Integrated Resource Plan Public Advisory Meeting #2

June 14, 2016

Welcome & Safety Message

Bill Henley, VP of Regulatory and Government Affairs

Meeting Guidelines

Dr. Marty Rozelle, Facilitator

Agenda for today

9:00am Welcome

Meeting Agenda and Guidelines

Summary & Feedback from IRP Public Advisory Meeting #1

Stakeholder Presentations

10:25am Break

Portfolio Comparison based on Metrics

Metrics Exercise

Resource Adequacy

12:00 – 12:30pm Lunch

Transmission & Distribution

Load Forecast

Environmental Risks

2:00pm Break

Modeling Update

Portfolio Exercise

Closing Remarks & Next Steps

3:15pm Meeting Concludes

Meeting Guidelines

- Time for clarifying questions at end of each presentation
- Small group discussions
- 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 June 21
- IPL will respond via website by July 5

Active Cases before the Commission

- Cause No. 42170, ECR-26
- Cause No. 44121, Green Power (GPR 9)
- Cause No. 43623, DSM 13
- Cause No. 44576, Rates (under appeal)
- Cause No. 44792, DSM 2017 Plan
- Cause No. 44794, SO_2 NAAQS and CCR
- Cause No. 44795, Capacity and Off System Sales Riders

Summary & Feedback from IRP Public Advisory Meeting #1

Joan Soller, Director of Resource Planning

Topics covered in Meeting #1

- IPL's IRP process and objective
- Supply side, distributed and demand side resources
- Modeling Demand Side Management (DSM) as a selectable resource
- Planning risks
- Scenario development with interactive exercise

Scenarios Exercise from Meeting #1 - Base Case

Scenario	Agree	Disagree	Proposed Integration
Base Case	• CPP – how specifically will it be included? • Pretty much agree with it.	• Smart homes should be included as a technology. • Why not include utility- owned DG? • Fuel prices including natural gas will increase more than indicated. Where is this reflected in the scenarios? (Can run sensitivities for this.)	• CPP will be modeled as mass-based • IPL will incorporate energy management and its technology-based smart thermostat pilot in DSM blocks • DG will be an input and may be customer or utility owned • IPL will run high/low sensitivities on commodities

Scenarios Exercise from Meeting #1 - Robust Economy

Scenario	Agree	Disagree	Proposed Integration
Robust Economy	• Could happen, would be nice if it did. • Agree that it's a potential future, but would not necessarily lead to increased electricity use. • Could lead to higher DG adoption.	• May not lead to increased use of electricity. • Capital costs might go up due to higher costs of materials.	• The load forecast will be a sensitivity in this scenario. • Still thinking about how to address varying capital costs for supply side resources.

Scenarios Exercise from Meeting #1 – Recession Economy

Scenario	Agree	Disagree	Proposed Integration
Recession Economy	• Hope it doesn't happen but it could – depends on things outside of our control, e.g. exodus or influx of people to Indiana. • A possibility. Question of whether shrinking industrial base is unique to this scenario – could happen in others.	• N/A	• Will likely run high/low load forecast sensitivities in other scenarios to incorporate potential recession effects

Scenarios Exercise from Meeting #1 - Strengthened Environmental Rules

Scenario	Agree	Disagree	Proposed Integration
Strengthened Environmental Rules	• Carbon tax is possible	• What if the Renewable Portfolio was federal or state? Could be part of the CPP. (Would probably have about the same impact.)	• In this scenario, there will be a 20% RPS in 2022 based on a national average. This could be federal or state proposed.

Scenarios Exercise from Meeting #1 – High Customer Adoption of DG

Scenario	Agree	Disagree	Proposed Integration
High Customer Adoption of DG	• There are reasons other than economic to go to DG. Residents seem to be more attracted, businesses less attracted. • Possible. If it's cost-effective there would be more community solar.	• N/A	• There will be some DG embedded in this scenario as a proxy for customers who will choose DG for reasons in addition to economics.

Additional stakeholder interaction

- Since the April meeting, IPL met with the following stakeholders:
  - IURC
  - OUCC
  - CAC
  - Sierra Club
  - Citizens Energy

Additional stakeholder interaction (cont'd)

- Continue to involve stakeholders in developing assumptions
- Consider C&I customer input in load forecast
- Consider discrete DSM bundles
- Coordinate planning efforts with Citizens Energy
- Consider more expansive sensitivities

Meeting #1 materials

- Approximately 20 stakeholders participated
- Presentation materials, audio recording, acronym list, and meeting notes are available on IPL's IRP webpage here: https://www.iplpower.com/irp/

Questions?

Stakeholder Presentations

Presenter #1: Denise Abdul-Rahman, Environmental Climate Justice Chair, NAACP Indiana

Presenter #2: Dr. Stephen Jay, Professor,

IU Fairbanks School of Public Health

Presenter #3: Larry Kleiman, Executive Director, Hoosier Interfaith Power & Light

Presenter #4: Jodi Perras, Indiana Campaign Representative, Sierra Club Beyond Coal

Short Break

Portfolio Comparison based on Metrics

Megan Ottesen, Regulatory Analyst

Resource Selection Process

1. Forecast energy and peak demand needs
2. Identify Risks and Develop Scenarios
3. Put scenario inputs into the Capacity Expansion model
4. Apply sensitivities to the resource portfolio selection process
5. Calculate portfolio performance metrics

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1. Forecast energy and peak demand needs
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Portfolios will result from each of these scenarios

- Base Case
- Robust Economy
- Recession Economy
- Strengthened Environmental Rules
- High Customer Adoption of Distributed Generation

Introduction to metrics

- IPL will use several metrics to compare the benefits and costs of each scenario's portfolios
- In past IRPs, IPL primarily evaluated portfolios in costs measured by Present Value Revenue Requirement (PVRR)
- In addition to cost, IPL is considering the following categories to measure portfolio performances:
  - Financial risk
  - Environmental stewardship
  - Reliability

Metrics to consider

Cost	Financial Risk	Environmental Stewardship	Reliability
• Present Value Revenue Requirement (PVRR) • Rate Impact	• Cost Variance Risk Ratio	• Annual average CO_2 emissions • CO_2 intensity	• Planning Reserves • Flexibility

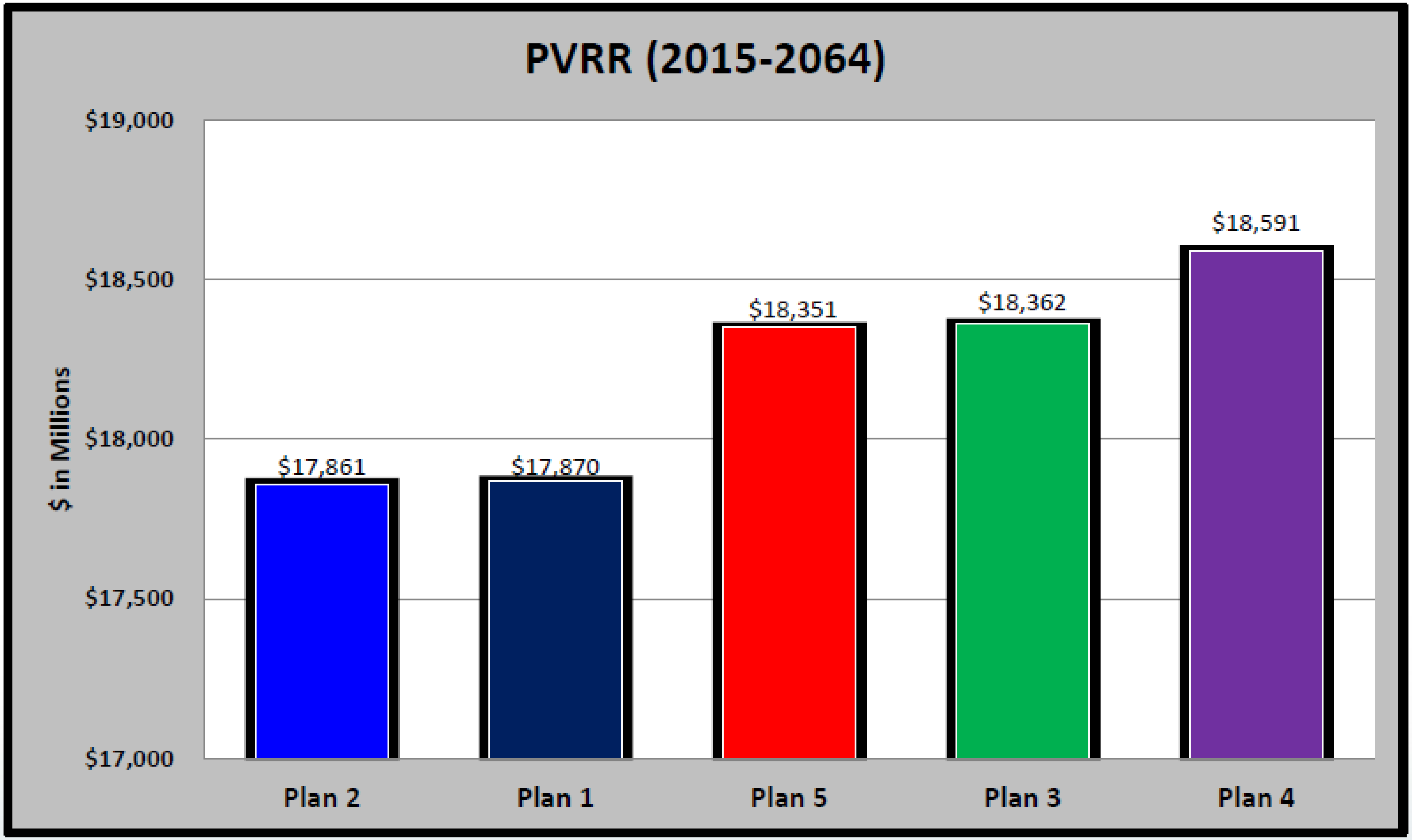
Cost Metrics

Present Value Revenue Requirement (PVRR):

- The total plan cost (capital and operating) expressed as the present value of revenue requirements over the study period

PVRR = Present Value of Revenue Requirements over the study period

PVRR Example



Source: IPL 2014 IRP

Cost Metrics

Present Value Revenue Requirement (PVRR):

- The total plan cost (capital and operating) expressed as the present value of revenue requirements over the study period

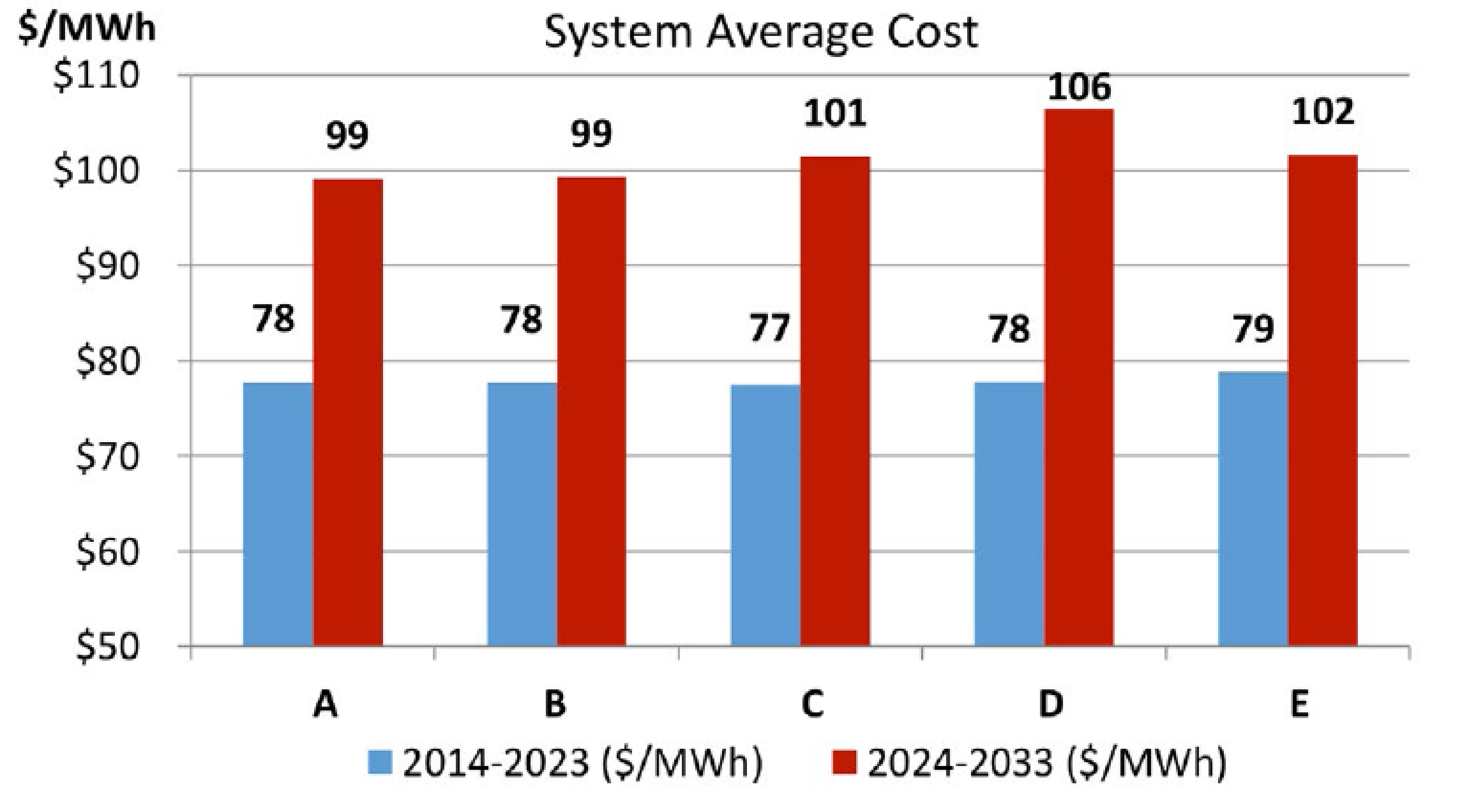
PVRR = Present Value of Revenue Requirements over the study period

Rate Impact:

- expressed in terms of cents/kWh for years 1-10 and 11-20
- Levelized average system cost

Rate Impact = $\dfrac{\text{\$ Total Revenue Requirements (10 yr period)}}{\text{Total kWh Sales (10 yr period)}}$

Rate Impact Example



Source: TVA 2015 IRP

Financial Risk Metrics

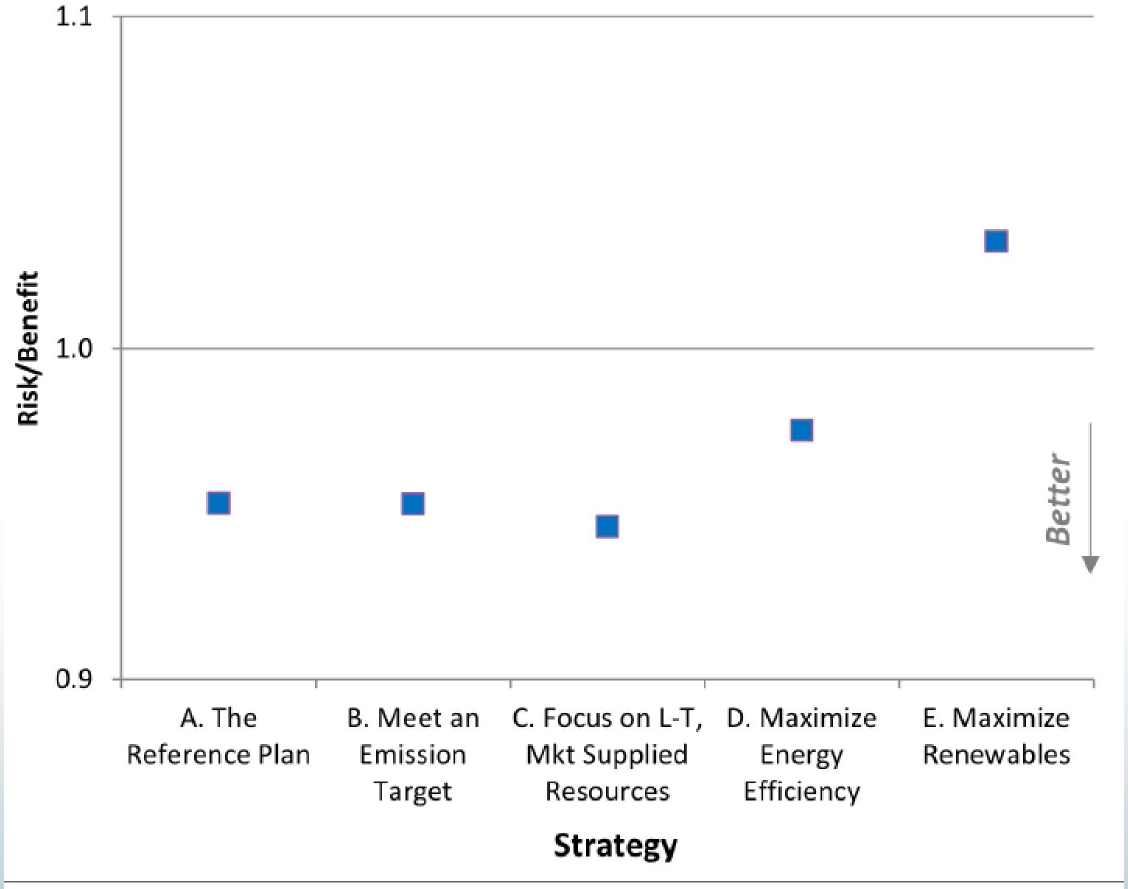
Cost Variance Risk Ratio:

- Shows how likely costs are to be higher or lower than the expected cost
- Ratio of how high costs could be to how low costs could be
- Calculated based on
  - Mean PVRR
  - Range of possible costs higher than mean PVRR
  - Range of possible costs lower than mean PVRR

$$\textbf{Cost Variance Risk Ratio} = \frac{95^{th}\text{ Percentile (PVRR)} - \text{Mean (PVRR)}}{\text{Mean (PVRR)} - 5^{th}\text{ Percentile (PVRR)}}$$

- Score less than 1.0: costs are more likely to be **lower** than mean PVRR
- Score greater than 1.0: costs are more likely to be **higher** than mean PVRR

Cost Variance Risk Ratio
(lower has less risk)



Source: TVA 2015 IRP

Strategy = Portfolio

Environmental Stewardship Metrics

Annual Average CO_2 emissions (tons)

– the annual average tons of CO_2 emitted over the study period

Annual Average CO_2 Emissions = $\frac{\text{Sum of } CO_2 \text{ tons emitted}}{\text{\# of years in the study period}}$

CO_2 intensity (tons/MWh)

– CO_2 Intensity for study period

CO_2 Intensity for study period = $\frac{\text{Sum of } CO_2 \text{ tons emitted}}{\text{MWh energy generated}}$

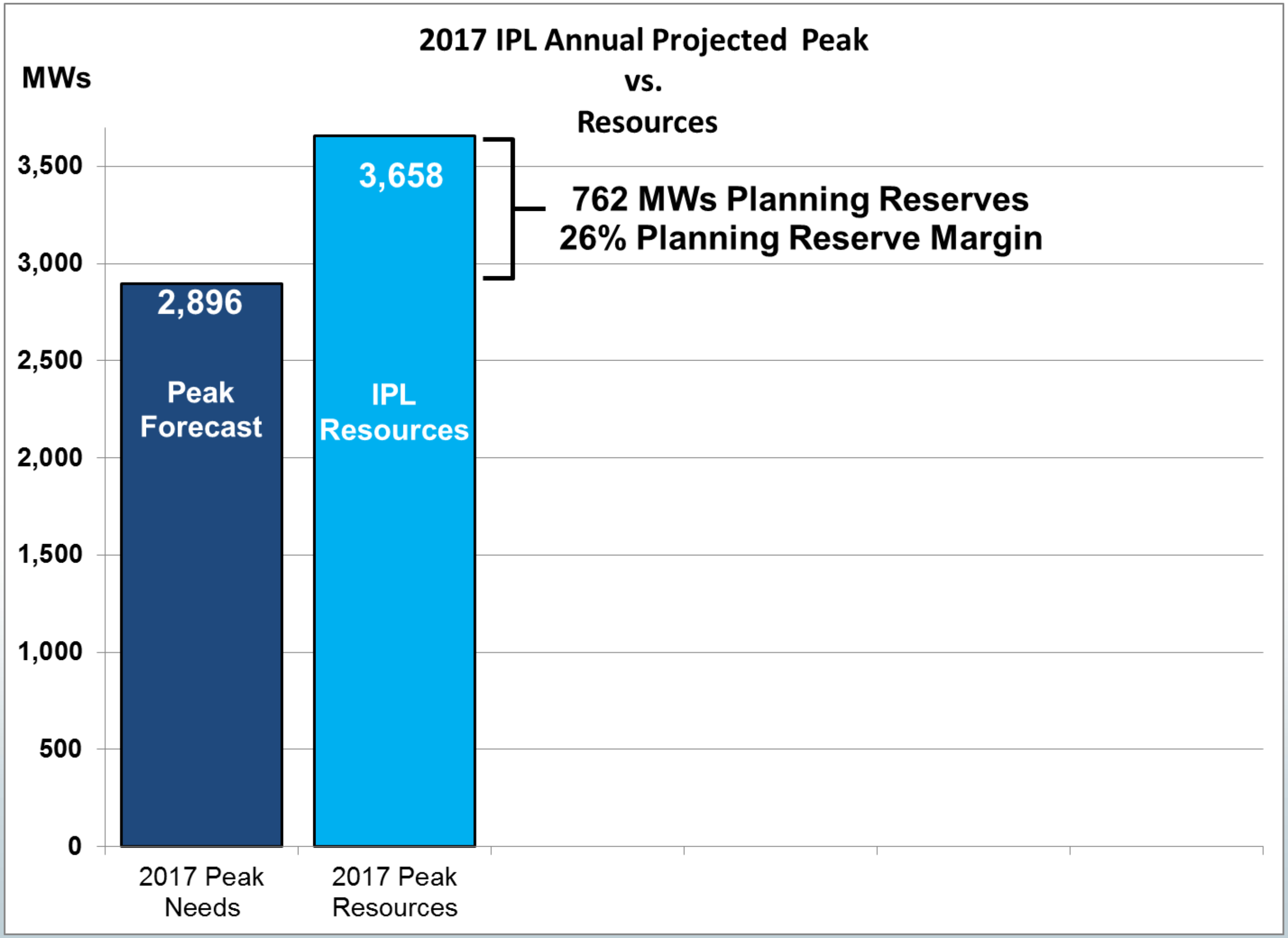
Reliability Metrics

Planning Reserves:

