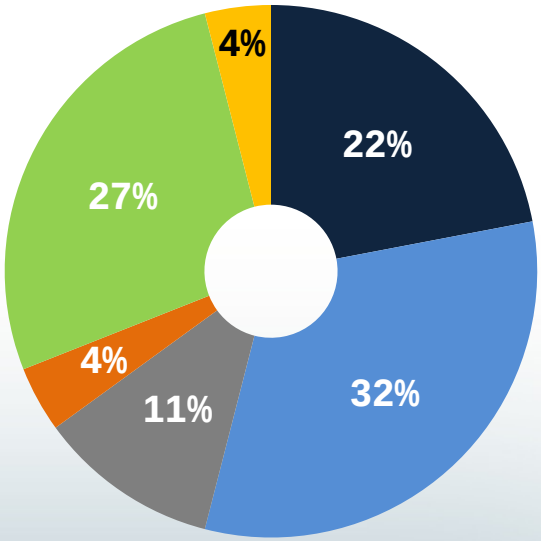
## 2007 - Historical




## 2017 - Projected



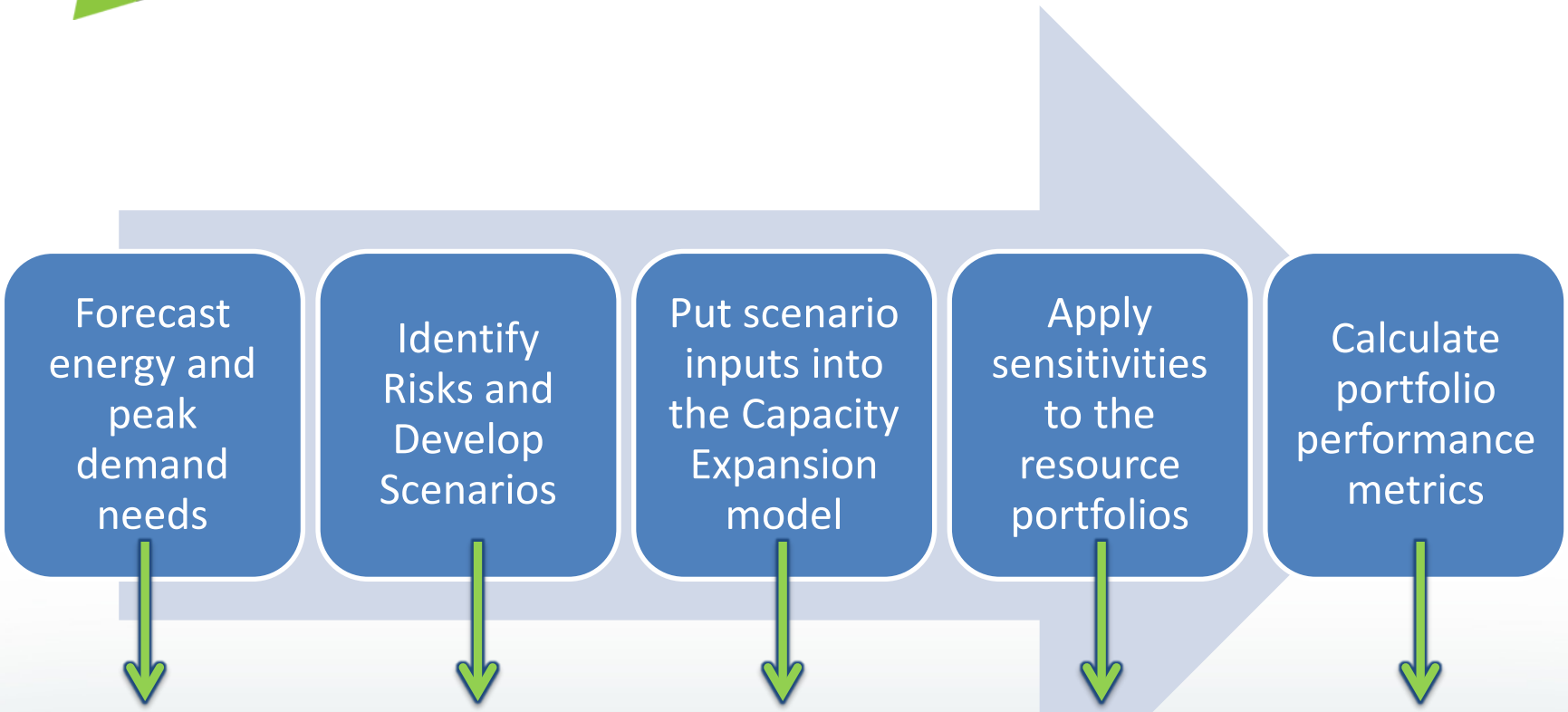

## 2036 - Forecasted




■ Coal ■ Natural Gas ■ Petroleum ■ Battery ■ DSM and DR ■ Wind* ■ Solar

** Wind plus ES in 2036*

# Resource Selection Process




Includes 15% planning reserve margin

