



Welcome!

The meeting will start momentarily.

Questions during the presentation?


Questions can be taken over the audio bridge or submit a question to us in the chat function at any time.

Audio Details

All lines are muted. Following the presentation, unmute your line by selecting your Attendee Name and clicking the microphone icon. If you are dialing from a touch tone, you will press *6 to unmute your line.



Skype Layout

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IPL 2019 IRP: PUBLIC ADVISORY MEETING #3

May 14, 2019



WELCOME & OPENING REMARKS

Lisa Krueger

President, AES US SBU

MEETING OBJECTIVES & AGENDA

Stewart Ramsay

Meeting Facilitator



AGENDA

Topic	Time (Eastern)	Presenter
Registration	9:00 – 9:30	-
Welcome & Opening Remarks	9:30 – 9:35	Lisa Krueger, President AES US SBU
Meeting Objectives & Agenda	9:35 – 9:40	Stewart Ramsay, Meeting Facilitator
Meeting 2 Recap	9:40 – 9:50	Patrick Maguire, Director of Resource Planning
Stakeholder Presentation: Indiana Chapter of the National Association for the Advancement of Colored People (NAACP)	9:50 – 10:05	Denise Abdul-Rahman, NAACP
Stakeholder Presentation: Advanced Energy Management Alliance (AEMA)	10:05 – 10:20	Ingrid Bjorklund, AEMA Consultant
Electric Vehicle (EV) & Distributed Solar Forecast	10:20 – 11:10	Ed Schmidt, MCR
BREAK	11:10 – 11:25	
Load Forecast – High & Low Presentation Recap Customer Class Breakout	11:25 – 11:40	Erik Miller, Senior Research Analyst
DSM Bundles for IRP Modeling	11:40 – 12:00	Erik Miller, Senior Research Analyst
LUNCH	12:00 – 12:45	
Modeling and Scenario Recap	12:45 – 1:45	Patrick Maguire, Director of Resource Planning
Final Q&A, Concluding Remarks & Next Steps	1:45 – 2:00	Stewart Ramsay, Meeting Facilitator



MEETING 2 RECAP

Patrick Maguire

Director of Resource Planning



IPL 2019 IRP

INTEGRATED RESOURCE PLAN (IRP):

IPL's plan to provide safe, reliable, and sustainable energy solutions for the communities we serve

- IRP submitted every three years
- Plan created with stakeholder input
- 20-year look at how IPL will serve load
- Modeling and analysis culminates in a preferred resource portfolio

What is a preferred resource portfolio?

“ ‘Preferred resource portfolio’ means the utility's selected long term supply-side and demand-side resource mix that safely, reliably, efficiently, and cost-effectively meets the electric system demand, taking cost, risk, and uncertainty into consideration.”

IURC RM #15-06, LSA Document #18-127

Link (PDF): https://www.in.gov/iurc/files/RM_ord_20181024141710007.pdf



2019 IRP STAKEHOLDER PROCESS

Dates to follow for Meeting #4 & Meeting #5

January 29th

- 2016 IRP Recap
- 2019 IRP Timeline, Objectives, Stakeholder Process
- Capacity Discussion
- IPL Existing Resources and Preliminary Load Forecast
- Introduction to Ascend Analytics
- Supply-Side Resource Types
- DSM/Load Forecast Schedule

March 13th

- Stakeholder Presentations
- Commodity Assumptions
- Capital Cost Assumptions
- IPL-Proposed Scenario Framework
- Scenario Workshop
- MPS Update and Plan

May 14th

- Stakeholder Presentations
- Summary of Stakeholder Feedback
- Present Final Scenarios
- Modeling Update
- Assumptions Review and Updates

August

- Stakeholder Presentations
- Summary of Stakeholder Feedback
- Preliminary Model Results
- Scenario Descriptions and Results
- Preliminary Look at Risk Analysis and Stochastics

October

- Stakeholder Presentations
- Final Model Results
- Scenario Updates
- Updates on Stakeholder Scenarios
- Preferred Plan

IPL is committed to conducting a robust and collaborative stakeholder process. Multiple communication avenues will be provided to ensure that all stakeholders have the opportunity to be a part of the 2019 IRP process.

STAKEHOLDER PRESENTATION

Denise Abdul-Rahman

NAACP

STAKEHOLDER PRESENTATION

Ingrid Bjorklund

Advanced Energy Management Alliance (AEMA)



ELECTRIC VEHICLE (EV) & DISTRIBUTED SOLAR FORECAST

Ed Schmidt

MCR Performance Solutions

MCR



Electric Vehicle and Distributed Solar Forecasts: 2020-2040



5/14/19

MCR Performance Solutions: Management Consulting to the Utility Industry

Regulatory Services

- Strategic Analysis
- Rate Design & Cost Analysis
- Regulatory Filings
- Process Improvement

Energy Efficiency

- Strategy and Program Design
- Process and Data Management
- Program Implementation
- Program Management & Administration
- Program Tracking & Reporting

Utility Transformation

- New Technology Strategy & Product Development: Electric Vehicles and C&I
- Customer Onsite Product Development
- Enhanced Customer Experience: Strategies, Roadmaps and Product Financing Strategy

Financial Advisory

- Financial Forecasting
- Enterprise Risk Management
- Strategic Planning
- Capital Allocation
- Financial Processes & Systems

Transmission Strategy

- Formula Rate and Cost Analysis
- FERC Filings
- Strategic Analysis

Asset Management

- Zero-Base Budgeting
- Capital Project Evaluation
- Life Cycle Management Planning
- Long Range Planning
- Management Reporting
- Capitalization Policies and Procedures

Table of Acronyms

BNEF Bloomberg New Energy Finance

BRT IndyGo bus rapid transit routes

BYD IndyGo-selected bus manufacturer

CAGR Compound annual growth rate

C&I Commercial and industrial

EEI Edison Electric Institute

EIA US Energy Information Administration

EV Electric vehicle

GTM GreenTech Media

ICE Internal combustion engine

IHS IHS Markit Company

IU Indiana University

LDEV Light duty electric vehicle

NEM Net metered

PV Photovoltaic, or distributed, solar

PVWatts US National Renewable Energy Laboratory PV calculation tool

Agenda

- EV Forecast
 - 2018 baseline data
 - Methodology
 - Input data
 - Forecast
- Distributed solar (PV) Forecast
 - 2018 baseline data
 - Methodology
 - Input data
 - Forecast
- Summary: EV and Distributed Solar Forecast

EV Forecast

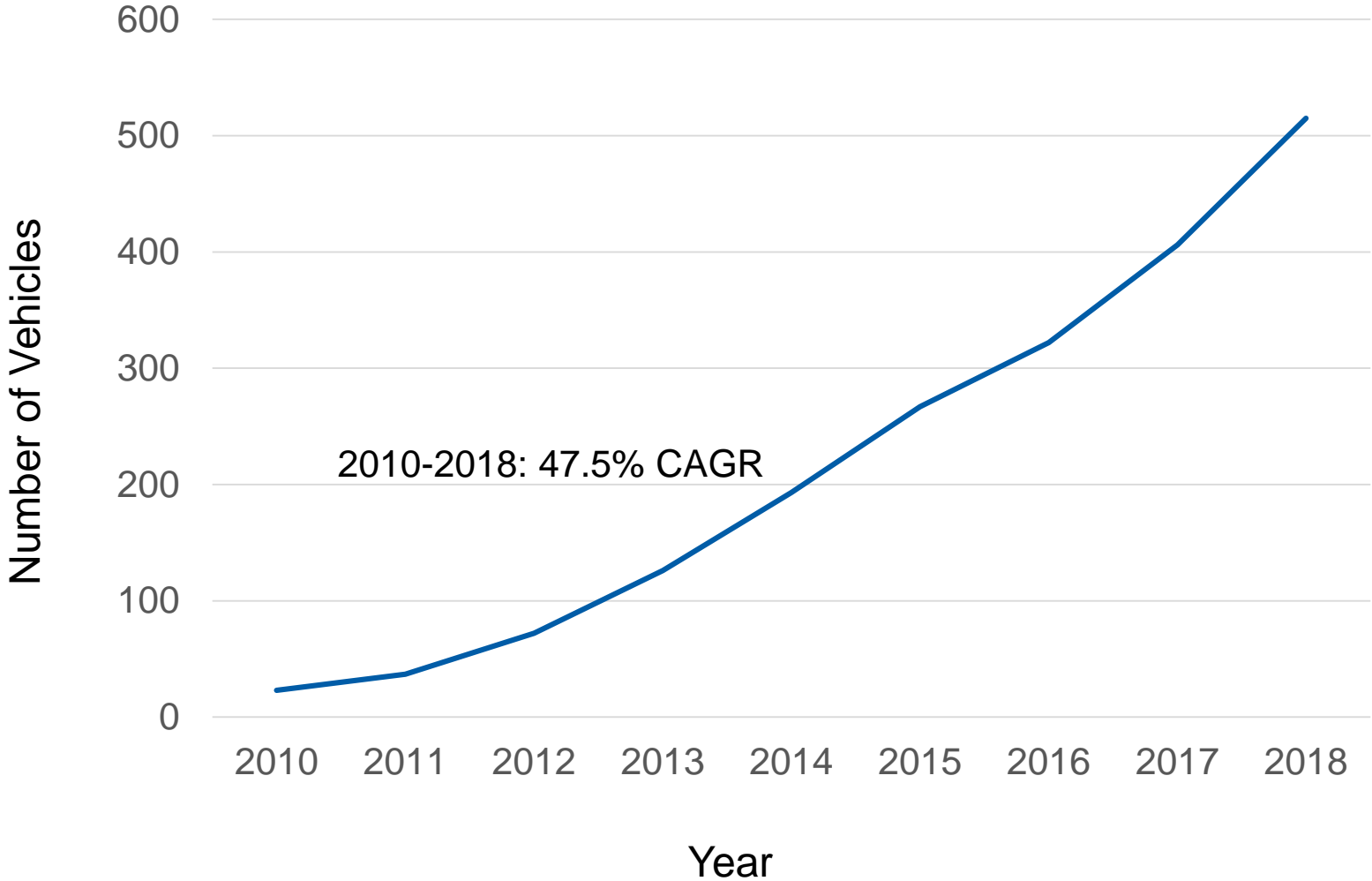
Light Duty EV (LDEV)

Attribute	Value	Source
Count	515	IPL-provided IHS/Polk
kWh/100 miles	31	www.fueleconomy.gov
Annual miles	11,655	www.carinsurance.com
Annual kWh	3,613	= 31 * (11,655/100)

- Notes: 1. 31 kWh/100 miles takes the weighted average for Bolt, Leaf, Tesla S, Tesla 3, Tesla X
2. Annual kWh = 11,655 miles / 100 * 31