- MW of supply above peak forecast

Planning Reserves = IPL’s resources (MW) - utility load forecast (MW)

Planning Reserves for IPL



Reliability Metrics

Planning Reserves:

- MW of supply above peak forecast

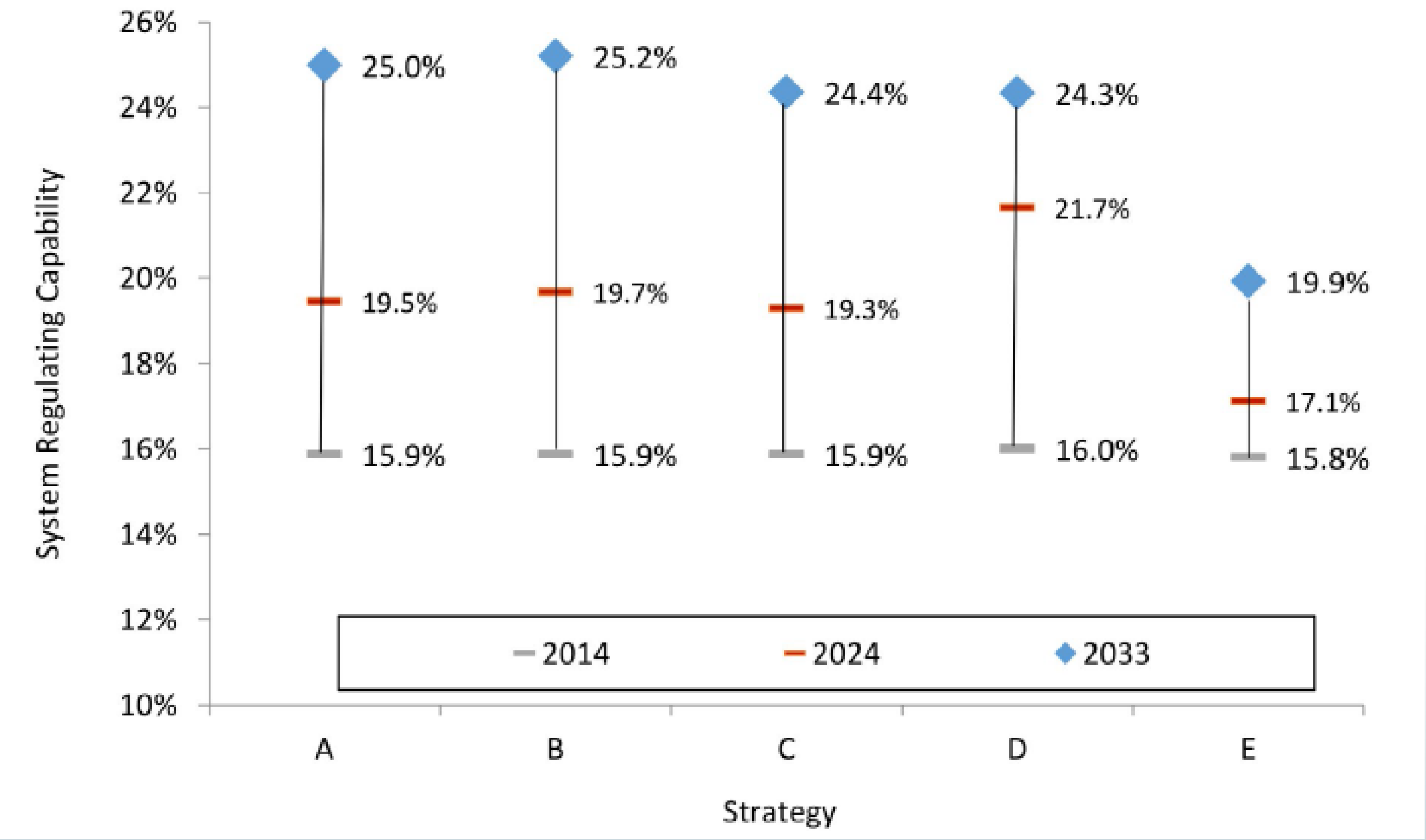
Planning Reserves = IPL's resources (MW) - utility load forecast (MW)

Flexibility:

- Ability of IPL's system to respond to load changes

Calculation = TBD open to input

Flexibility: (higher is more flexible)



Source: TVA 2015 IRP

Questions?

Cost	Financial Risk	Environmental Stewardship	Reliability
• Present Value Revenue Requirement (PVRR) • Rate Impact	• Cost Variance Risk Ratio	• Annual average CO_2 emissions • CO_2 intensity	• Planning Reserves • Flexibility

Metrics Exercise

Resource Adequacy

Ted Leffler, Senior Risk Management Analyst

Introduction

- IRP process focuses on the future portfolio of resources needed to meet the
  - peak and
  - energy
  - needs of our customers.
- Resource Adequacy (RA) focuses on peak needs
- Resource Adequacy is the responsibility of the regulated utilities (part of the obligation to serve)
- MISO administers a short term Resource Adequacy construct
  - MISO is not responsible for Resource Adequacy
  - MISO's construct is focused on existing not future resources

Definitions (1 of 5)

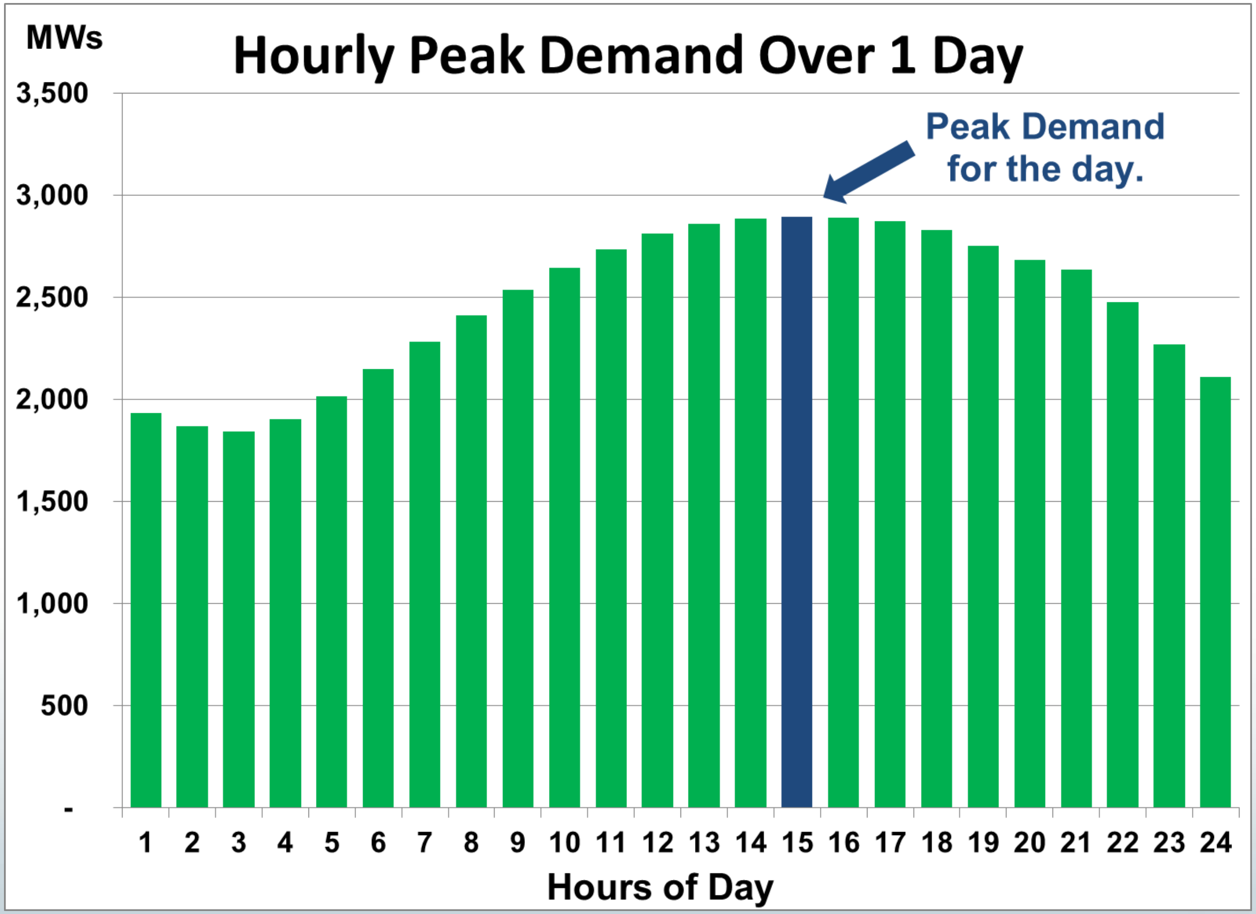
- **Resource Adequacy**
  - ensuring that IPL has sufficient Resources to meet anticipated peak demand requirements plus an appropriate planning reserve

- **RA Time Horizon**
  - Resource Adequacy = > year out

- **MWs**
  - Measure of power
  - 1 MW = 1,340 Horsepower

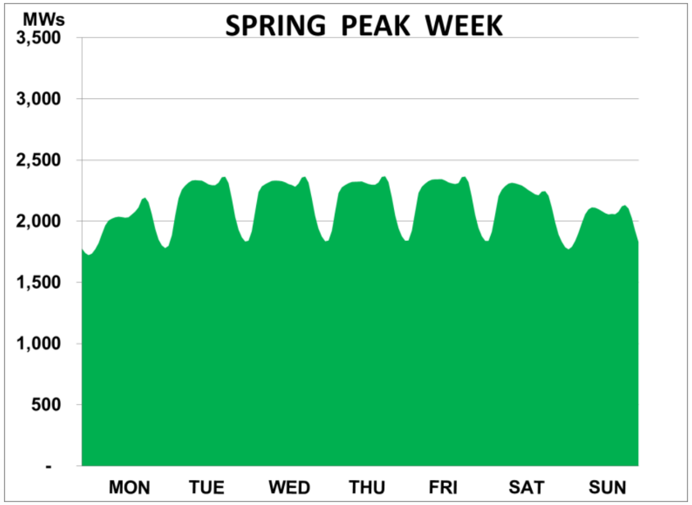
Definitions (2 of 5)

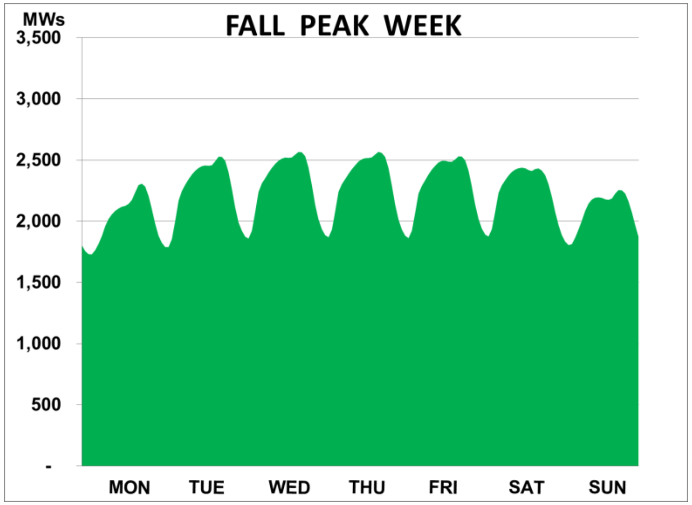
- **Peak Demand**
  - Instantaneous measure of the highest usage for a given period of time
  - Measured in MWs
    - MISO peak demand for summer 2017 estimate at about 123,000 MWs (165 million horsepower)
    - IPL peak demand for summer of 2017 estimate at about 2,900 MWs (3.9 million horsepower)

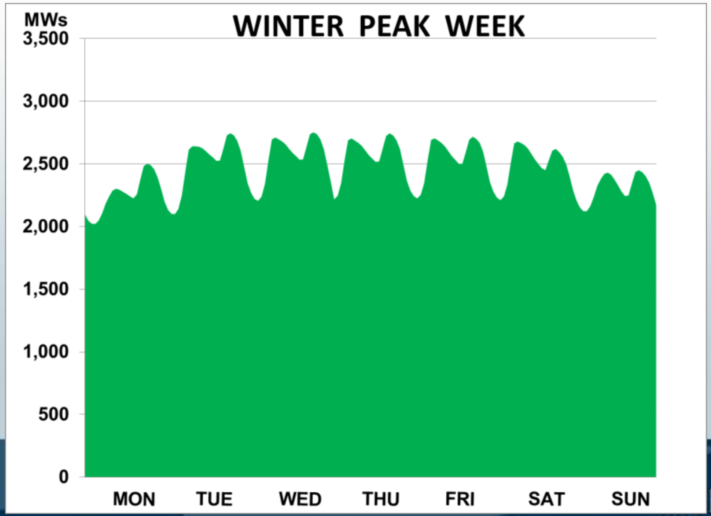


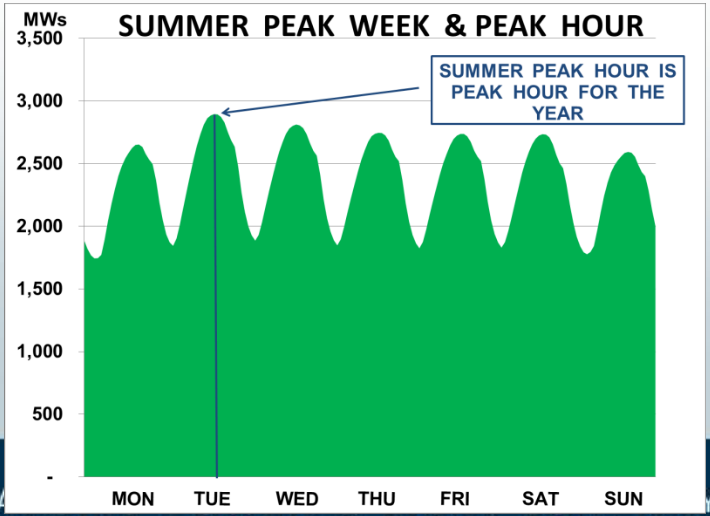
Definitions (3 of 5)

- **Peak Demand**
  - Instantaneous measure of the highest usage for a given period of time
  - In the Midwest and at IPL the peak demand typically occurs in the summer



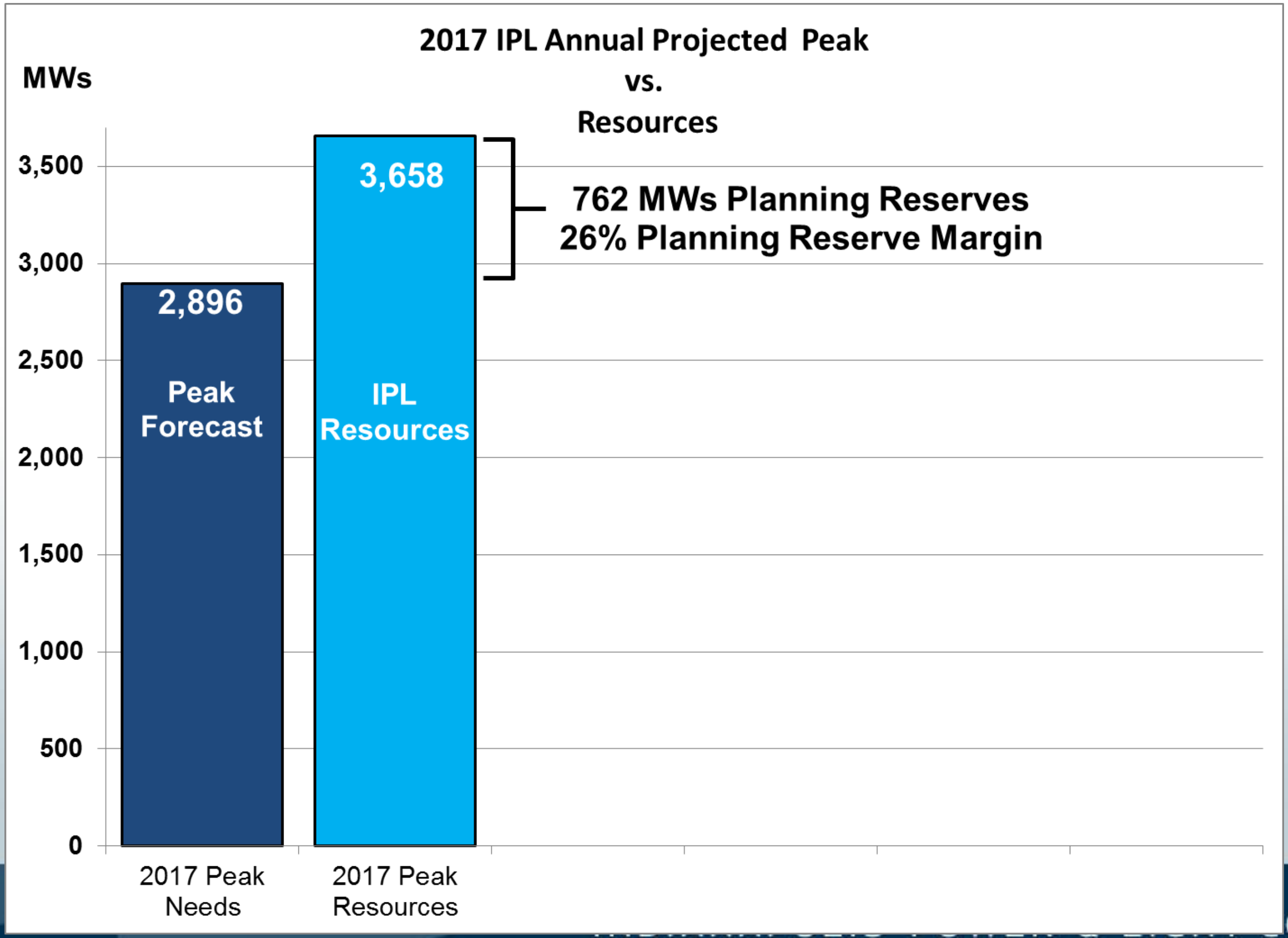






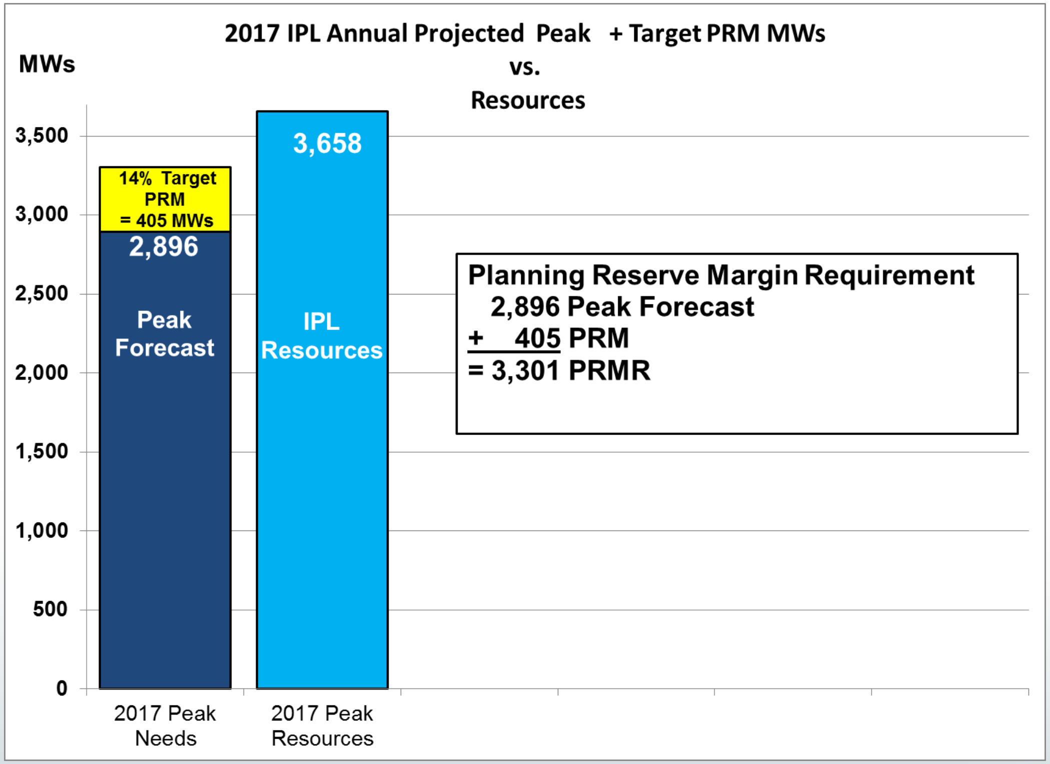
Definitions (4 of 5)