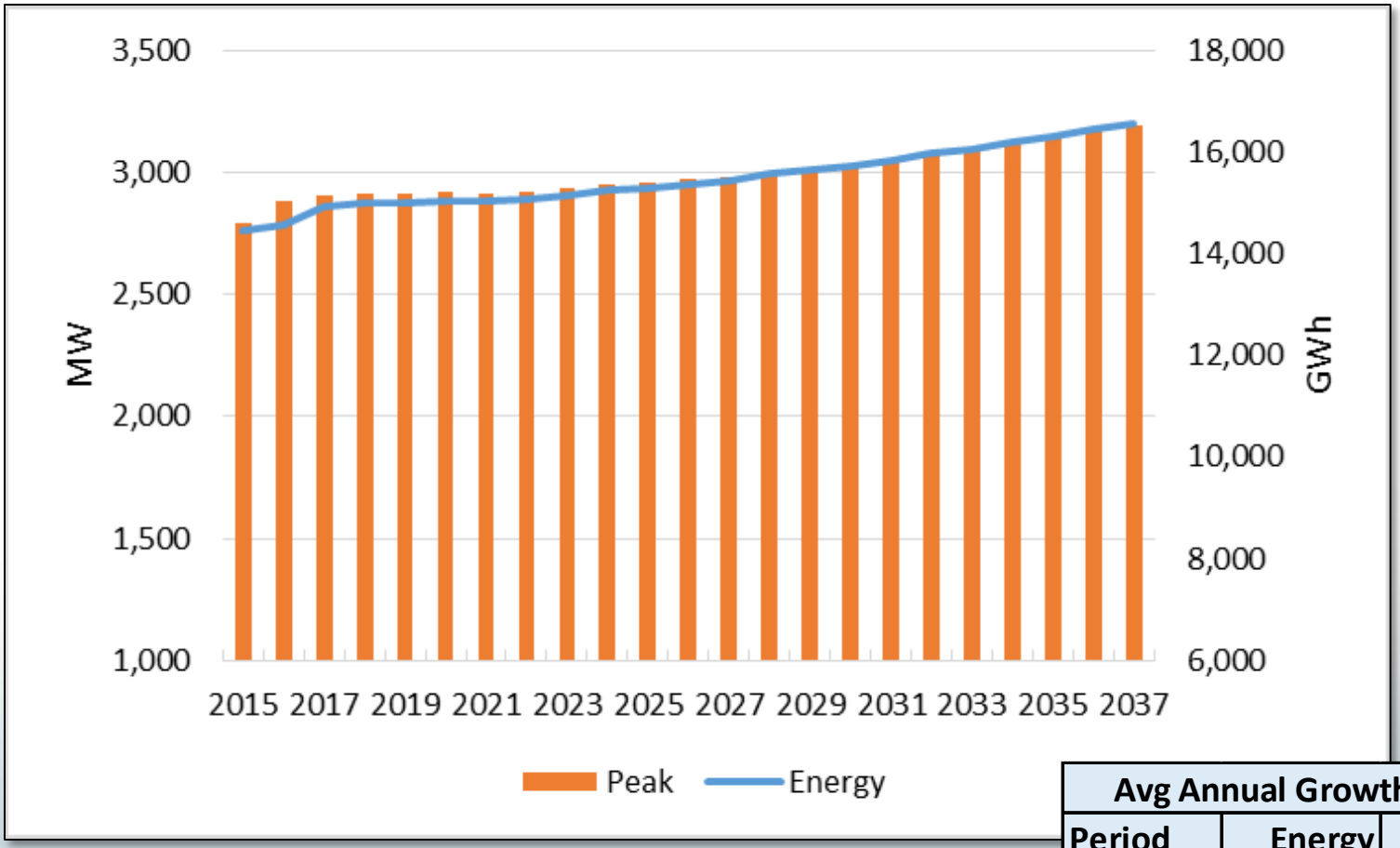
Risks include
- natural gas prices
- coal & market prices
- load forecast
- technology prices
- environmental rules

For each scenario, the model selects the least cost resources to meet energy and peak needs

How will the portfolios perform if key assumptions change?

