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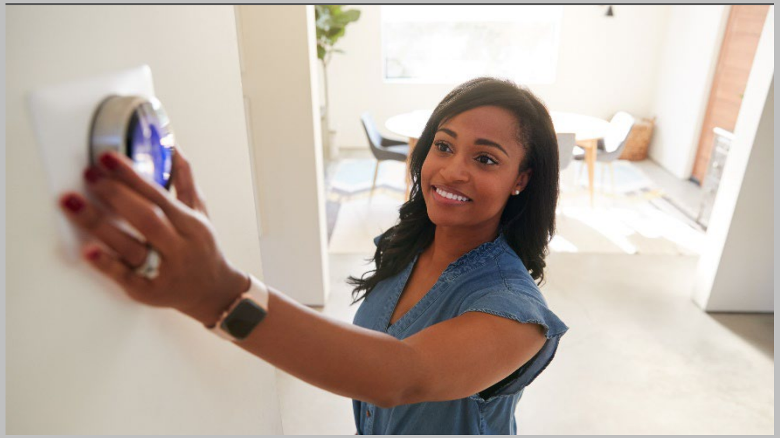
# 2024 NIPSCO INTEGRATED RESOURCE PLAN



First Stakeholder Advisory Meeting

April 23, 2024
9 A.M.-2 P.M. CT



# Fair Oaks Farms

NIPSCO MEETSAFE

LOCATION OF **NEAREST EXIT**

NEAREST PLACE TO **SEEK SHELTER**

IN AN EMERGENCY, **WHO WILL DIAL 911**

WHO WILL DIRECT THE **EMERGENCY RESPONDER**

LOCATION OF THE **AUTOMATED EXTERNAL DEFIBRILLATOR (AED)**

WHO CAN **PERFORM CPR**

OTHER **POTENTIAL HAZARDS**

**Fire:** Exit out any door that is furthest away from the fire. Gather as a group in the front parking lot – near the Tesla chargers.

**Shelter:** Restrooms, Jasper Ballroom (if closed), Employee Banquet Hallway.

**AED Location:** On the wall in the Employee Banquet Hallway.

**Other Hazards:** N/A

**Dial 911:**

**Direct Responders:**

**CPR:**

# SAFETY MOMENT: FIRE SAFETY

April 30 concludes the Indiana Spring Fire Season. The risk of fire in homes and workplaces exists all times of year, however.  Please remember to protect yourself, your family, and your coworkers by remaining mindful of fire threats and fire safety throughout the year.


Source: NISTGlobal https://nistglobal.com/blog/2022/03/home-fire-prevention-safety-tips/

## Consider two actions that will be impactful

When new positive behaviors are implemented, or unsafe practices are eliminated, safety increases

1. Keep matches and lighters out of children's reach
2. Use flashlights during power outages rather than candles
3. Never leave a burning candle unattended
4. Turn off space heaters when you leave the room, and do not leave them unattended
5. Only use smoking materials outside
6. Keep flammable items away from anything that can get hot, such as space heaters and stove tops

# STAKEHOLDER ADVISORY MEETING PROTOCOLS

- **Your input and feedback is critical to NIPSCO's Integrated Resource Plan (IRP) Process.**
- **The Public Advisory Process provides NIPSCO with feedback on its assumptions and sources of data. This helps inform the modeling process and overall IRP.**
- **We set aside time at the end of each section to ask questions.**
- **Your candid and ongoing feedback is key to this process:**
  - Please ask questions and make comments on the content presented
  - Please provide feedback on the process itself
- **Please identify yourself by name prior to speaking. This will help keep track of comments and follow up actions.**
- **If you wish to make a presentation during a meeting, please reach out to Erin Whitehead (ewhitehead@nisource.com).**