- Planning Reserve MWs
  - MW difference between the Peak forecast and generating unit availability
- Planning Reserve Margin (PRM)
  - The percentage of resources above the Peak forecast



Definitions (5 of 5)

- Target Planning Reserve Margin (Target PRM)
  - The percentage of resources above the Peak forecast needed to cover forecast and unit availability uncertainty
  - Calculated by MISO each November for the following summer
  - Result of the “Loss of Load Expectation Study”
  - This analysis produces a PRM that is expected to result in a loss of load event once every 10 years
- Planning Reserve Margin Requirement (PRMR)
  - MWs needed to meet the Peak forecast plus minimum MWs needed to cover potential for higher than normal peaks and lower than normal generating unit availability
  - PRMR = PEAK LOAD FORECAST X (1+Target PRM)
  - Calculated by MISO each November for the following summer
  - Typically around 14%: 7% for forecast uncertainty, 7% for availability uncertainty



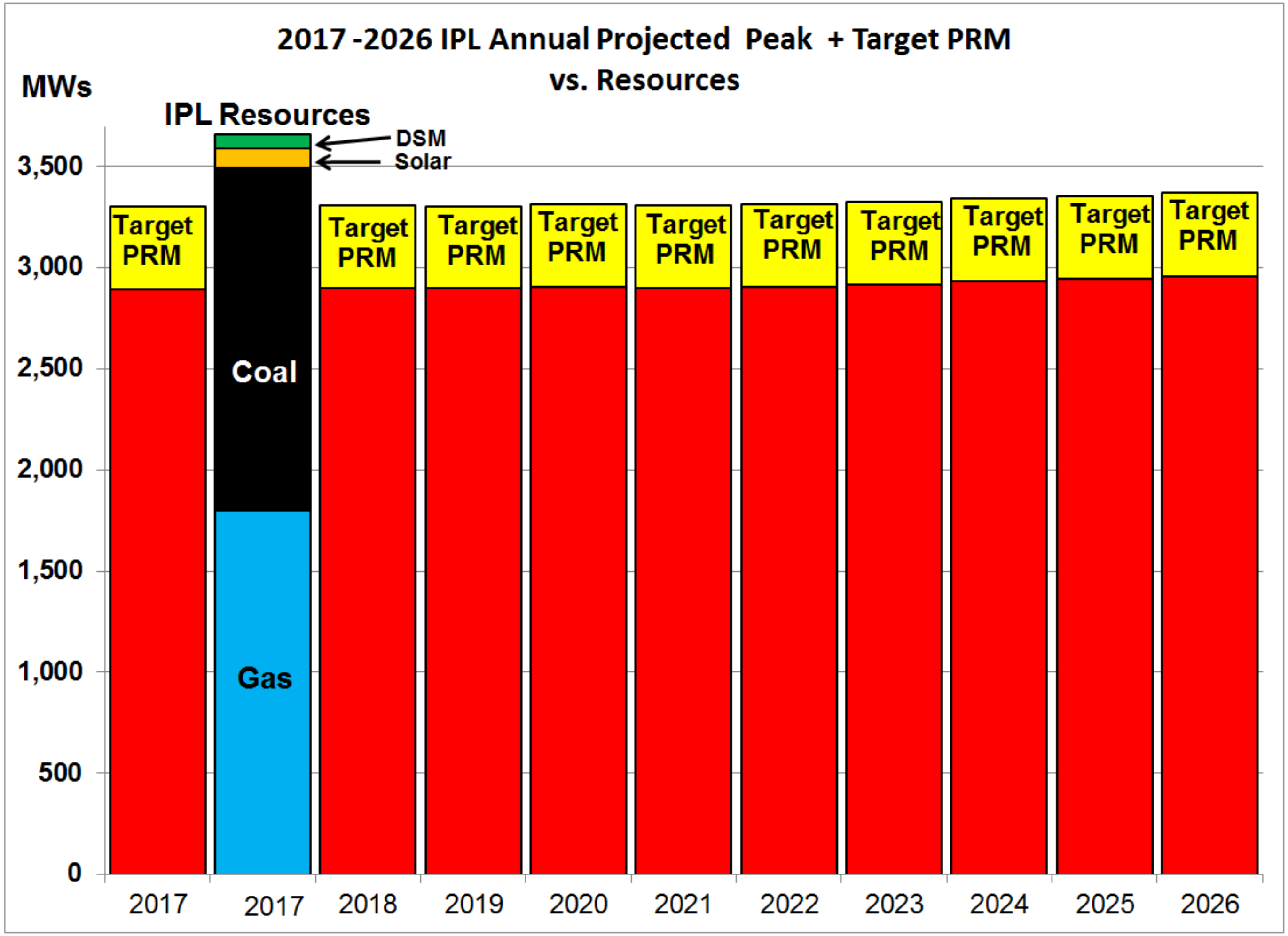
Planning to Provide Resource Adequacy

- IPL plans to meet the peak plus reserves with the following:
  - Demand Side Management Programs
  - IPL Generating Assets
  - Long Term Contracted Generating Assets
  - Balance of needs or excesses are purchased or sold in MISO capacity markets[1]

Footnote 1:
- Each year, prior to the summer, resource owners in MISO test the capacity level for each resource
- MISO populates an accounting system with 1 capacity credit for each MW of capacity
- Capacity credits can be purchased and sold
- Capacity credit sales do not impact energy sales
- Each utility with load must have capacity credits equal to its PRMR in the accounting system prior to the summer

IRP RA Process

- Resource Adequacy (RA) Process
  - Given current portfolio of resources
    - and future projected peak needs
    - and future projected energy needs
  - What portfolio of resources will be used to meet those needs?



MISO's RA Process

- In Indiana, RA Process is the responsibility of the Utilities
- IRP process and the certificate of need process are regulated by the State, and the responsibility of the 'obligation to serve' resides with the utilities
- MISO has a Resource Adequacy process but MISO is not responsible for Resource Adequacy
- IRP process is focused on the long term (several years out)
  - Focus is on future portfolio of resources
- The MISO Resource Adequacy process is focused on the short term: less than a year out
  - Focused on existing resources

MISO’s role is an administrator of a reserving sharing pool

- This reserve sharing pool allows utilities to benefit from the diversity of resources across MISO
- Investments in and deployment of resources is lumpy
- Some utilities are slightly short, others slightly long of meeting their RA targets
- MISO’s RA construct allows utilities that are temporarily short of meeting their RA target to purchase capacity credits from utilities that have more than enough resources to meet their short term RA targets
- Capacity credits are based on existing resources
- MISO capacity credits do not reflect the future value of adding resources or DSM

Key Takeaways

- IRP process must consider the future peak and energy needs of our customers
- Resource Adequacy (RA) focuses on peak needs
- Resource Adequacy is the responsibility of the regulated utilities (part of the obligation to serve)
- MISO administers a short term Resource Adequacy construct
  - MISO is not responsible for Resource Adequacy
  - MISO's construct is focused on <u>existing</u> not future resources

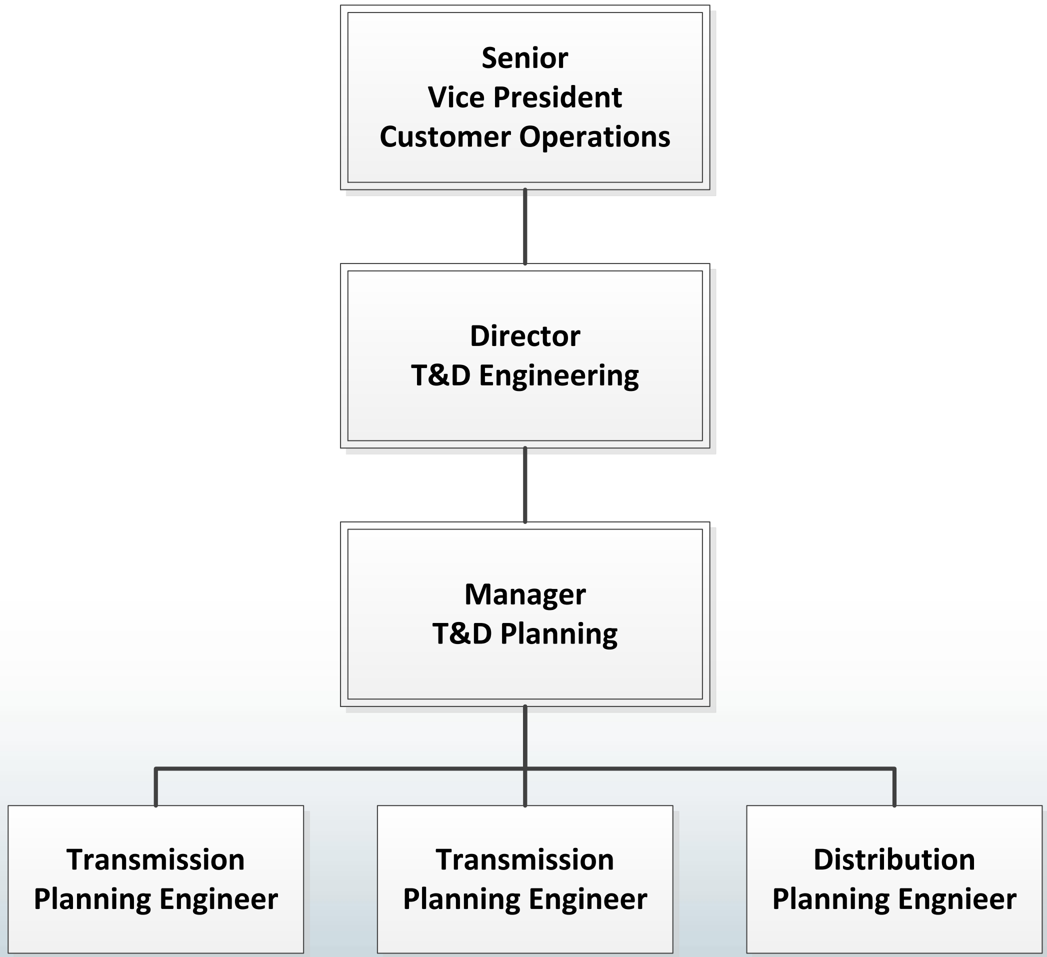
Questions?

Lunch Break

Transmission & Distribution

Mike Holtsclaw, Director of Engineering

Transmission Planning Organization



IPL has a dedicated Transmission Planning group within the Customer Operations Organization

IPL Transmission Planning

- IPL performs near term system studies for 1-5 years out and long term reliability planning studies for 10 years out
  - Studies are performed for on peak load, off peak load, and sensitivity cases looking for deficiencies on the transmission system
  - Steady state Power Flow studies show thermal (Rating) and voltage limits of the IPL transmission system
- Dynamic studies (0 to 20 seconds) show how the system performs to events
- IPL must also comply with the mandatory NERC Reliability Standards

IPL Transmission Planning (cont'd)

- The results of the studies are analyzed for deficiencies in the system such as thermal ratings that are exceeded on equipment such as transmission lines or transformers

- For the dynamic studies, voltage recovery times, and generation synchronization are analyzed to see that they meet IPL's planning criteria

MISO Transmission Planning Coordination

- MISO performs various planning studies for the full MISO footprint and for the three planning regions
- IPL is part of the MISO Central Planning region
- MISO will identify market efficiency projects and reliability projects for possible inclusion in their MISO Transmission Expansion Plan (MTEP)
- IPL participates in the MTEP studies and stakeholder groups to advocate solutions for customers

Recent IPL Transmission System Upgrades

- **Projects to Improve Reliability for Summer 2016**
  - Upgraded 345/138 kV auto transformer from 275 MVA to 500 MVA, included 138 kV bus modification to a ring bus arrangement
  - Installed the 275 MVA 345/138 kV auto transformer at another substation
  - Installed a 138 kV Static VAR Compensator +300/-100 MVAR for transient voltage support

Recent IPL Transmission System Upgrades (cont'd)

- **Projects to Support New Eagle Valley CCGT (COD Spring 2017)**
  - New 23 mile 138 kV line (Eagle Valley – Franklin Twp)
  - 138 kV Breaker Upgrades (Mooresville, Southport)
  - 138 kV Line Rating Upgrades
    - Eagle Valley – Southport
    - Eagle Valley – Glenns Valley
  - New 138 kV Capacitor Bank

- **MISO MTEP** – Upgrade Petersburg – AEP Sullivan 345 kV line

Distribution Planning

- Continuously reviews distribution system and develops a 5 year construction plan for new primary feeder circuits and substation capacity additions
- While distribution system load growth is relatively flat, neighborhood and commercial revitalization serves as a catalyst to improve existing circuits or extend new facilities
- Distributed Generation (DG) is also incorporated into the planning process through interconnection studies
- IPL has flexibility to switch loads due to compact service territory
- Recent distribution automation/smart grid deployment of >95% of the system supports remote switching operation

Smart Grid Project served as a catalyst

- Leveraged Department of Energy $20m grant toward $52m cost from 2010 to 2013
- Integrated holistic approach to include metering, distribution automation projects and customer facing technologies
- Sustainable solutions

U.S. DEPARTMENT OF ENERGY

Customer Systems have been deployed

- Customer Energy Management
  - Online Energy Feedback (PowerView®) for all customers
- Electric Vehicle Support
  - ~160 home, business & public chargers
  - Special rates
- Customer Web Engagement Tools
  - Smart grid education and outage reporting
  - Program enrollment for DSM

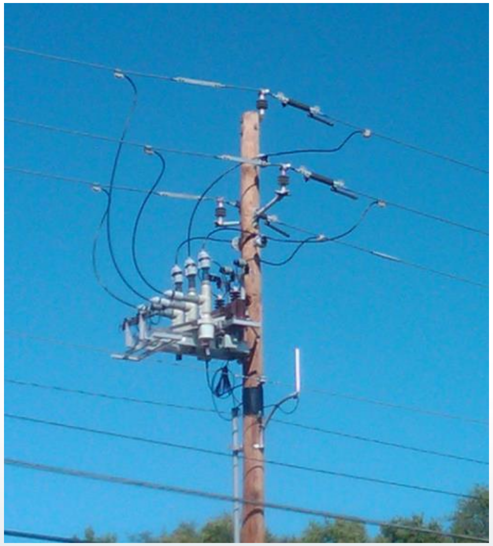
Distribution Automation Devices Currently Used Daily (1 of 3)

1. Central Business District Network Relays & Fault Indicators
   - Relays provide better protection
   - Fault indicators speed fault location and reduces cable damage

2. Digital Feeder Relays
   - Allows integration of DG onto the feeder
   - Reduced O&M costs by allowing reclosing to be turned off remotely
   - Provides 3 Phase currents, for better utilization of capacity
   - Distance to fault, reduces outage time
   - Feeder VAR readings integrated with capacitor control system to minimize substation and feeder losses

Distribution Automation Devices Currently Used Daily (2 of 3)

3. Recloser Installations on Primary Circuits
   - Reduces number of complete circuit lockouts
   - Reduces number of customers affected by an outage
   - Speeds restoration as they can be controlled remotely through the dSCADA system



4. Smart Capacitor Bank Controls
   - Better voltage regulation on distribution feeders
   - Ability to change setting from central locations

Distribution Automation Devices Currently Used Daily (3 of 3)

5. Load Tap Changer Controls
   - Key to Conservation Voltage Reduction (CVR) program settings can be changed remotely
   - CVR program is 20 MW of capacity
   - Tap changer operations recorded in historical database

6. Transformer On-line Monitoring
   - Improved asset health monitoring
   - Quicker indication of possible problems

7. Substation Security & Infrared Monitoring
   - Improved security and allows for quicker response when intruders are detected
   - Infrared Monitoring provides continuous monitoring of critical equipment

Smart Energy Project Successes

- Increased reliability from mid-point reclosers which reduce circuit lockouts and number of customers affected
- Improved personnel safety through remote operation of overhead and underground equipment
- Leverage data for distribution asset management
- Avoided truck rolls in 2015 total over 91,000
- Better information for operational and long-term decision making

Questions?

Load Forecast

Eric Fox, Director Forecast Solutions, Itron Inc.

Forecast Overview

1. Energy Trends – Why the disconnect between economic growth (GDP) and electricity use

2. Long-term Forecast Approach
   – Capturing end-use efficiency improvements

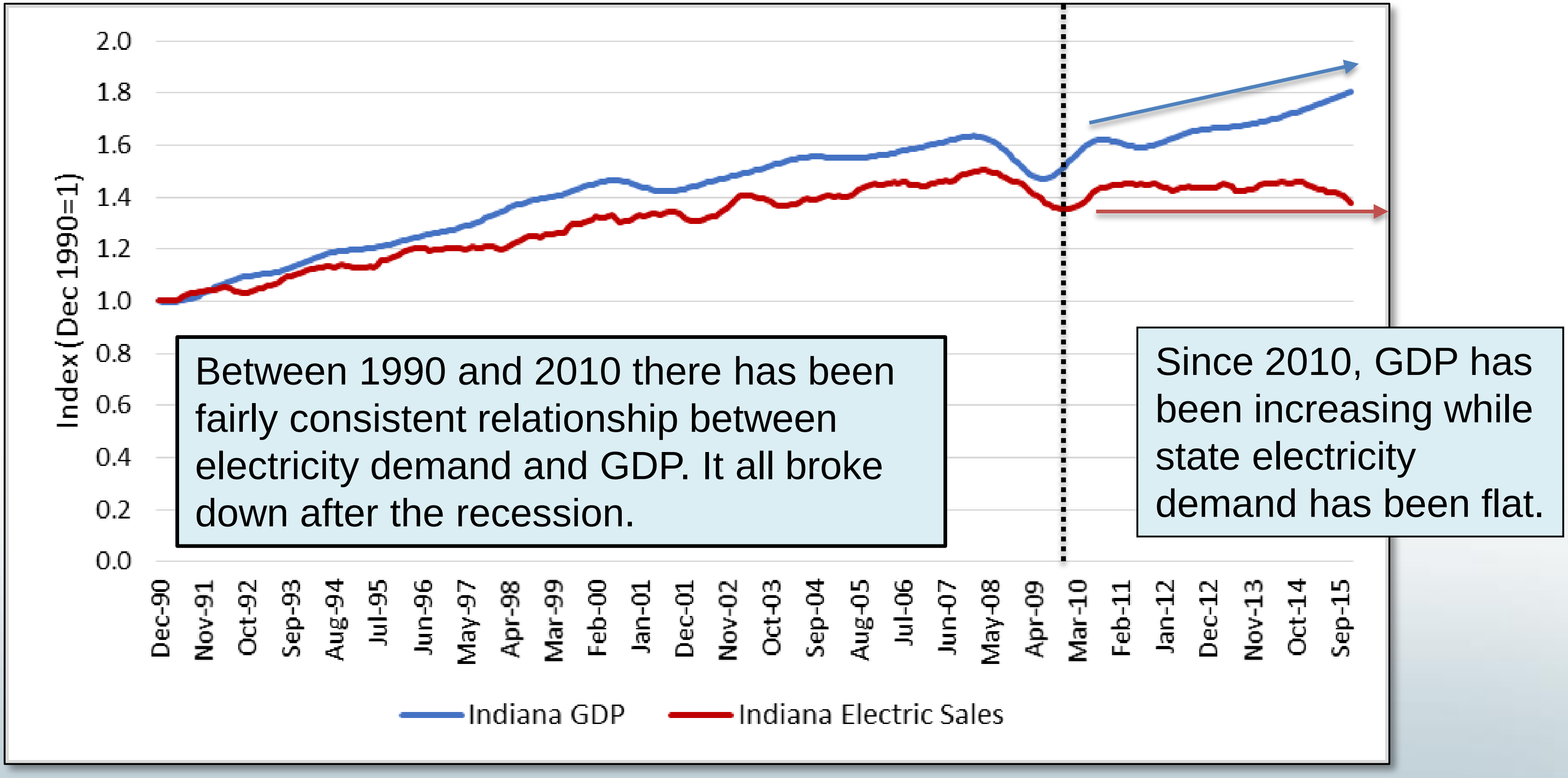
3. Forecast Model and Base Case Forecast Overview
   1. Residential
   2. Commercial
   3. Industrial
   4. Energy and Peak

4. Forecast Sensitivity

5. Summary

Top-Level Look

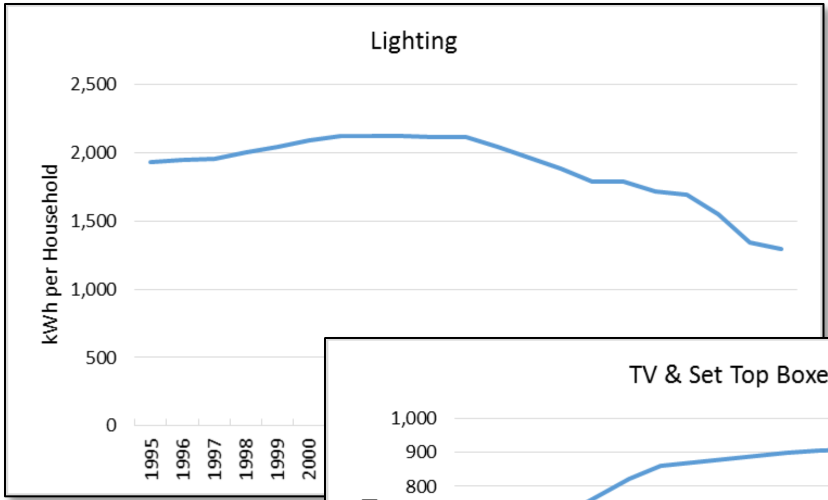
- Indiana GDP vs. Electricity Consumption