Metrics Categories
- Cost
- Financial Risk
- Environment
- Resiliency

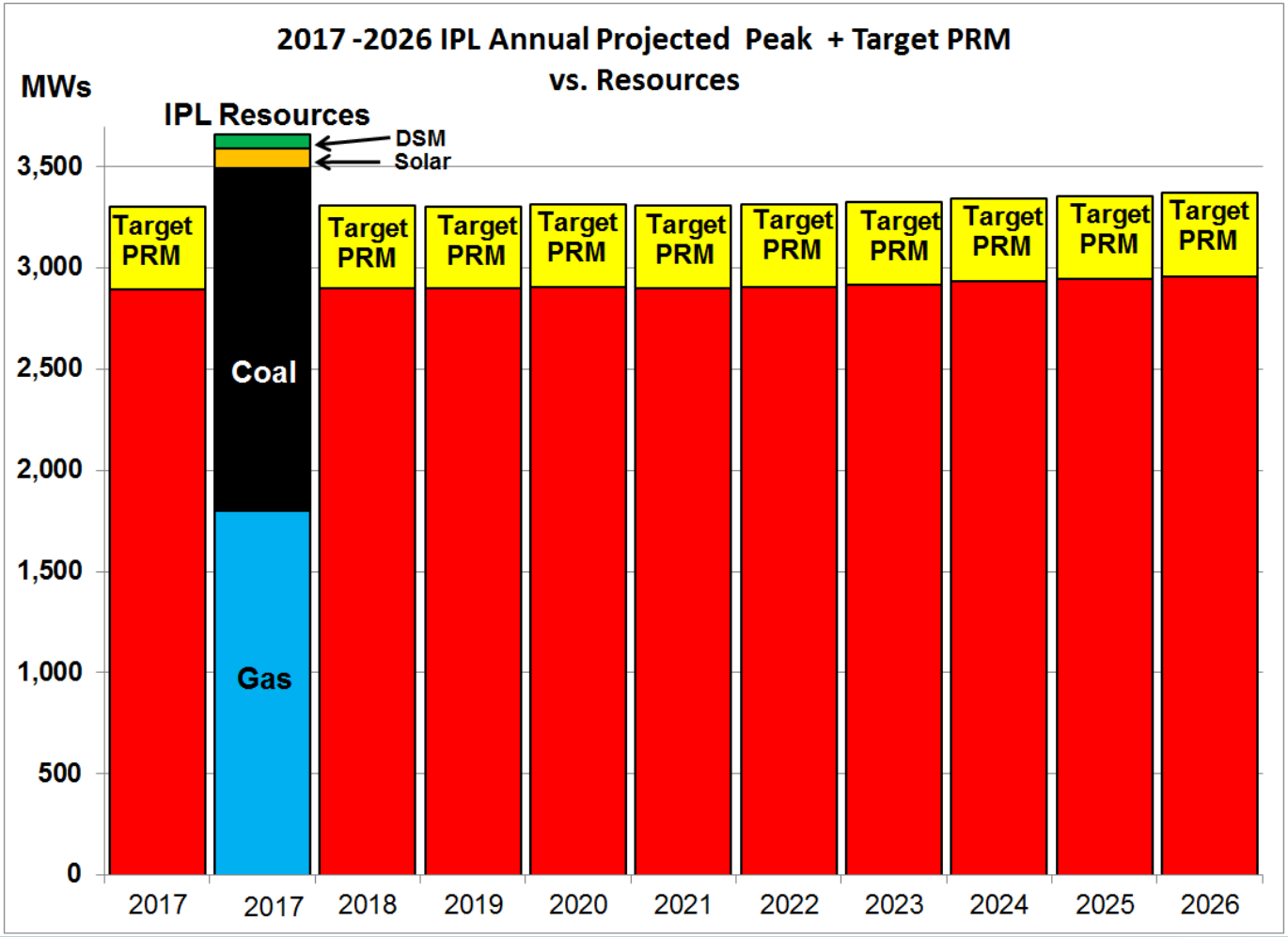
# Energy & Peak Forecast (before DSM impacts)




| Avg Annual Growth Rate | | |
|---|---|---|
| **Period** | **Energy** | **Peaks** |
| 2016-37 | 0.5% | 0.4% |

# IRP Resource Adequacy Process

- Given current portfolio of resources
  - Future projected peak and energy needs
  - Plus planning reserve margin (PRM)



# IPL Changing Energy Mix Drivers

- Environmental Compliance
  - Air Pollutants
  - Wastewater
- Natural gas prices
- Market prices
- Economic growth rates
- Demand side management
- Wind and Solar declining costs
- Energy storage declining costs

# Scenario drivers varied

| Scenario Name | | Load Forecast | Natural Gas and Market Prices | Clean Power Plan (CPP) and Environment | Distributed Generation (DG) |
|---|---|---|---|---|---|
| 1 | Base Case | Use current load growth methodology | Prices derived from an ABB Mass-based CPP Scenario | CPP starting in 2022, Low cost environmental regulations | Expected moderate decreases in technology costs for wind, storage, and solar |
| 2 | Robust Economy | High | High | Base Case | Base Case |
| 3 | Recession Economy | Low | Low | Base Case | Base Case |
| 4 | Strengthened Environmental Rules | Base Case | Base Case | 20% RPS, high cost CPP and environmental regulations | Base Case |
| 5 | Distributed Generation | Base Case | Base Case | Base Case | Fixed additions of 150 MW DG in 2022, 2025, and 2032 |
| 6 | Quick Transition | Base Case | Base Case | Base Case | Fixed portfolio to retire coal, add max DSM, minimum baseload (NG), plus solar, wind and storage |

# Supply side resources characteristics

## Model inputs include:

- Nameplate capacity
- Capital construction costs
- Fixed Operating and Maintenance (O&M)
- Variable O&M costs
- Operating characteristics
- Typical availability

# Supply side resources modeled

- Natural gas
- Nuclear
- Utility-scale solar
- Community solar
- Wind
- Combined Heat and Power (CHP)
- Battery Energy Storage

