Integrated Resource Plan
Public Advisory Meeting #1

April 11, 2016

Welcome and Safety Message

Bill Henley, VP of Regulatory and Government Affairs

Meeting Guidelines and Stakeholder Process

Dr. Marty Rozelle, Facilitator

Agenda for today

8:30	Registration
9:00	Welcome
9:15	Agenda Review and Meeting Guidelines
9:30	Introduction to IPL's IRP Process
10:00	Supply Side & Distributed Resources
10:30	Demand Side Resources
11:15	Demand Side Management (DSM) Modeling
12:00	Lunch
12:45	Discussion of Risks
1:45	Discussion of Scenarios
2:45	Next Steps

Objectives

- Listen to diverse stakeholders
- Describe IRP planning process
- Engage in meaningful dialogue
- Continue relationship built on trust, respect and confidence

Note: IPL will use publicly available data as much as possible

Meeting Guidelines

- Time for clarifying questions at end of each presentation
- Small group discussions on risks and scenarios
- The phone line will be muted. During the allotted questions, press *6 to un-mute your line, and please remember to press *6 again to re-mute when you are finished asking your question.
- Use WebEx online tool for questions during meeting
- Email additional questions or comments by April 18
- IPL will respond via website by May 2

Meeting #2

- Date: June 14, 2016
- In response to your request,

  ~60 to 90 minutes will be reserved for listening to stakeholders' points of view.

- Let us know by May 17 if you plan to speak by emailing ipl.irp@aes.com
- Pre-registered speakers will split allocated time

Introduction to IPL's IRP

Joan Soller, Director of Resource Planning

Introduction to IPL

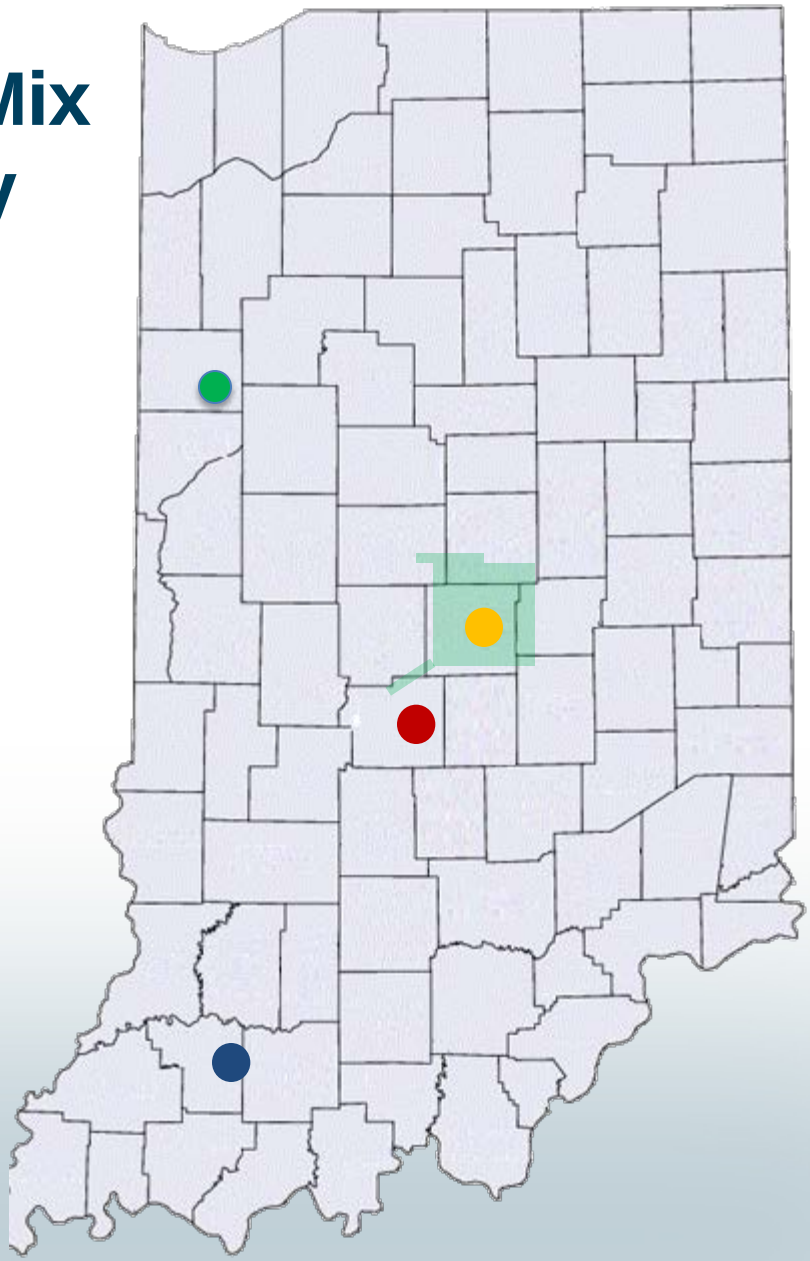
Quick facts

- 480,000 customers
- 1,400 employees
- 528 sq. miles territory
- 144 substations
- ~3,300 MW of Resources
- Serving Indianapolis reliably since 1929

IPL 2016 Resource Mix based upon capacity

- **Indianapolis area assets 1,222 MW**
  - **Harding Street Station (HS) –** 977 MW
  - **Georgetown Station –** 150 MW
  - **Solar PPAs* –** 95 MW
- **Eagle Valley (EV) Generating Station**
  - Retiring 263 MW coal in April 2016
  - Constructing 671 MW Combined Cycle Gas Turbine (CCGT) for Spring 2017 operation
- **Petersburg Generating Station** – 1,697 MW
- **Hoosier Wind Park PPA** – 100 MW
- **Lakefield Wind Park PPA** – 200 MW
  (In Minnesota – Not pictured)

*PPAs = Power Purchase Agreements



What is an IRP?

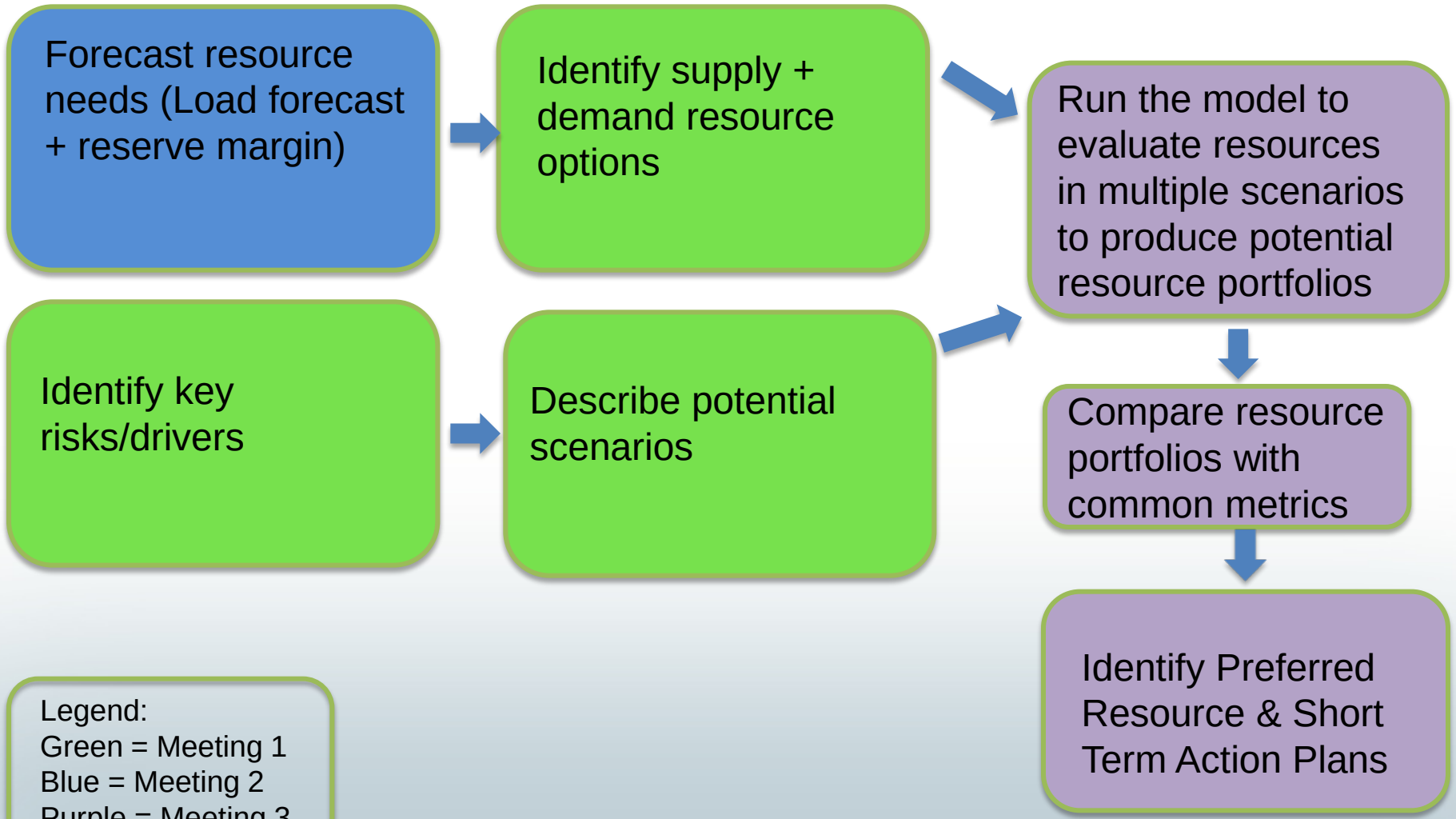
- An Integrated Resource Plan represents how a utility expects to provide its customers
  - reasonable least cost service
  - for a 20 year period
  - utilizing existing and future supply and demand side resources
  - following an analysis of multiple potential future scenarios.