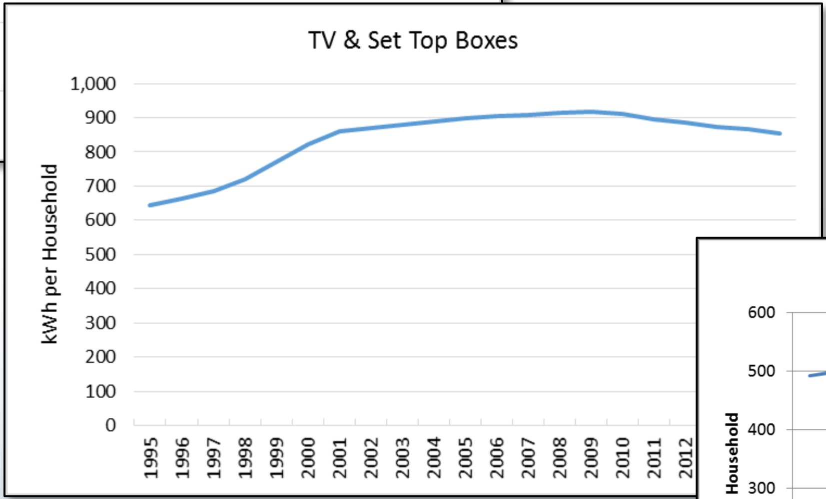


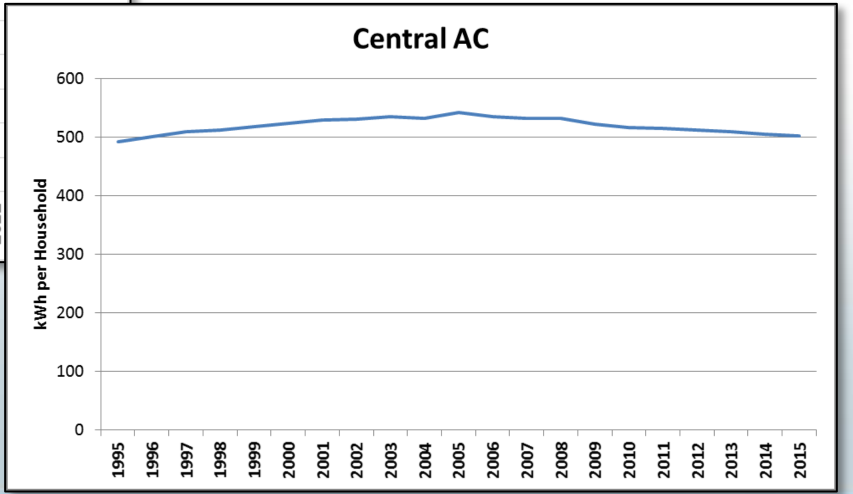
Why the disconnect?

- Strong residential appliance and commercial equipment efficiency improvements
  - Implementation of new end-use efficiency standards
- Increase in utility and state sponsored efficiency program activity
- Increasing share of less energy-intensive industries
- Smaller home square footage – increasing share of multifamily homes
- Changing demographics – smaller families and slower household formation growth
- Slower household income growth

End-Use Efficiency Impact



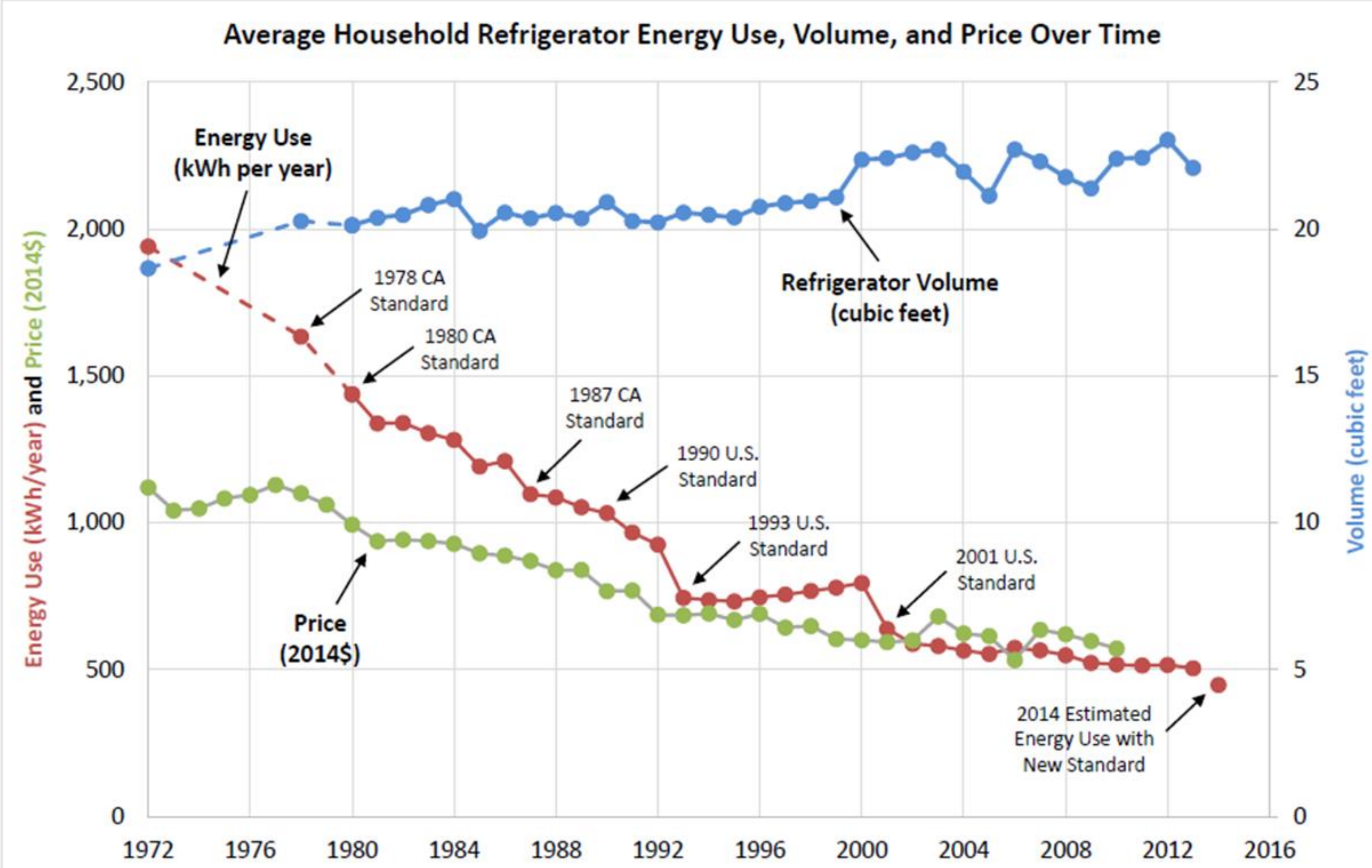




- By far, the largest impact on sales over the last five years can be attributed to residential and commercial end-use efficiency improvements

Refrigerator Usage Trend

ASAP | APPLIANCE STANDARDS AWARENESS PROJECT

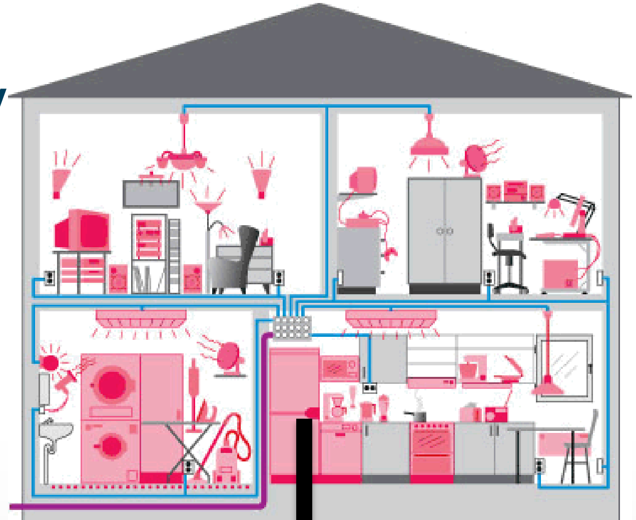


Sources: Association of Home Appliance Manufacturers (AHAM) for energy consumption and volume; U.S. Census Bureau for price.

http://www.appliance-standards.org/

The Problem with using GDP as a Primary Forecast Driver

- GDP is correlated with electric sales, but GDP does not cause electric sales
- We use the stuff that uses electricity
  - We light our homes
  - We refrigerate and cook our food
  - We vacuum up after the kids and dog
  - We dry our clothes
  - We watch TV

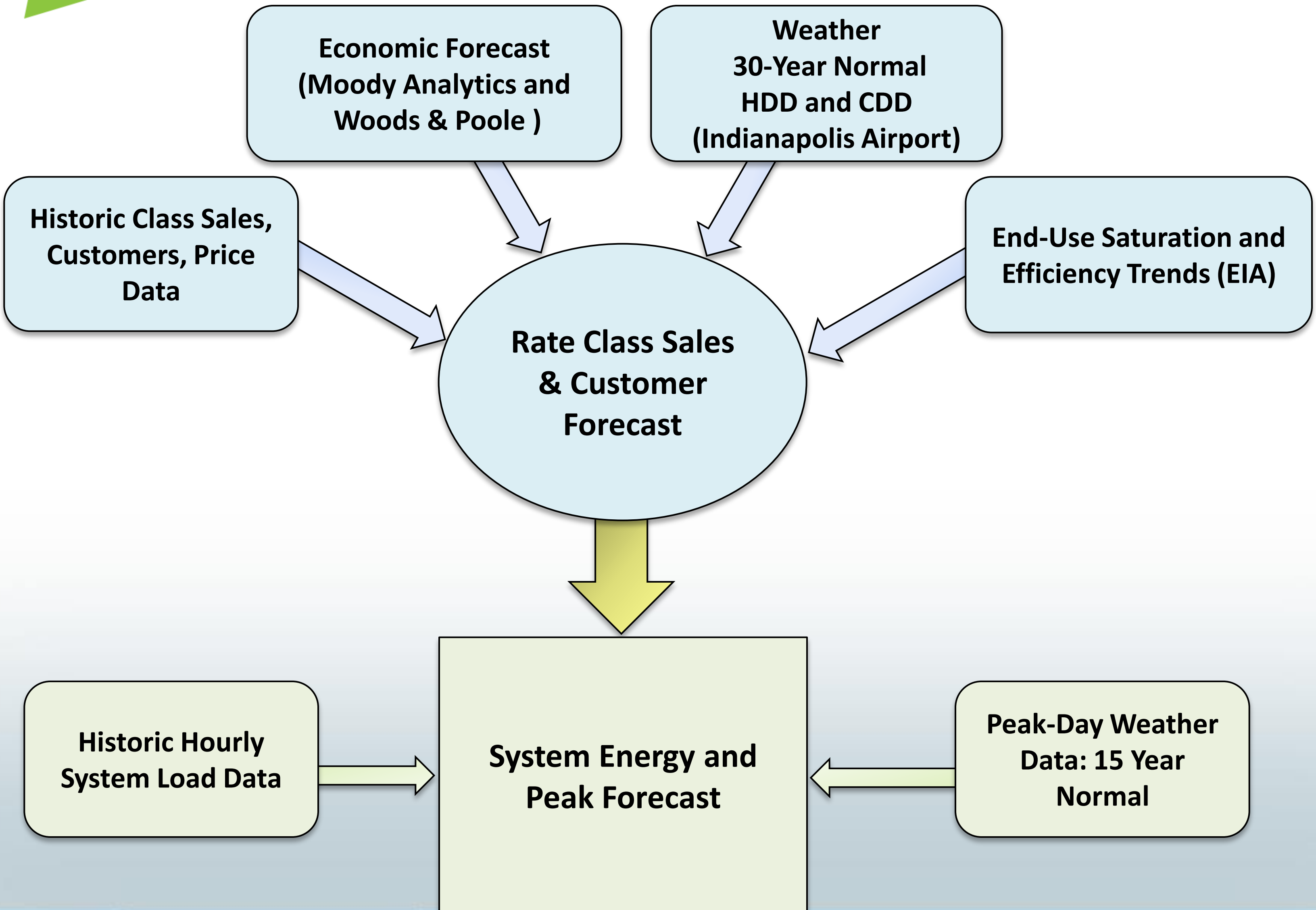


It's the other way around. Electricity generation and the things we buy are inputs into GDP

A Better Approach

- To the extent possible, we want to estimate forecast models of causation and not correlation
- That means understanding how changes in the technology we use at home and at work impacts our energy needs
- In addition to GDP as an economic variable

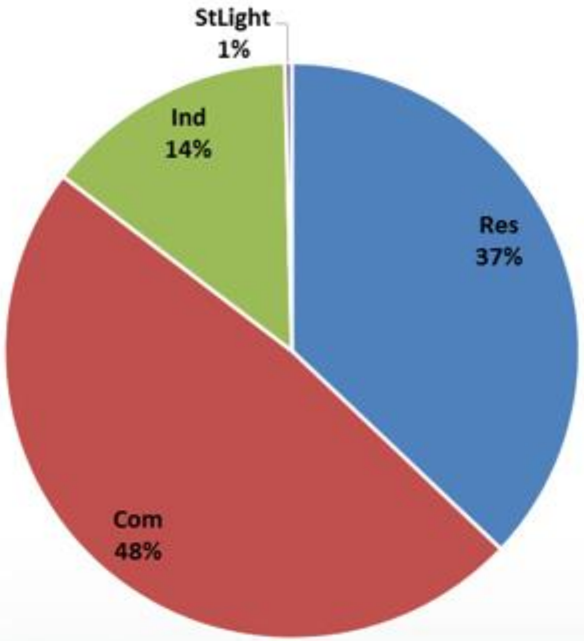
Forecast Modeling Framework



Forecast Models

- Forecasts are based on monthly regression models using ten-years of billed sales and customer data (January 2005 to March 2016)
- Sales Models
  - Residential and commercial models estimated using a blended end-use/econometric modeling framework
  - Industrial sales are estimated with a generalized econometric model
  - Small rate classes such as process heating, security lighting, and street lighting are estimated using simple trend and seasonal models
- Demand Model
  - Monthly system peak model based on heating, cooling, and base-use energy requirements derived from the sales forecast models

Models estimated at rate schedule level

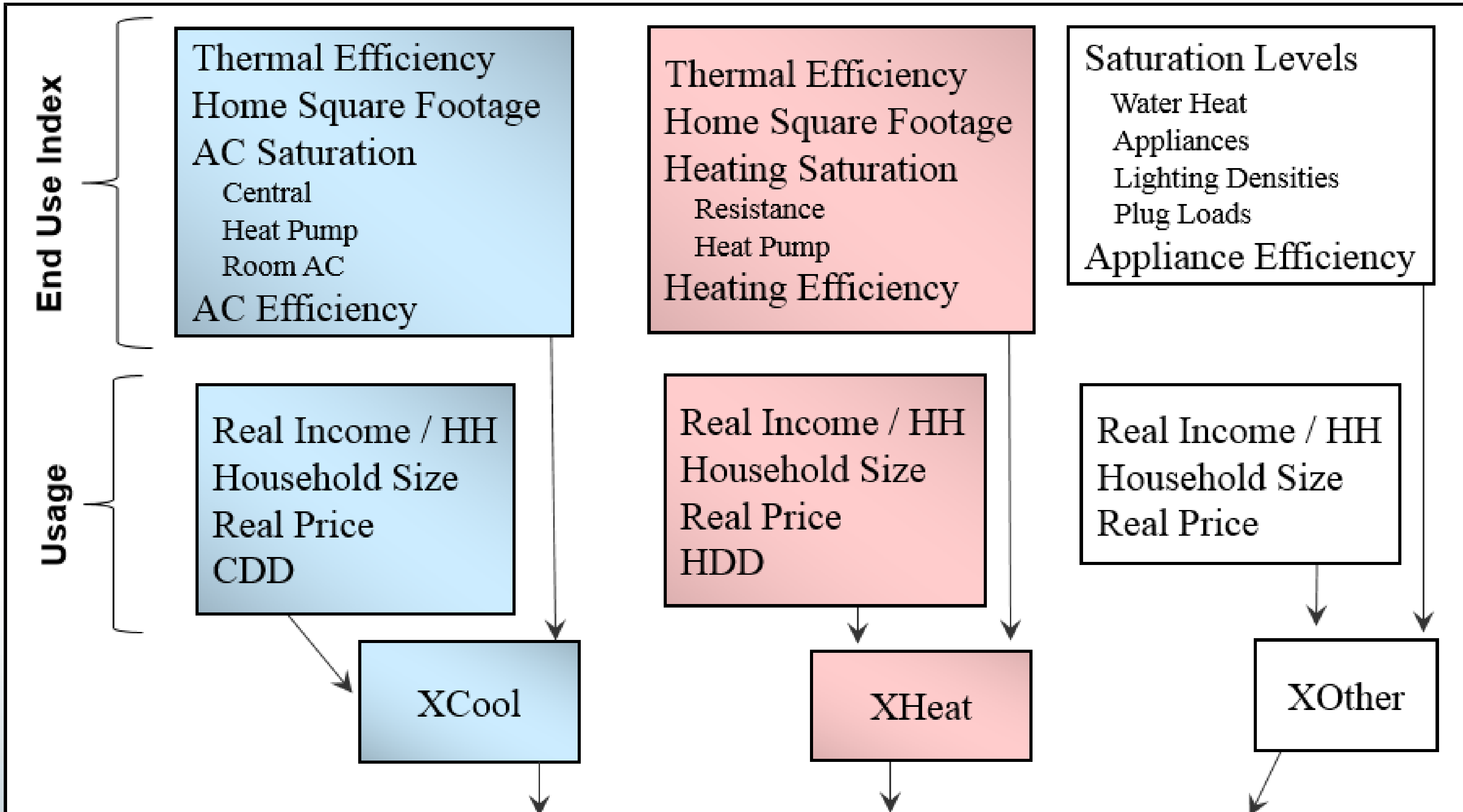


Percentage of 2015 Annual Sales

2015 Sales and Average Annual Customers

Rate Class	Rate Schedule	Definition	Customers	MWh	Avg_kWh
RES	RS	General Service	246481	2342108	9,502
RES	RH	Electric Heat	150498	2,323,908	15,441
RES	RC	Electric Water Heat	32022	406,586	12,697
Sml Com	SS	General Service	46,153	1,228,878	26,626
Sml Com	SH	GS All Electric	4,035	562,864	139,495
Sml Com	SE	GS Electric Heat	3,357	19,383	5,774
Sml Com	CB	GS Water Heat (Controlled)	95	432	4,549
Sml Com	UW	GS Water Heat (Uncontrolled)	84	1,506	17,923
Sml Com	APL	GS Security Lighting	364	31,620	86,868
Lrg Com	SL	Secondary Service	4,539	3,504,652	772,120
Lrg Com	PL	Primary Service	142	1,260,060	8,873,662
IND	HL1	High Load Factor 1	28	1,373,248	49,044,571
IND	HL2	High Load Factor 2	5	225,376	45,075,200
IND	HL3	High Load Factor 3	3	345,920	115,306,667
IND	APL	Ind Security Light	364	5,725	15,728
Other	ST	Street Lighting		53,280	
Total			488,170	13,685,546	28,034