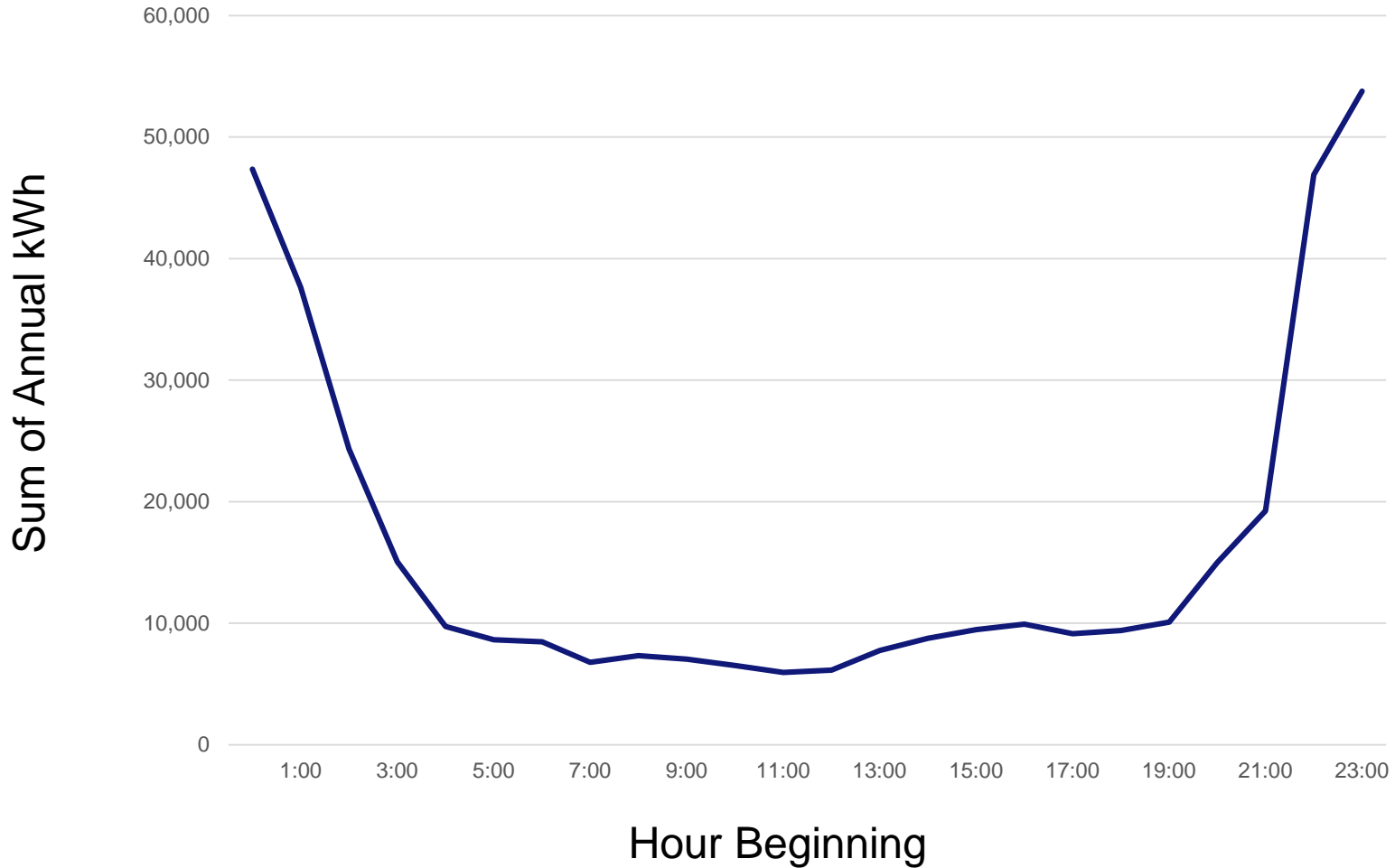
Historical Light Duty EV Fleet Growth

Marion County EV Fleet



EV Charging Curve – IPL Electric Vehicle Rates

Actual kWh Curve for EV Charging, 2018

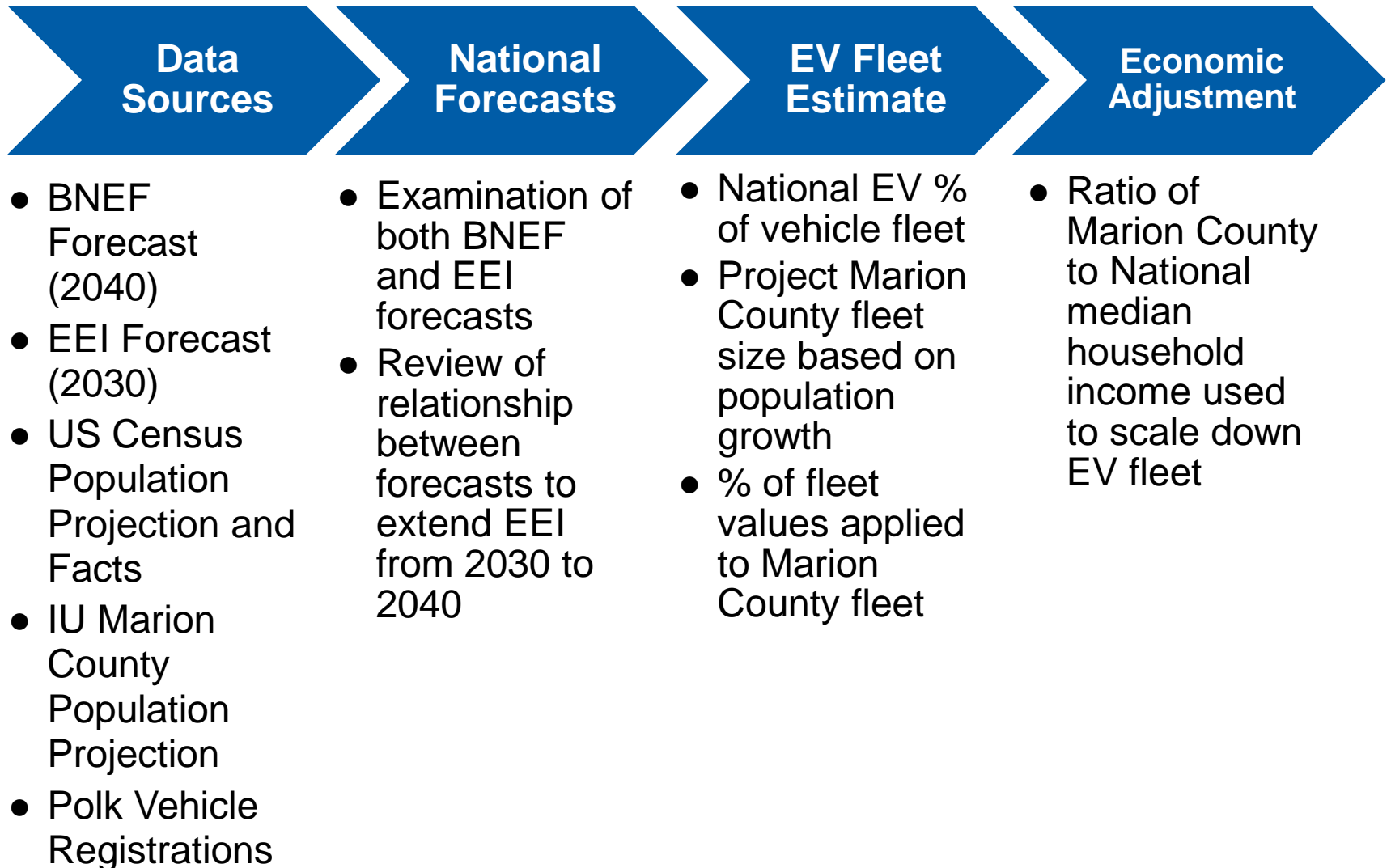


IndyGO Electric Buses

Attribute	60' BYD BRT	40' Fleet
Current quantity	2	21
2032 quantity	56	144
Range	275	250
Miles/year	45,600	45,600
Charger	40 kW x 2	40 kW x 2
Battery kWh	652	489
Charge time hours	6	4.5

- Notes:
1. 2032 quantities are per IndyGO capital plan
 2. Ranges are current per manufacturers
 3. BYD charger, battery kWh and charge time are per BYD, fleet buses are estimated

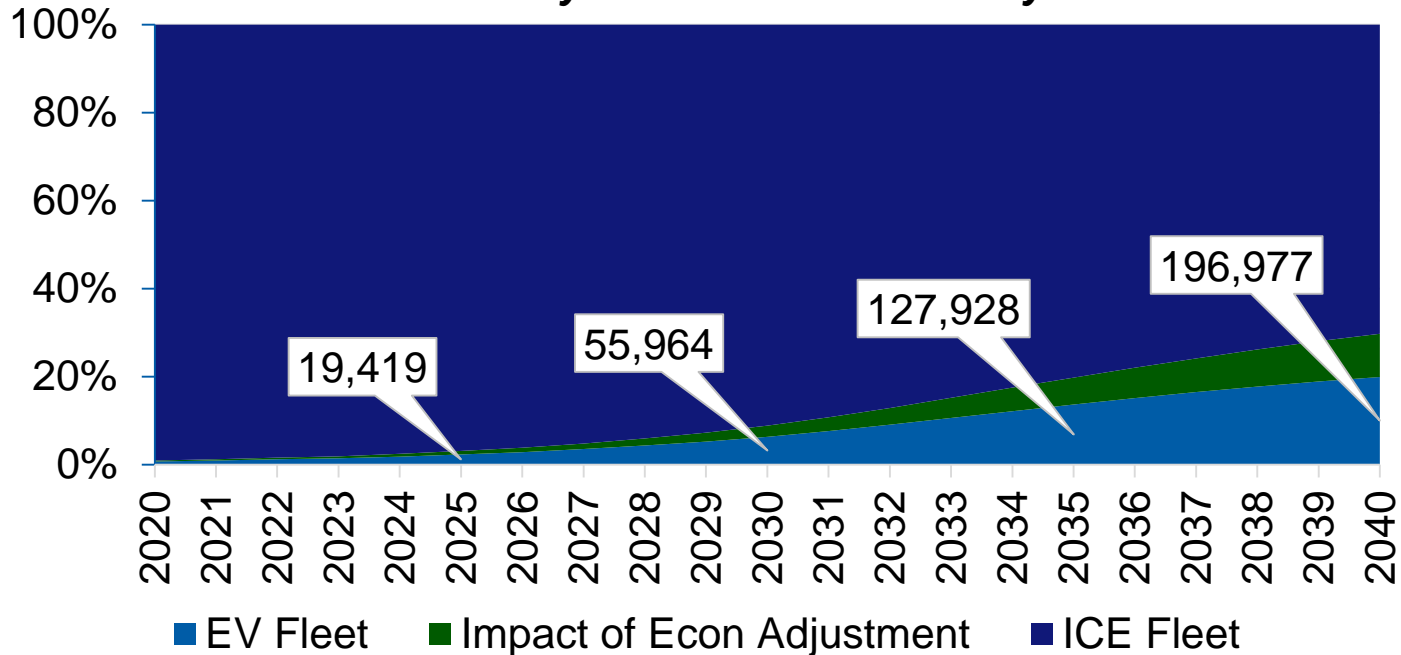
LDEV Unit Forecasting Methodology



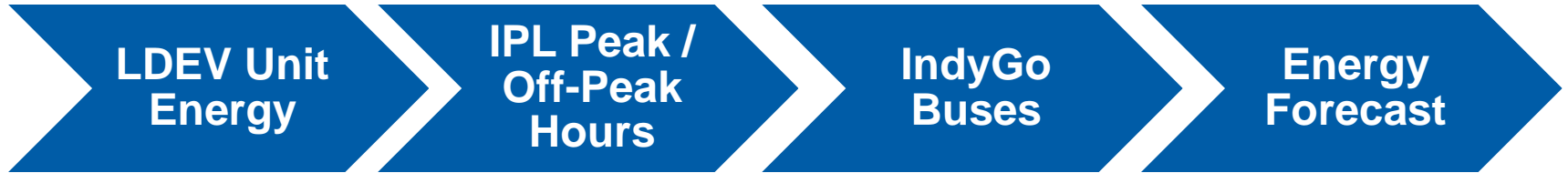
LDEV Unit Forecast

Year	Total Fleet	EV Fleet	ICE Fleet	EV % Fleet
2020	833,269	5,573	827,696	0.7%
2025	850,552	19,419	831,133	2.3%
2030	865,691	55,964	809,727	6.5%
2035	879,523	127,928	751,595	14.6%
2040	893,781	196,977	696,804	22.0%