Joint IRP 101 meeting

- Indiana utilities co-hosted IRP 101 session on Feb 3, 2016
- Included general information about the planning process
- Review materials at this link:

  https://www.iplpower.com/IRP/?terms=IRP

IRP process overview



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.

Actions since 2014 IRP

- Implemented short term action plan
  - Transmission expansion projects
  - DSM program implementation
  - MISO capacity purchases
  - Mercury and Air Toxics Standard (MATS) compliance
  - EV CCGT 671 MW
  - Blue Indy implementation
  - National Pollutant Discharge Elimination System (NPDES) compliance
  - Harding Street 5, 6 & 7 refuel/conversion to NG
  - Retire EV units 3 - 6

Proposed enhancements based on feedback

	2014 IRP Feedback	IPL Response/Planned Improvements
1	Constrained Risk Analysis	Stakeholder discussion about risks will occur early in the 2016 IRP process.
2	Load Forecasting Improvements Needed	IPL is reviewing load forecast to enhance data in the 2016 IRP.
3	DSM Modeling not robust enough	IPL has piloted modeling DSM as a selectable resource and will discuss this in public meetings.
4	Customer-Owned and Distributed Generation lacked significant growth	IPL will develop DG growth sensitivities to understand varying adoption rate impacts.
5	Incorporation of Probabilistic Methods	IPL will incorporate probabilistic modeling in 2016 IRP.
6	Enhance Stakeholder Process	IPL participated in joint education session with other utilities to develop foundational reference materials. We will incorporate more interactive exercises in 2016.

2016 IRP timeline

Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016
Pilot DSM modeling	Conduct IRP 101 session Identify risks	Hold 1st IRP meeting	Continue modeling & narrative	Finalize and file IRP
Initiate scenario development	Initiate DSM MPS	Complete DSM MPS	Perform Sensitivity Analyses	
Research DG resources		Complete load forecast	Hold 2nd & 3rd IRP meetings	
Update Reference case data		Initiate narrative & modeling		

Questions?

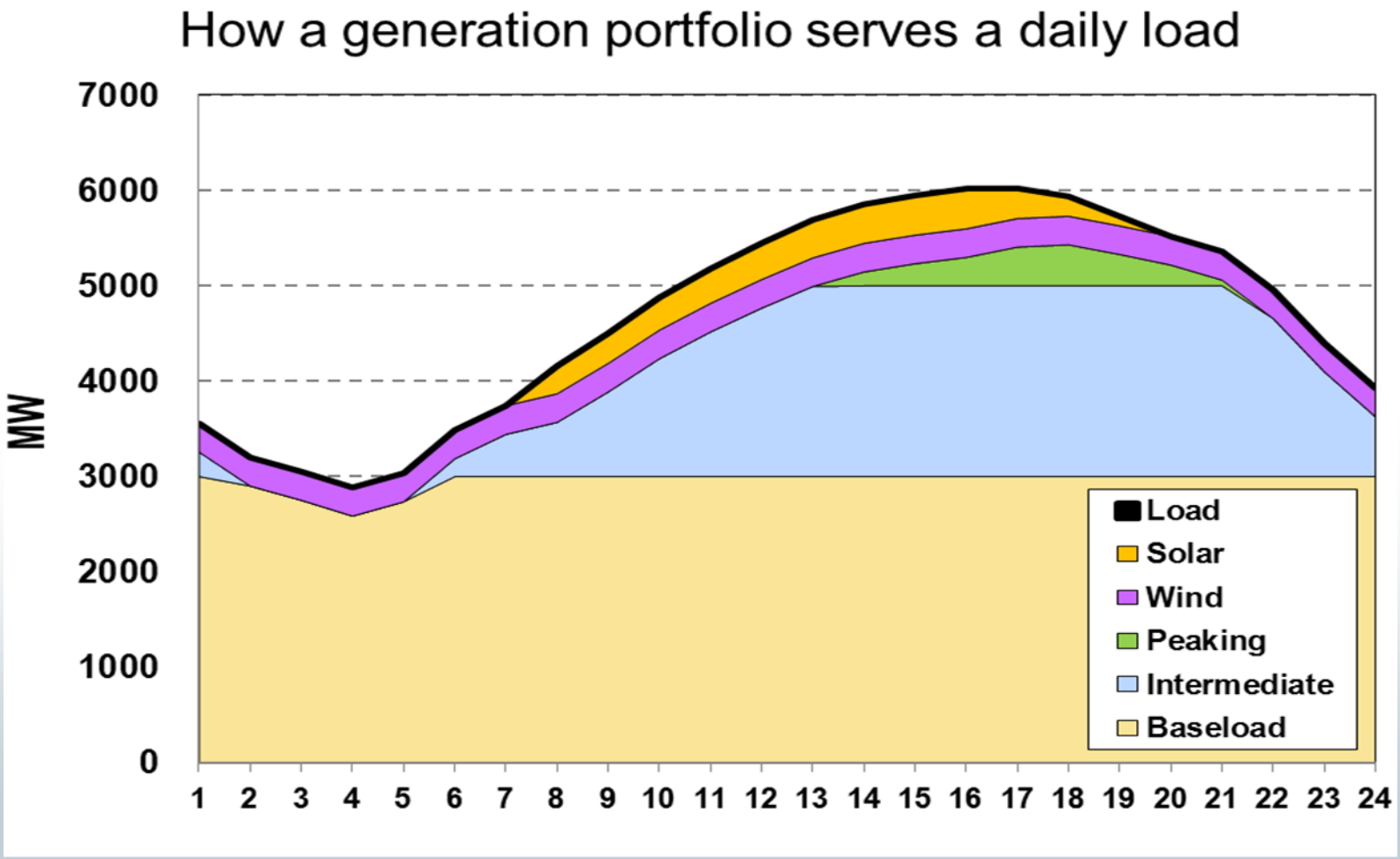
Supply Side Resources

Joan Soller, Director of Resource Planning

Supply side resources

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

Typical summer load & resource mix



Supply side resource alternatives

IRP Resource Technology Options			
	MW Capacity	Performance Attributes	Representative Cost per Installed KW
Simple Cycle Gas Turbine[1]	160	Peaker	$676
Combined Cycle Gas Turbine - H-Class[1]	200	Base	$1,023
Nuclear[1]	200	Base	$5,530
Wind[2,3]	50	Variable	$2,213
Solar[4]	> 5 MW	Variable	$2,270
Energy Storage[5]	20	Flexible	~ $1,000
CHP – industrial site (steam turbine)[6]	10	Base	Ranges from ~ $670 to $1,100
Other?			