# Demand side resources considered

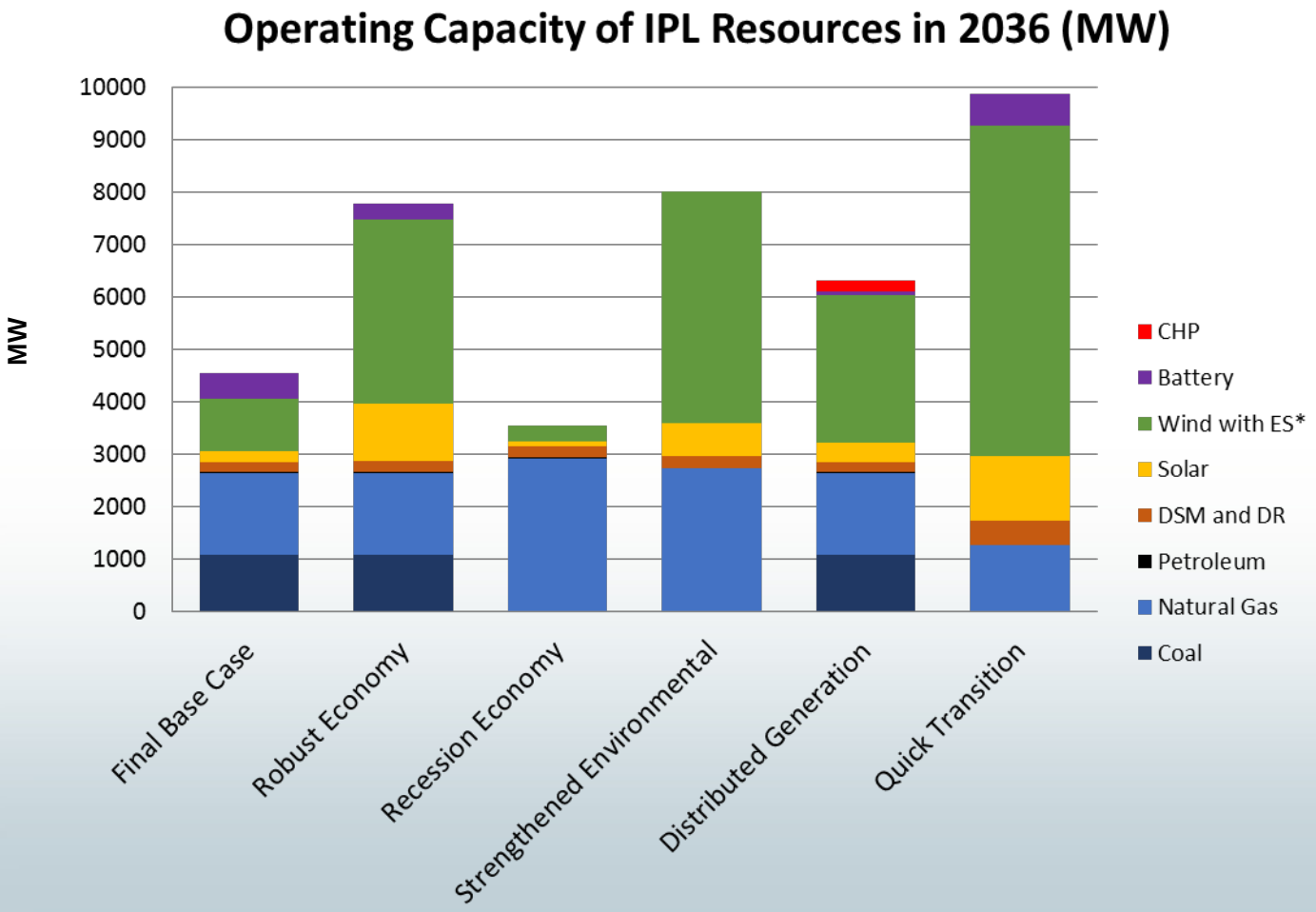
- IPL completed a DSM Market Potential Study analysis
- Similar EE measures were grouped into defined "DSM bundles"
- IPL used Maximum Achievable Potential (MAP) to create the selectable "DSM Bundles"

| | Levelized Utility Cost per MWh | | |
|---|---|---|---|
| Sector and Technology | (up to $30/MWh) | ($30-60/MWh) | ($60+ /MWh) |
| EE Residential HVAC | x | x | x |
| EE Residential Lighting | x | N/A | N/A |
| EE Residential Other | x | x | x |
| EE C&I HVAC | x | x | x |
| EE C&I Lighting | x | x | x |
| EE C&I Other | x | x | x |
| EE C&I Process | x | x | N/A |
| | Levelized Utility Cost per MW/MWh without tiers | | |
| EE Residential Behavioral | x | | |
| DR Water Heating DLC | x | | |
| DR Smart Thermostats | x | | |
| DR Emerging Tech | x | | |
| DR Curtail Agreements | x | | |
| DR Battery Storage | x | | |
| DR Air Conditioning Load Mgmt | x | | |
| *N/A indicates that a bundle was not needed; all measures fell within lower cost bundles. | | | |