Marion County EV Percent of Fleet by Year



EV MWh Forecasting Methodology



- 3,613 kWh/year used, as discussed above

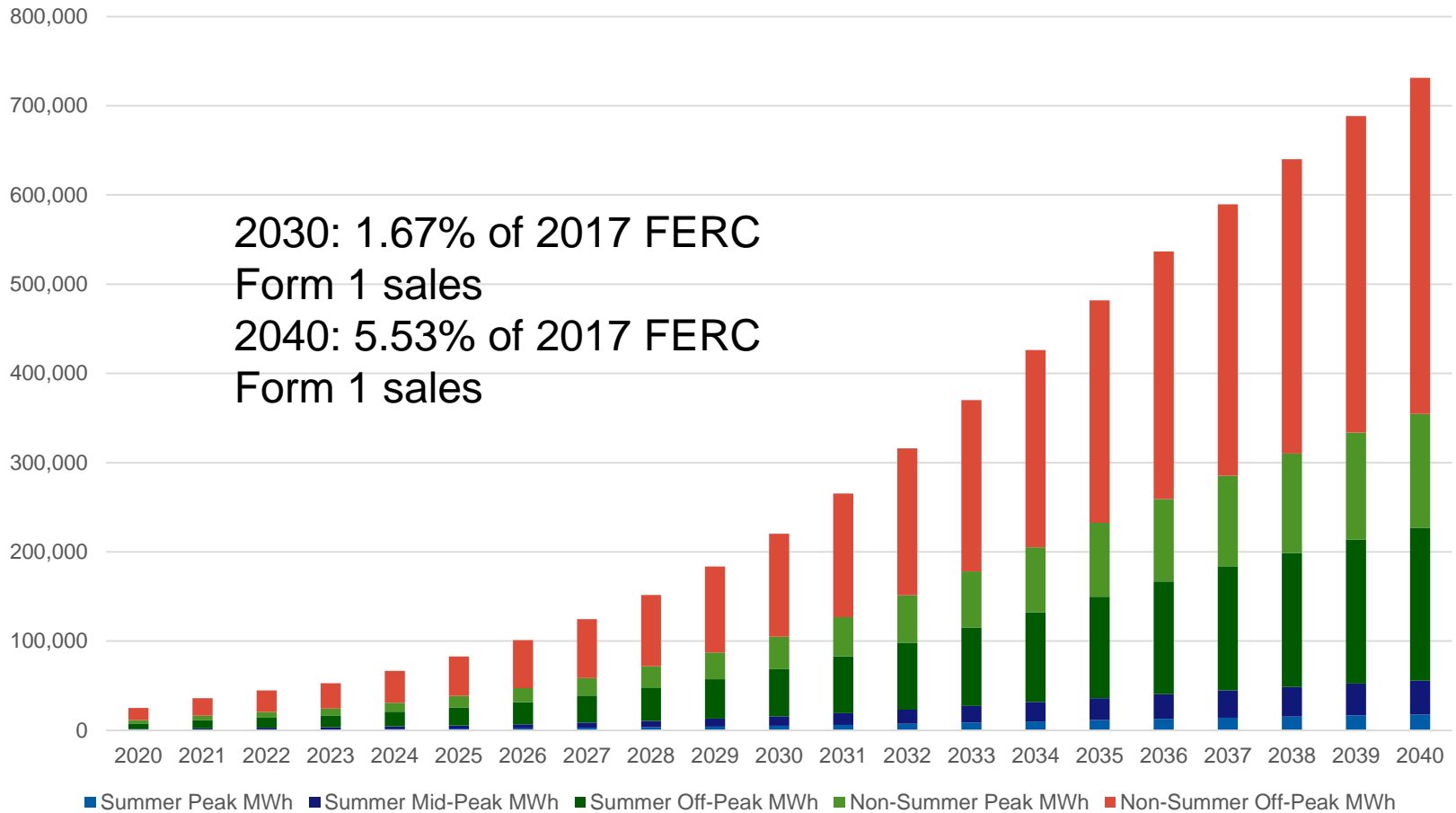
- Rate EVX pricing periods used
- 2.5% of charging occurs in the Summer peak period

- Annual energy usage based on vehicle specs and operations

- Annual energy and impacts driven by fleet size and unit kWh

Electric Vehicle MWh Impacts through 2040

Marion County EV MWh by Year



Distributed Solar Forecast

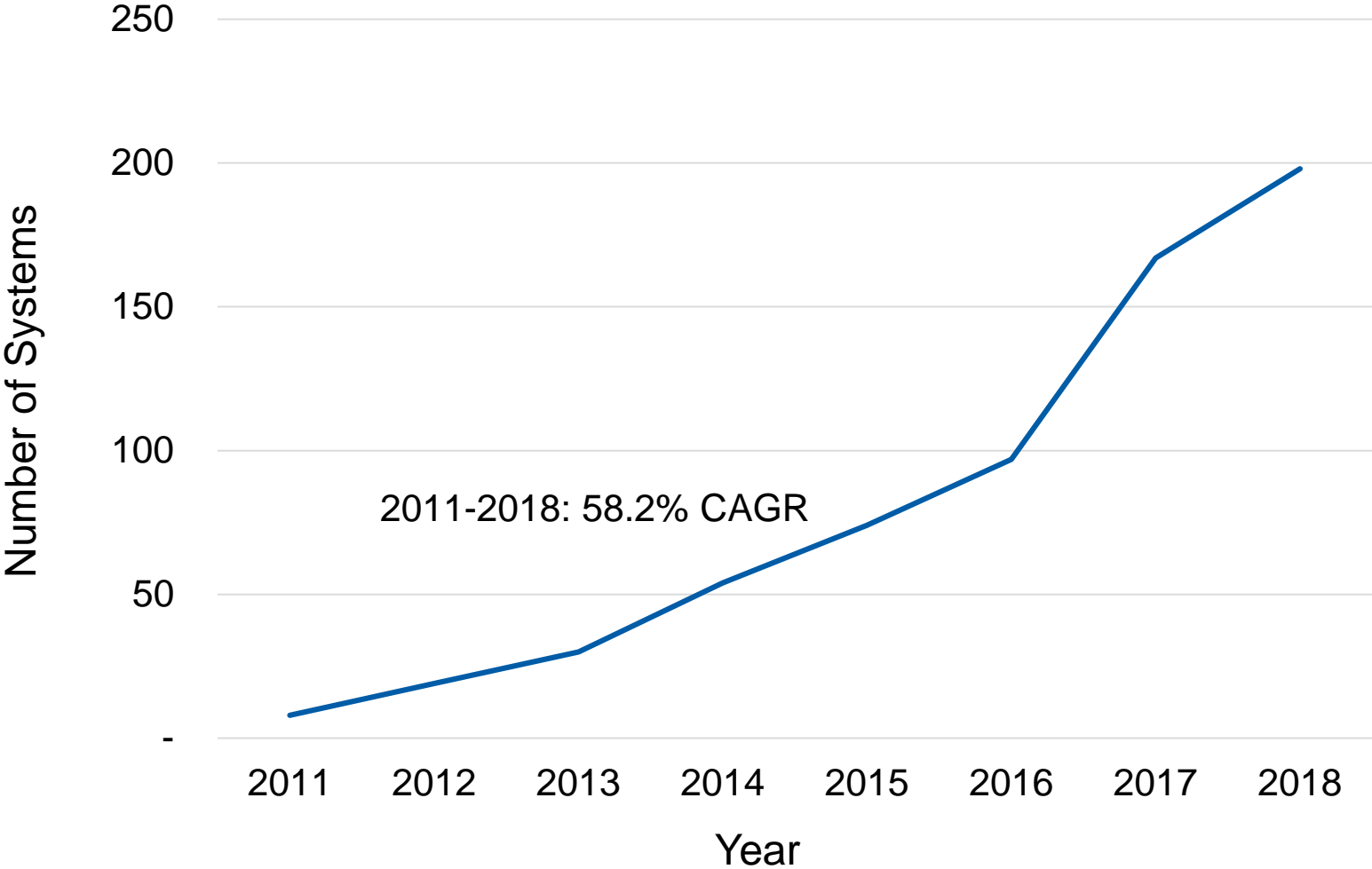
2018 Residential and Commercial Distributed Solar Baseline

Attribute	Residential	C&I
IPL NEM count (Adjusted EIA counts from IPL 2018 NEM file)	177	21
Size (kW - DC)	8	125
Panel type	Anti-reflective crystalline silicon	Anti-reflective crystalline silicon
Array type	Fixed	Fixed
Capacity factor (AC)	15.8%	15.8%
Production basis	PVWatts – 46241	PVWatts – 46241

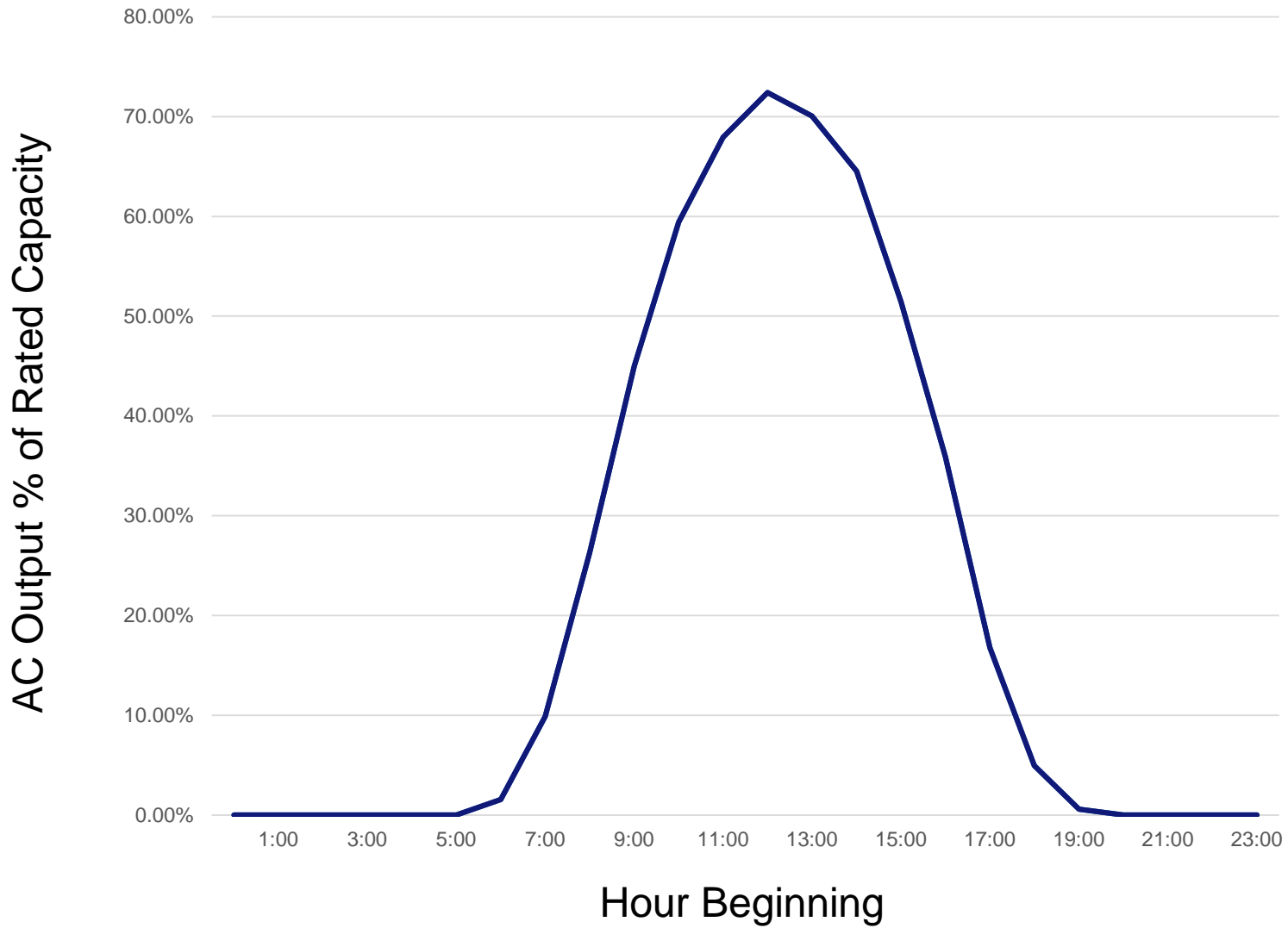
- Notes: 1. Panel type is PVWatts “premium”
2. Zip code 46241 shows relatively high solar penetration

Historical Distributed Solar System Growth

Marion County PV Systems



Distributed Solar Production Curve



Distributed Solar Unit Forecasting Methodology

IPL 2018 NEM Baseline

- Cleaned input 2018 IPL NEM census dataset
- Retained all NEM records showing non-null system size and installation date

GTM 4Q18 Solar Outlook

- Compiled annual installed MWdc national actual and forecasts for 2013-2023 separately for residential and non-residential customers
- Examined impact of high-volume states, relative intensity of activity in Indiana, etc.