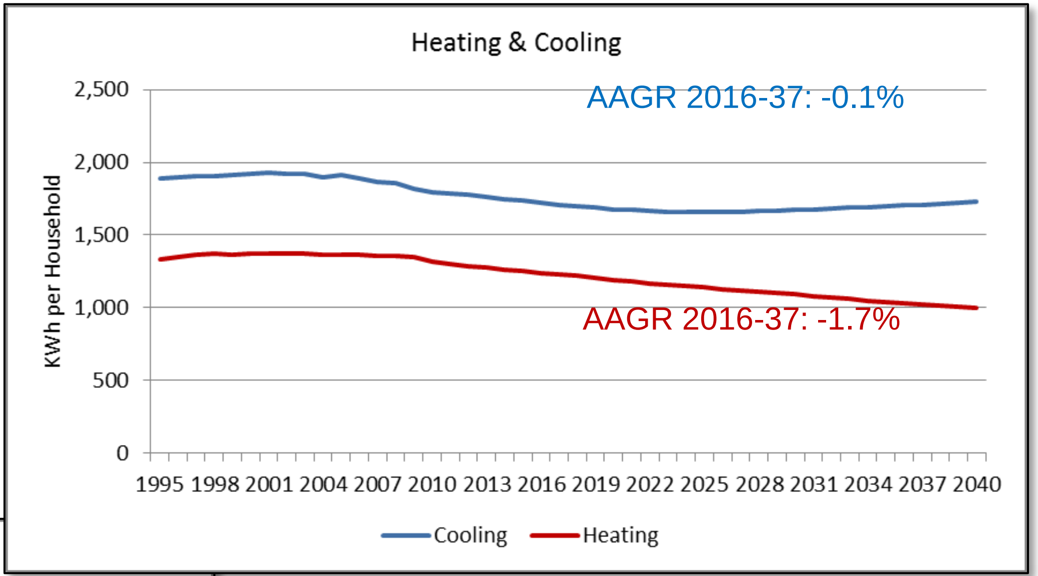
Residential Model

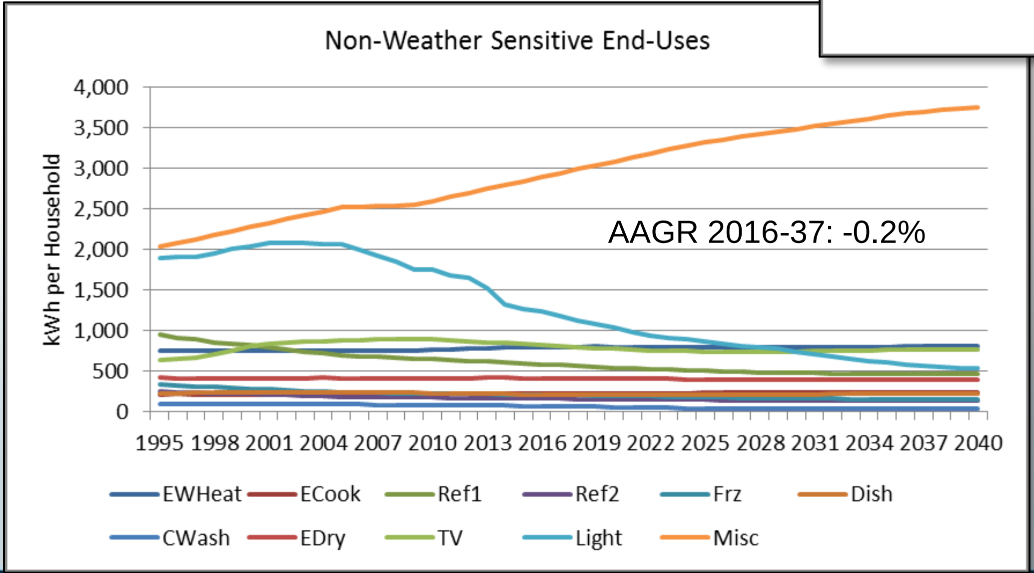


$$AvgUse_m = a + b_c \times XCool_m + b_h \times XHeat_m + b_o \times XOther_m + e_m$$

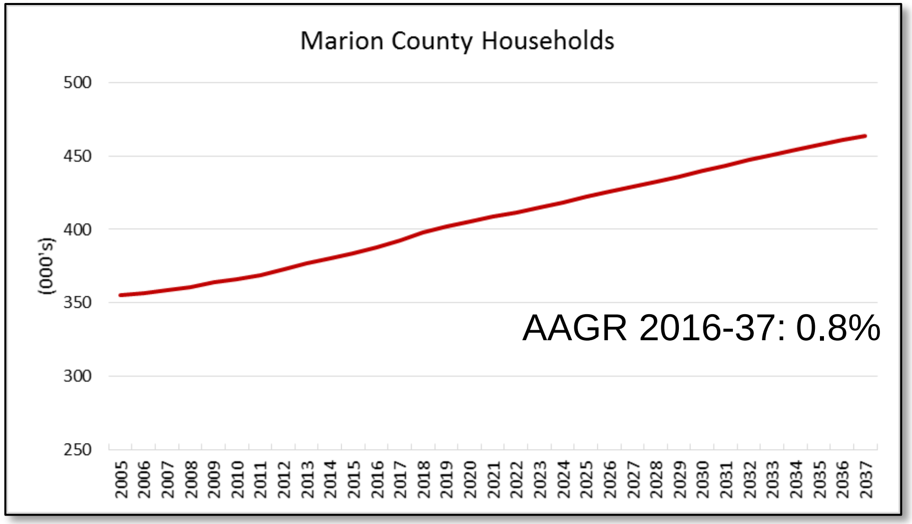
Residential End-Use Intensity Trends

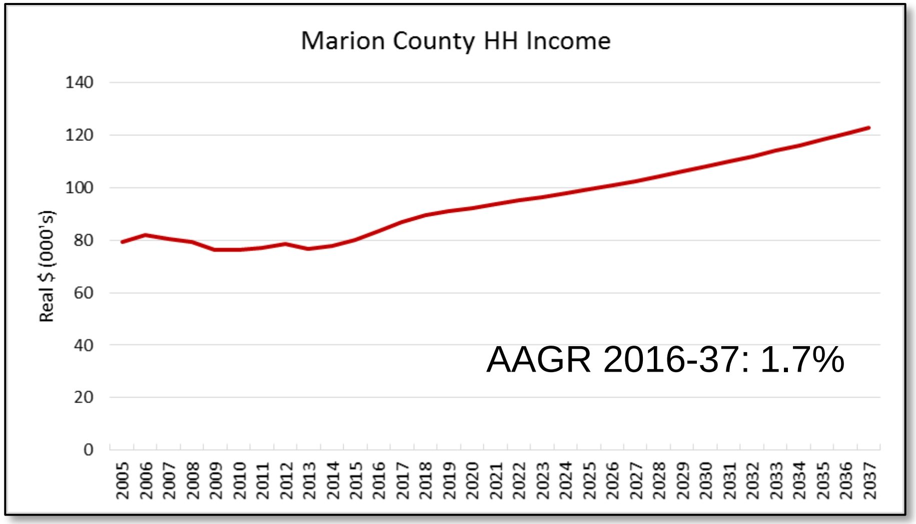
- Energy intensities derived from the EIA 2015 Annual Energy Outlook for the East North Central Census Division



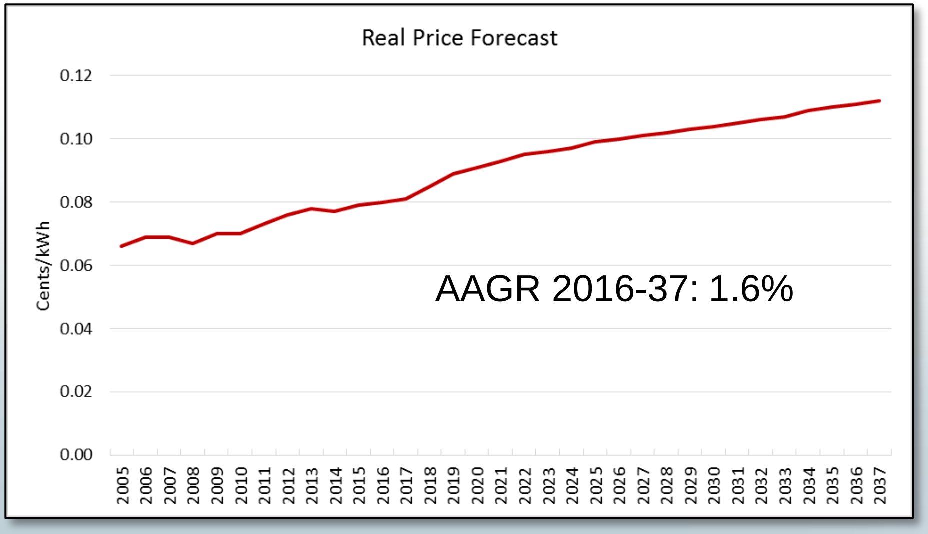


Residential Economic Drivers



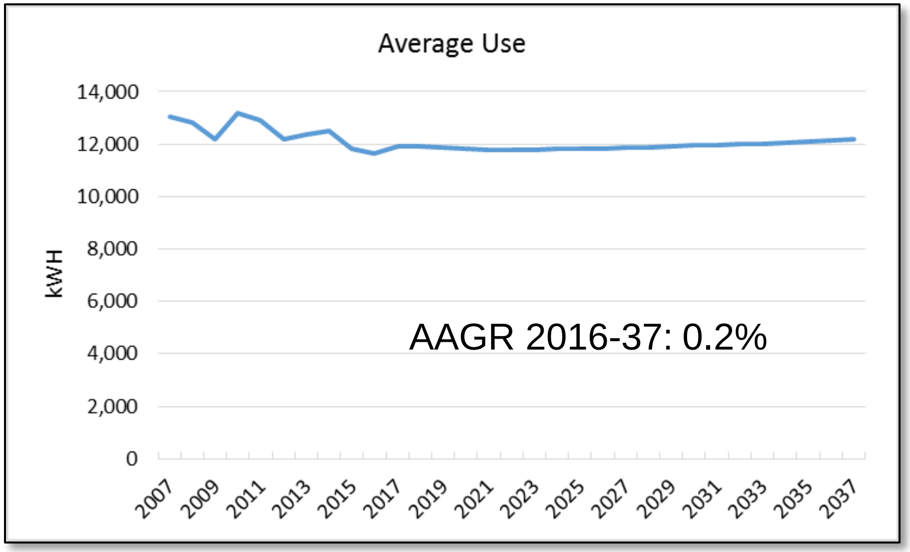


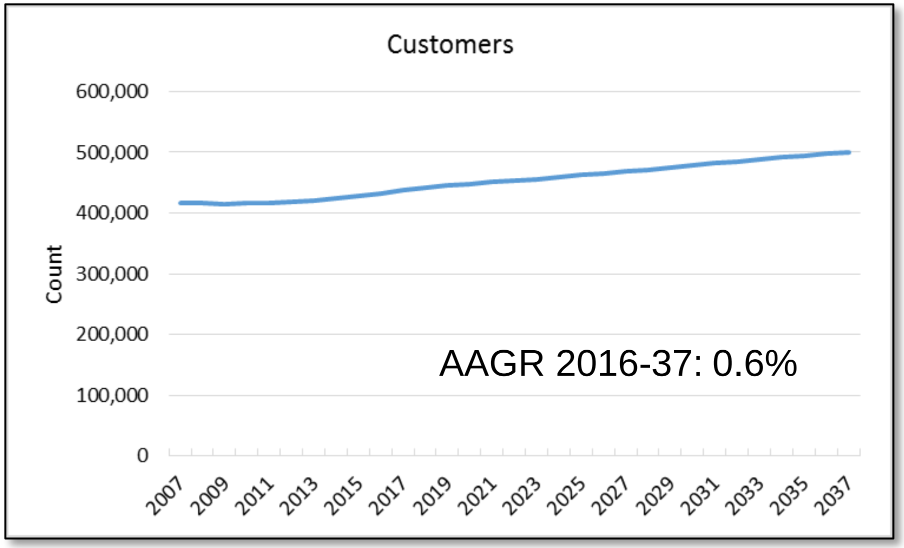
- Marion County Economic Forecast
- Blended Woods & Poole near-term forecast with Moody Analytics long-term forecast
- Price projections developed by IPL

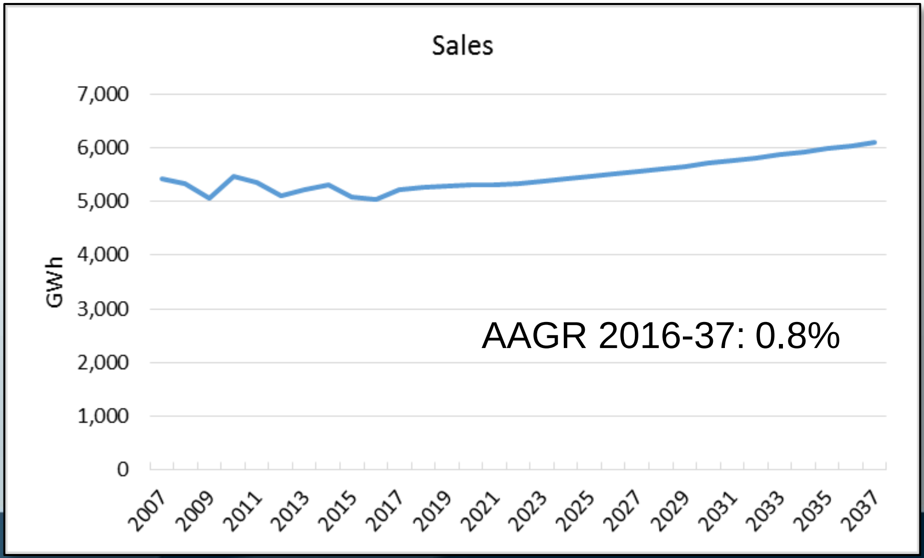


*AAGR=Average Annual Growth Rate

Residential Forecast

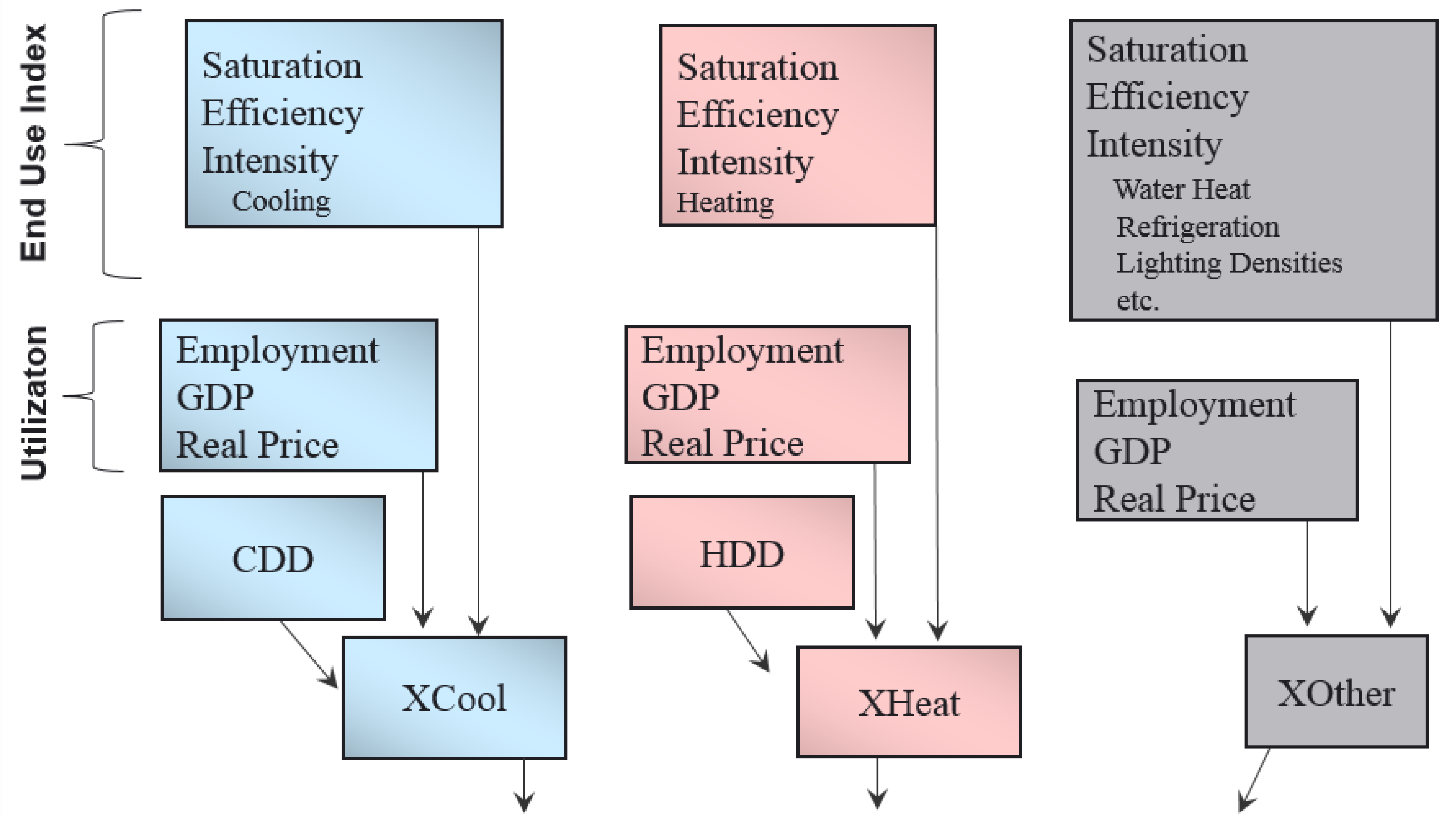






*AAGR=Average Annual Growth Rate

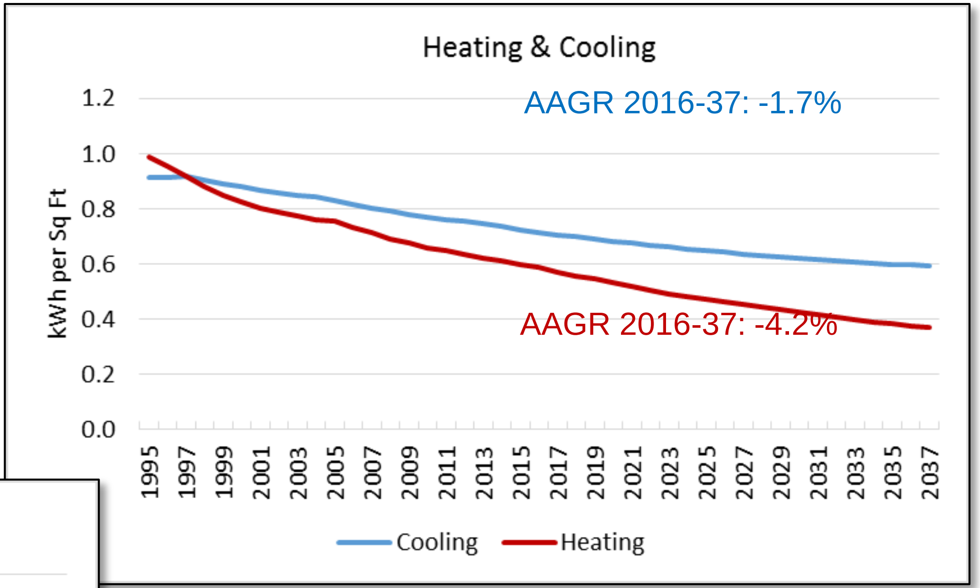
Commercial Model Framework

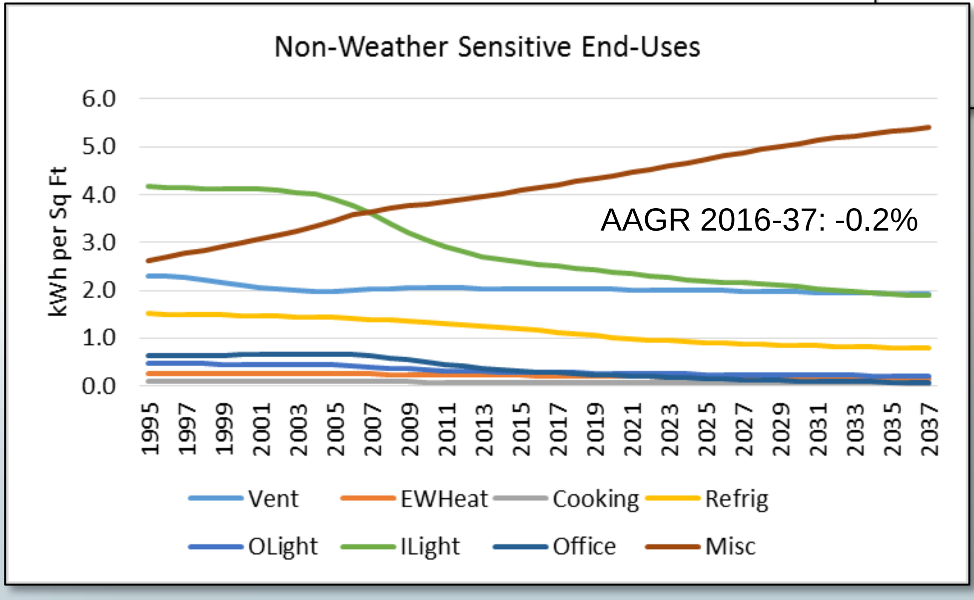


$$Sales_m = a + b_c \times XCool_m + b_h \times XHeat_m + b_o \times XOther_m + e_m$$