Sources for IRP resource technology options

[1] These costs from *EIA Updated Capital Cost Estimates for Utility Scale Electricity Generating Plants Report* (published April 2013) are shared as proxies for IPL's confidential costs.
http://www.eia.gov/forecasts/capitalcost/pdf/updated_capcost.pdf

[2] Excludes transmission costs

[3] U.S. Energy Information Administration | *Assumptions to the Annual Energy Outlook 2015*

[4]2015 SunShot National Renewable Energy Laboratory (NREL) Solar Report, *Photovoltaic System Pricing Trends*, normalized and converted from DC to AC, utility scale defined as greater than 5MW. Retrieved from:
https://emp.lbl.gov/sites/all/files/pv_system_pricing_trends_presentation_0.pdf

[5]AES Energy Storage Website http://www.aesenergystorage.com/choosestorage/

[6]EPA Combined Heat and Power Partnership. Retrieved from
https://www.wbdg.org/resources/chp.php

Distributed Resources Discussion

John Haselden, Principal Engineer

Customer-Sited Generation

- Typically diesel generators
- Usually not synchronous with IPL
- Size: 100 kW – 20 MW
- EPA regulations restrict availability to run during non-emergencies
- Indy area resources
  - 2010: 40.1 MW
  - 2014: 31.7 MW
  - 2016: 0 MW
- Quick start, high variable cost, limited run time

Combined Heat & Power (CHP)

- Combined Heat and Power
  - Usually customer sited and owned
  - Thermal requirements
- 5 MW – 100 MW
- Technology options
  - Conventional
    - Natural gas reciprocating engines
    - Natural gas turbines
  - Advanced
    - Fuel cell
    - Microturbine
    - Micro-CHP

Wind

- Poor wind resource in this area – low energy output
- Height is important for production
- 5 kW – 1.5 MW
- Siting/zoning issues
- Noise

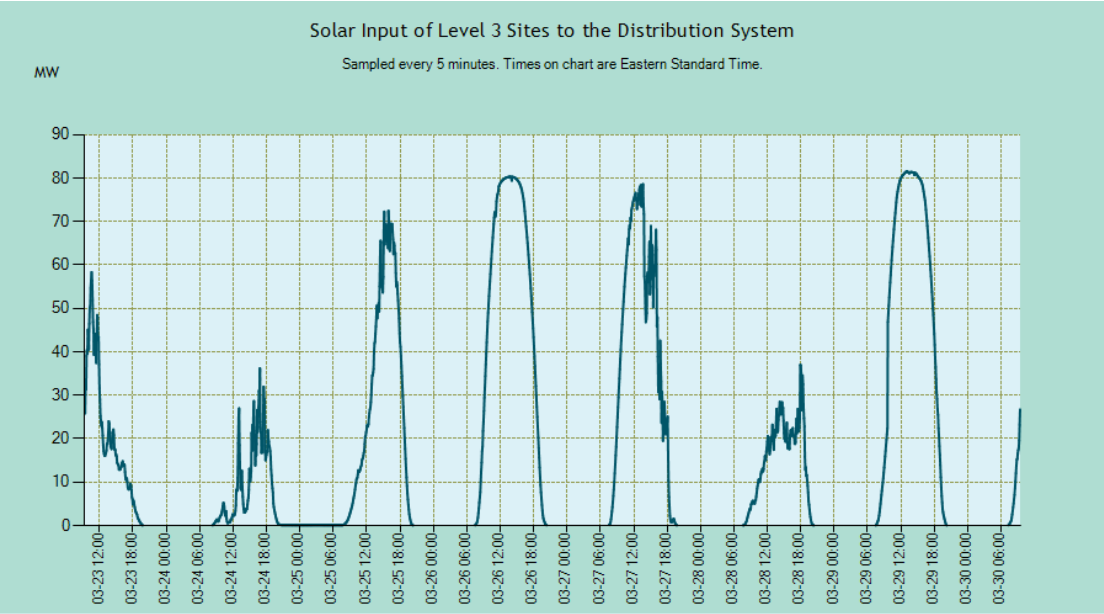
- Low coincidence with system peak, variable production
- Higher production costs than might otherwise be expected

Biomass

- Includes anaerobic digesters and combustion of organic products
- Siting and zoning issues
- Usually base load generation
- Customer choice to install
- Fuel transportation and emissions are a challenge

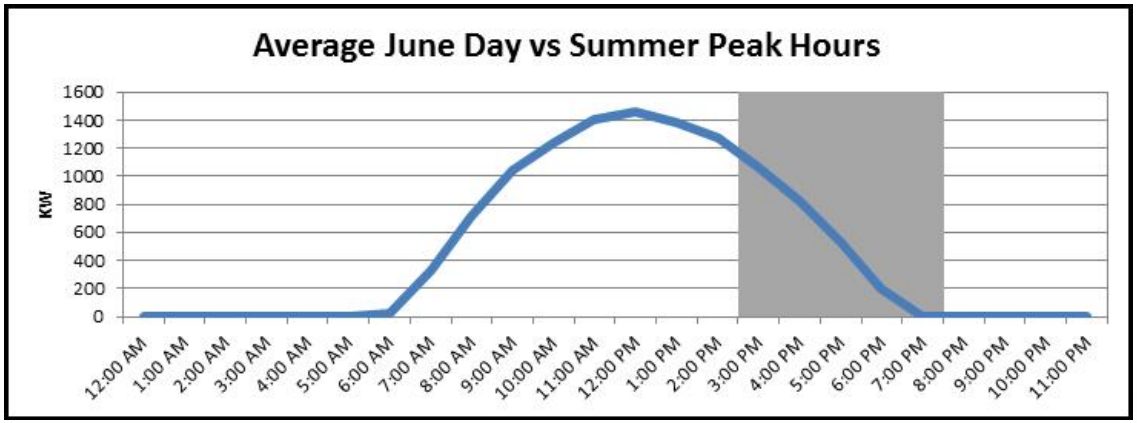
Solar Photovoltaic

- Permitting and construction are usually quick and not complicated
- Location determined by others
- Requires large spaces – 5-7 acres/MW
- Low capacity factor – 15-18%
- Variable production



Solar Photovoltaic (cont.)