2019-23 GTM-based CAGR

- Computed 2019-2023 compound annual growth rates for residential and non-residential MWdc installed nationally

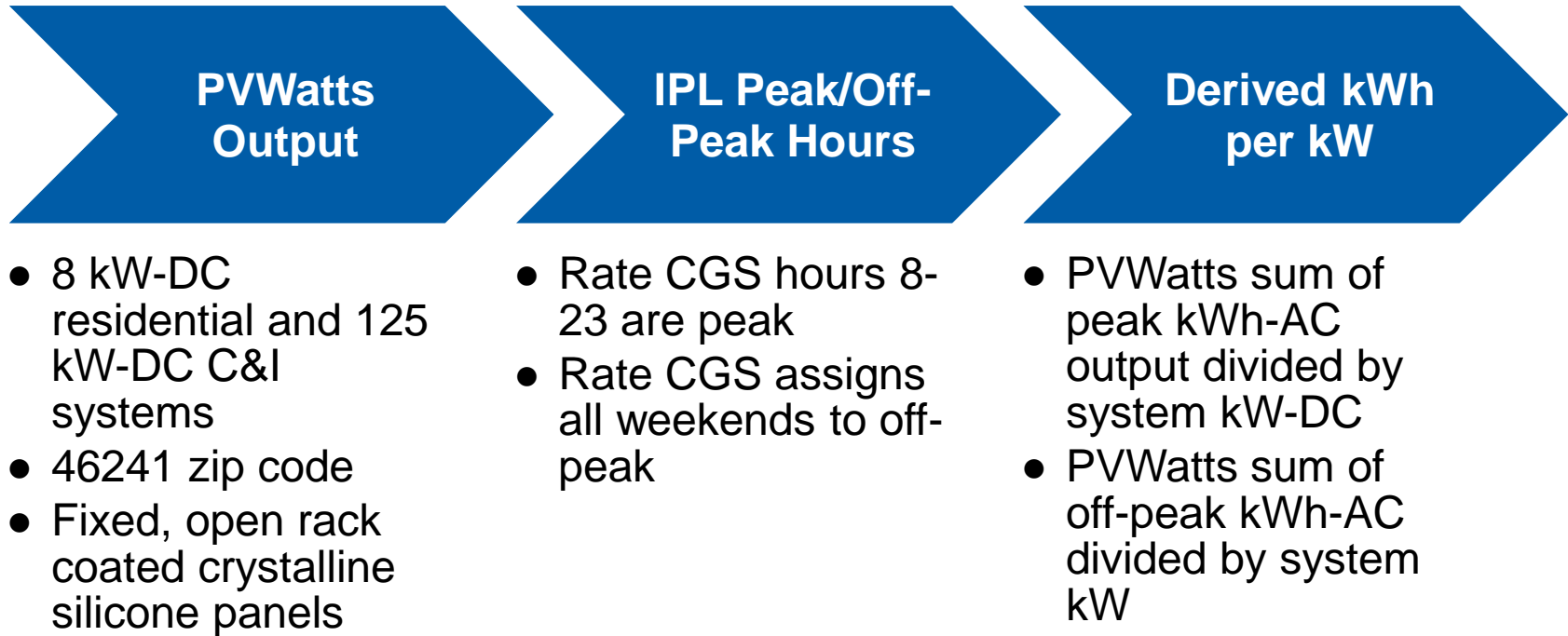
Apply CAGR to IPL NEM Baseline

- Applied compound annual growth rates to 2018 IPL actual number of systems for 2019 and 2020-2040
- Applied baseline IPL system size in kW-DC and annual kWh-AC separated into Rate CGS peak/off-peak splits

Input Data: GTM-based CAGR

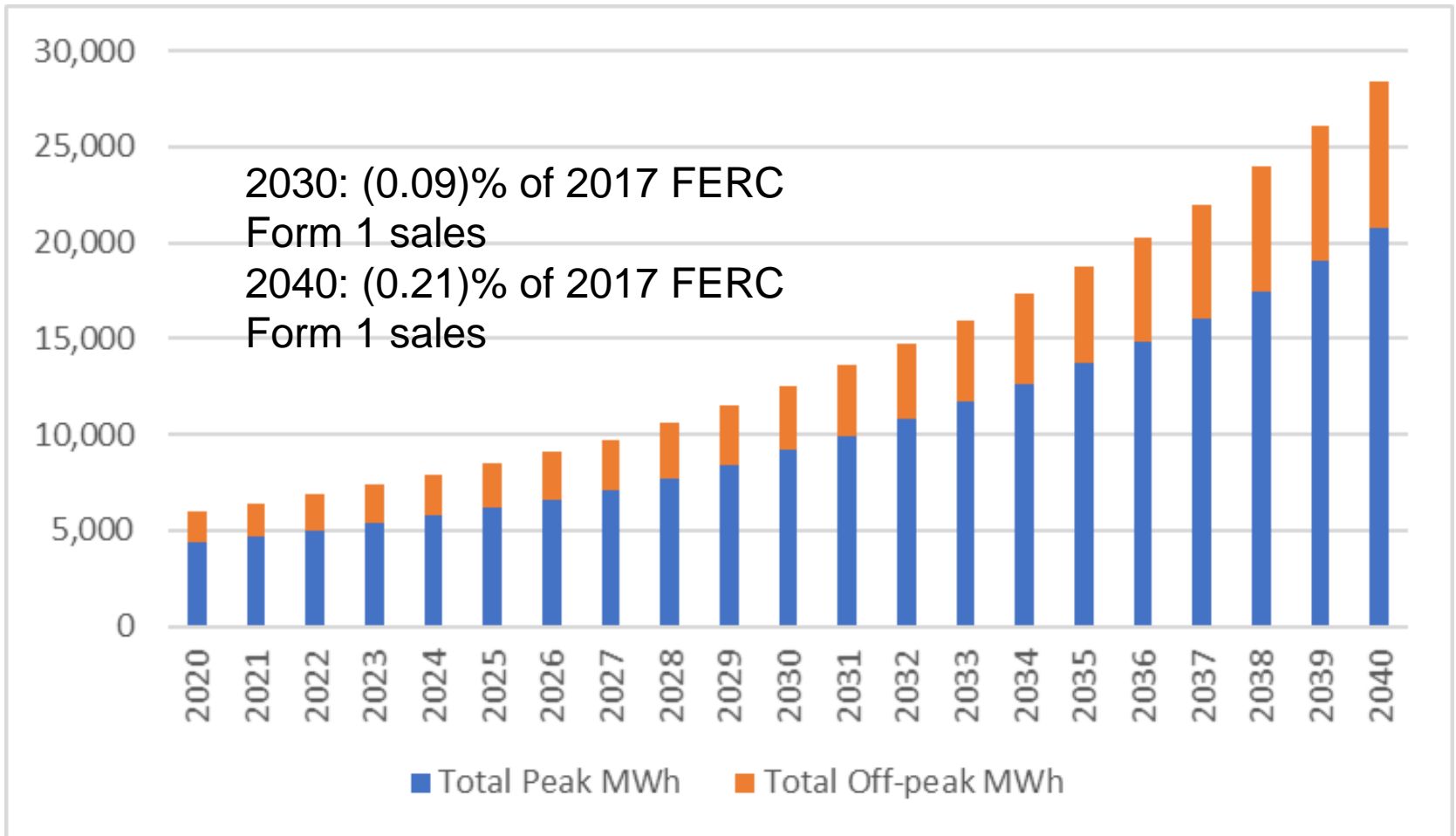
Year	Incremental Residential MWdc	Incremental Residential Growth Rate	Incremental C&I MWdc	Incremental C&I Growth Rate
2019	2,510	10.62%	1,761	-16.70%
2020	2,827	12.63%	1,853	5.22%
2021	3,302	16.80%	1,965	6.04%
2022	3,424	3.69%	1,944	-1.07%
2023	3,775	10.25%	2,144	10.29%
CAGR		10.74%		5.04%

Distributed Solar kW and MWh Forecasting Methodology



Distributed Solar MWh Impacts through 2040

Marion County PV MWh by Year



Summary: EV and Distributed Solar Forecast

EV and Distributed Solar Forecast Summary: MWh

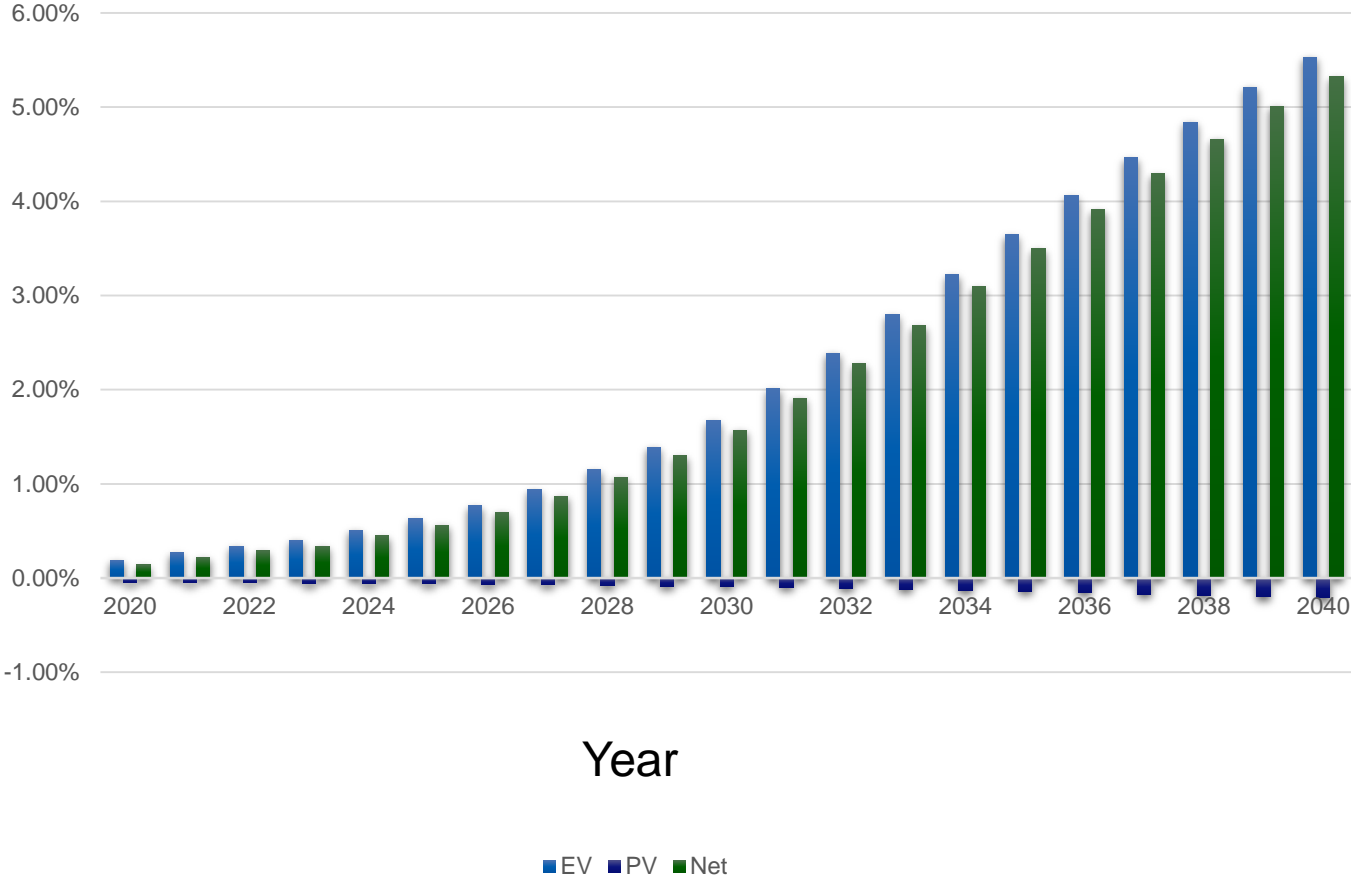
Year	EV Summer Peak MWh	EV Summer Mid-Peak MWh	EV Summer Off-Peak MWh	EV Non-Summer Peak MWh	EV Non-Summer Off-Peak MWh	EV Annual MWh	PV Peak MWh	PV Off-Peak MWh	PV Annual MWh
2020	500	1,076	6,273	3,610	13,506	24,965	4,388	1,619	6,007
2021	697	1,500	9,129	5,031	19,595	35,952	4,701	1,734	6,435
2022	887	1,908	11,277	6,399	24,255	44,726	5,035	1,858	6,893
2023	1,063	2,287	13,296	7,668	28,631	52,944	5,399	1,992	7,391
2024	1,378	2,966	16,620	9,947	35,883	66,795	5,783	2,134	7,917
2025	1,743	3,751	20,399	12,578	44,140	82,611	6,197	2,286	8,483
2026	2,175	4,680	24,803	15,693	53,776	101,126	6,632	2,447	9,079
2027	2,730	5,875	30,362	19,702	65,961	124,630	7,114	2,626	9,740
2028	3,374	7,259	36,738	24,343	79,945	151,657	7,754	2,861	10,615
2029	4,138	8,903	44,241	29,856	96,417	183,555	8,432	3,111	11,543
2030	5,023	10,809	52,878	36,248	115,389	220,348	9,170	3,383	12,553

EV and Distributed Solar Forecast Summary: MWh (continued)

Year	EV Summer Peak MWh	EV Summer Mid-Peak MWh	EV Summer Off-Peak MWh	EV Non-Summer Peak MWh	EV Non-Summer Off-Peak MWh	EV Annual MWh	PV Peak MWh	PV Off-Peak MWh	PV Annual MWh
2031	6,117	13,163	63,456	44,142	138,644	265,523	9,948	3,670	13,618
2032	7,358	15,833	75,151	53,094	164,413	315,848	10,777	3,976	14,753
2033	8,706	18,734	87,718	62,822	192,132	370,112	11,677	4,308	15,985
2034	10,095	21,723	100,667	72,845	220,694	426,023	12,648	4,666	17,314
2035	11,483	24,709	113,604	82,859	249,229	481,884	13,689	5,050	18,739
2036	12,843	27,636	126,285	92,675	277,200	536,639	14,811	5,464	20,275
2037	14,156	30,462	138,525	102,150	304,200	589,493	16,034	5,916	21,950
2038	15,414	33,168	150,251	111,227	330,063	640,122	17,490	6,453	23,943
2039	16,615	35,751	161,440	119,888	354,744	688,439	19,057	7,031	26,088
2040	17,681	38,045	171,380	127,583	376,669	731,358	20,756	7,658	28,414

