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SCENARIO AND METRIC DEVELOPMENT IN 2016 IRP



OUTLINE

1. 2016 IRP

- a) Overview
- b) Scenario development process
- c) Sensitivity analysis
- d) Metrics

2. Considerations for future IRPs



IPL 2016 IRP

- IRP Filed on November 1, 2016



April

Public
Advisory
Meeting #1



June

Public
Advisory
Meeting #2



August

Public
Advisory
Meeting #3



September

Public
Advisory
Meeting #4



November

IRP Filed

Integrated Resource Plan (IRP)

Every two years Indianapolis Power & Light Company (IPL) must submit its Integrated Resource Plan (IRP) to the Indiana Utility Regulatory Commission (IURC). The plan is a 20-year forecast outlining how IPL will provide reliable electricity to its customers.

IPL's 2016 IRP was filed on November 1, 2016.

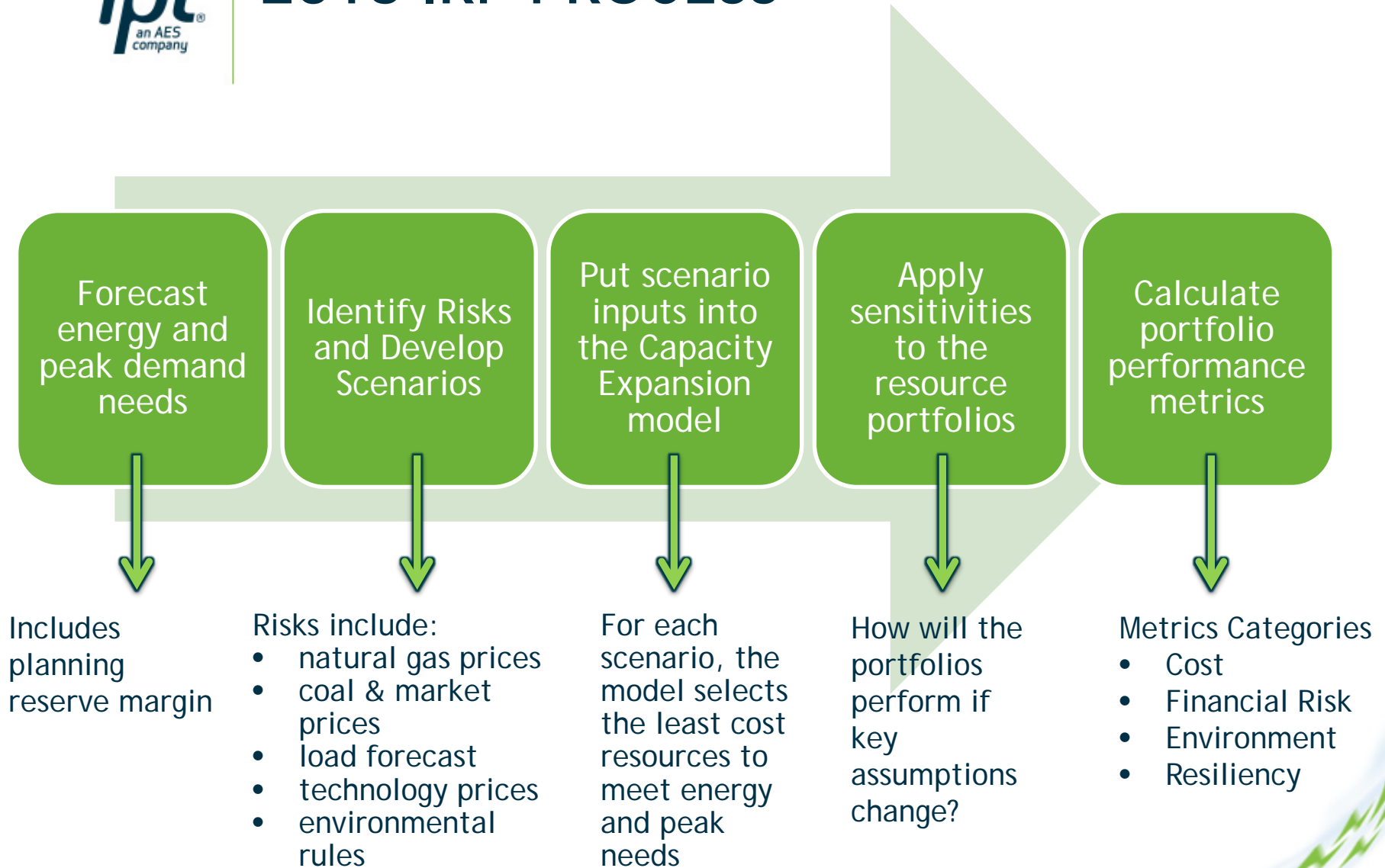
Final 2016 IRP Documents:

- [IRP Non-Technical Summary](#)
- [Final IRP Report - Volume 1](#)
- [Final IRP Report - Volume 2](#)
- [Final IRP Report - Volume 3](#)

<https://www.iplpower.com/IRP/>



2016 IRP PROCESS





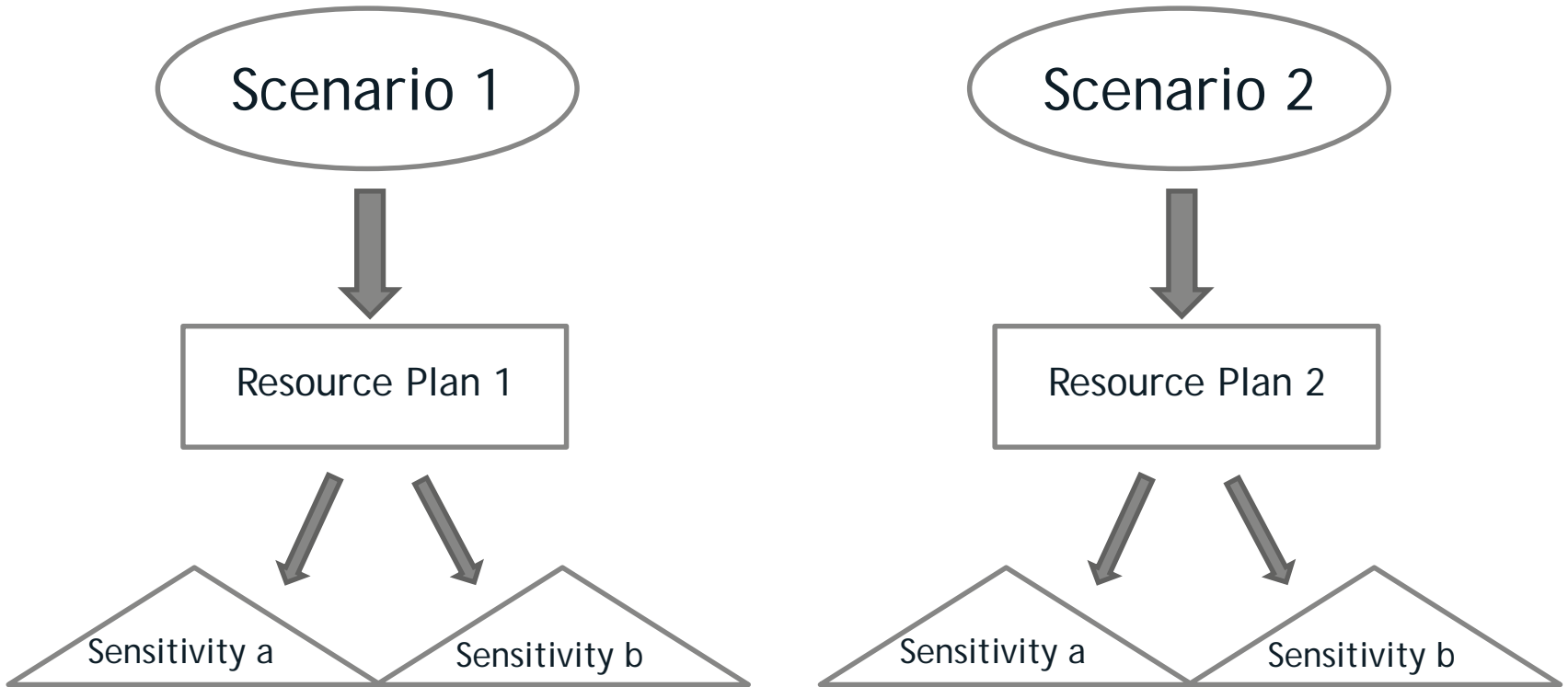
IRP SCENARIO DEVELOPMENT

- Scenarios proposed by IPL and further developed with stakeholder input

Base Case	Robust Economy	Recession Economy	Strengthened Environmental Rules	High Adoption of Distributed Generation
<ul style="list-style-type: none">• Known events and expected trends• Base Case commodity prices• Clean Power Plan in 2022• Existing environmental regulations realized• Moderate decreases in technology costs for renewables and storage	<ul style="list-style-type: none">• High local and national