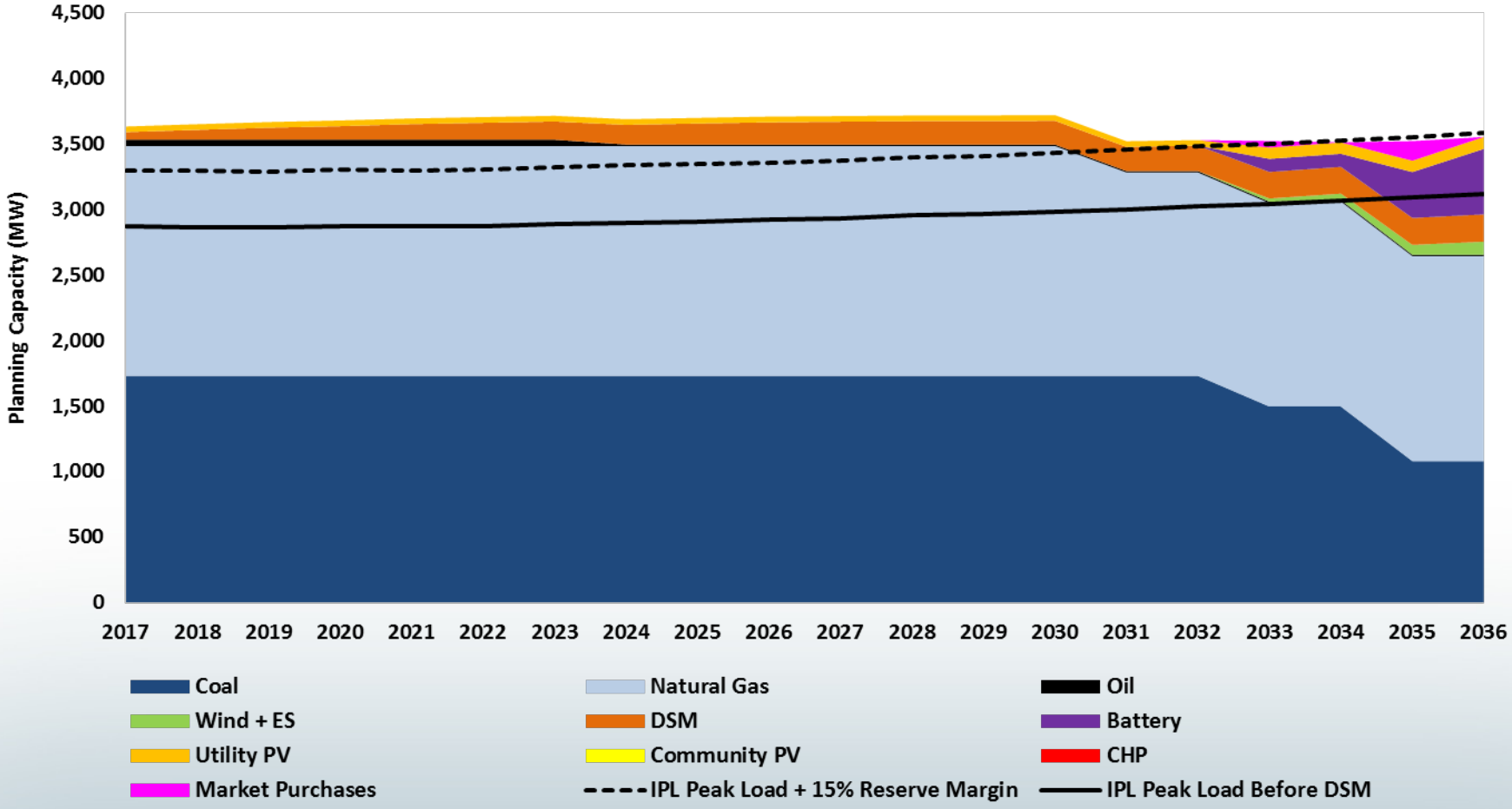
# Final Model Results

Patrick Maguire, Director of Corporate Planning & Analysis

# Candidate Resource Portfolio Results in 2036

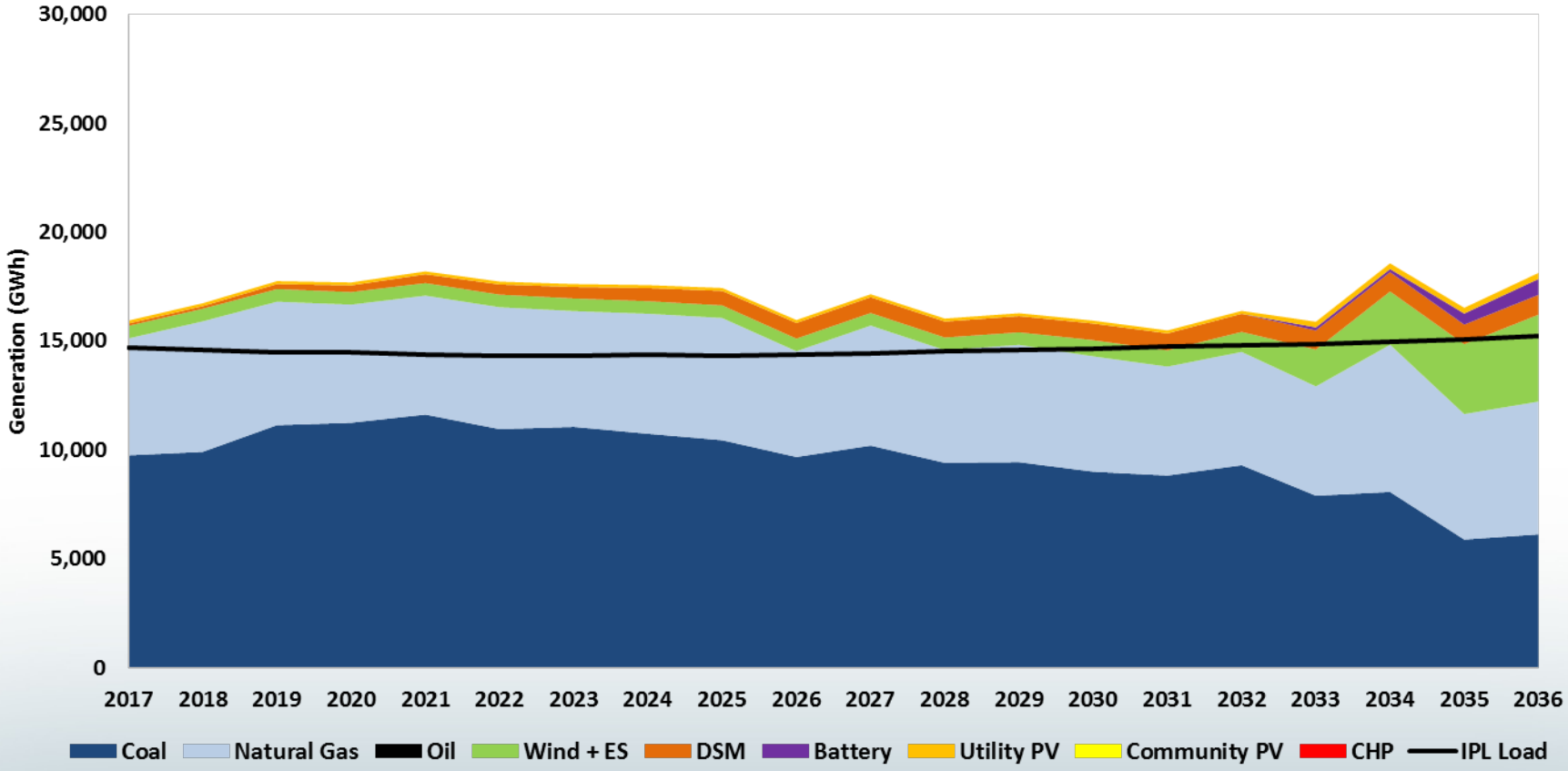


# Base Case Capacity

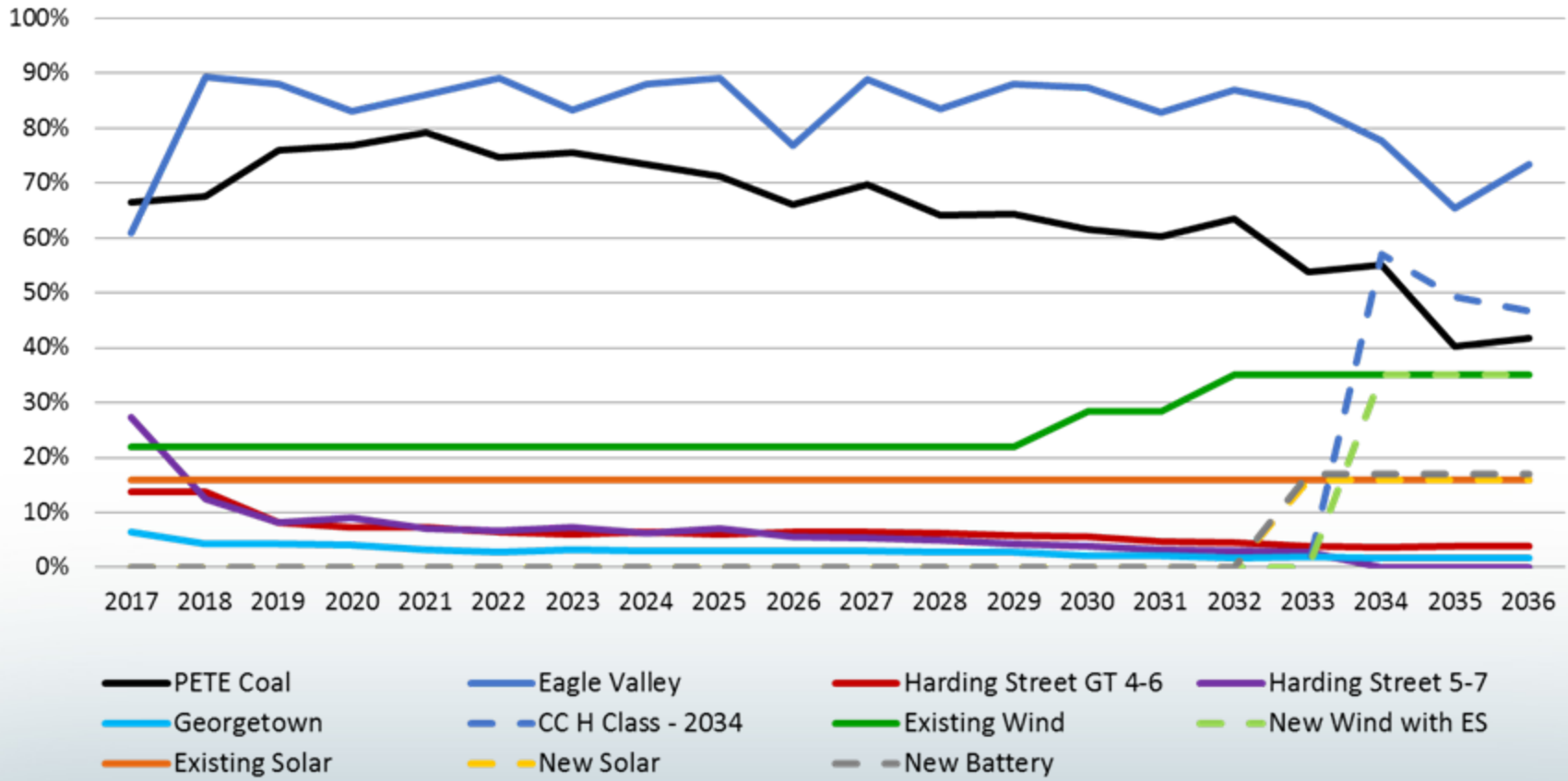



- Includes Petersburg upgrades for NAAQS, $SO_2$ and CCR

# Base Case Energy



# Capacity factors for Base Case



# Metrics are based upon a blend of model results

## Deterministic Model

- Change selected variables by a fixed and known amount
- Example:
  - Natural gas prices up 10%
  - Load up 10%
- Output
  - PVRR for each sensitivity
  - Change in emissions