- Some coincidence with system peak

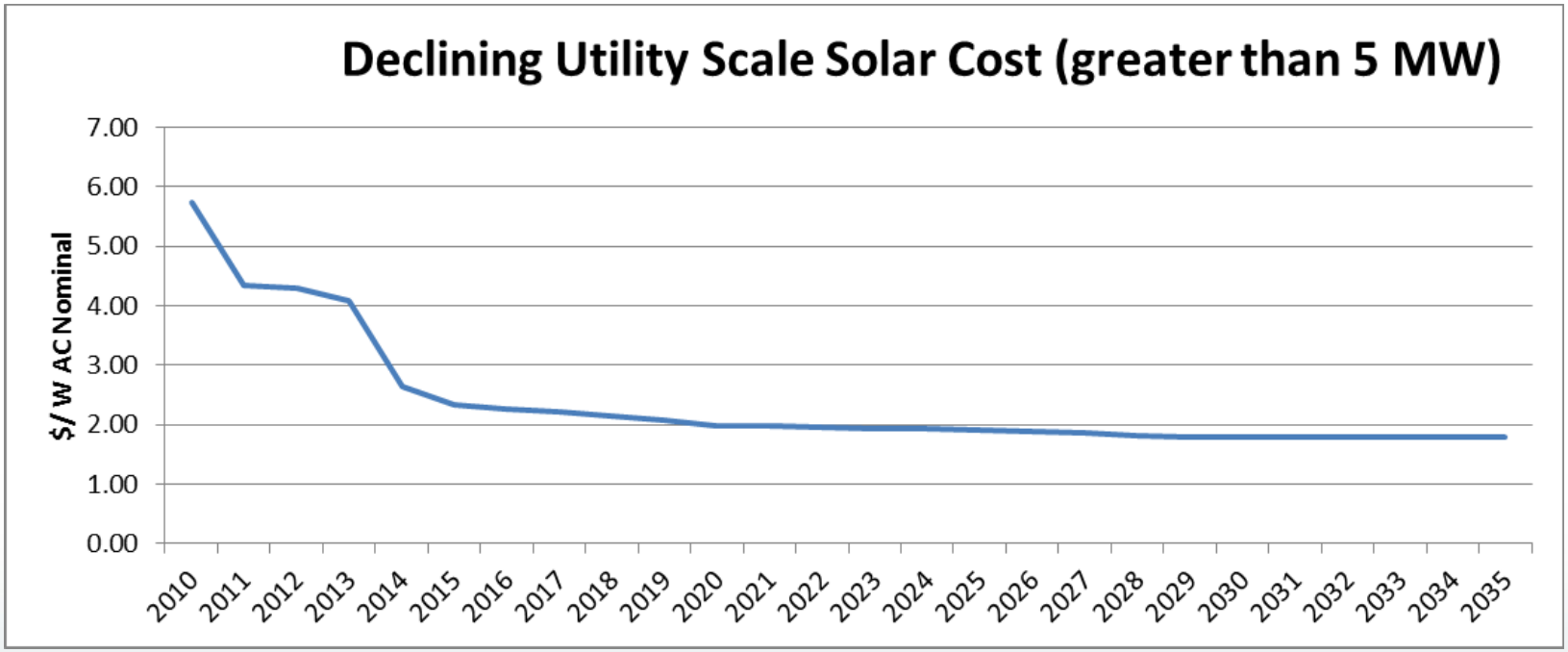


- Solar Renewable Energy Credit (SREC) value is variable and a short-term market

IPL experience with Solar PV

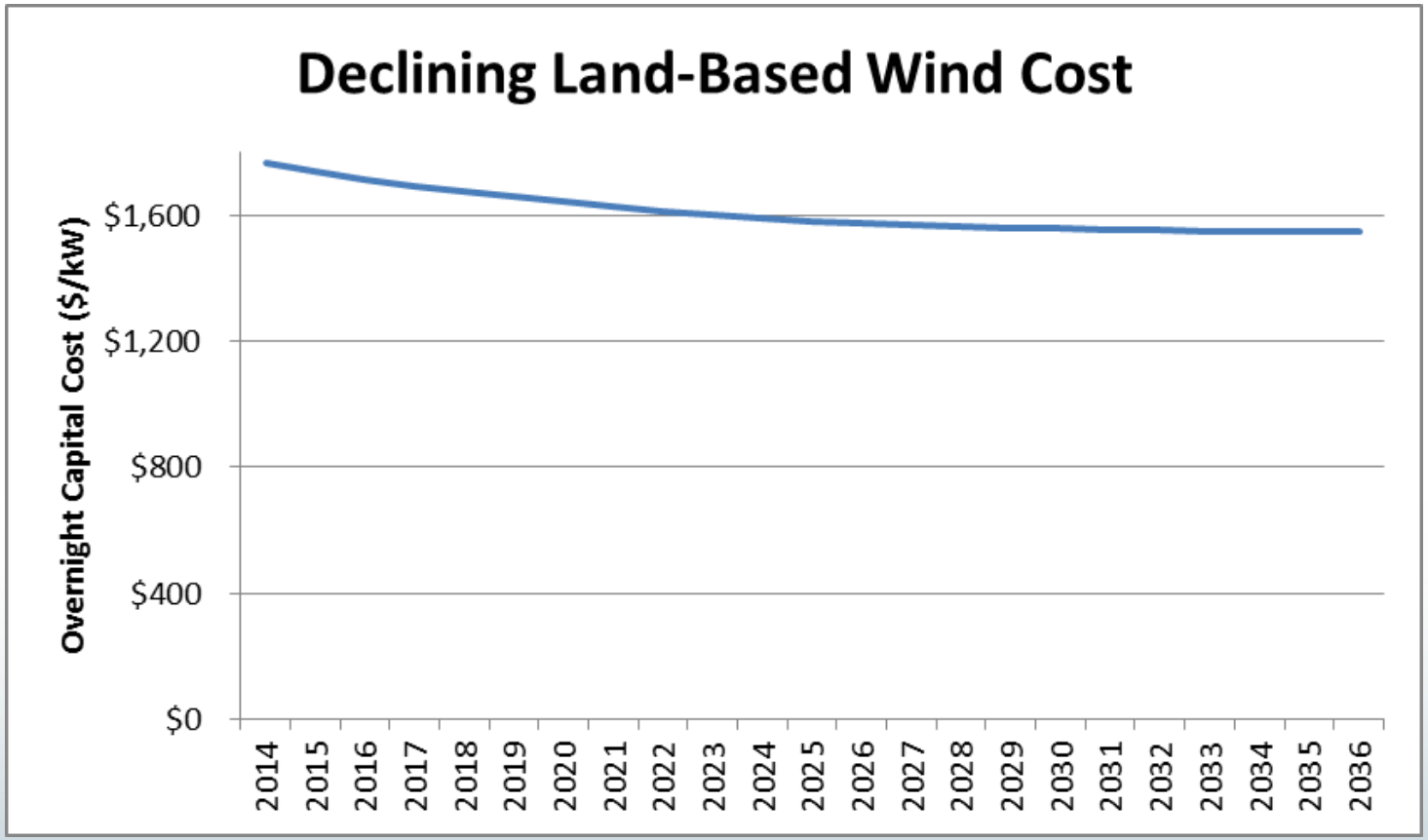
- Net metering
  - Small projects – Total capacity 1.45 MW
- Renewable Energy Production (REP) Rate
  - 95 MW operating solar
  - Approximately 45 MW contribution to capacity

Solar cost trend



Source: 2015 SunShot National Renewable Energy Laboratory (NREL) Solar Report, Photovoltaic System Pricing Trends, normalized and converted from DC to AC, utility scale defined as greater than 5MW. Retrieved from: https://emp.lbl.gov/sites/all/files/pv_system_pricing_trends_presentation_0.pdf

Wind cost trend



Source: Discussion Draft of NREL 2016 Annual Technology Baseline Now Available for Review. Retrieved from http://www.nrel.gov/analysis/data_tech_baseline.html

Other Distributed Resources

- Technology innovation is impacting the industry
  - "Distributed Resources" go beyond "Distributed Generation" and will be considered as they mature
  - Microgrids
  - Energy storage
  - Voltage controls
  - Electric vehicles

Questions?

Demand Side Resources

Jake Allen, DSM Program Development Manager

Section Overview

- Demand side management (DSM) definition
- IPL's DSM Experience
- Current DSM programs (2015-2016)
- Update of DSM "Action Plan" for 2017
- Anticipated filing schedule for approvals to continue to offer DSM programs
- New Market Potential Study (MPS) underway

Demand Side Management

- Encompasses both:
  - Energy Efficiency – reduced energy use for a comparable or imposed level of energy service (kWh)
  - Demand Response – a reduction in demand for limited intervals of time, such as during peak electricity usage or emergency conditions (kW)

Demand side resource alternatives

Demand Side Resource Examples			
	2015 MWh Savings	Performance Attributes	Representative First Year Cost per kWh (on net basis)
Energy Efficiency programs			
- Residential Lighting	15,908	Dependent upon customer participation	$ 0.19/kWh
- Small Business Direct Install	4,407		$0.30/ kWh
	MW Savings	Performance Attributes	Representative Cost per Installed KW
Demand Response programs – - Air Conditioning Load Management (ACLM)	30	Peak Use	$300
- Conservation Voltage Reduction	20	Peak Use	Field assets are in place for this capacity

How do supply and demand side resources compare?

Characteristic	Supply	Demand
Size in terms of capacity	+++ (10-700 MW)	+ (1-10 MW)
Flexible response to capacity need	+	+++
Initial Costs	+++	+ to ++
Ongoing Costs	++	+
Lead time	++	+
Dispatchability	+++	+ to ++
Dependent upon customer behavior	+	+++