# AGENDA

| Time<br>*Central Time | Topic | Speaker |
|---|---|---|
| 9:00-9:10AM | Welcome & Introduction | Tara McElmurry, Communications Manager, NiSource<br>Vince Parisi, President & COO, NIPSCO |
| 9:10-9:20AM | Kick Off | Vince Parisi, President & COO, NIPSCO |
| 9:20-10:00AM | NIPSCO Integrated Resource Planning Process Overview<br>State and Federal Policy Developments<br>Environmental Policy Review | Fred Gomos, Director Strategy, NiSource<br>Pat Augustine, Vice President, CRA<br>Stephen Holcomb, Director Environmental Policy & Sustainability, NiSource |
| 10:00-10:10AM | Break | |
| 10:10-11:00AM | 2021 Short Term Action Plan Update<br>Continuous Improvements for 2024 IRP<br>2024 IRP Analytical Framework | Fred Gomos, Director Strategy, NiSource<br>Pat Augustine, Vice President, CRA |
| 11:00-11:50AM | Lunch | |
| 11:50AM-12:50PM | Reference Case Load Forecast | Pat Augustine, Vice President, CRA<br>Fred Gomos, Director Strategy, NiSource |
| 12:50-1:00PM | Break | |
| 1:00 – 1:30PM | 2024 Request for Proposal | Patrick d'Entremont, Manager Planning Commercial Support, NIPSCO<br>Bob Lee, Vice President, CRA |
| 1:30-1:55PM | 2024 Public Advisory Process Next Steps | Fred Gomos, Director Strategy, NiSource |
| 1:55-2:00PM | Closing | |



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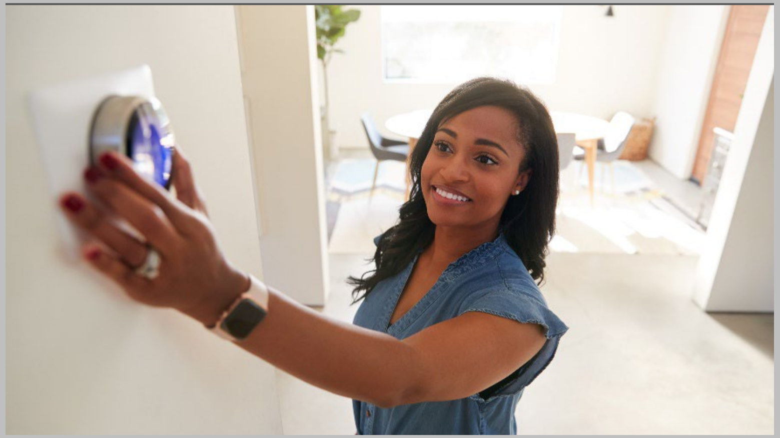
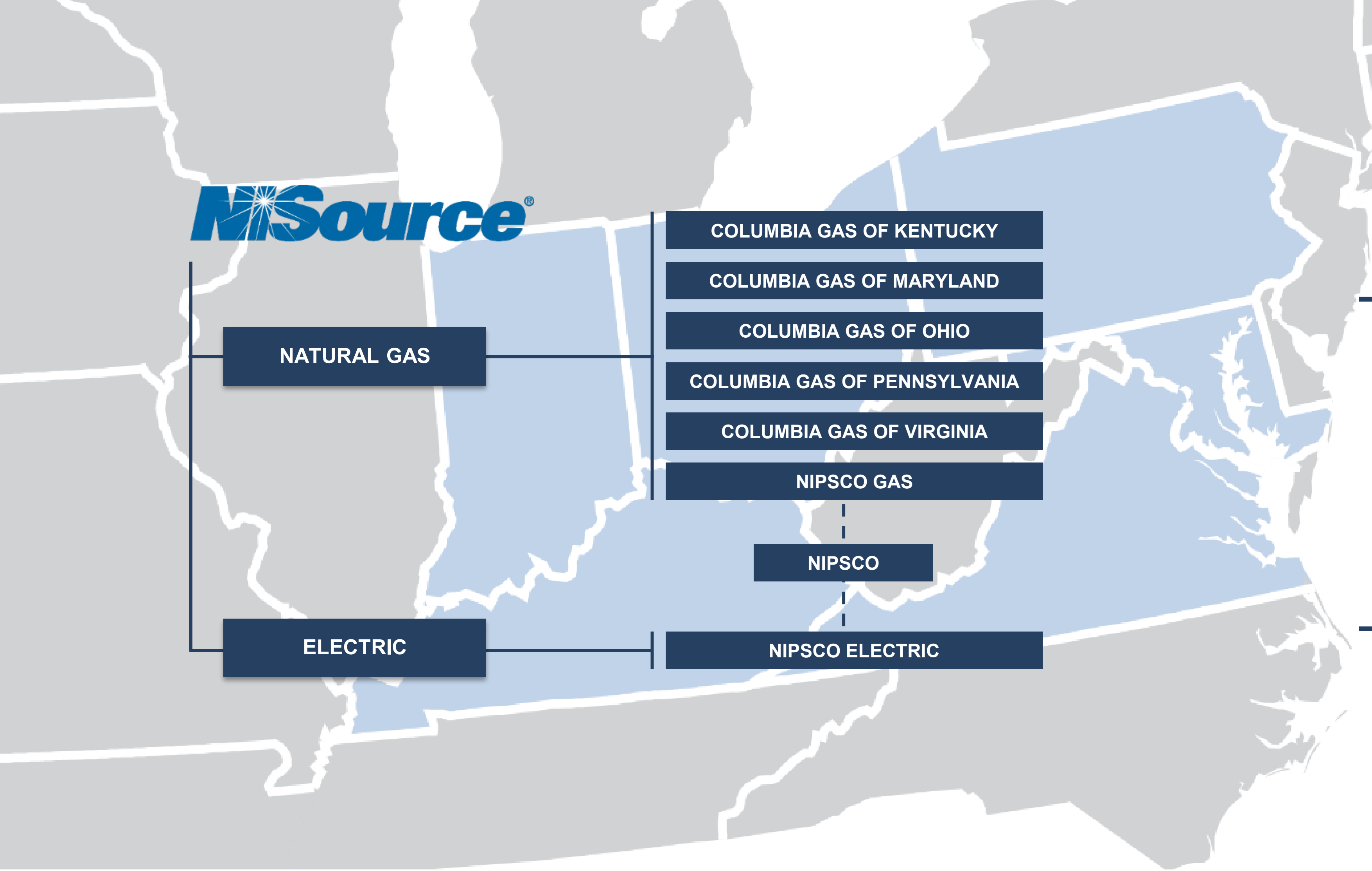
# KICK OFF