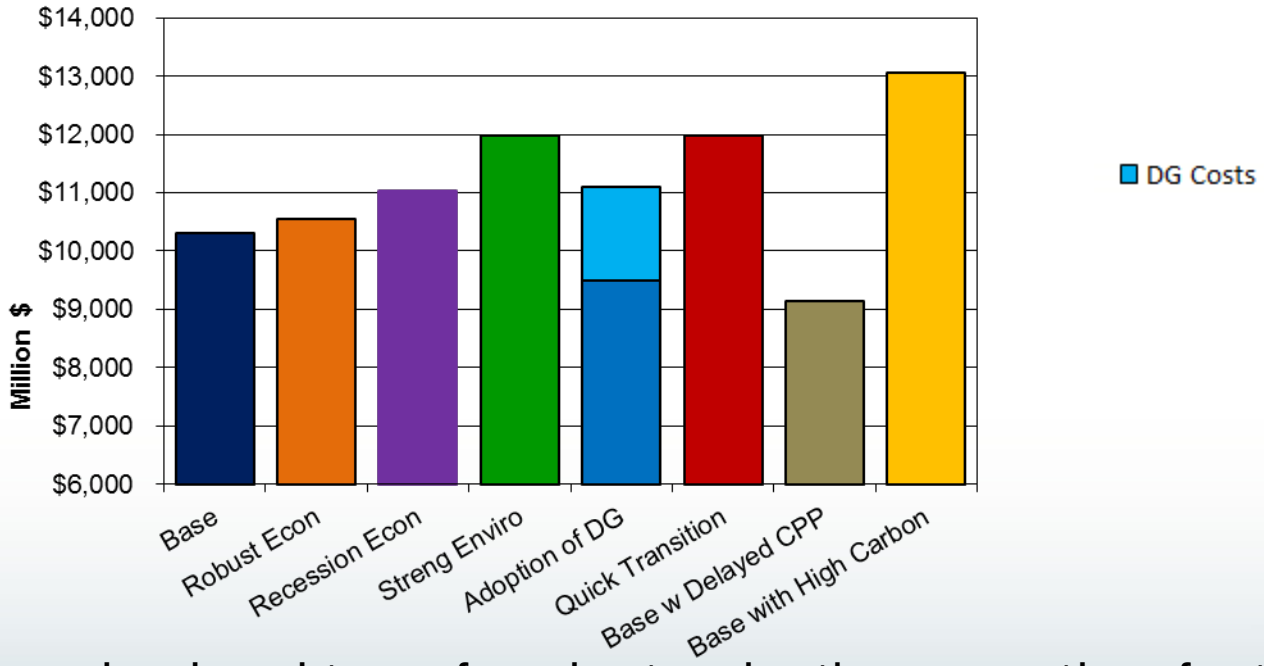
## Stochastic Model

- Subject multiple variables to randomness
- Ranges are bound by estimated probability distributions and statistical properties
- Output
  - 50 model iterations for each portfolio
  - Risk profiles
  - Financial metrics

# Metrics developed with stakeholder input

| Cost | Financial Risk | Environmental Stewardship | Resiliency |
|---|---|---|---|
| • Present Value Revenue Requirement (PVRR)<br>• Rate Impact | • Risk Exposure | • Average annual $CO_2$ emissions<br>• Average annual $NO_x$ emissions<br>• Average annual $SO_2$ emissions<br>• $CO_2$ intensity | • Planning Reserves<br>• Distributed Generation penetration<br>• Market reliance (energy and capacity) |

# Scenario Present Value of Revenue Requirements (PVRR) 2017-2036




- Each portfolio was developed to perform best under the assumptions for that scenario
- Since assumptions vary between scenarios, not all portfolios are directly comparable
- This graph shows the PVRR of all portfolios *utilizing the base assumptions* prior to introducing stochastic uncertainty