+ reflects relative scale

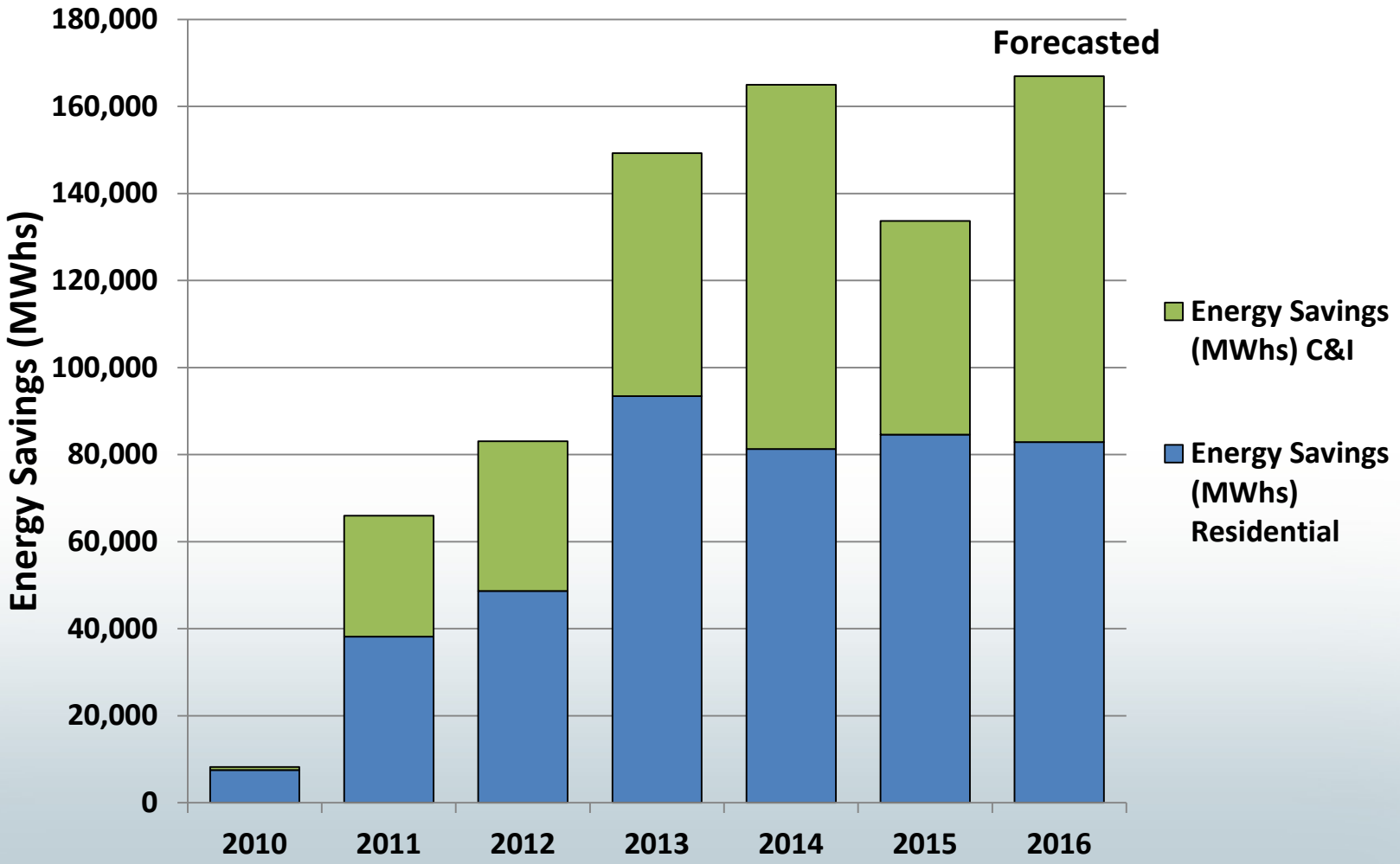
IPL's DSM experience

- IPL has offered DSM since 1993
- Commission Generic Order issued in 2009 (covered 2010-2014)
- Currently offering DSM Programs for a two year period (2015-2016)
  - pursuant to approvals in Cause No. 44497
- Current DSM efficiency goal is approximately 1.1% of total sales

Current DSM programs

Current Program Offerings
Residential
Air Conditioning Load Management
Appliance Recycling
Home Energy Assessment
Income Qualified Weatherization
Lighting
Multi-Family Direct Install
Online Assessment w/ Kit
Peer Comparison Reports
School Education w/ Kit
Business (C&I)
Air Conditioning Load Management
Custom Projects
Prescriptive
Small Business Direct Install

DSM program achievement



DSM guiding principles

- Offer programs that:
  - Are inclusive for customers in all rate classes
  - Are appropriate for our market and customer base
  - Are cost effective
  - Modify customer behavior
  - Provide continuity from year to year

Other planning considerations

- Large Commercial and Industrial Customer Opt out
  - Customers with demand > 1 MW may elect to opt-out of utility sponsored DSM programs
  - Customers representing approximately 26% of IPL's sales are eligible to opt-out
  - Approximately 81% of eligible customers have opted out
- Cost effectiveness challenges due to changing baselines – e.g. lighting

DSM Market Potential Study (MPS)

- 1st step in DSM planning
- Underway for 2018-2037
- Initial Kick Off Meeting was held late February
- Screening analysis to prepare for IRP modeling inputs completed by May

DSM planning – 2017

- Expect to propose one-year extension of current programs
  - Approvals would allow us to continue delivery of DSM programs in 2017
  - While the current IRP modeling is completed
  - IPL plans a filing with the Commission in May 2016
  - Updating previously filed 2015-2017 DSM Action Plan for 2017

Future planning – beyond 2017

- Develop a three year DSM Action Plan (2018-2020) consistent with the 2016 IRP
  - New Market Potential Study (2018-2037)
  - Identify blocks of DSM as a selectable resource for modeling in the IRP
  - DSM will be evaluated in multiple scenarios
  - With the expectation of making a filing in early 2017 for a three-year approval

Questions?

DSM Modeling Options

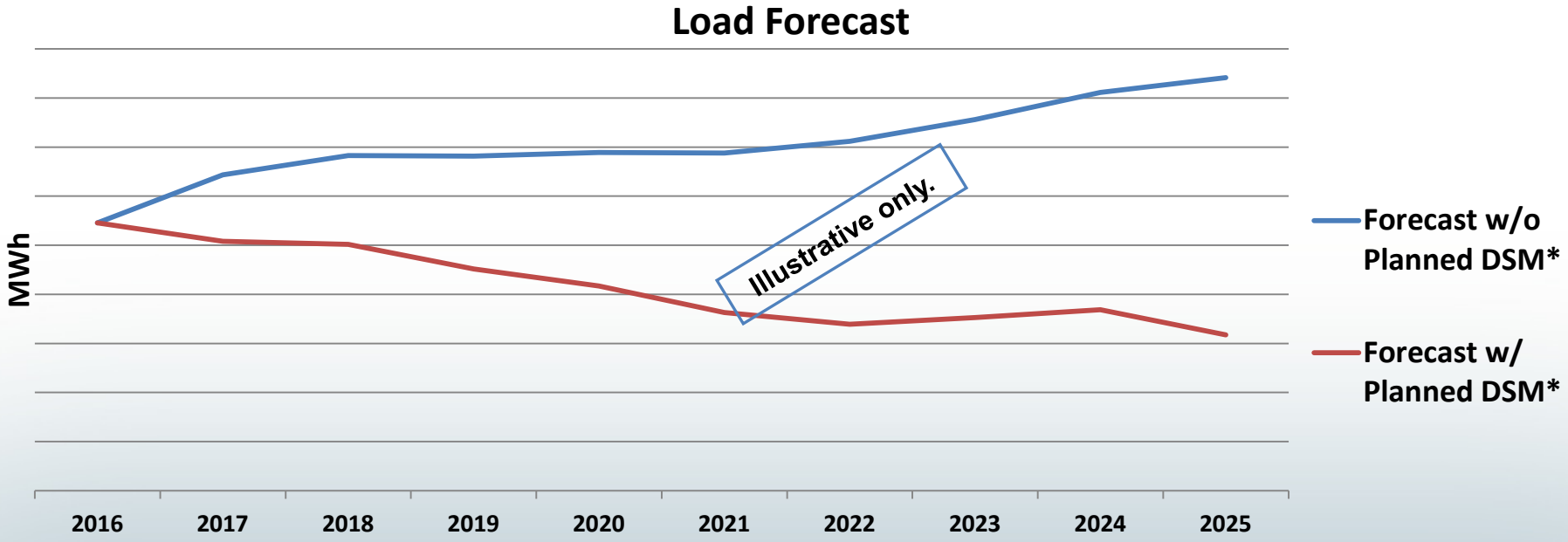
Erik Miller, Senior Research Analyst

DSM modeling options

Historical IRP Approach

Market Potential Study determines cost effective DSM Action Plan

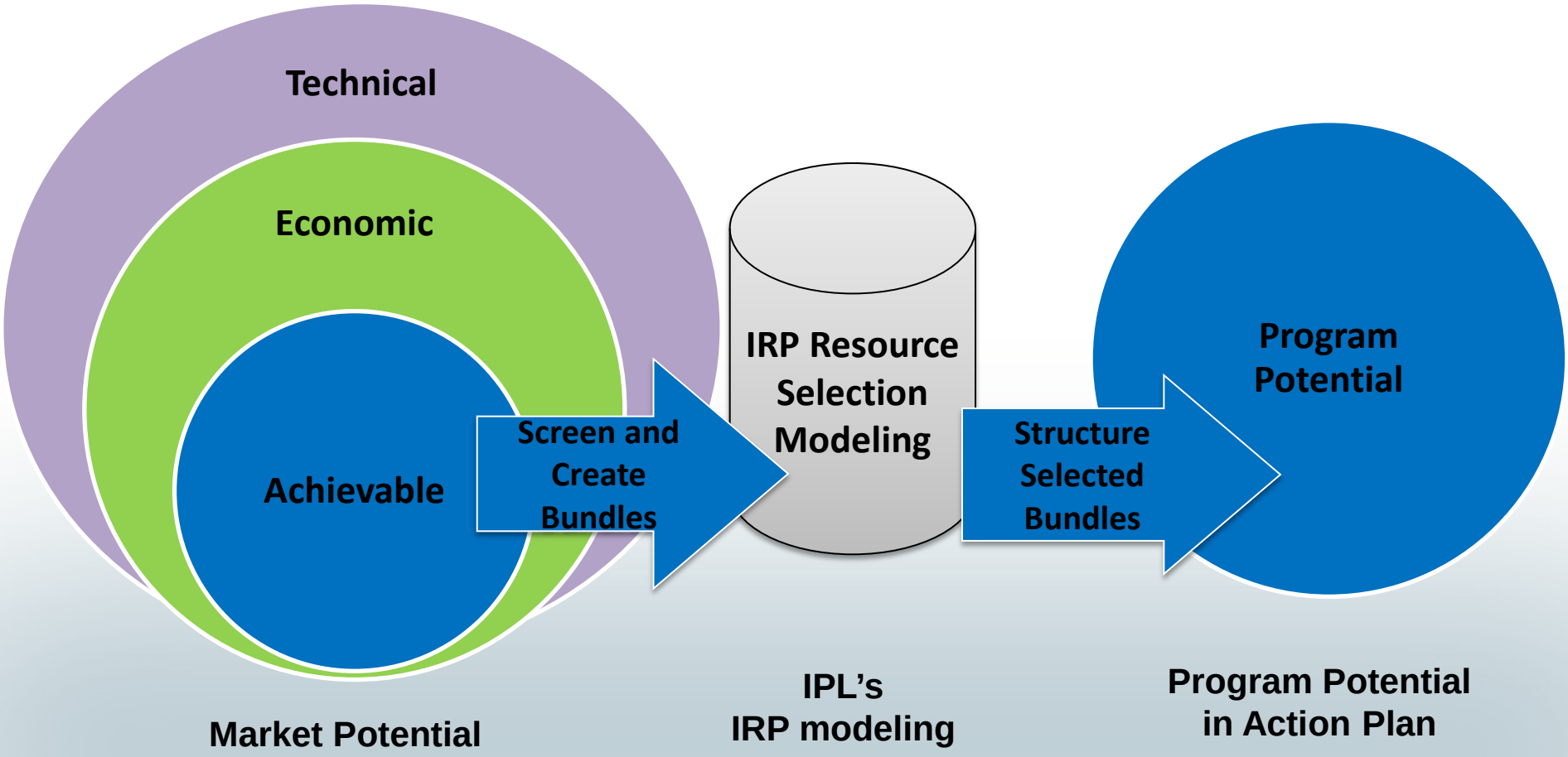
DSM Action Plan reduced from load forecast