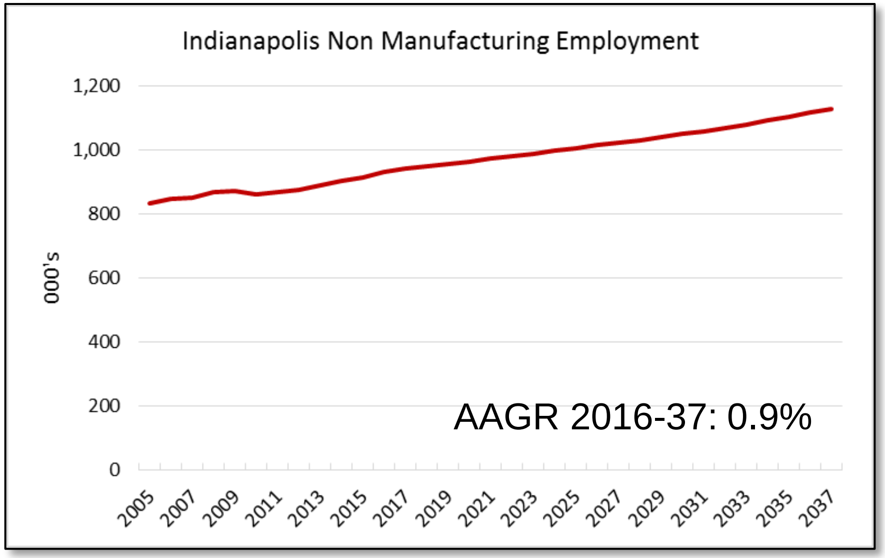
Commercial End-Use Intensities

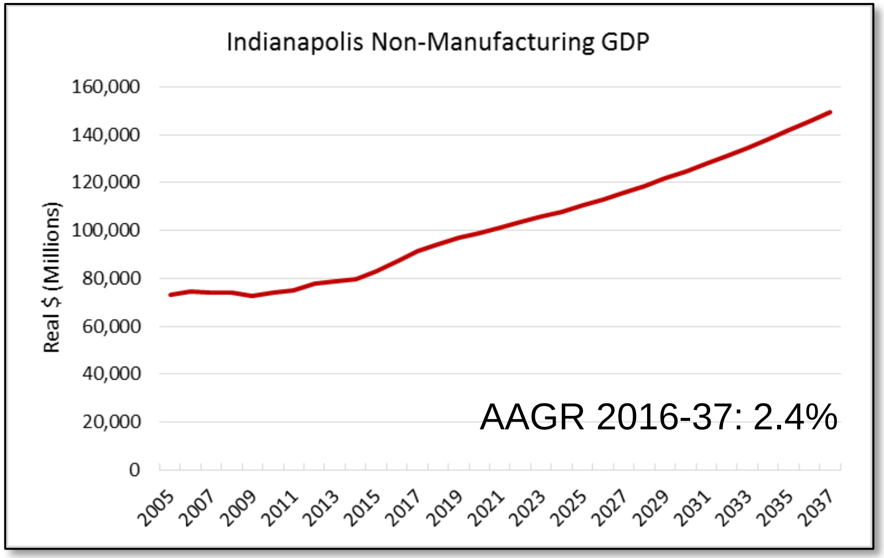
- Energy intensities derived from the EIA 2015 Annual Energy Outlook for the East North Central Census Division



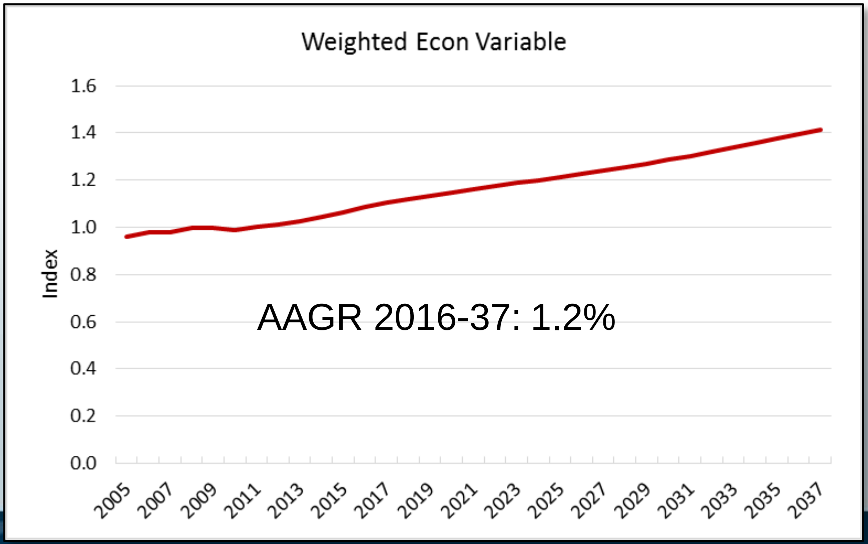


Commercial Economic Drivers





- Indianapolis MSA
- Blended Woods & Poole (in the near-term) and Moody Analytics in the long-term)
- Weighted economic variable: 80% employment/20% GDP



*AAGR=Average Annual Growth Rate

Industrial Model Framework

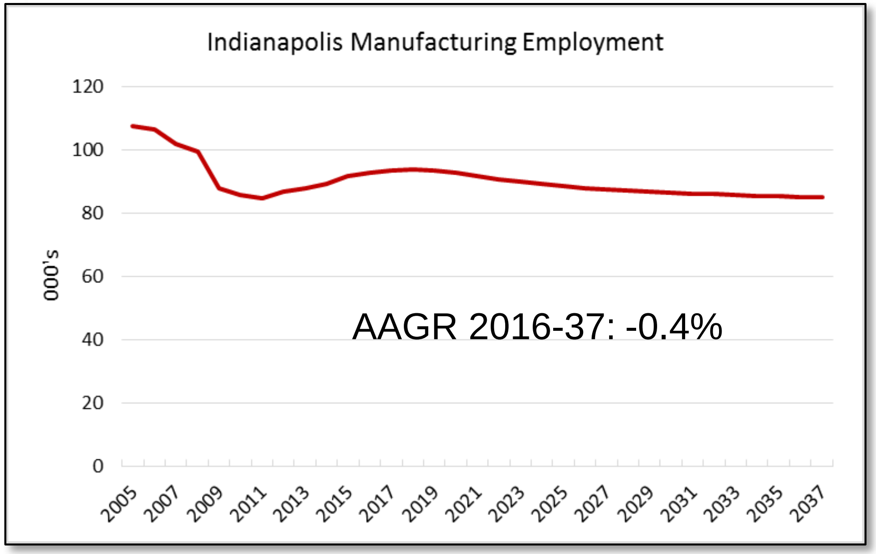
- Industrial sales are estimated with a generalized econometric model

Cooling Degree Days

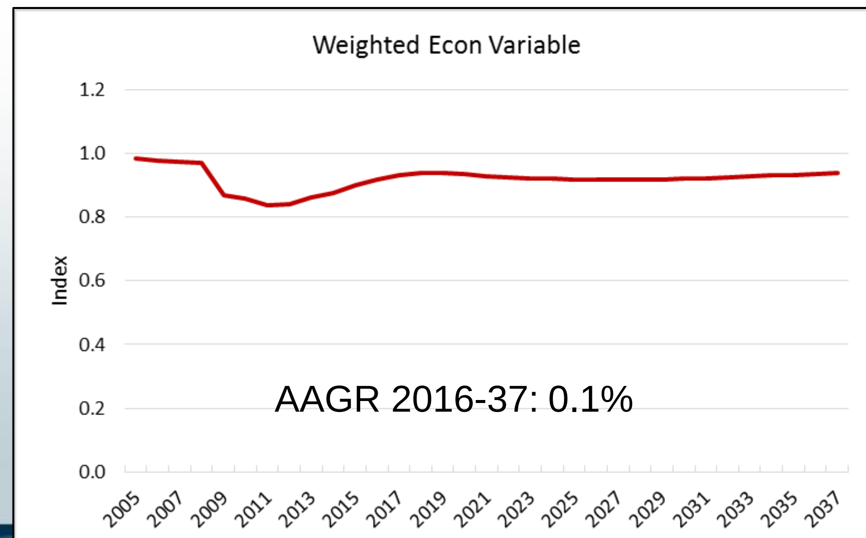
Manufacturing Employment
Manufacturing Output
Price

$$Sales_m = a + b_{cdd} \times CDD_m + b_{Econ} \times EconVariable_m + e_m$$

Industrial Economic Drivers

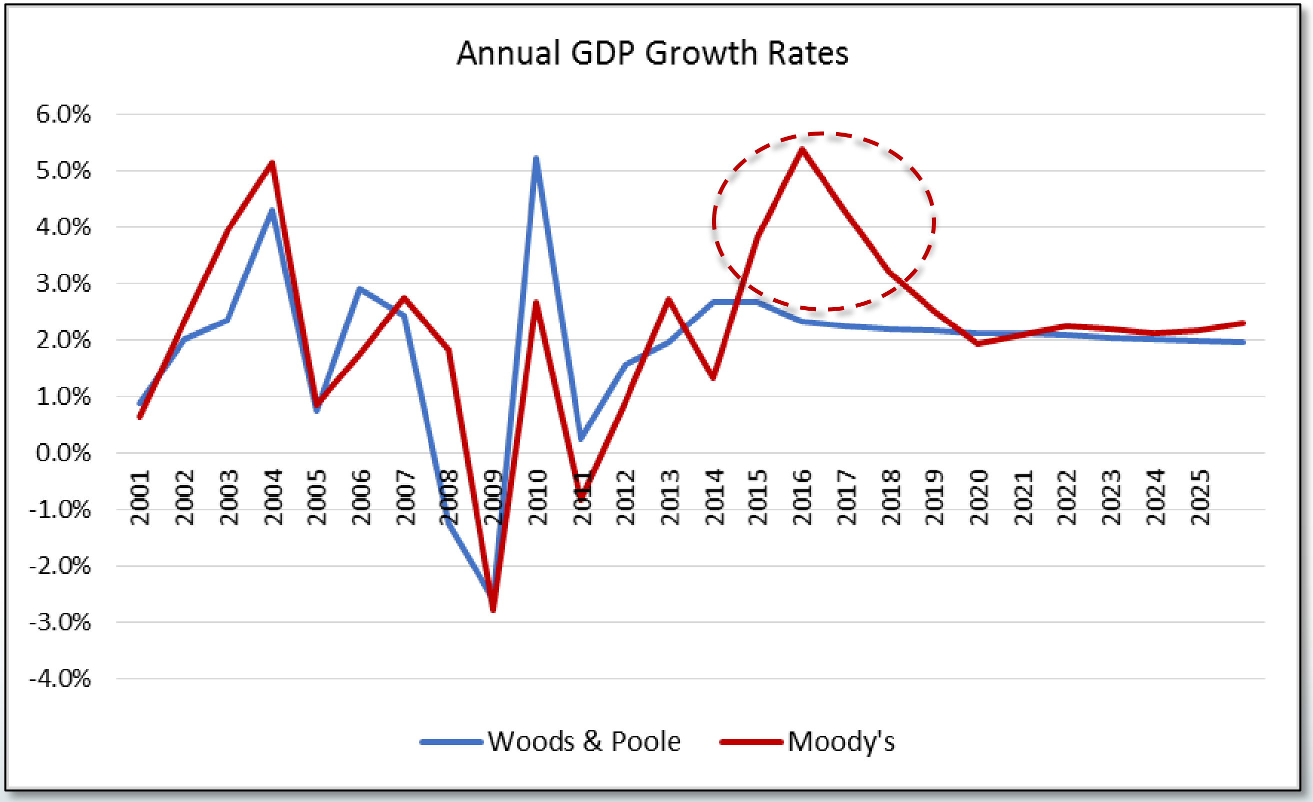


- Indianapolis MSA
- Blended Woods & Poole (near-term) and Moody Analytics long-term
- Strong employment weighting



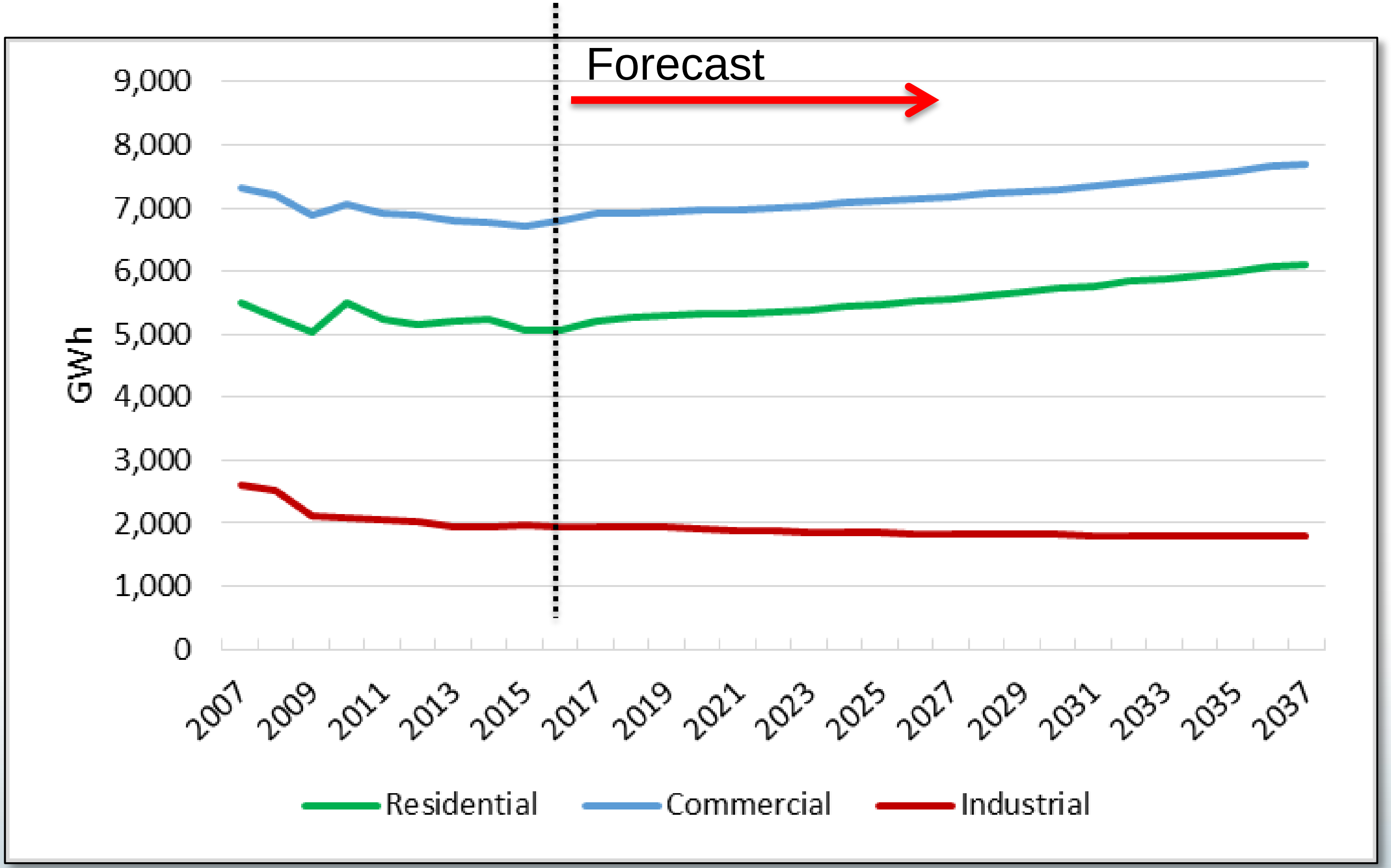
*AAGR=Average Annual Growth Rate

Comparison of GDP forecasts -
Indianapolis Metropolitan Statistical Area (MSA)



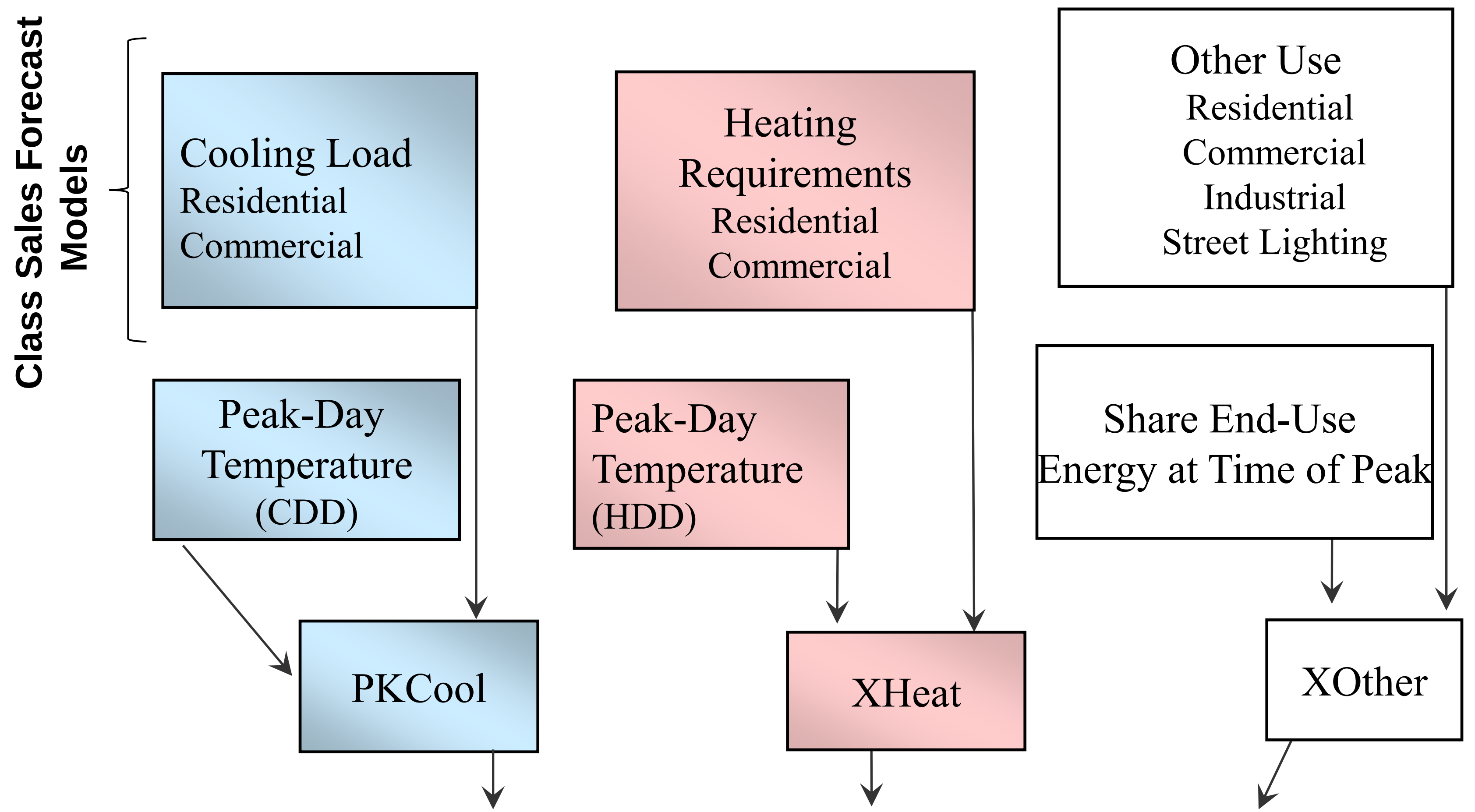
- Near-Term based on Woods & Poole GDP Forecasted Growth

Class Sales Forecast (before EE program savings)



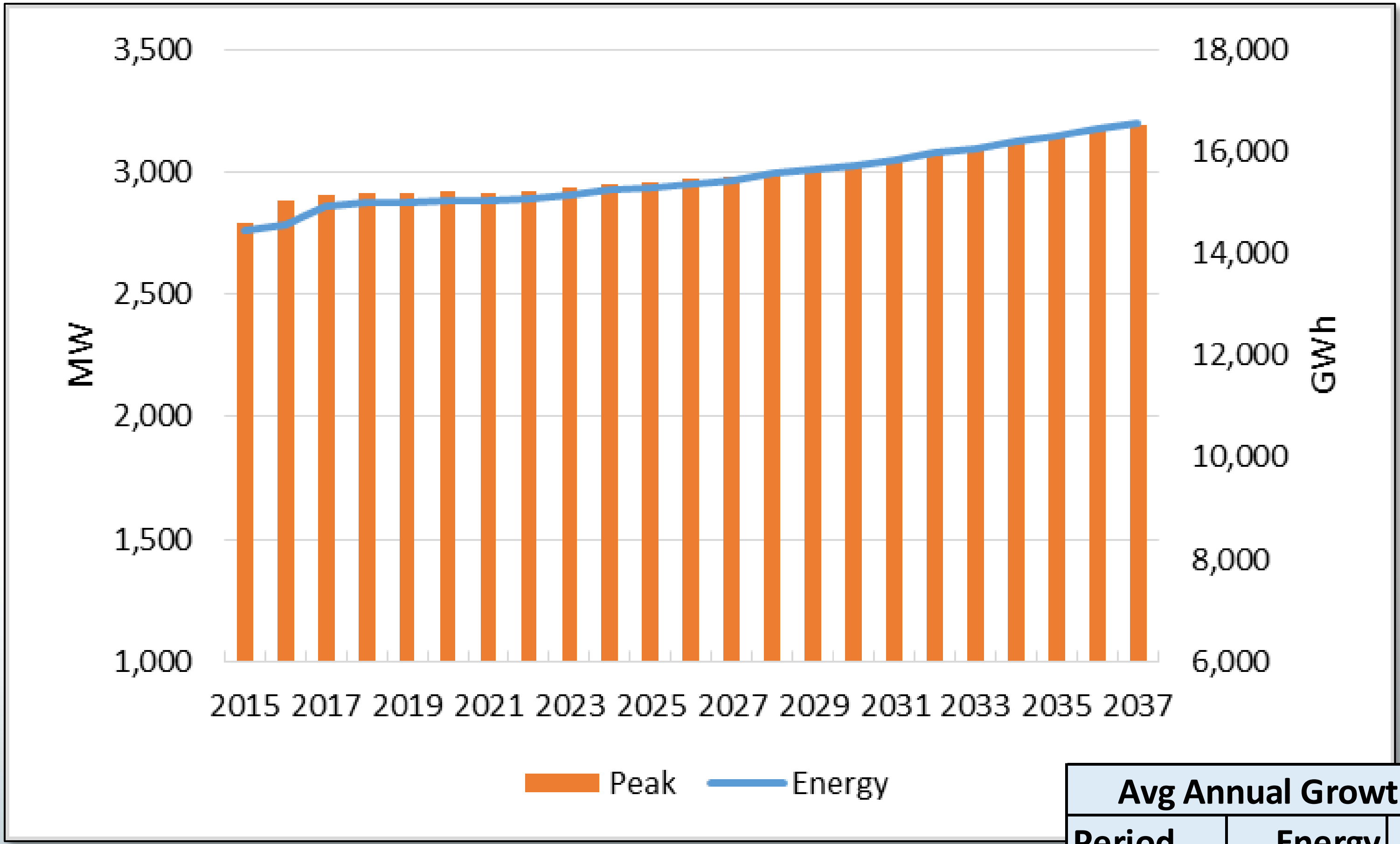
Avg Annual Growth Rate			
Period	Residential	Commercial	Industrial
2016-37	0.8%	0.5%	-0.4%