# Metrics Summary

| Scenarios | Cost | | Financial Risk | Environmental Stewardship | | | | Resiliency | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 20 yr PVRR ($ MN) | Rate Impact, 20 yr average (real cents/kWh) | Risk Exposure ($) | Average annual CO2 emissions (tons) | Average annual NOx emissions (tons) | Average annual SO2 emissions (tons) | Total CO2 intensity (tons/MWh) | Planning Reserves (lowest amount over 20 yrs | Distributed Generation (Max DG as percent of capacity over 20 yr) | Market Reliance for Energy (Max over 20 yrs) | Market Reliance for Capacity (Max MW over 20 yrs) |
| Base | $ 10,309 | 3.53 | $1,324,989,546 | 12,883,603 | 13,181 | 11,808 | 0.79 | 15% | 3% | 9% | 150 |
| Robust Econ | $ 10,550 | 3.62 | $1,303,754,944 | 12,883,183 | 13,181 | 11,808 | 0.70 | 27% | 15% | 9% | 200 |
| Recession Econ | $ 11,042 | 3.78 | $1,463,842,563 | 3,334,067 | 1,925 | 593 | 0.44 | 3% | 3% | 58% | 0 |
| Streng Enviro | $ 11,990 | 4.11 | $1,126,983,327 | 3,309,326 | 1,910 | 629 | 0.28 | 15% | 10% | 52% | 50 |
| Adopt of DG | $ 11,092 | 3.80 | $1,294,337,690 | 13,219,942 | 12,910 | 10,874 | 0.78 | 15% | 11% | 9% | 50 |
| Quick Transition | $ 11,988 | 4.20 | $1,311,247,113 | 5,403,645 | 4,320 | 3,243 | 0.32 | 15% | 35% | 57% | 0 |

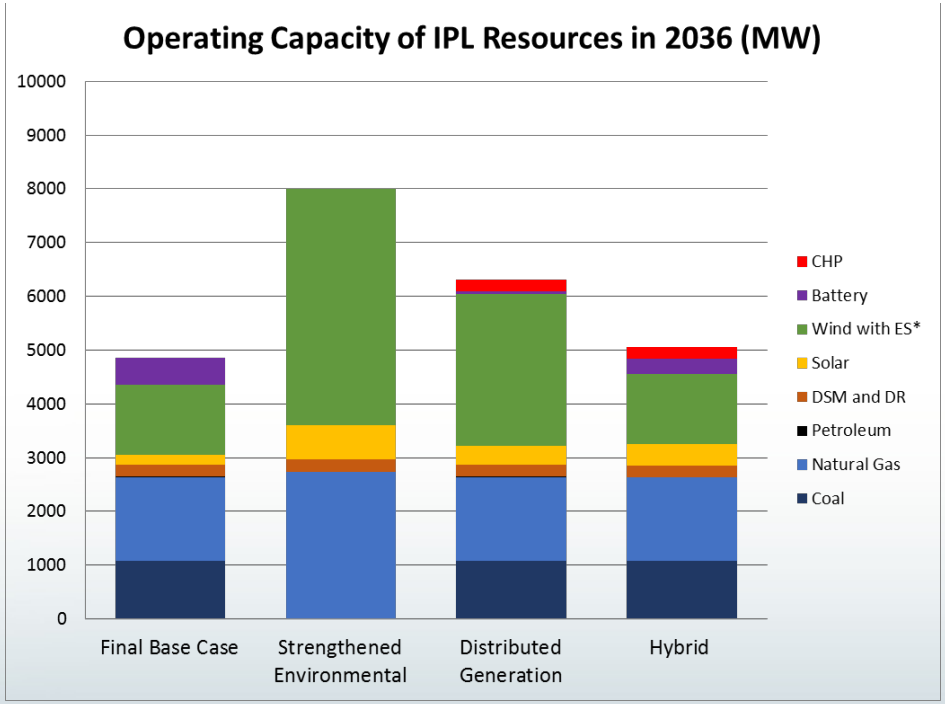
**Key:**

| | |
|---|---|
| | Best |
| | Better |
| | Worse |

# IPL's Preferred Resource Portfolio is the Base Case

- This reflects the most likely inputs and most probable risks known at this point in time
- The primary selection criteria was the reasonable least cost to customers stated in terms of the Present Value Revenue Requirement (PVRR) metric
- Other metrics including rate and environmental impacts, market reliance and risk exposure were considered but not equally weighted

# Hybrid portfolio may evolve




- Technology costs declining more quickly as in 2016
- Higher customer adoption of distributed generation
- Public interest to reduce carbon exposure

# 2016 Short Term Action Plan (2017-2019)

| | | |
|---|---|---|
| **Resource Changes** | 2017 | Implement DSM proposed for 2017, draft and seek approval for 2018-2020 DSM action plan |
| | 2017 | Complete EV CCGT Construction |
| | 2018 | Complete CCR/NAAQS-SO2 Pete upgrades |
| **Transmission** | 2017 | Upgrade (1) 138 kV line, replace (1) auto-transformer |
| | 2018 | Upgrade 3 substations, (3) 138 kV lines, and replace breakers at 2 substations |
| | 2019 | Implement projects identified in 2017 & 2018 |

# IPL's planned improvements to 2019 IRP process

1. Analyze smart meter data for more granular load forecasting
2. Refine Demand Side Management (DSM) modeling
3. Research MISO transmission congestion forecasts
4. Assess 138 kV voltage stability options
5. Refine frequency & reactive support requirements of new wind assets
6. Study firming benefits of batteries with renewables

# Next Steps

| 2016 IPL IRP Schedule Moving Forward | |
|---|---|
| 90 days after filing: February 1, 2017 | Interested Party Deadline to Submit Comments to the IURC. See 170 IAC 4-7-2* for details |
| 120 days after filing: March 1, 2017 | IURC Director's Draft Report publication expected |

IAC – Indiana Administrative Code
*The draft proposed rule is available at: http://www.in.gov/iurc/2674.htm

# Stakeholder Questions

Joan Soller, Director of Resource Planning

# Thank you for participating in the WebEx presentation!

Email ipl.irp@aes.com with any other comments or questions.