Vince Parisi, President & COO, NIPSCO





# PREMIER REGULATED UTILITY BUSINESS




## SIGNIFICANT SCALE ACROSS 6 STATES

**~3.2M**

GAS CUSTOMERS

**~500K**

ELECTRIC CUSTOMERS

# NIPSCO PROFILE

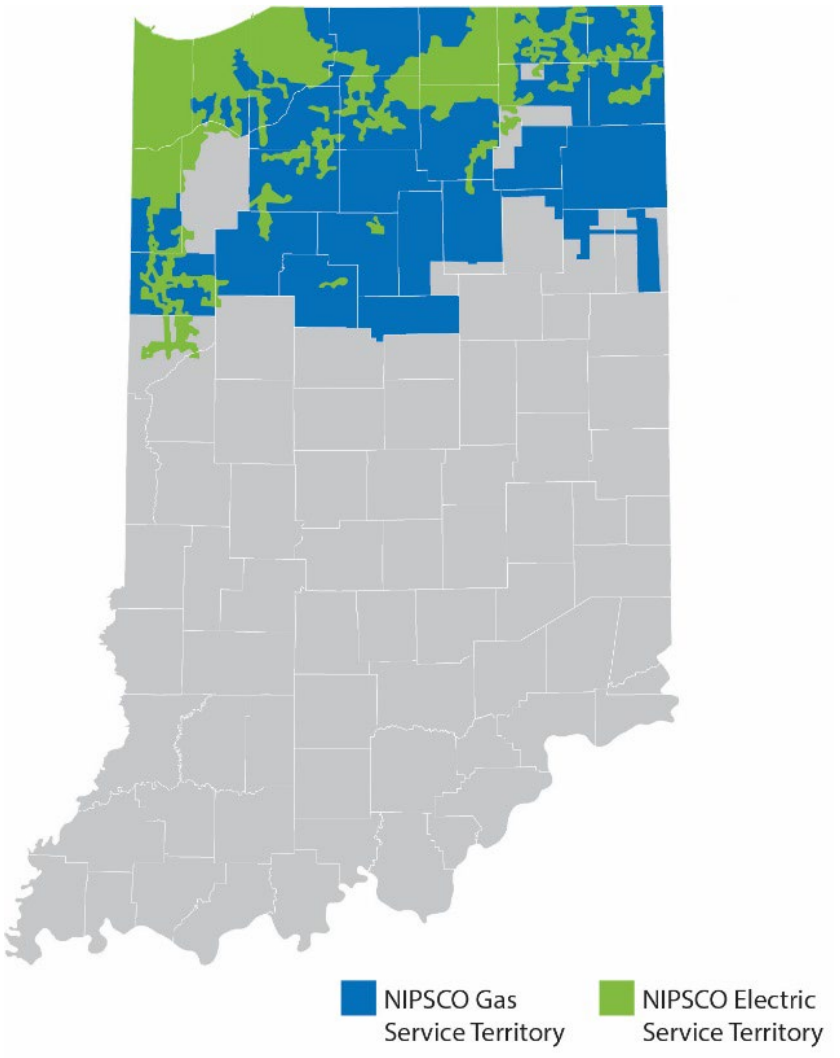
Working to Become Indiana's Premier Utility