*Past DSM performance and organic efficiency included in forecast.

DSM modeling options

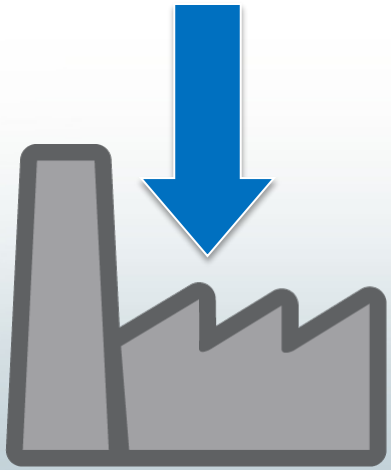
DSM as a Selectable Resource



Creating a DSM selectable resource

Different Bundling Approaches

Simple Cycle Gas Turbine
160 MW
Low capacity factor
Peaker

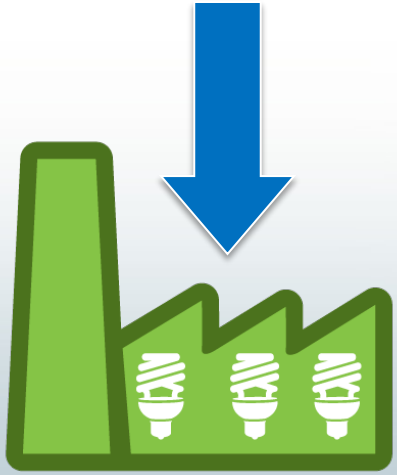


"CT" Power Plant

HEA Program Bundle
Measures include:
CFLs
LEDs
Low Flow Showerheads
Faucet Aerators
Programmable Thermostat
Energy Assessments

DSM "Program" Bundle

Portfolio Bundle
Home Assessment Program
Multifamily Program
Peer Comparison Program
Residential Lighting Program
School Education Program
Appliance Recycling Program

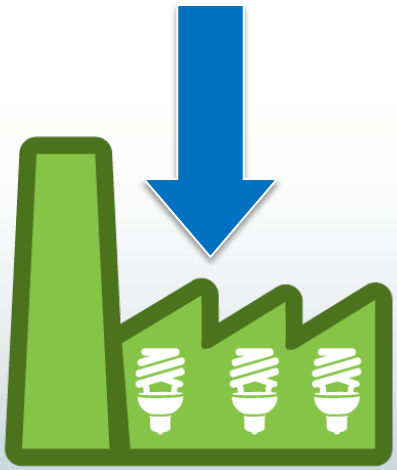


DSM "Portfolio" Bundle

Creating a DSM selectable resource

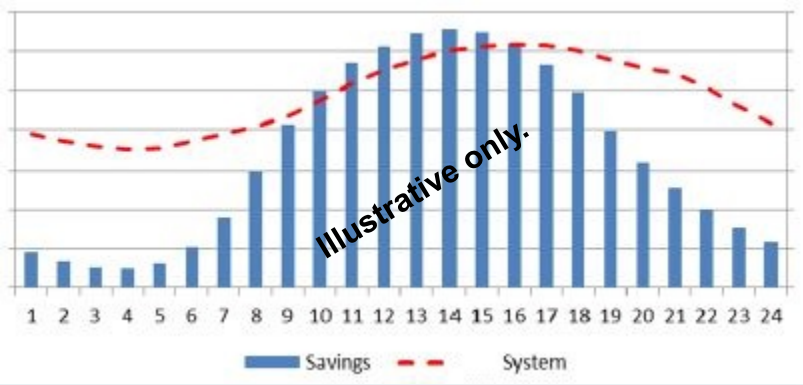
Similar Measure "HVAC" Bundle

Air Conditioners
Heat Pumps
Ductless Heat Pumps
AC Tune Up
ECM
Programmable Thermostats



DSM "Similar Measure" Bundle

"HVAC" Bundle Load Shape



Creating a DSM selectable resource

- Create a "bundle" of Energy Efficiency or Demand Response that resembles a power plant
- Bundle Characteristics
  - Cost to "build"/implement
  - Installed cost ($/kWh)
  - Load shape (8,760 hours)
  - Timing for implementation
  - Ramp rate
- Sectors
  - Residential
  - Commercial & Industrial

IRP/DSM pilot runs

- Objectives
  - Identify a potential approach for DSM block structures
  - Understand how the resource assessment model handles DSM
- Approach
  - Modeled individual residential program blocks based on 2015 DSM programs
  - DSMore model was used to create block load shapes
  - Load shapes were inputs in the resource assessment model
- Findings
  - Limited program offerings in early years
  - Staggered program selections
  - Less “cost effective” programs don’t get selected
  - Program bundles contribute to staggered offerings

Questions?

Lunch Break

Risk Discussion

Joan Soller, Director of Resource Planning

Risks include internal and external factors

- Planning Risks
  - Environmental Regulations
  - Fuel Costs
  - MISO Market Changes
    e.g. capacity auction, fast ramp products
  - Economic Load Impacts
  - Weather
  - Customer Adoption of DG
  - Technology Advancements
    e.g. solar and wind costs
- Operational Risks
  - Fuel Supply
  - Generation Availability
  - Construction Costs
  - Production Cost Risk
  - Access to Capital
  - Regulatory Risk

Environmental Regulations

- Recent Environmental Regulations/Projects
  - Mercury and Air Toxics Standard (MATS)
  - National Pollutant Discharge Elimination System (NPDES) Water Discharge Permits
  - Cross State Air Pollution Rule (CSAPR)
- Future Environmental Regulations
  - Coal Combustion Residuals (CCR)
  - National Ambient Air Quality Standards (NAAQS)
  - Effluent Limitations Guidelines (ELG) Rule
  - 316(b) – Cooling water intake structures
  - Office of Surface Mining
  - Clean Power Plan (CPP)

Exercise

- Seek stakeholder feedback regarding risk likelihoods and/or importance

Scenario Discussion

Ted Leffler, Senior Risk Management Analyst

Planning under uncertainty

- Uncertainty = Potential for change
  - Examples:
    - Environmental Regulations
    - Commodity Prices
    - Load
    - Renewables Penetration
    - Distributed Generation Penetration
- Scenarios and sensitivity analysis are two forms of uncertainty analysis used in resource planning