EV and Distributed Solar as a Percent of 2017 Sales

Percent of 2017 FERC Form 1 MWh



BREAK



LOAD FORECAST - HIGH & LOW RECAP OF CUSTOMER CLASS BREAKOUT

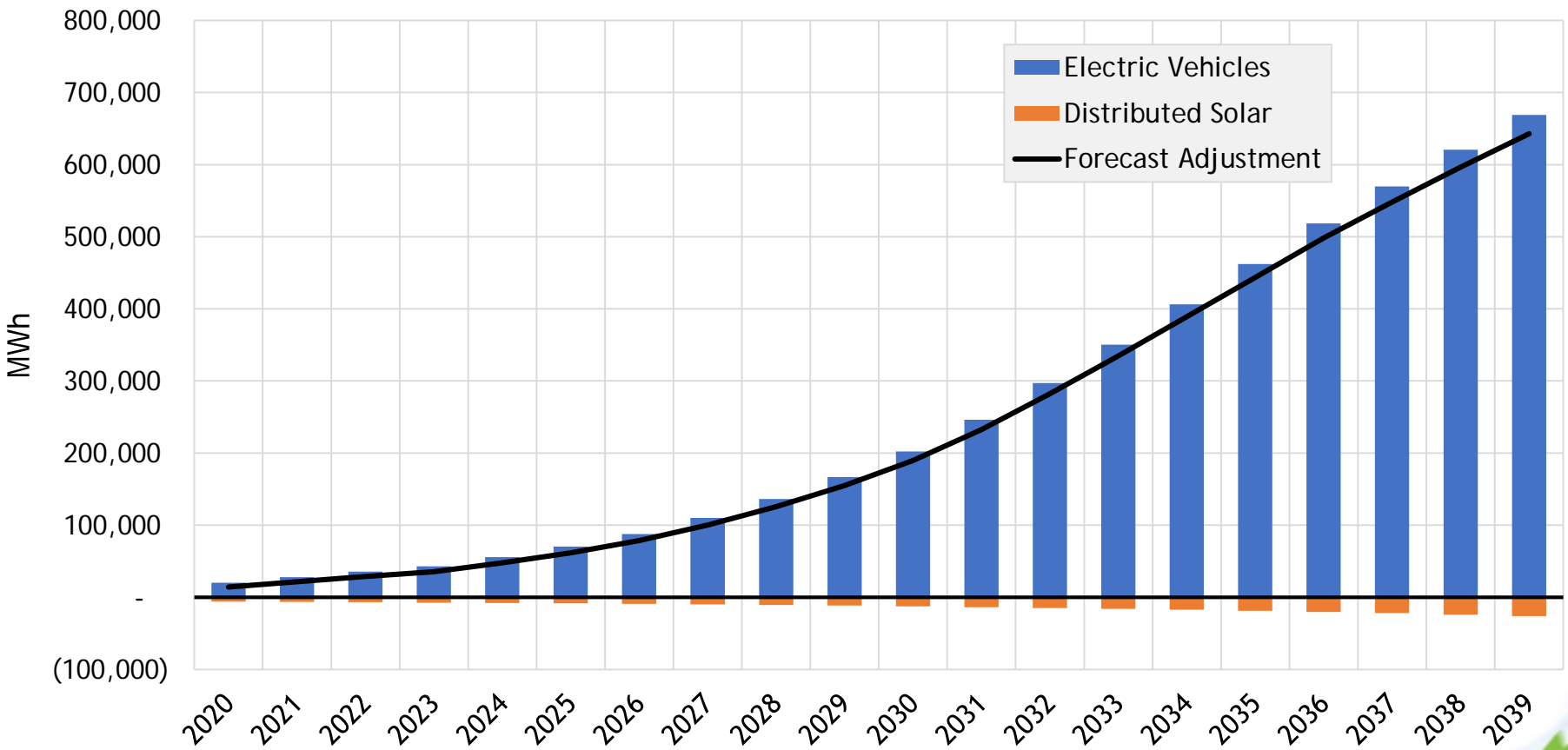
Erik Miller

Senior Research Analyst



EV & PV ADJUSTMENT

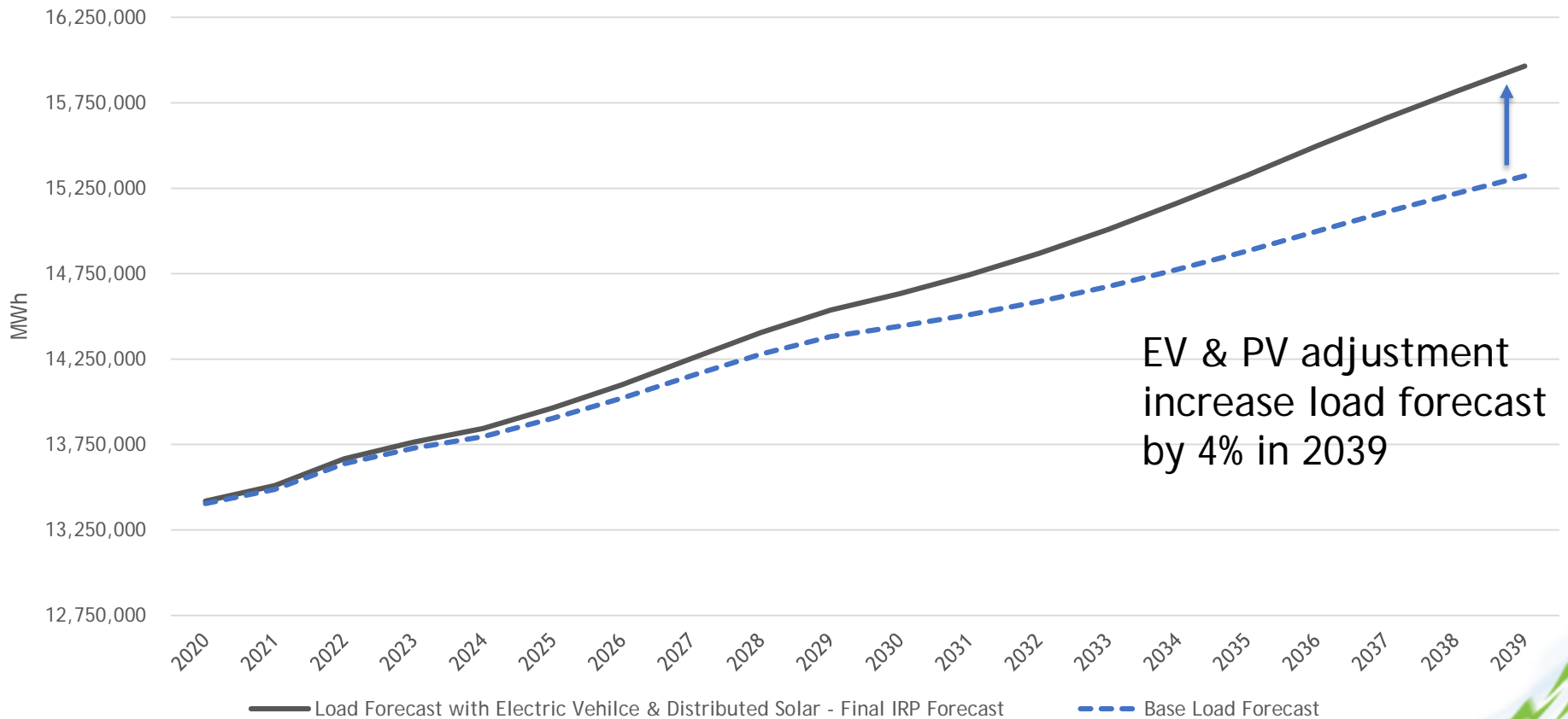
Electric Vehicle and Distributed Solar Annual kWh for IPL Service Territory