economic growth• High Natural Gas and market prices	<ul style="list-style-type: none">• National and local economic downturns• Low natural gas and market prices	<ul style="list-style-type: none">• Higher compliance costs for known regulations• High Carbon prices• 20% In-State RPS	<ul style="list-style-type: none">• Customers adopt DG with lower technology costs



IRP SCENARIO DEVELOPMENT





SENSITIVITY ANALYSIS

Deterministic Model

Scenario

Resource Plan

Sensitivity a

e.g. NG ↑
NG ↑+ Load ↑

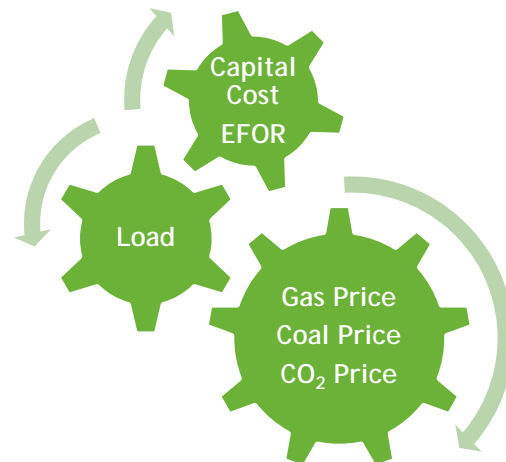
Sensitivity b

e.g. NG ↓
NG ↓+ Load ↓

Stochastic Model

Scenario

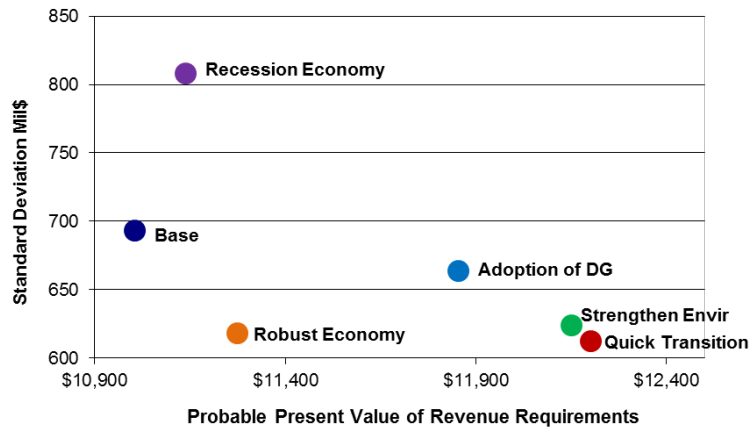
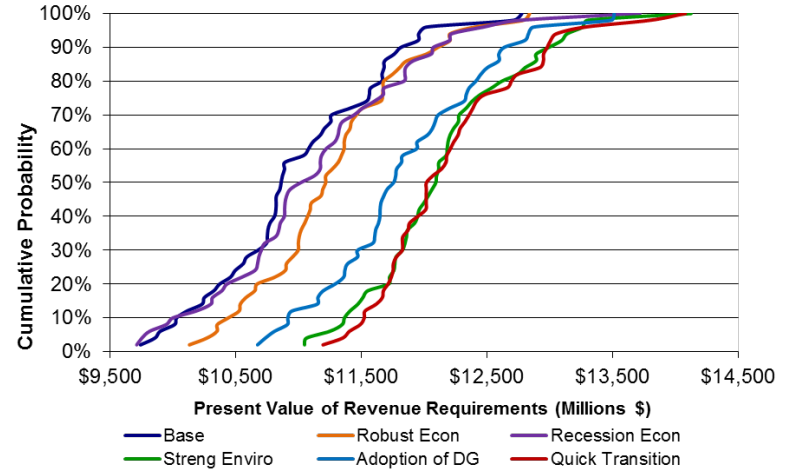
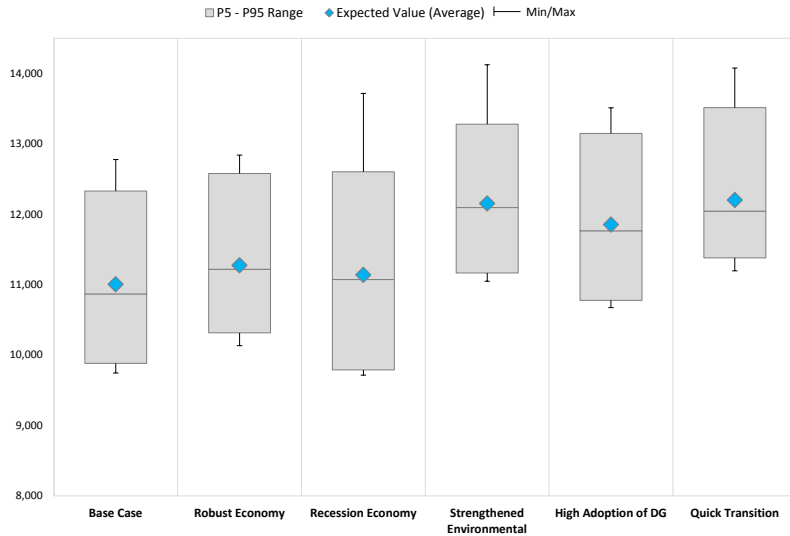
Resource Plan