Scenarios

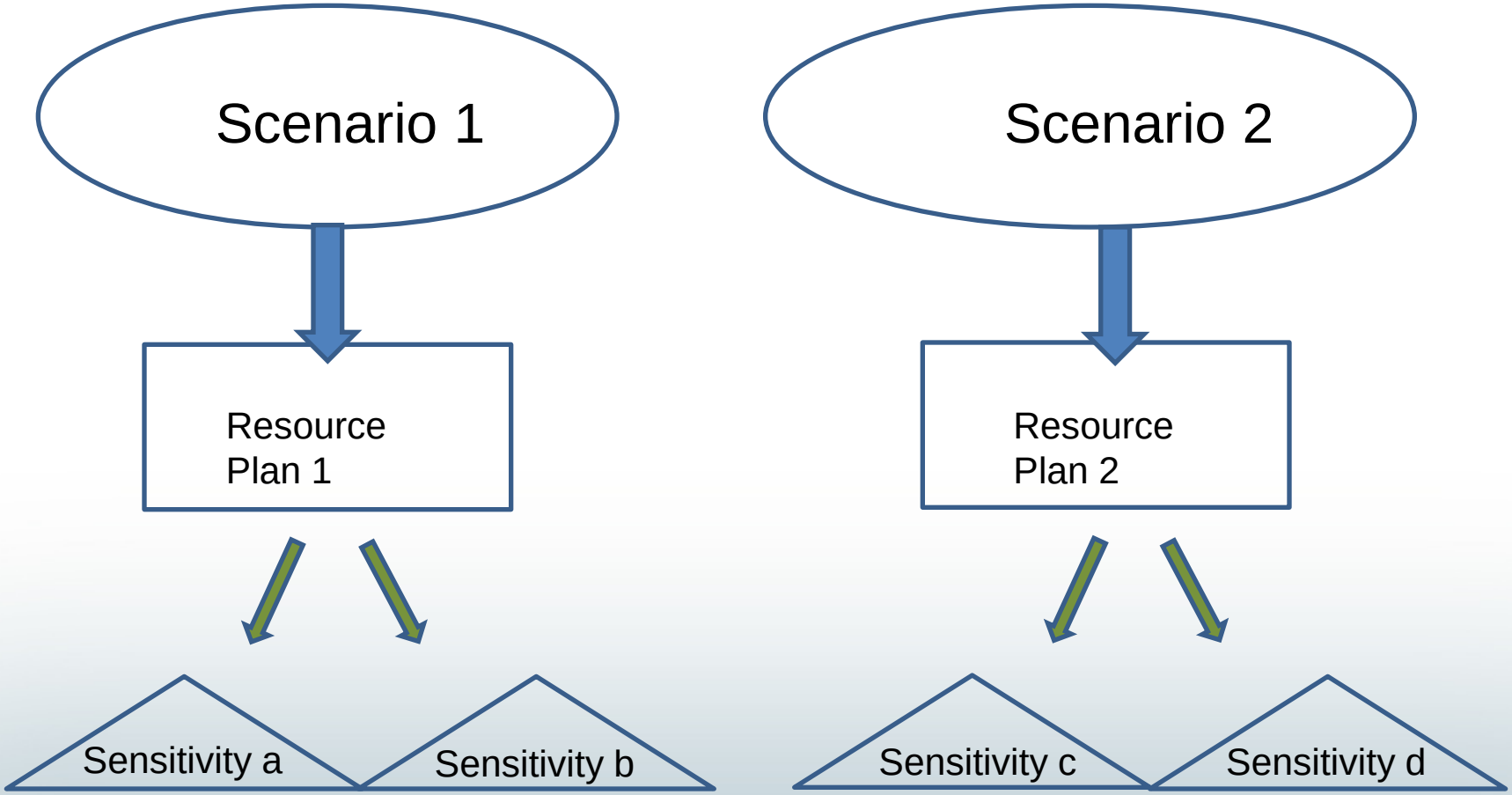
- *"A scenario is*
  - a simulation of a future world technical, regulatory and load environment."*
- *A scenario is not…*
  - A resource plan
  - A sensitivity
  - Not a representation of preferred outcome
- Base Case Scenario
  - "The base case [scenario] should describe the utility's best judgment (with input from stakeholders) as to what the world might look like in 20 years if the status quo would continue without any unduly speculative and significant changes to resources or laws /policies affecting customer use and resources."*

*2015 Director's Report

What is a Sensitivity?

- A sensitivity measures how a resource plan performs across a range of possibilities for a specific risk or variable

Scenarios and Sensitivities



Scenario development process

- Cross functional IPL team considered future risks
- Reviewed other utilities IRP scenarios
- Reviewed MISO MTEP 2017 scenarios
- Qualitatively discussed recent trends/significant changes and impact likelihoods

Scenario development process

- Developed a list of risks or ‘major forces that might move the world in different directions’*
  - Economic Growth
  - Change in electricity use
  - Commodity Prices
  - Capital Costs
  - CO_2 regulation
  - Other environmental regulation
  - Change in Renewable & Storage Costs
  - Distributed Generation Adoption

* Source: Electric Power Resource Planning Under Uncertainty: Critical Review and Best Practices, White Paper, November 2014 Prepared by Adam Borison

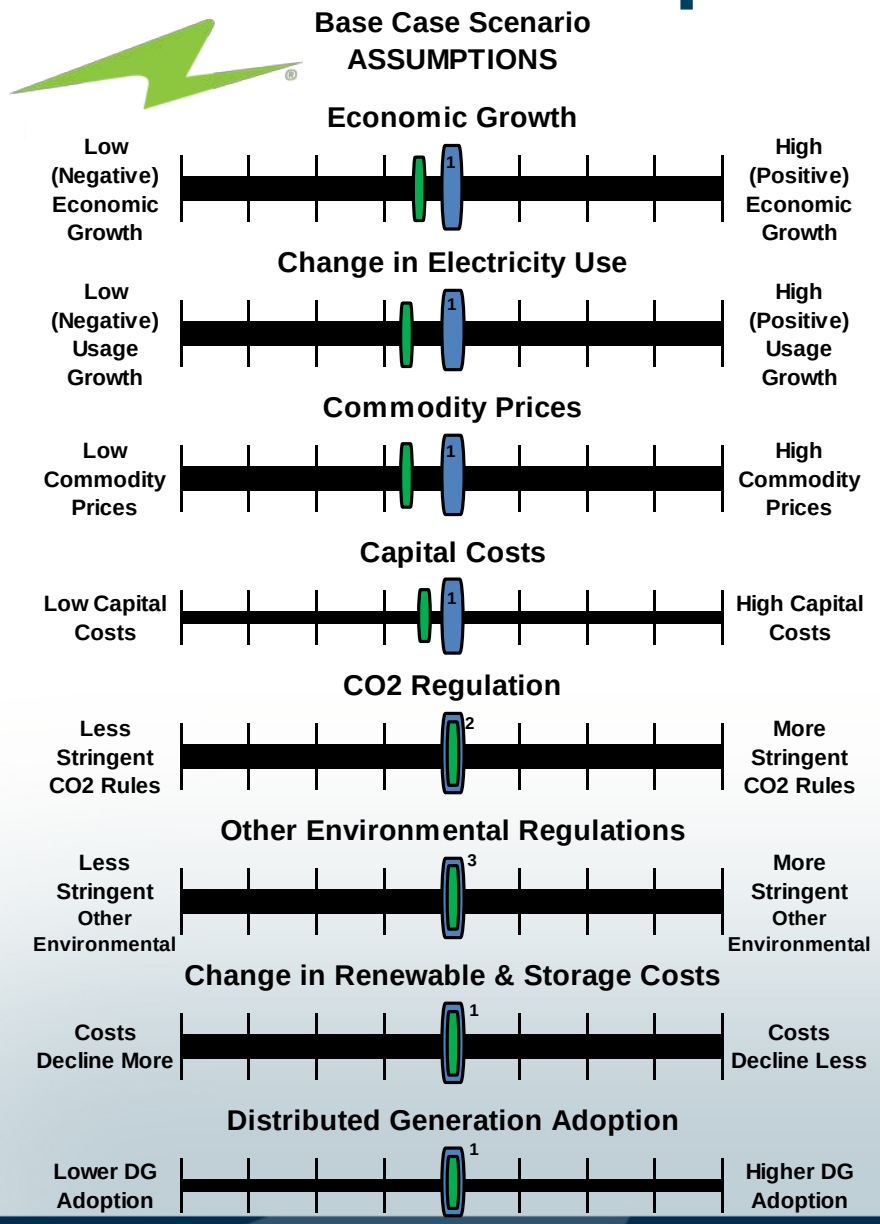
Scenario development process

- Developed a list of potential futures
  - Base Case
  - Robust Economy
  - Recession Economy
  - Strengthened Environmental Rules
  - High Customer Adoption of Distributed Generation (DG)

Potential Scenarios

- Base Case
  - Only known events and expected trends
  - Commodity prices influenced by Clean Power Plan (CPP) beginning in 2022
  - Existing environmental regulations realized
  - Moderate decreases in technology costs for renewables and storage
- Robust Economy
  - High local and national economic growth
- Recession Economy
  - National and local economic downturns
- Strengthened Environmental Rules
  - Higher compliance costs for known regulations including CO_2 + RPS
- High Adoption of Distributed Generation
  - Customers adopt DG with lower technology costs

Example Scenario – Base Case



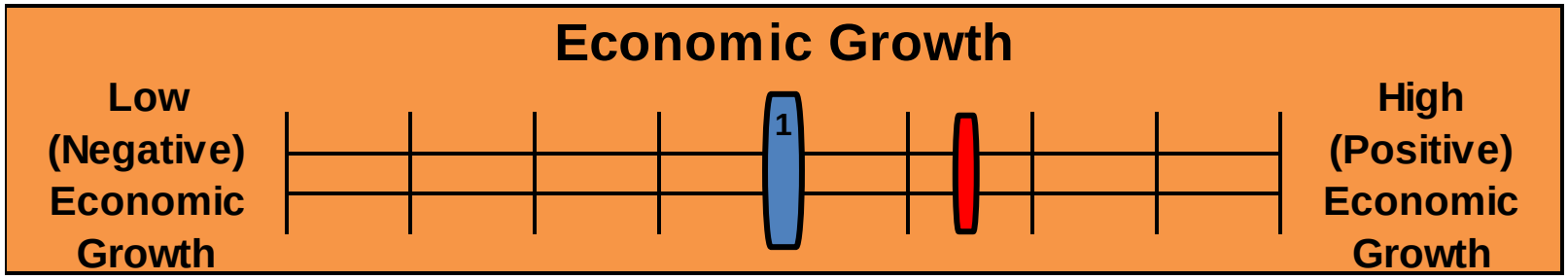
Examples are illustrative only.