IPL LOAD FORECAST EV & PV ADJUSTMENT

IPL Load Forecast - EV and PV Adjustments

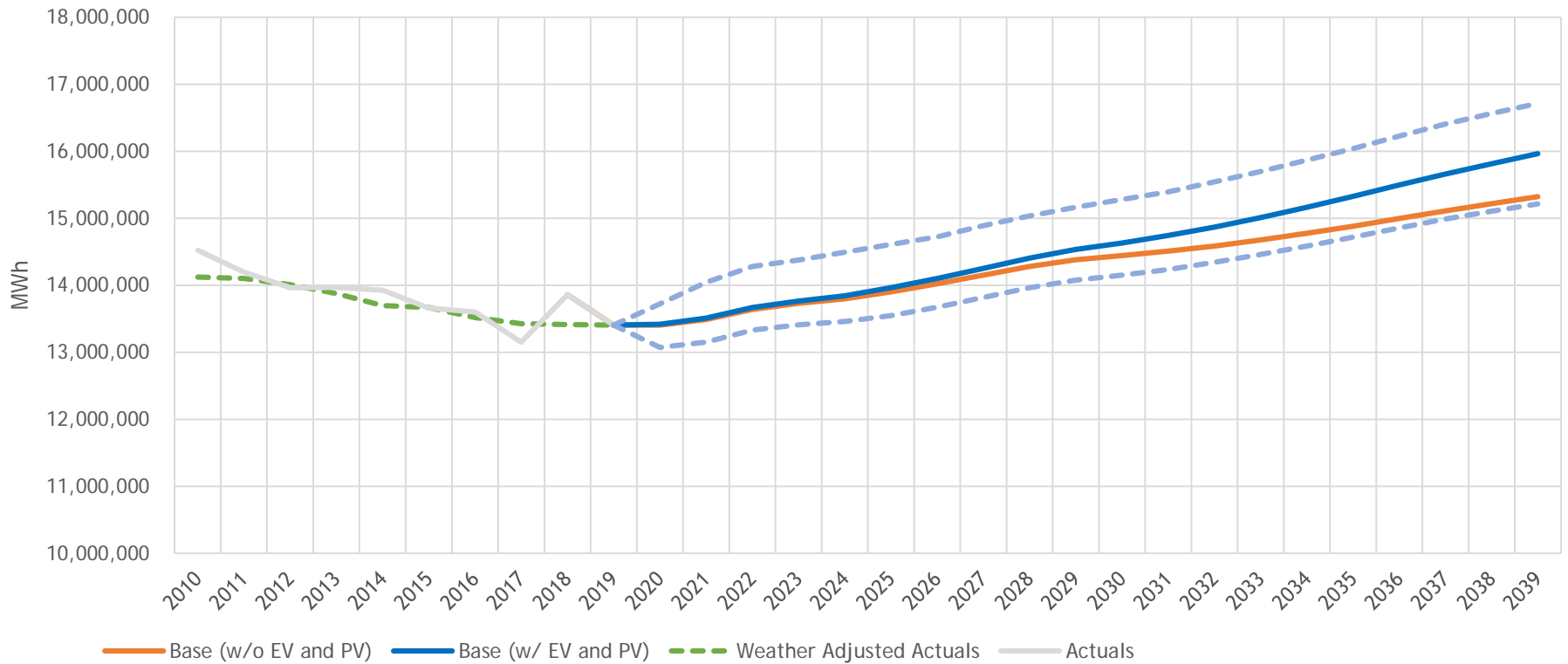




IPL BASE, HIGH & LOW LOAD FORECAST

*INCLUDES PRIOR YEAR DSM IMPACTS;
FUTURE DSM WILL BE MODELED IN THE IRP*

IPL Base, High & Low Load Forecast

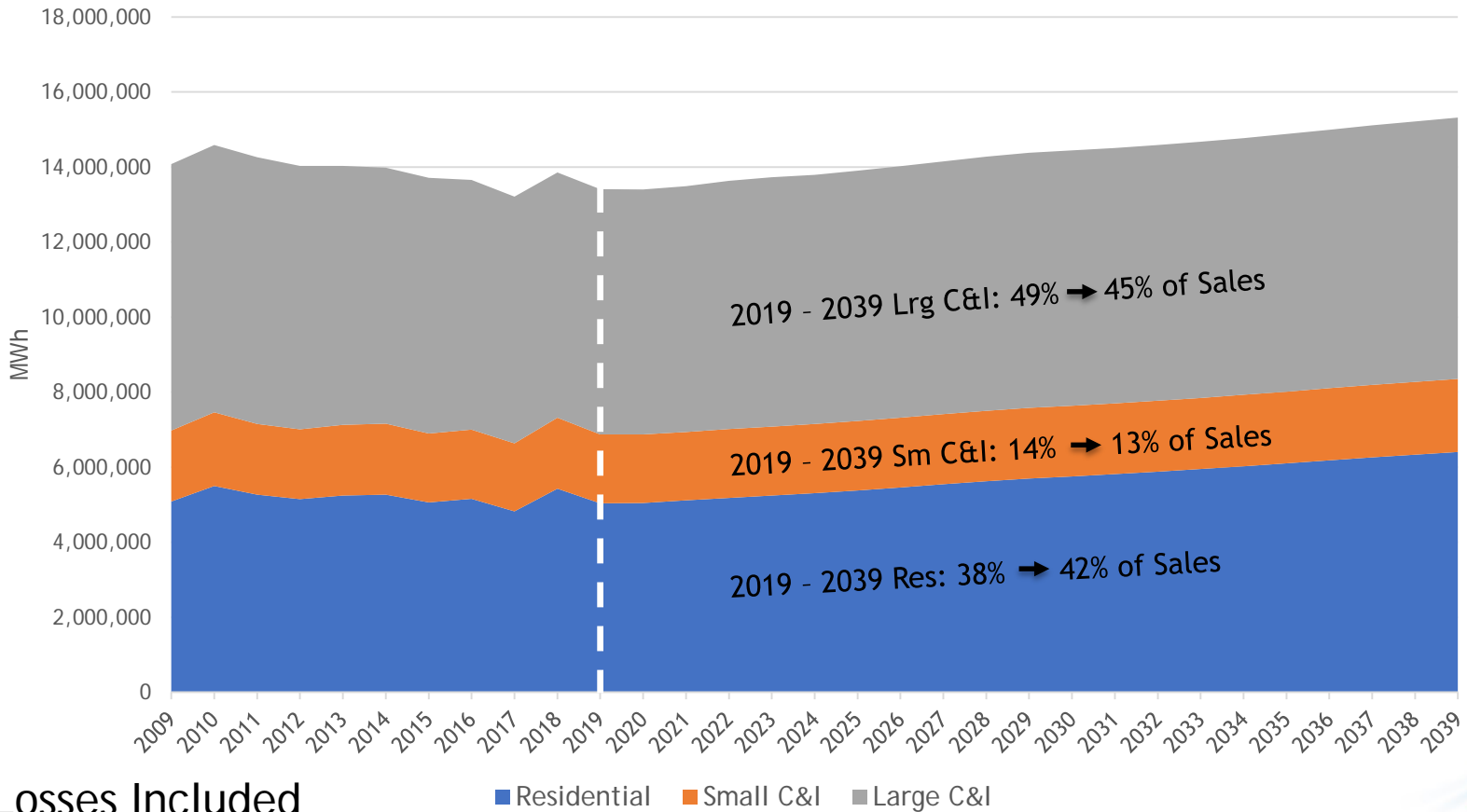




CLASS SALES FORECAST

INCLUDES PRIOR YEAR DSM IMPACTS;
 FUTURE DSM WILL BE MODELED IN THE IRP

	<u>Residential</u>	<u>Small C&I</u>	<u>Large C&I</u>
Average Annual Growth Rate 2020 - 2039:	1.2%	0.2%	0.3%



No Losses Included

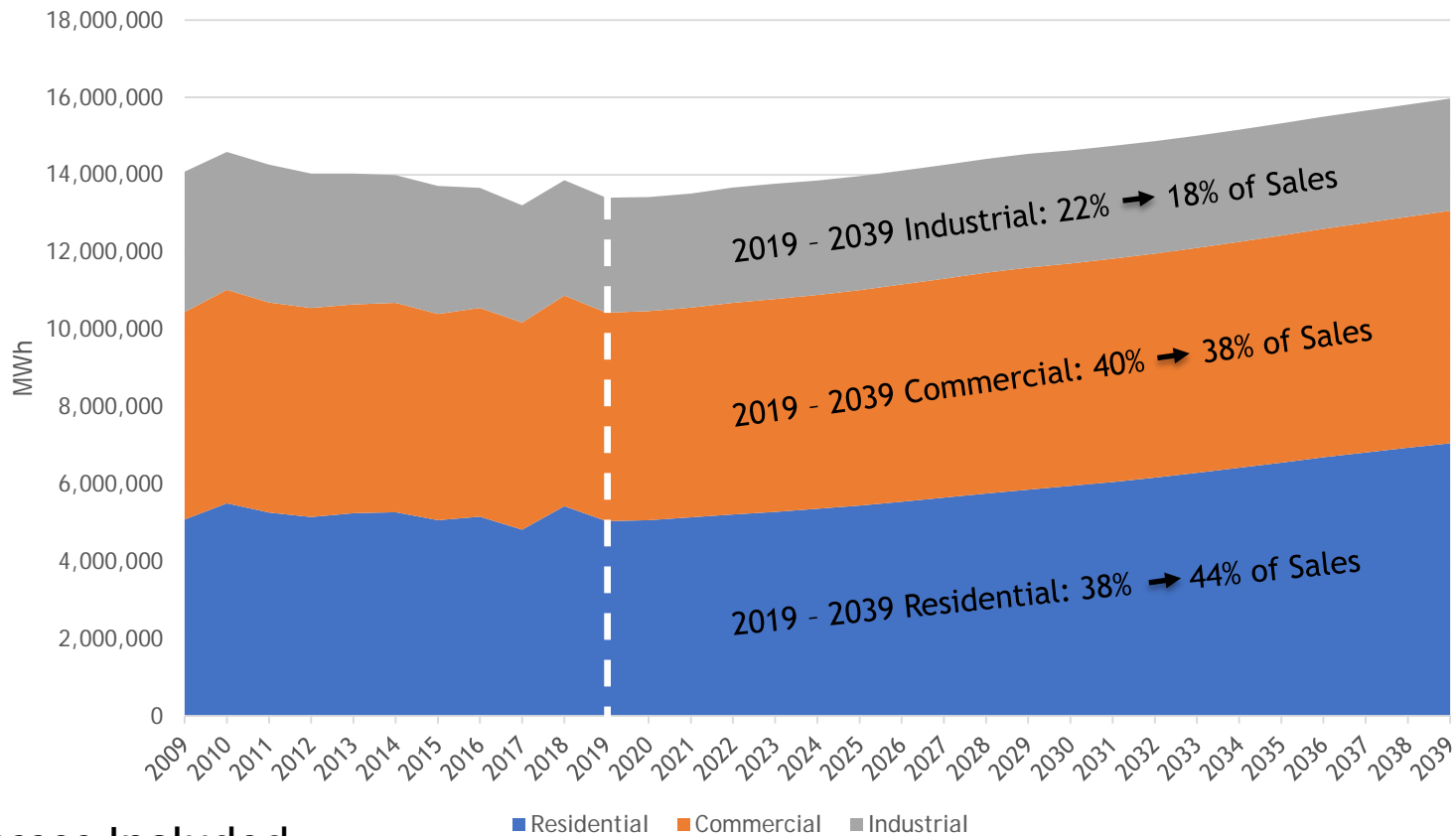
■ Residential ■ Small C&I ■ Large C&I



CLASS SALES FORECAST

INCLUDES PRIOR YEAR DSM IMPACTS;
 FUTURE DSM WILL BE MODELED IN THE IRP;
 INCLUDES EV & PV

Average Annual Growth Rate 2020 - 2039:	<u>Residential</u>	<u>Commercial</u>	<u>Industrial</u>
	1.7%	0.5%	-0.1%