Peak Model



$$Peak_m = a + b_c \times PkCool_m + b_h \times PkHeat_m + b_o \times PKOther_m + e_m$$

Energy & Peak Forecast

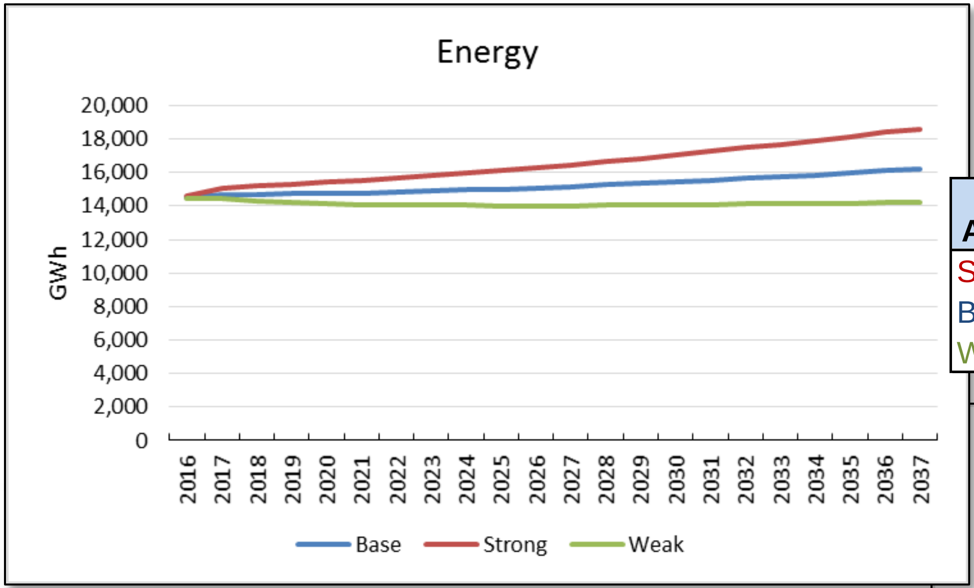


Avg Annual Growth Rate		
Period	**Energy**	**Peaks**
2016-37	0.5%	0.4%

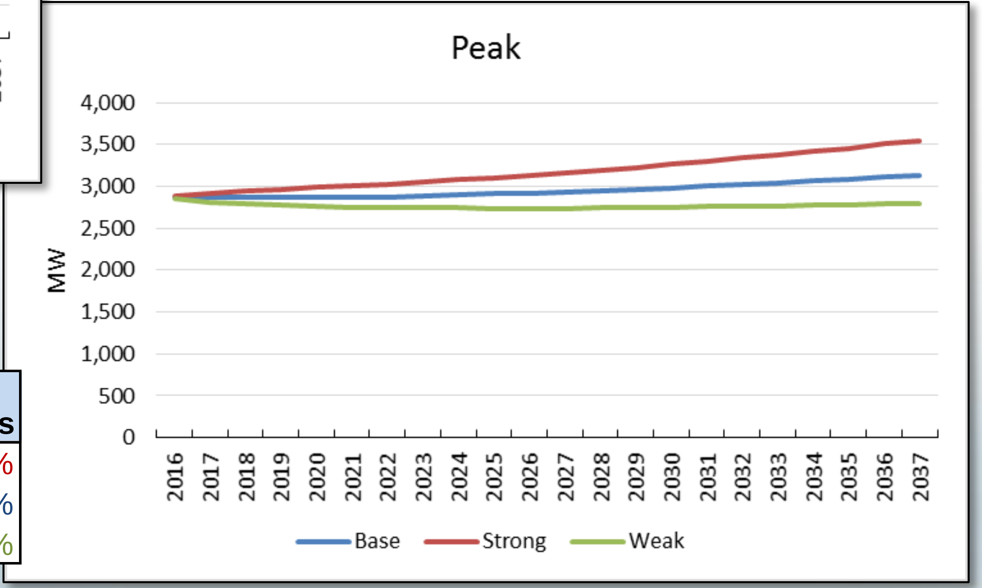
Forecast Sensitivity

- "Strong Economy"
  - Based on Moody Analytics "stronger near-term rebound" scenario for the Indianapolis MSA
- "Weak Economy"
  - Based on Moody Analytics "protracted slump" scenario for the Indianapolis MSA

Sensitivity Comparison



Avg Annual Growth Rates	
Strong	1.2%
Base	0.5%
Weak	-0.1%



Avg Annual Growth Rates	
Strong	1.0%
Base	0.4%
Weak	-0.1%

Summary

- Relatively strong customer growth and business activity
- But slow energy and demand growth
  - Sales growth is mitigated by continued improvement in end-use efficiency coupled with IPL’s energy efficiency program activity
- The blended end-use/econometric model works extremely well in capturing the impact of improvements in end-use efficiency as well as customer and economic growth

Questions?

Environmental Risks

Angelique Collier, Director of Environmental Policy

Current Environmental Controls for Coal-Fired Generation

Unit	In Service Date	Generating Capacity (MW)	SO_2 Control	NO_x Control	PM Control	Hg Controls
Petersburg 1	1967	232	Scrubber (1996)	LNB (1995)	ESP (1967)	ACI (2015) SI (2015)
Petersburg 2	1969	435	Scrubber (1996)	LNB (1994) SCR (2004)	Baghouse (2015)	ACI (2015) SI (2015)
Petersburg 3	1977	540	Scrubber (1977)	SCR (2004)	ESP (1986) Baghouse (2016)	ACI (2016) SI (2016)
Petersburg 4	1986	545	Scrubber (1986)	LNB (2001)	ESP (1986)	ACI (2016) SI (2016)

SO_2 = Sulfur dioxide
NO_x = Nitrogen oxides
MW = Mega Watts
ACI = Activated Carbon Injection

ESP = Electricstatic Precipitator
SCR = Selective catalytic reduction
LNB = Low NO_x Burners
SI = Sorbent Injection

Environmental Regulations

- Recent Environmental Regulations/Projects
  - Mercury and Air Toxics Standard (MATS)
  - NPDES Water Discharge Permits
  - Cross State Air Pollution Rule (CSAPR)

- Future Environmental Regulations
  - 316(b) – Cooling water intake structures
  - Office of Surface Mining
  - Clean Power Plan (CPP)
  - Coal Combustion Residuals (CCR)
  - Effluent Limitations Guidelines (ELG) Rule
  - National Ambient Air Quality Standards (NAAQS)

NPDES= National Pollutant Discharge Elimination System

Recent Environmental Regulations

- MATS
  - Mercury and other air toxics from utilities
  - Compliance date: April 2016
  - Ceased coal-combustion on older, smaller coal-fired units
  - $450 million in new and upgraded air pollution controls at Petersburg
- NPDES
  - New metal limits for Harding Street and Petersburg
  - Compliance date: September 2017
  - Cease coal-combustion at Harding Street Unit 7
  - Scrubber wastewater treatment system and dry fly ash handling at Petersburg
  - $250 million in wastewater treatment
- CSAPR
  - Phase I effective January 2015; Phase II January 2017
  - Existing controls and purchase of allowances on the open market

Future Environmental Regulations - NAAQS and CSAPR

- National Ambient Air Quality Standards (NAAQS)
  - PM2.5 and Ozone
    - Lowered standards
    - IPL areas designated or expected to be designated at attainment

- Cross State Air Pollution Rule Ozone Update
  - Proposed December 3, 2015
  - Would address lowered 2008 Ozone standard
  - Lower Ozone Season allowances allocated
  - Compliance through additional purchase of allowances or additional NO_x controls

NAAQS = National Ambient Air Quality Standards
CAIR = Clean Air Interstate Rule
$PM_{2.5}$ = Particulate Matter less than 2.5 microns in diameter

SO_2 = Sulfur Dioxide
SCR = Selective catalytic reduction
EPA = Environmental Protection Agency

Future Environmental Regulations - Cooling Water Intake Structures Rule

- Final Rule published August 2014
- Regulates environmental impact from cooling water intake structures (CWIS)
  - Impingement and entrainment of aquatic species
  - Closed cycle cooling systems may be required
- Studies underway to determine impact
  - Eagle Valley and Harding Street already equipped with closed cycle cooling.
  - Two of four Petersburg units fully equipped with closed cycle cooling
- Compliance required in 2020 or later

Future Environmental Regulations - Office of Surface Mining Rule

- Proposed Rule expected in 2016
- Would regulate placement of ash as backfill in mines
- If backfill prohibited, IPL Petersburg may require expansion of onsite landfill

Future Environmental Regulations - Clean Power Plan

- Final Rule published August 23, 2015
- Requires carbon dioxide emissions reductions
  - Indiana must develop a State Plan or be subject to Federal Plan
  - May be achieved through
    - Heat rate improvements;
    - Re-dispatch from coal to new renewables or existing NGCCs; or
    - Other measures.
- New Eagle Valley NGCC not subject to Rule
- Harding Street will comply by combusting natural gas
- Rule stayed by SCOTUS pending legal resolution
  - Initial State Plan deadline of September 6, 2016 no longer in place
  - Compliance deadline likely delayed by 18 months or longer

NGCC = Natural Gas Combined Cycle
SCOTUS = Supreme Court of the U.S.

Future Environmental Regulations - Clean Power Plan Allocations

Plant Name	Boiler ID	Unit's First Period Allocation (short tons) 2022-2024	Unit's Second Period Allocation (short tons) 2025-2027	Unit's Third Period Allocation (short tons) 2028-2029	Unit's Final Allocation (short tons) 2030-2031
Harding Street	50	**397,900**	**382,078**	**359,864**	**346,958**
Harding Street	60	**365,218**	**350,695**	**330,305**	**318,460**
Harding Street	70	**1,712,557**	**1,644,458**	**1,548,847**	**1,493,304**
Petersburg	1	**968,248**	**929,747**	**875,690**	**844,287**
Petersburg	2	**1,808,953**	**1,737,021**	**1,636,028**	**1,577,359**
Petersburg	3	**2,356,018**	**2,262,332**	**2,130,797**	**2,054,384**
Petersburg	4	**2,222,084**	**2,133,724**	**2,009,666**	**1,937,597**
Total		**9,830,978**	**9,440,055**	**8,891,197**	**8,572,349**

Model Assumptions and Inputs

Potential Impacts of Environmental Regulations

Regulation	Expected Implementation Year	Cost Range Estimate ($MM)	Assumed Technology
Office of Surface Mining	2018	0-15	Onsite Landfill
Cooling Water Intake Structure	2020	10-160	Closed Cycle Cooling
Ozone National Ambient Air Quality Standards	2020	0-150	Selective Catalytic Reduction

Questions?
Part 1

Short Break

Upcoming Environmental Regulations - Coal Combustion Residuals (CCR) Rule

- Final rule published April 2015
- Regulates ash as non-hazardous waste
  - Minimum criteria for ash ponds
  - Closure and post-closure requirements
- HS and EV ponds will be closed because ceased coal combustion
- Petersburg ponds must meet minimum criteria or cease use and close
  - Pond closure would require system to handle bottom ash
  - Closed-loop bottom ash handling system

Future Environmental Regulations - Effluent Limitations Guidelines (ELG) Rule

- Final rule published November 2015
- Technology-based standard regulating wastewater
  - Scrubber wastewater treatment
  - Dry fly ash handling
  - Dry or closed-loop bottom ash handling
- No impact at Harding Street or Eagle Valley
- Petersburg compliant due to other requirements
  - NPDES
  - CCR

Upcoming Environmental Regulations - SO_2 NAAQS

- HS and EV comply by combusting natural gas
- Compliance required in 2017
- More stringent limits at Petersburg will require improved SO_2 control
  - Dibasic acid injection
  - Emergency ball mill
  - Emergency limestone conveyance
  - Unit 1 & 2 switch gear

NAAQS = National Ambient Air Quality Standards
SO_2 = Sulfur Dioxide

Model Assumptions and Inputs

Upcoming Impacts of Environmental Regulations

Regulation	Expected Implementation Year	Cost Estimate ($MM)	Assumed Technology
Effluent Limitations Guidelines	2018	0	None
Coal Combustion Residuals	2018	47	Bottom Ash Dewatering System
SO_2 National Ambient Air Quality Standards	2017	48	FGD Improvements

Questions?
Part 2

Short Break

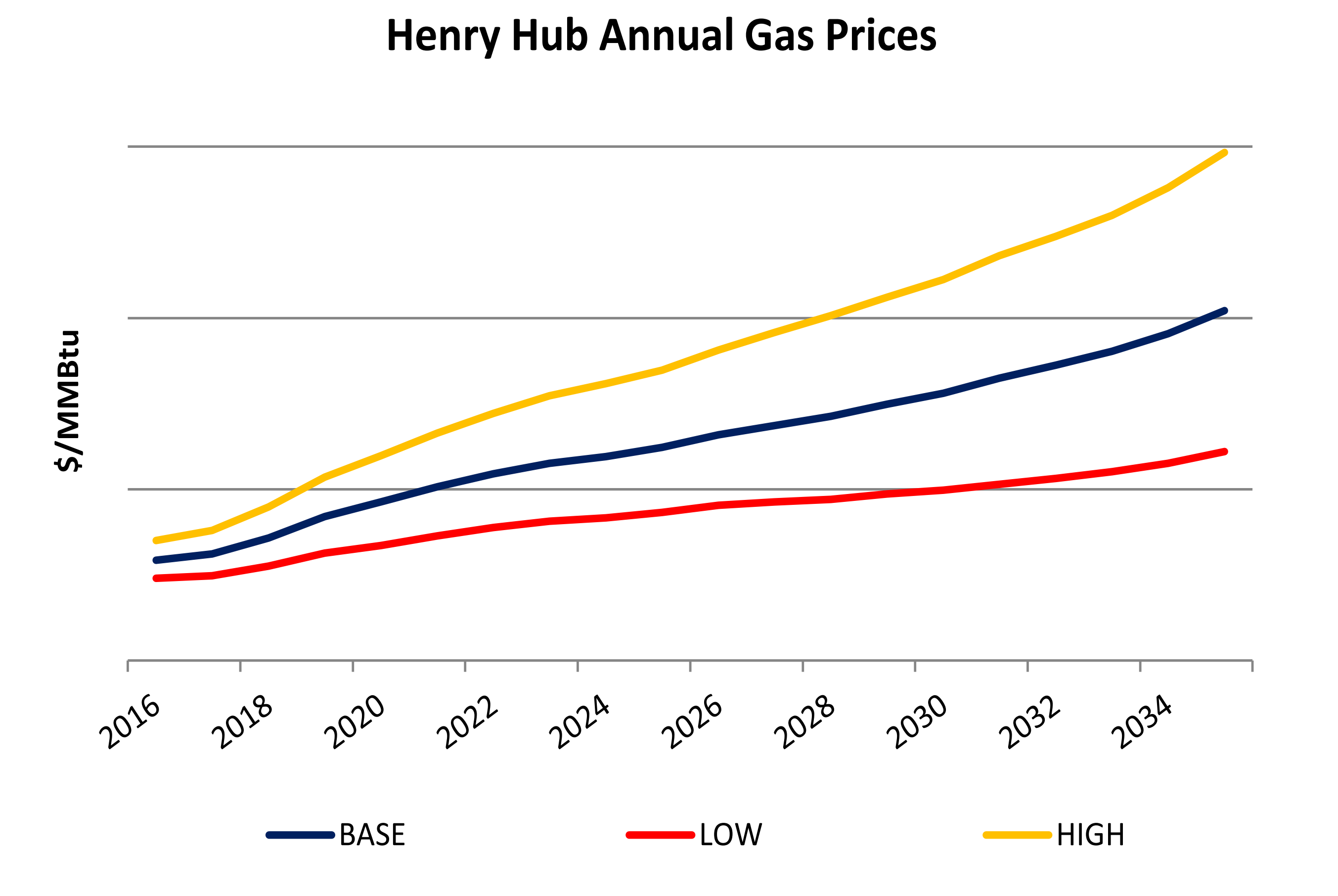
Modeling Update

Joan Soller, Director of Resource Planning

Modeling work continues

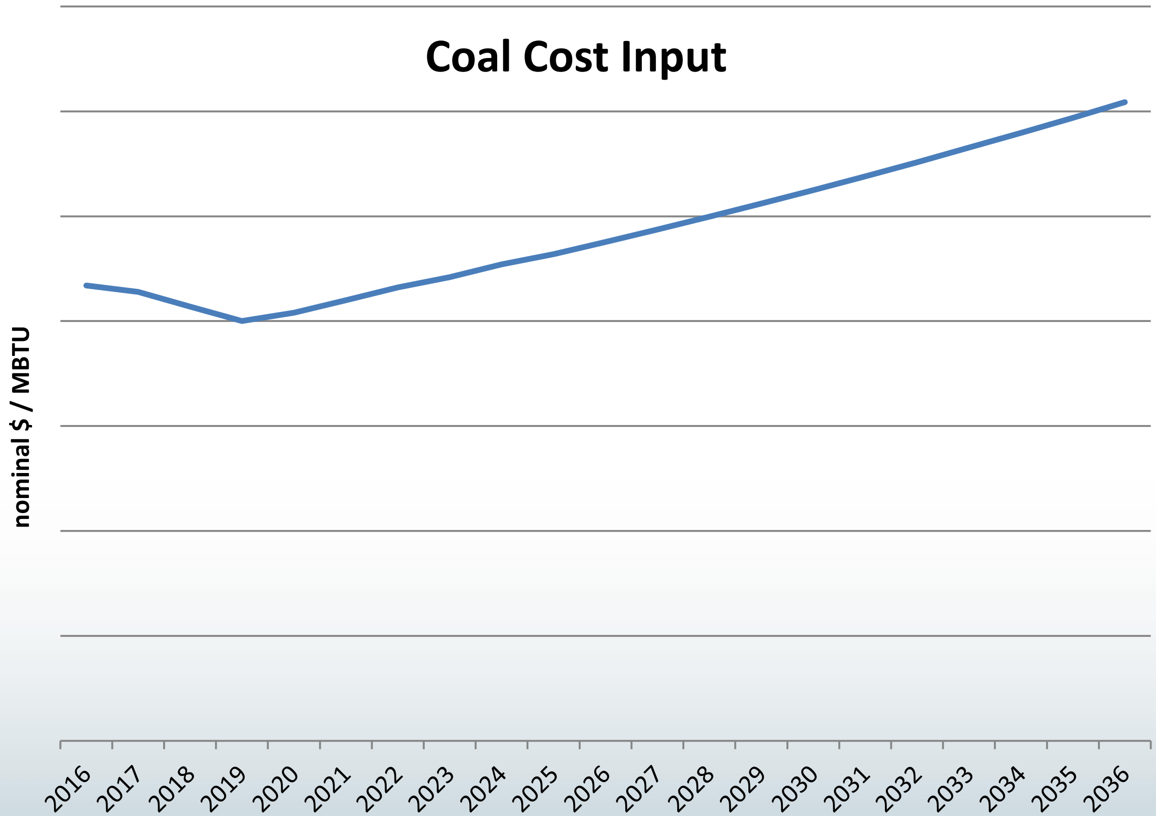
- Updated NG, market price, capacity cost and environmental inputs
- Refreshed existing resource information
- Fine-tuned supply resource parameters
- Created DSM bundles
- Updated load forecast
- Ran initial base case scenario