## Electric

- 483,000 Electric Customers in 20 Counties
- 3,365 MW Generating Capacity
  - 11 Electric Generating Facilities
    (2 Coal, 1 Natural Gas, 2 Hydro, 4 Wind, 2 solar)
  - 1,000 MW of New Wind Energy
    (Rosewater, Jordan Creek and Indiana Crossroads Wind I & II online in 2020 2021 and 2023)
  - 465 MW of New Solar Energy
    (Dunns Bridge I and Indiana Crossroads solar online in 2023)
- 12,800 Miles of Transmission and Distribution
  - Interconnect with 5 Major Utilities (3 MISO; 2 PJM)
  - Serves 2 Network Customers and Other Independent Power Producers

## Natural Gas

- 859,000 Natural Gas Customers; 32 Counties
- 17,000 Miles of Transmission and Distribution Line/Main
- Interconnections with Seven Major Interstate Pipelines
- Two On-System Storage Facilities




**2,900** Employees

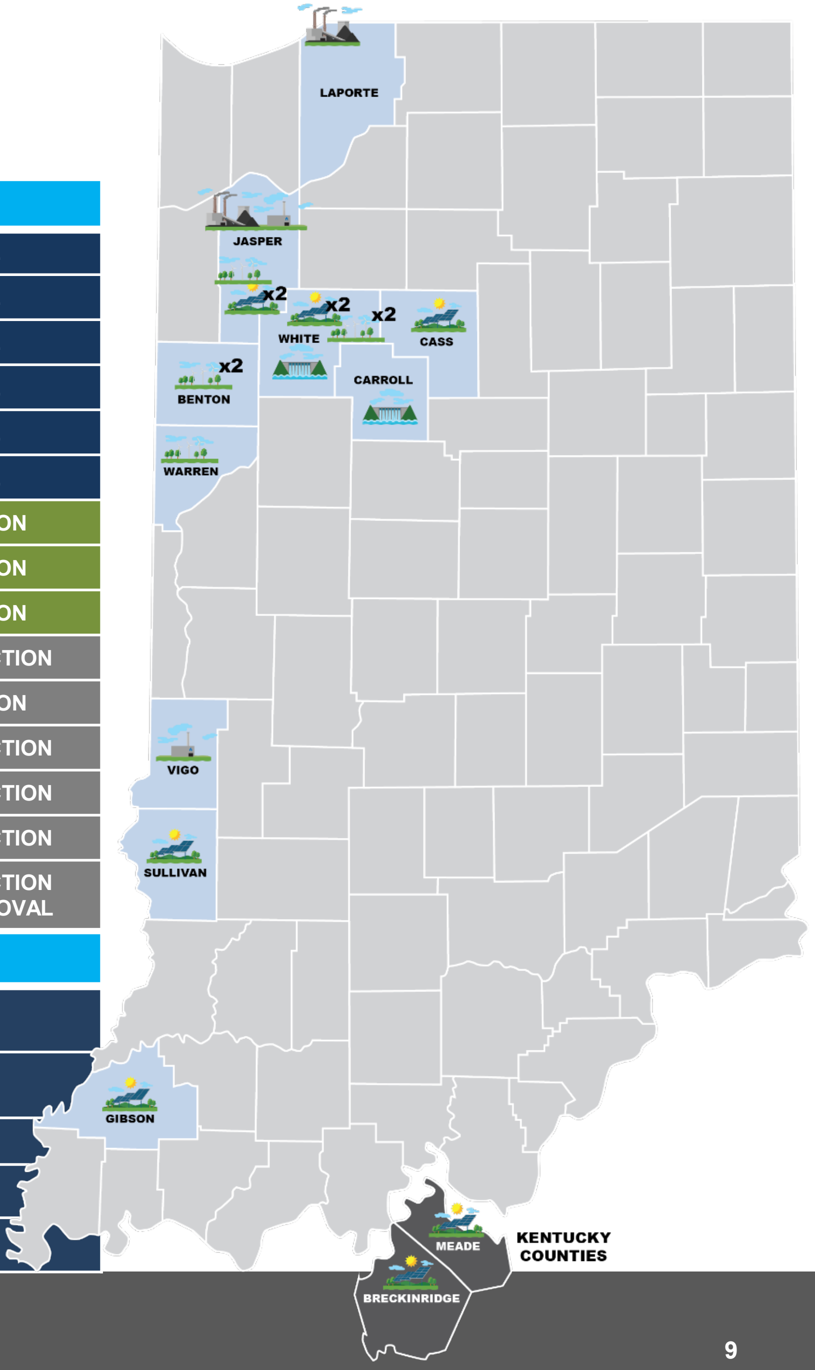
**Merrillville, Ind.** Headquarters

# CURRENT & FUTURE NIPSCO GENERATION PORTFOLIO

## Robust Renewable Investments in Indiana

| NEW GENERATION FACILITIES* | INSTALLED CAPACITY (MW) | COUNTY | IN SERVICE |
|---|---|---|---|
| ROSEWATER WIND | 102 MW | WHITE | 2020 COMPLETE |
| JORDAN CREEK WIND | 400 MW | BENTON & WARREN | 2020 COMPLETE |
| INDIANA CROSSROADS WIND | 302 MW | WHITE | 2021 COMPLETE |
| DUNNS BRIDGE SOLAR I | 265 MW | JASPER | 2022 COMPLETE |
| INDIANA CROSSROADS SOLAR | 200 MW | WHITE | 2023 COMPLETE |
| INDIANA CROSSROADS II WIND | 200 MW | WHITE | 2023 COMPLETE |