Footnotes:

- #1 = 1 = Historic Average
- #2 = 2 = CO2 regulation based on August 2015 Rules. Mass Based.
- #3 = 3 = Existing Environmental Regulations
- = Base Case Scenario Assumption Level

Example Scenario – Robust Economy

Robust Economy Case Scenario
ASSUMPTIONS



Other risks / major driver levels = Base Case Levels

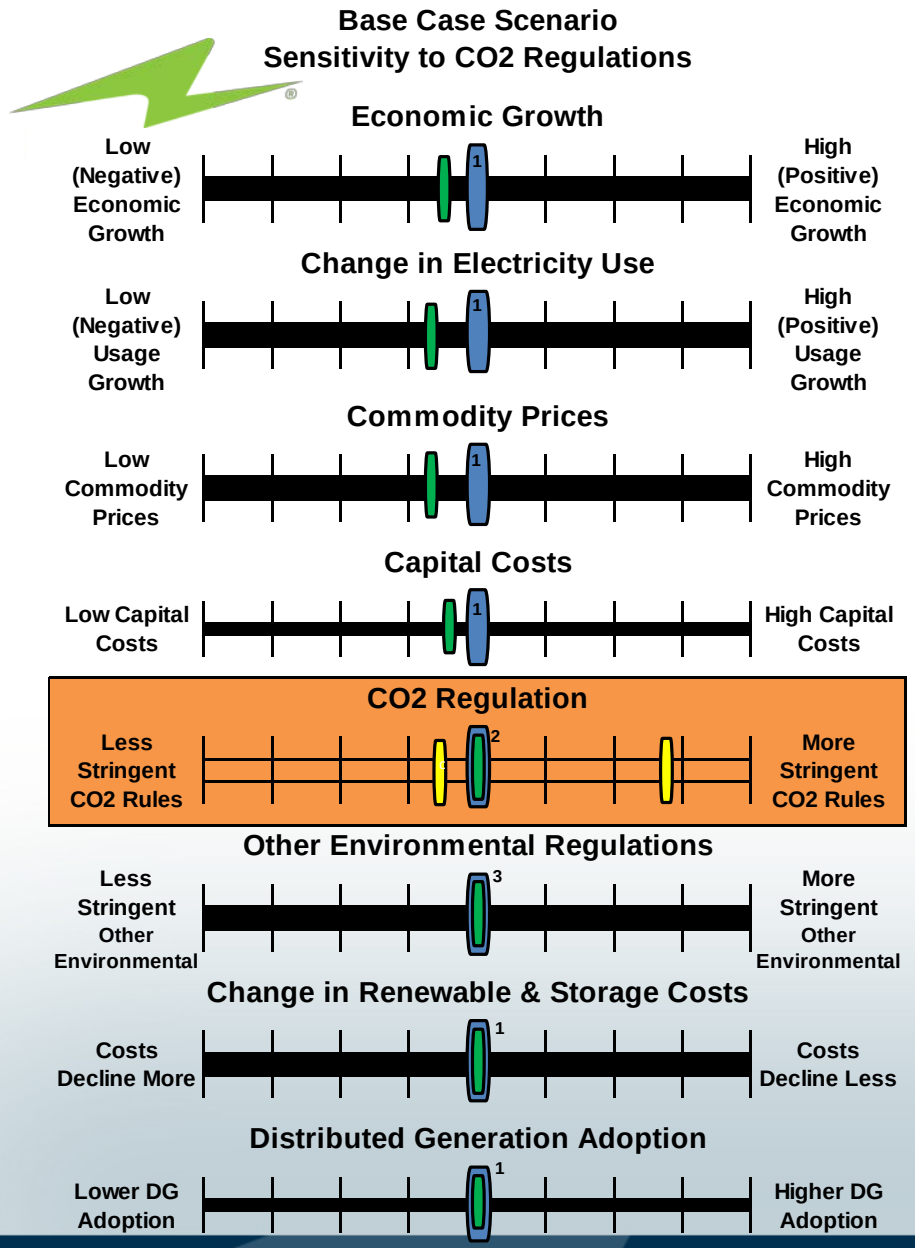
Examples are illustrative only.

Footnotes:

#1 =  = Historic Average

 = Robust Economy Case Scenario Assumption Level

Example Sensitivity - Base to CO2



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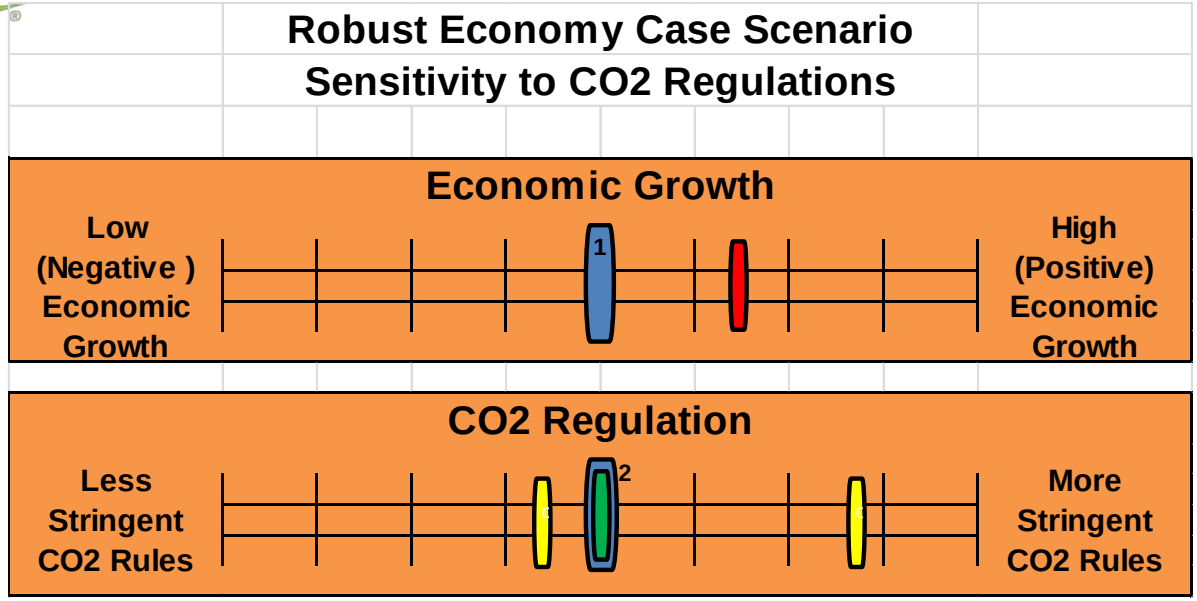
- #3 = = Existing Environmental Regulations
- = Base Case Scenario Assumption Level
- = CO2 Sensitivity Levels

Example Sensitivity – Robust Economy to CO2



Other risks / major driver levels = Base Case Levels

Examples are illustrative only.

Footnotes:

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- #2 = 2 = CO2 regulation based on August 2015 Rules. Mass Based.
- = Base Case & Robust Economy Scenario Assumption Level
- = Robust Economy Case Scenario Assumption Level
- = CO2 Sensitivity Levels

Exercise

- Seek stakeholder feedback regarding scenarios

Next Steps

Dr. Marty Rozelle, Facilitator

Next meetings

June 14, 2016

- Stakeholder Points of View presentations
- Load Forecast and Forecasting Methodology
- RTO/ MISO/Resource Adequacy
- Transmission & Distribution
- Environmental Risks including Clean Power Plan
- Modeling Parameters

September 16, 2016

- Resource Portfolio results
- Sensitivities
- Preferred Resource Plan
- Short Term Action Plan

Written comments and feedback

- Deadline to send written comments and questions regarding this meeting to ipl.irp@aes.com is Monday, April 18
- All IPL responses will be posted on the IPL IRP website by Monday, May 2

Thank you!