Natural gas inputs



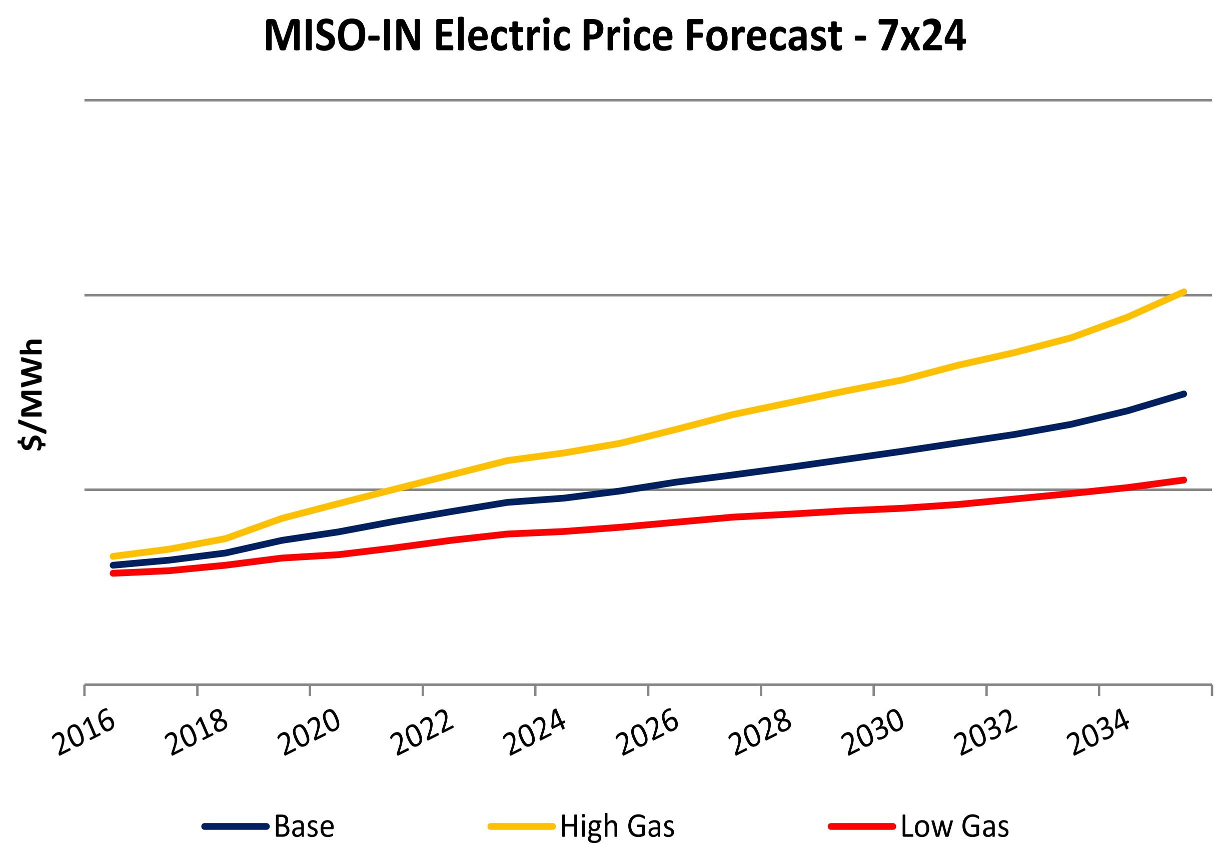
Source: ABB 2015 Fall Reference Case in nominal dollars

Coal cost inputs



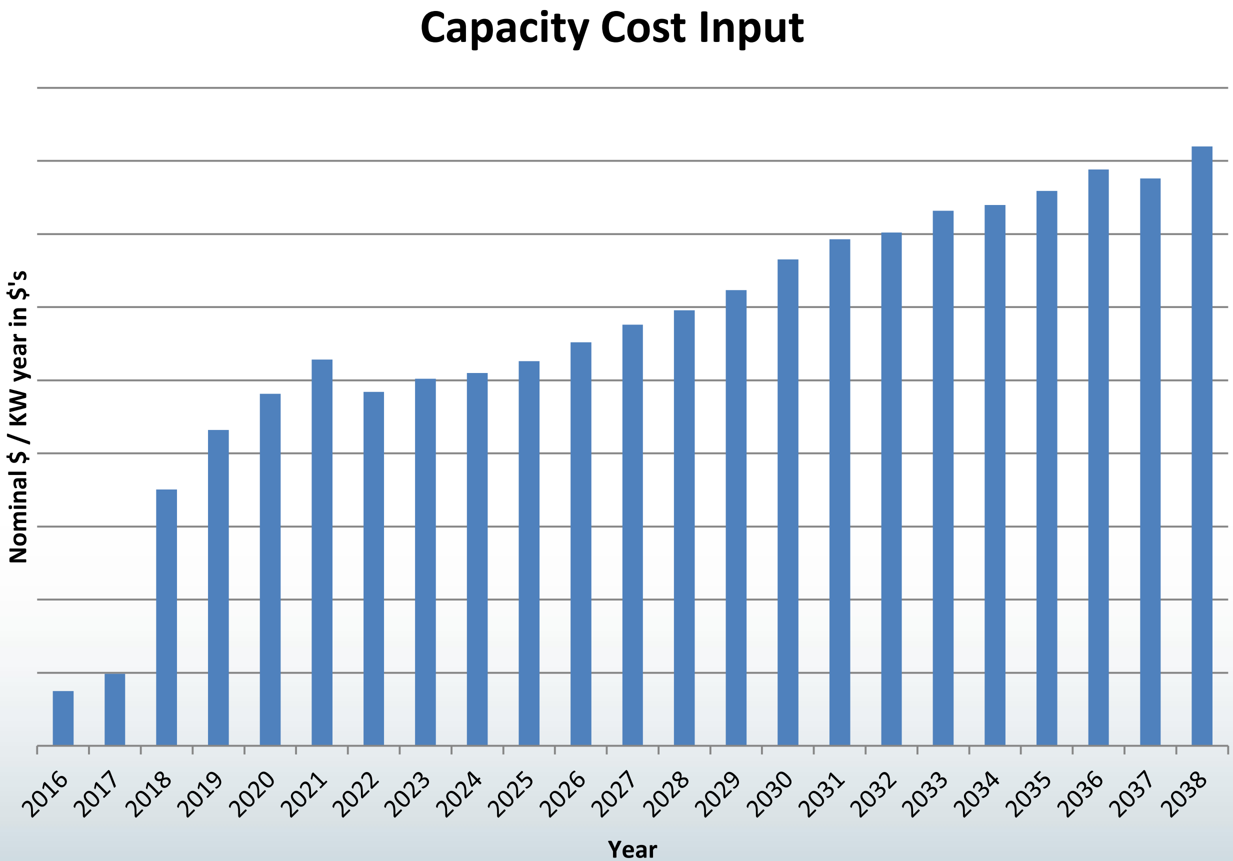
Source: IPL Forecast

Market price inputs



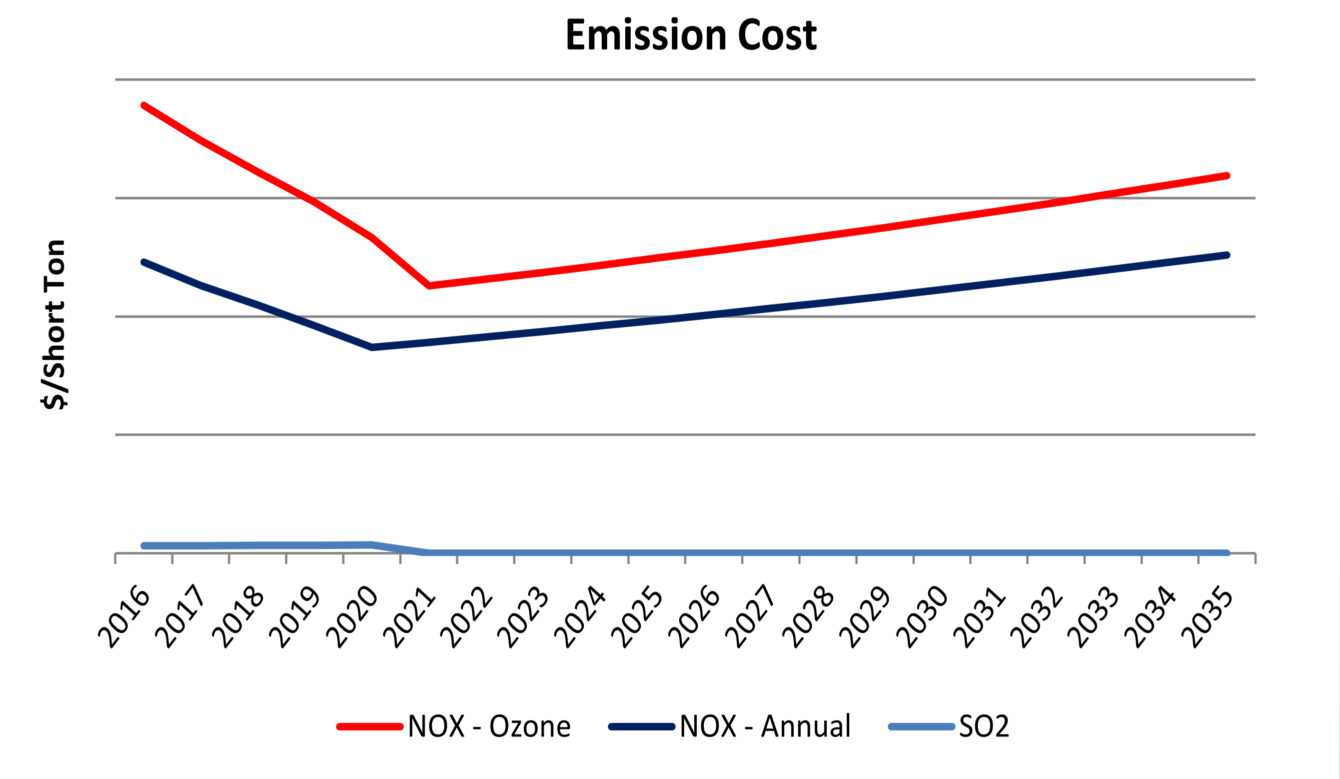
Source: ABB 2015 Fall Reference Case in nominal dollars

Capacity cost inputs



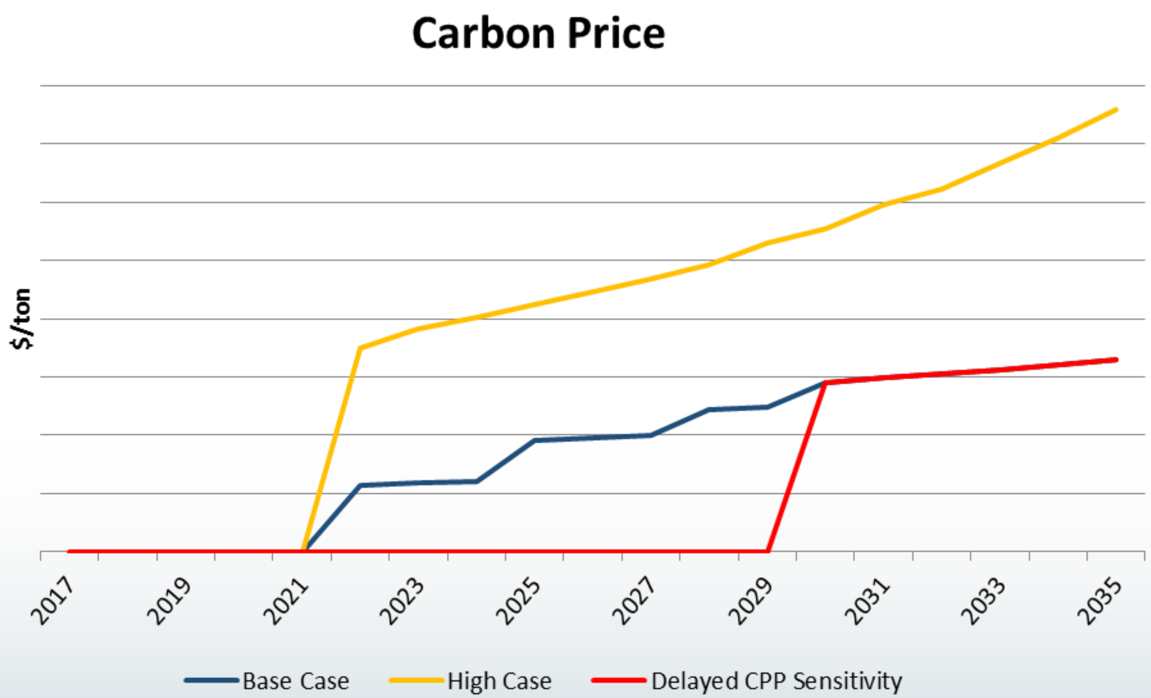
Source: Market Transactions and ABB 2015 Fall Reference Case

Emission cost inputs



Source: ABB 2015 Fall Reference Case in nominal dollars

Carbon cost inputs



Source: ABB Fall 2015 Reference Case and ICF Federal Legislation

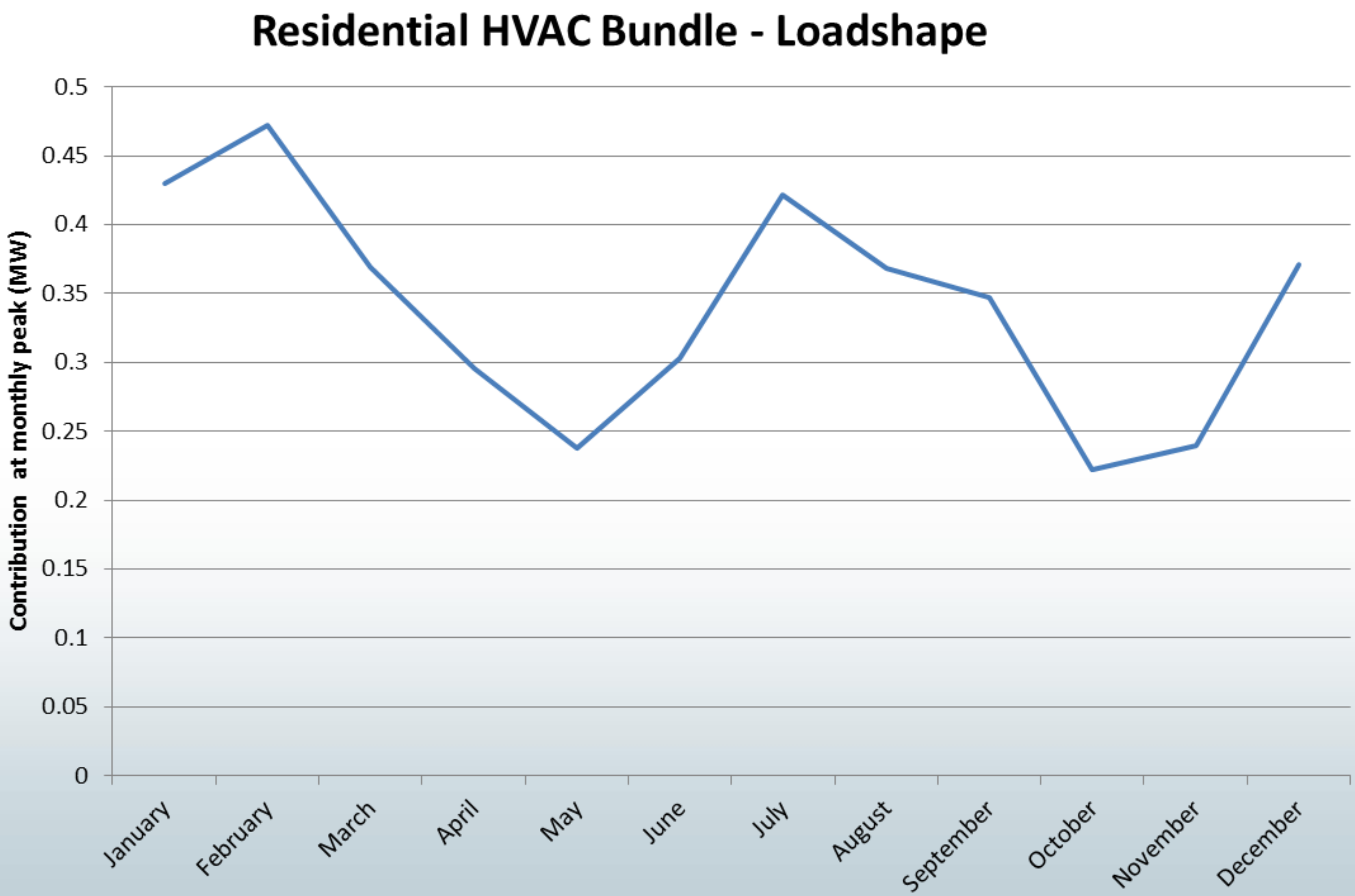
*Price is in nominal dollars

DSM bundles from Market Potential Study

1. EE Res Other (up to $30/MWh)
2. EE Res Other ($60+ /MWh)
3. EE Res Other ($30-60/MWh)
4. EE Res Lighting (up to $30/MWh)
5. EE Res HVAC (up to $30/MWh)
6. EE Res HVAC ($60+ /MWh)
7. EE Res HVAC ($30-60/MWh)
8. EE Res Behavioral Programs
9. EE Bus Process (up to $30/MWh)
10. EE Bus Process ($30-60/MWh)
11. EE Bus Other (up to $30/MWh)
12. EE Bus Other ($60+ /MWh)
13. EE Bus Other ($30-60/MWh)
14. EE Bus Lighting (up to $30/MWh)
15. EE Bus Lighting ($60+ /MWh)
16. EE Bus Lighting ($30-60/MWh)
17. EE Bus HVAC (up to $30/MWh)
18. EE Bus HVAC ($60+ /MWh)
19. EE Bus HVAC ($30-60/MWh)
20. DR Water Heating DLC
21. DR Smart Thermostats
22. DR Emerging Tech
23. DR Curtail Agreements
24. DR Battery Storage
25. DR Air Conditioning Load Mgmt

EE = Energy Efficiency
DR = Demand Response

DSM sample monthly load shape



Initial base model run results

DRAFT RESULTS – NOT FINAL

YEAR	Base*
2017	DSM - 21 MW
2018	DSM - 23 MW
2019	DSM - 17 MW
2020	DSM - 13 MW
2021	DSM - 12 MW
2022	DSM - 12 MW
2023	**Retire HS GT 1 & 2 (-32 MW) Oil** DSM - 12 MW
2024	DSM -13 MW
2025	DSM - 13 MW
2026	DSM - 11 MW
2027	DSM - 6 MW
2028	DSM - 7 MW
2029	DSM - 3 MW
2030	DSM - 4 MW
2031	**Retire HS 5 & 6 (-200 MW) NG** DSM - 5 MW
2032	**Retire Pete 1 (-227 MW) Coal** DSM - 12 MW
2033	**Retire HS 7 (-430 MW) NG** DSM - 11 MW Battery 140 MW PV 20 MW
2034	**Retire Pete 2 (-410 MW) Coal** DSM - 5 MW Battery 460 MW
2035	DSM - 5 MW CC 200 MW Battery 240 MW
2036	DSM - 5 MW CC 200 MW Battery 60 MW

*Batteries were modeled as "peakers" without additional grid benefits. Technology and market changes may affect implementation timing.

Initial findings

- The base scenario model results include environmental compliance capital expenditures at Petersburg
- Incremental DSM additions were selected each year starting at ~1% of forecasted sales
- Supply side additions of batteries and solar occur near the unit retirements
- CCGT is selected in later years of study period

Modeling work will continue

- Review base case including inherent DSM
- Run Capacity Expansion model for the other 4 scenarios
- Run Production Cost model for all scenarios
- Calculate PVRRs
- Calculate metrics
- Share results

Questions?

Portfolio Exercise

Joan Soller, Director of Resource Planning

Dr. Marty Rozelle, Facilitator

Stakeholders draft portfolios

- Consider mix of supply and demand resources to meet ~3000 MW peak load requirement
- Recall representative costs from the April meeting on the next slide
- We are interested in your points of view

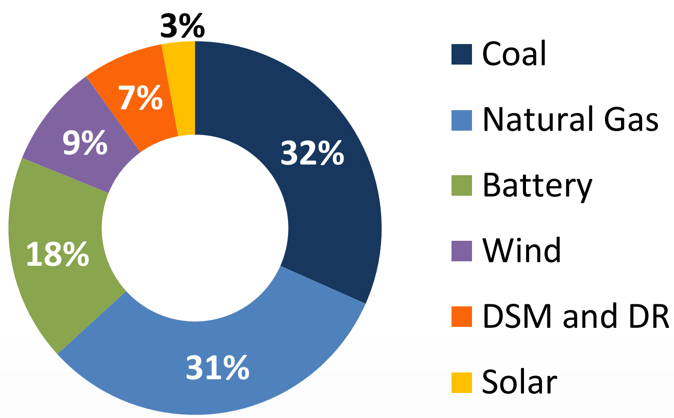
Supply side resource alternatives (from Meeting #1)

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

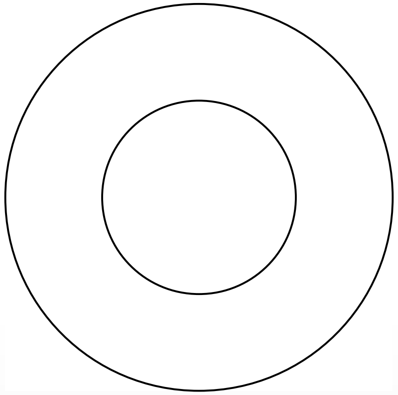
*See Meeting #1 presentation for sources

Exercise worksheet

Potential IPL 2034 portfolio
(nameplate capacity)



“My” portfolio



- ☐ coal ____%
- ☐ battery ___%
- ☐ DSM and DR ____%
- ☐ natural gas ____%
- ☐ oil _____%
- ☐ solar ______%
- ☐ wind ____%
- ☐ other ____%

Discussion

Next Steps

Dr. Marty Rozelle, Facilitator

Written comments and feedback

- Deadline to send written comments and questions regarding this meeting to ipl.irp@aes.com is Tuesday, June 21
- All IPL responses will be posted on the IPL IRP website by Tuesday, July 5
- IPL is considering a webinar to share modeling results in August

Next scheduled meeting

Friday, September 16, 2016

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

Thank you!

We value your input and appreciate your participation. Please submit your feedback form and recycle your nametag at the registration table as you leave the meeting today.