| GREEN RIVER SOLAR | 200 MW | BRECKINRIDGE & MEADE (KY) | 2024 CONSTRUCTION |
| DUNNS BRIDGE SOLAR II | 435 MW + 75 MW BATTERY | JASPER | 2024 CONSTRUCTION |
| CAVALRY SOLAR | 200 MW + 60 MW BATTERY | WHITE | 2024 CONSTRUCTION |
| GIBSON SOLAR | 200 MW | GIBSON | 2025 PRE-CONSTRUCTION |
| FAIRBANKS SOLAR | 250 MW | SULLIVAN | 2025 CONSTRUCTION |
| TEMPLETON WIND | 200 MW | BENTON | 2025 PRE-CONSTRUCTION |
| CARPENTER WIND | 200 MW | JASPER | 2025 PRE-CONSTRUCTION |
| APPLESEED SOLAR | 200 MW | CASS | 2025 PRE-CONSTRUCTION |
| GAS PEAKING RESOURCE | 400 MW | JASPER | 2027 PRE-CONSTRUCTION PENDING IURC APPROVAL |

| GENERATION FACILITIES | INSTALLED CAPACITY (MW) | FUEL | COUNTY |
|---|---|---|---|
| MICHIGAN CITY<br>RETIRING 2028 | 455 MW | COAL | LAPORTE |
| R.M. SCHAFHER<br>RETIRING 2025 (COAL) – 2028 (NG) | 722 MW + 155 MW | COAL + NATURAL GAS | JASPER |
| SUGAR CREEK | 563 MW | NATURAL GAS | VIGO |
| NORWAY HYDRO | 7.2 MW | WATER | WHITE |
| OAKDALE HYDRO | 9.2 MW | WATER | CARROLL |




* Since 2018

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# PILLARS OF OUR ONGOING GENERATION TRANSITION PLAN

This plan creates a vision for the future that is better for our customers and it's consistent with our goal to transition to the best cost and cleanest electric supply mix available while maintaining reliability, diversity and flexibility for the technology and market changes on the horizon.