No Losses Included

■ Residential ■ Commercial ■ Industrial

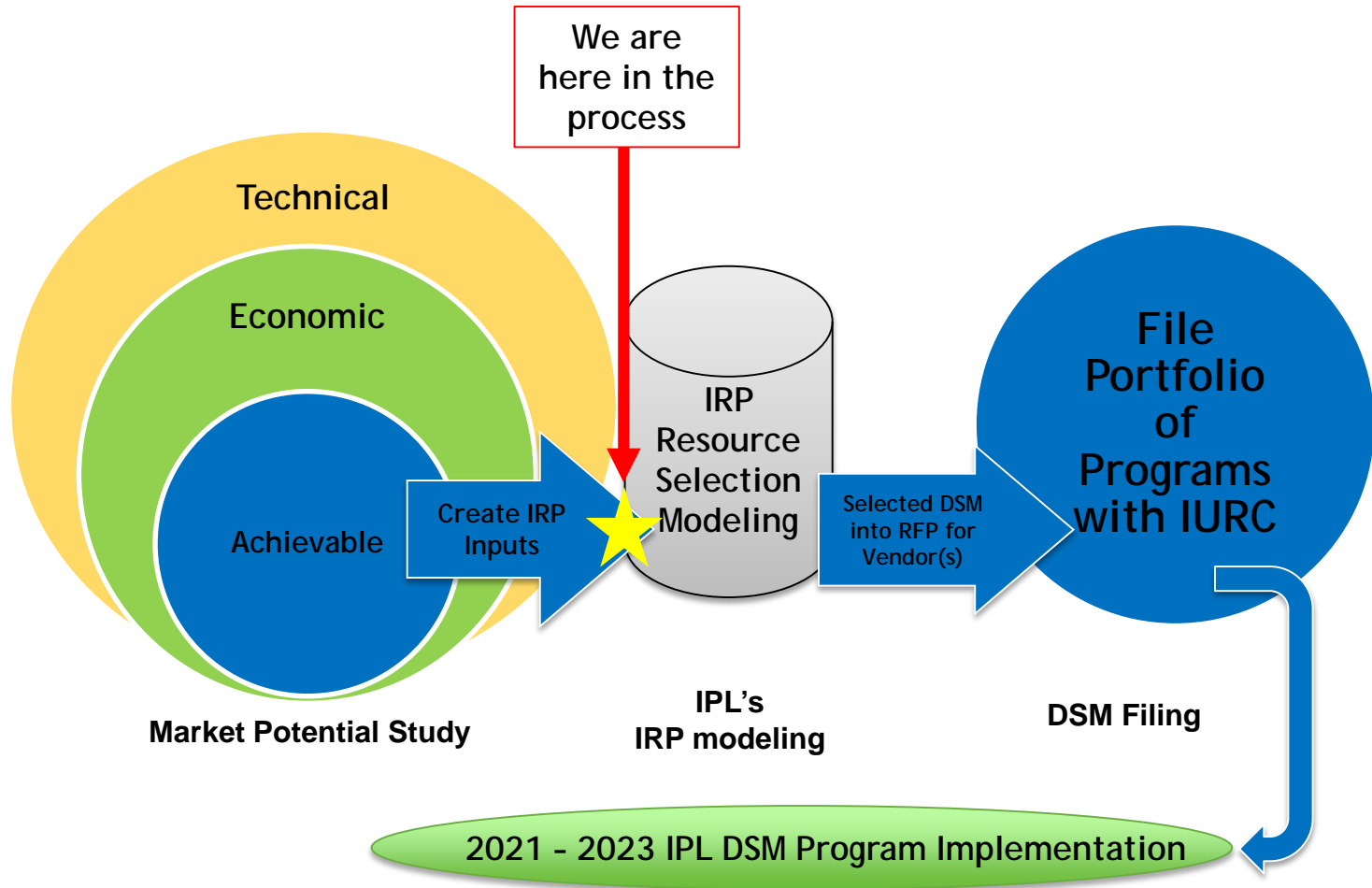
DSM BUNDLES IN IRP MODELING

Erik Miller

Senior Research Analyst



DSM PROCESS & THE IRP





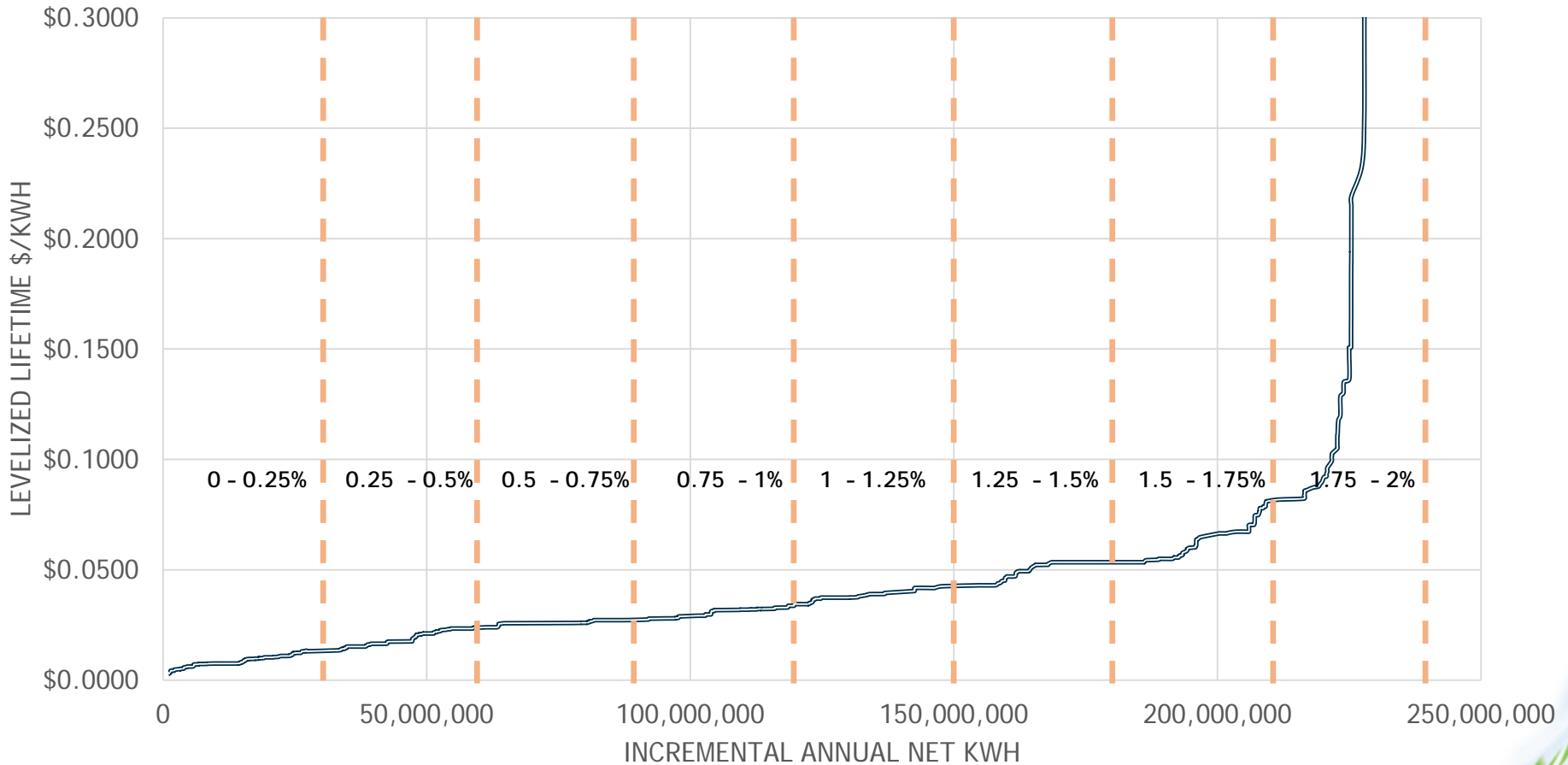
IRP DSM BUNDLING APPROACH

- DSM Bundles are 0.25% “decrements” of annual load excluding Opt Out customers
- Bundles are created from the Market Potential Study’s Realistic Achievable Potential
- Each “decrement” bundle has an associated loadshape and cost/MWh that serves as inputs into the IRP model
- GDS uses loadshapes specific to measure-types to create 8760s for the IRP model
- Residential and C&I are combined in bundles
- Ten bundles will be included as selectable resources in the IRP model
 - 8 - Energy Efficiency Bundles
 - 2 - Demand Response Bundles



DSM DECREMENT BUNDLES

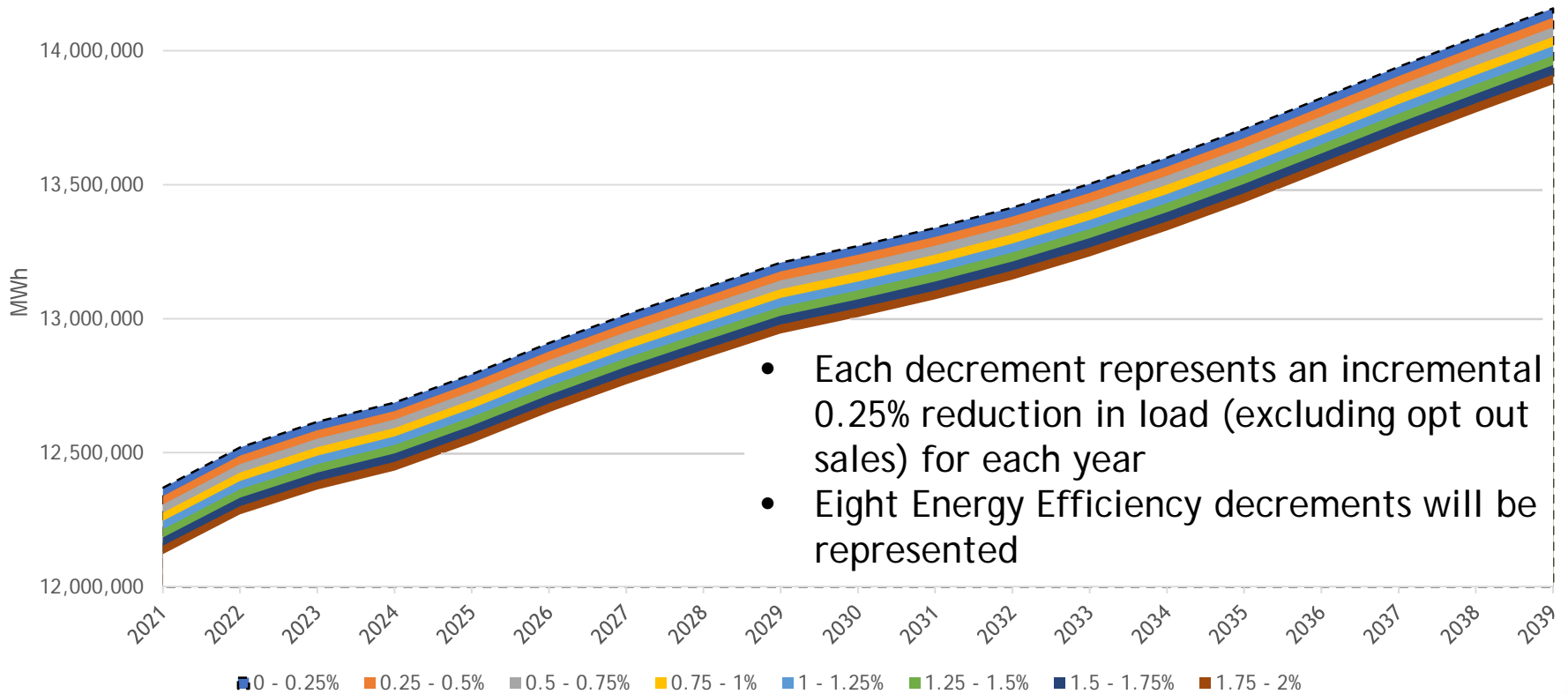
MPS - Realistic Achievable Potential Supply Curve



Data from IRP/MPS Planning Year: 2026

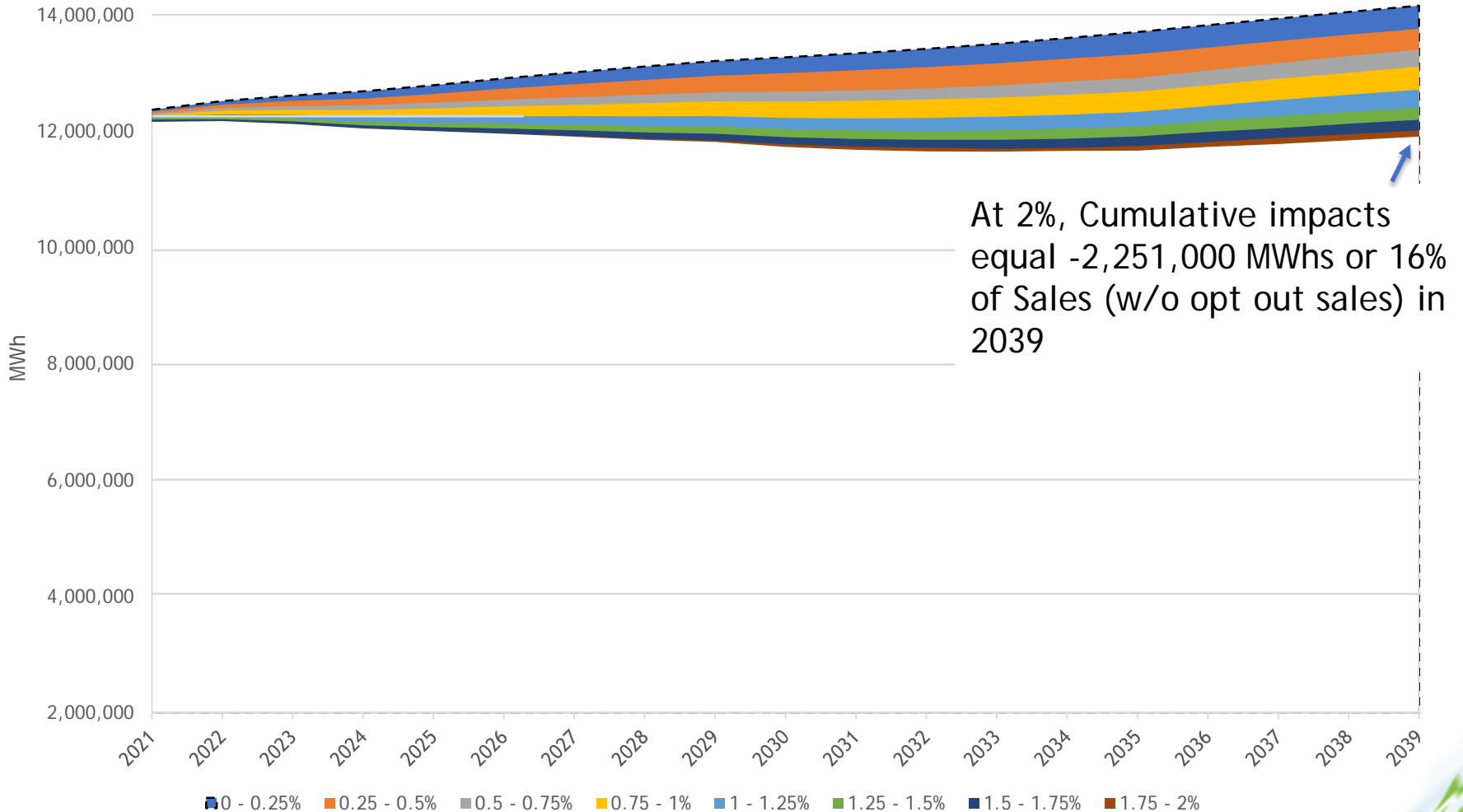


DSM DECREMENT BUNDLES - PERCENT OF OPT OUT SALES





DSM DECREMENT BUNDLES - CUMULATIVE IMPACTS





DSM NEXT STEPS

Next Steps:

- Evaluate DSM in the IRP Model in May and June
- Present results at Public Advisory Meeting #4

LUNCH BREAK

MODELING AND SCENARIO RECAP

Patrick Maguire

Director of Resource Planning



RECAP: SCENARIO DRIVERS

	Reference Case	Scenario A: Carbon Tax	Scenario B: Carbon Tax + High Gas	Scenario C: Carbon Tax + Low Gas	Scenario D: No Carbon Tax + High Gas
Natural Gas Prices	Base	Base	HIGH ↑	LOW ↓	HIGH ↑
Carbon Tax	No Carbon Price	Carbon Price (2028+)	Carbon Price (2028+)	Carbon Price (2028+)	No Carbon Price
Coal Prices	Base	Base	Base	Base	Base
IPL Load	Base	Base	Base	LOW ↓	HIGH ↑
Capital Costs for Wind, Solar, and Storage	Base	Base	Base	Base	Base



FUNDAMENTAL FORECAST VENDOR



Custom sensitivities completed for IPL - provided to NDA stakeholders

- Wood Mackenzie H1 2018 Long Term Outlook
- Provided Cases:
 1. Federal Carbon Case (Carbon tax starting 2028)
 2. Federal Carbon Case + High Gas Sensitivity
 3. No Carbon Case
 4. No Carbon + Low Gas Sensitivity
 5. No Carbon Case + High Gas Sensitivity
 6. Federal Carbon Case + Low Gas Sensitivity