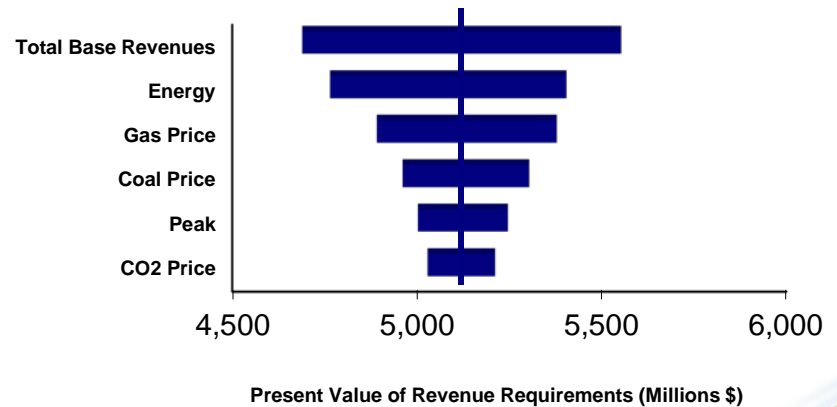


STOCHASTIC RESULTS

20-Year PVRR Range



2017-2026





2016 IRP METRICS

Cost

- Present Value Revenue Requirement (PVRR)
- Rate Impact

Financial Risk

- Risk Exposure

Environmental Stewardship

- Average annual CO₂ emissions
- Average annual NO_x emissions
- Average annual SO₂ emissions
- CO₂ intensity

Reliability

- Planning Reserves
- Distributed Generation penetration
- Market reliance (energy and capacity)



2016 IRP METRICS TABLE

Figure 8.65 – Metrics Summary

Scenarios	Cost		Financial Risk	Environmental Stewardship				Resiliency			
	20 yr PVRR (\$ MN)	Rate Impact, 20 yr average (real cents/kWh)		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

Source: IPL 2016 IRP

Key:

	Best
	Better
	Worse

Metrics in 2016 IRP:

- Broad overview of portfolio performance: cost, risk, environmental, reliability
- Cost and risk still the primary measures of portfolios
- Metrics not weighted
- Carefully evaluated but subjective ratings (Best, Better, Worse)



FUTURE METRIC DEVELOPMENT

- Metrics cannot be looked at in isolation
- Can metrics be objectively weighted by importance or significance?
- Can portfolios be rated/ranked objectively within a specific metric?
- Time series metrics - how do metrics change over the study period? Is there a crossover point for portfolios?
- How are metrics defined? E.g. Reliability/Resiliency
- Could metric definitions help shape portfolio optimization?



MORE INFORMATION

<https://www.iplpower.com/IRP/>

Final 2016 IRP Documents

Public Advisory Meeting Materials