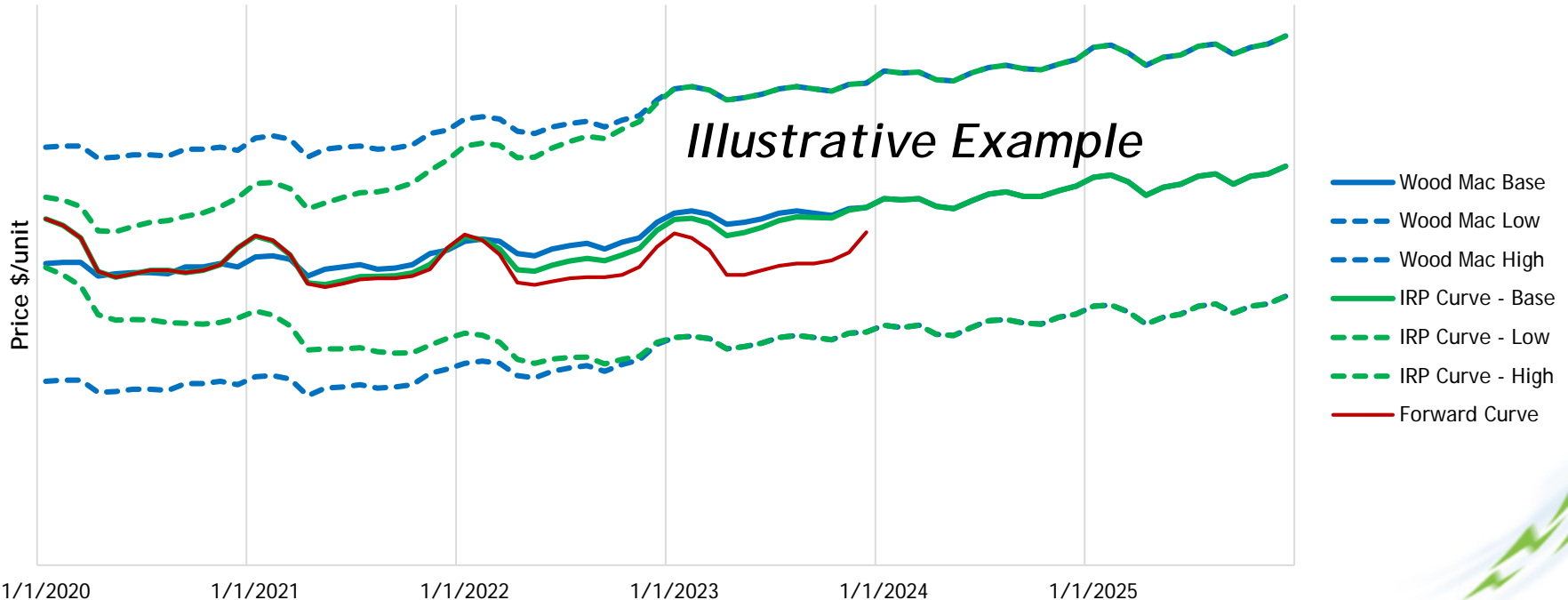
RECAP: FORWARD CURVES

	Deterministic Modeling	Stochastic Ranges	Notes
Power	✓	✓	On/Off peak monthly power prices from Wood Mackenzie. Hourly shapes created in PowerSimm.
Natural Gas	✓	✓	Wood Mackenzie monthly gas prices with delivery adders. Daily price shapes created in PowerSimm.
Coal	✓	✓	Internally sourced IPL coal curves.
Fuel Oil	✓	✓	Wood Mackenzie
Emissions	✓	✗	NOx and SO2 curves will be sourced from forward curves. Carbon prices from Wood Mackenzie.
Capacity	✓	✓	Capacity will be valued at the estimated bilateral price for MISO Zone 6.



POWER AND NATURAL GAS: BLENDED CURVES FOR YEARS 1-3

- Forward curves utilized through 2023
- Blended into fundamental curves starting in 2021 for Base Case, 2020 for High and Low Gas Sensitivities

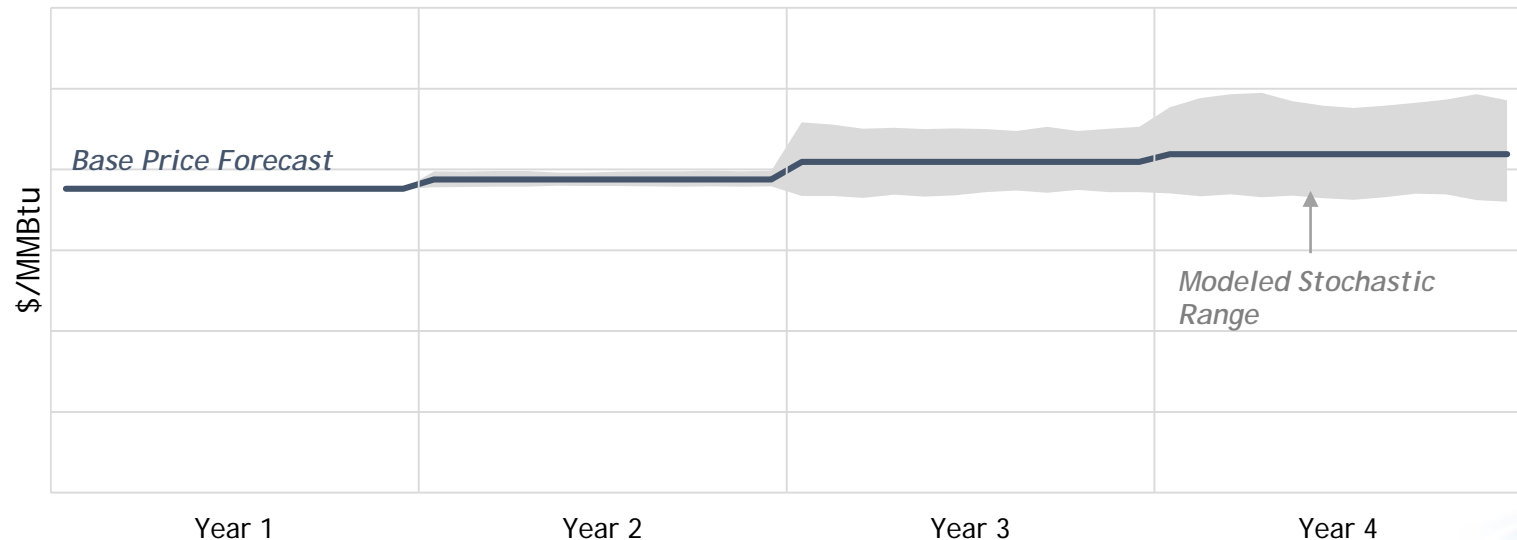




COAL PRICE MODELING

- IPL Coal Curve based on RFP prices and market intelligence on southern Indiana inland coal market
- Stochastic volatility applied only to open/unhedged portion

IPL Coal Price Volatility Tied to Contracted Percentage





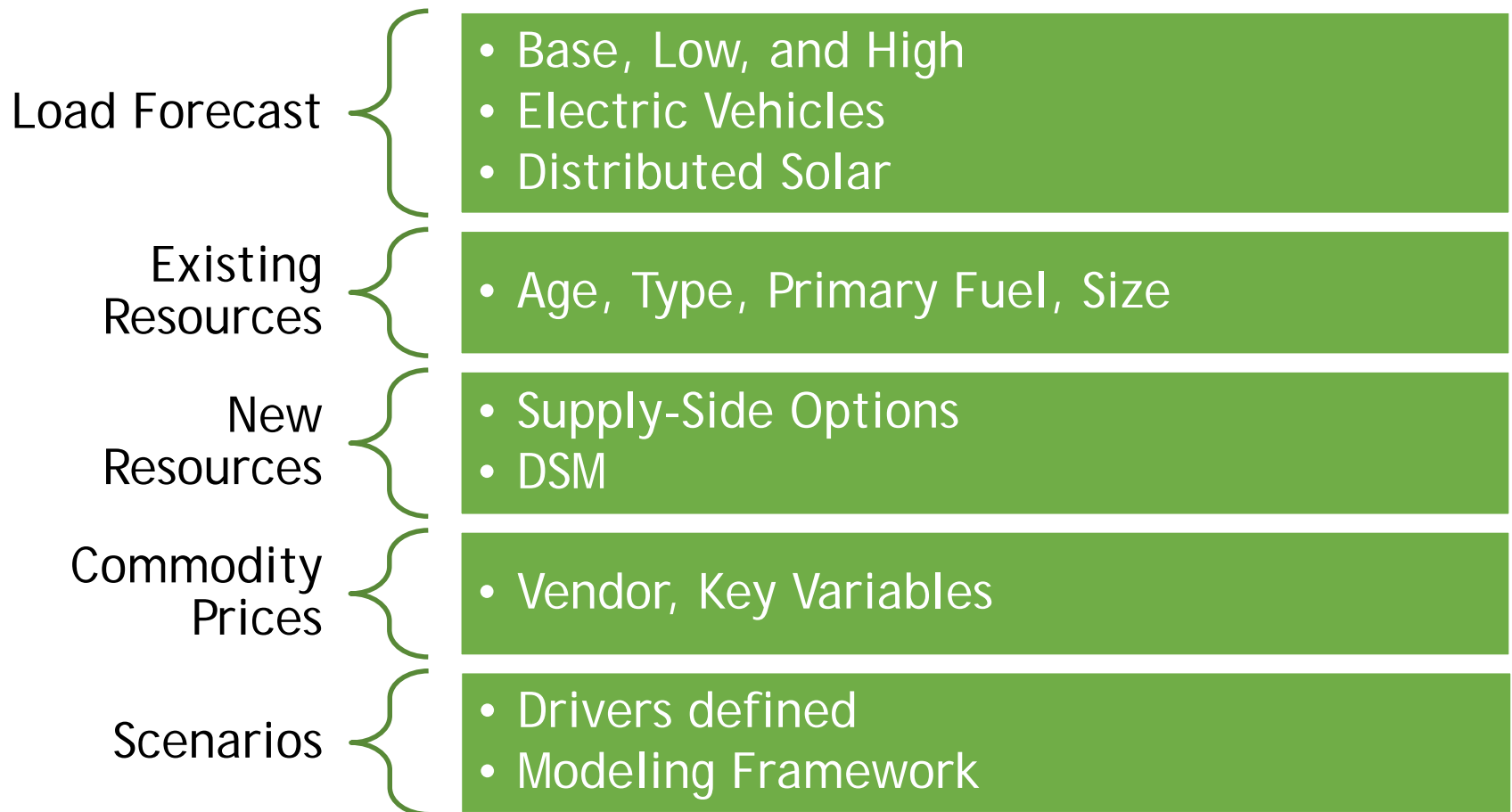
SCENARIO FRAMEWORK

	Reference Case	Scenario A	Scenario B	Scenario C	Scenario D
No Accelerated Retirements	Portfolio 1	1a	1b	1c	1d
Pete Unit 1 Retire <u>2021</u> Pete Units 2-4 Operational	Portfolio 2	2a	2b	2c	2d
Pete 1 Retire <u>2021</u> ; Pete 2 Retire <u>2023</u> Pete Units 3-4 Operational	Portfolio 3	3a	3b	3c	3d
Pete 1 Retire <u>2021</u> ; Pete 2 Retire <u>2023</u> ; Pete 3 Retire <u>2026</u> ; Pete Unit 4 Operational	Portfolio 4	4a	4b	4c	4d
Pete 1 Retire <u>2021</u> ; Pete 2 Retire <u>2023</u> ; Pete 3 Retire <u>2026</u> ; Pete 4 Retire <u>2030</u>	Portfolio 5	5a	5b	5c	5d

Wide range of scenarios and portfolios will inform resource decisions. Modeling underway and will be ongoing over the next two months.



IRP MODELING: PUTTING THE PIECES TOGETHER





DATA RELEASE SCHEDULE

IPL 2019 IRP Assumptions: Data Release Schedule

Dataset	Data Available
Commodity Price Forecasts [Complete]	Friday, April 12, 2019
MISO Solar Capacity Credit Calculation [Complete]	Friday, April 12, 2019
Capital Cost Assumptions for New Resources [Complete]	Friday, April 12, 2019
Updated Commodity Price Forecasts	Tuesday, May 14, 2019
IPL Load Forecast: Energy, Peak, Reserve Margin Target	Tuesday, May 14, 2019
Operating Characteristics for New Resources	Tuesday, June 11, 2019
Modeling Constraints for New Resources	Tuesday, June 11, 2019
Cost and Operating Characteristics for Existing IPL Resources	Tuesday, June 11, 2019
Stochastic Parameters and Distributions	Tuesday, June 11, 2019



Q&A, CONCLUDING REMARKS & NEXT STEPS

Stewart Ramsay

Meeting Facilitator

Patrick Maguire

Director of Resource Planning



NEXT STEPS

- Next Meeting: TBD
- Meeting #4 Material:
 - Scenario Descriptions and Results
 - Preliminary Model Results
 - Risk Analysis and Stochastics

Email questions, comments, or other feedback to ipl.irp@aes.com