**Reliable and sustainable** | **Flexibility for the future** | **Local and statewide economic benefits** | **Best plan for customers and the company**




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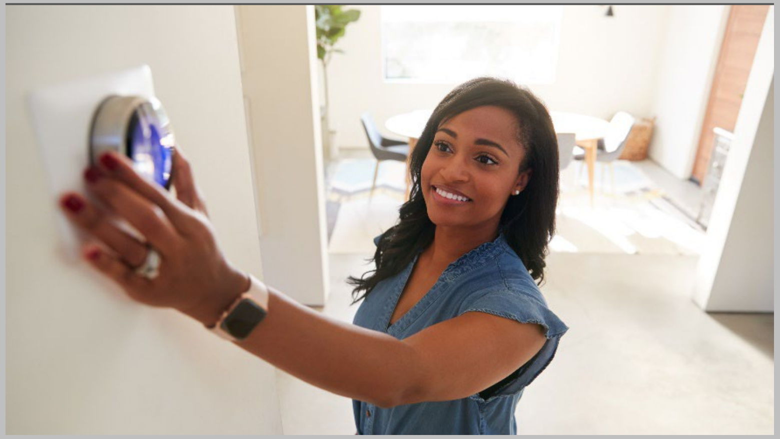
# NIPSCO INTEGRATED RESOURCE PLANNING PROCESS OVERVIEW

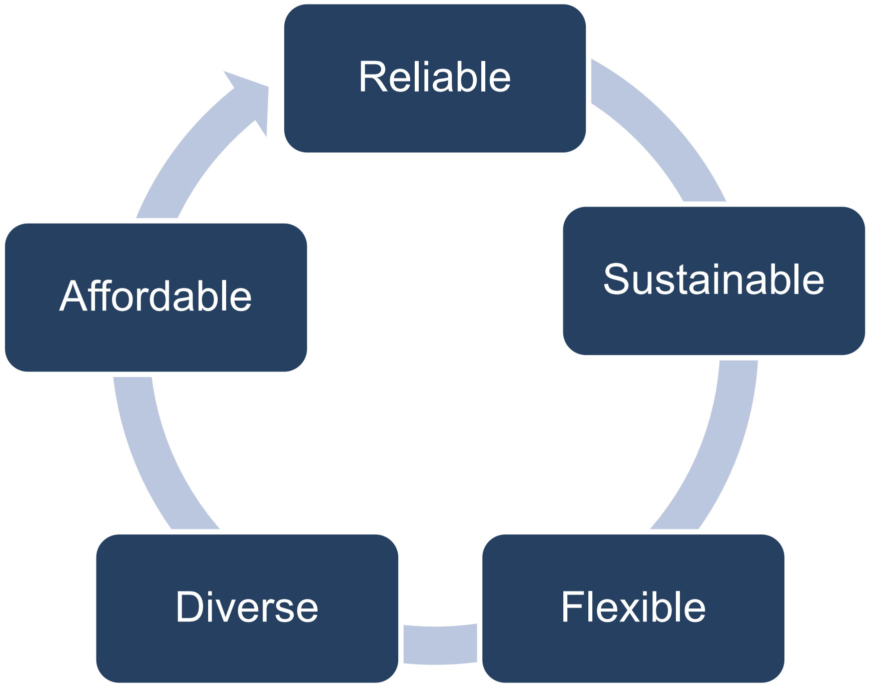


Fred Gomos, Director Strategy, NiSource
Pat Augustine, Vice President, CRA



# HOW DOES NIPSCO PLAN FOR THE FUTURE?

- **At least every three years, NIPSCO outlines its long-term plan to supply electricity to customers over the next 20 years**
- **This study – known as an Integrated Resource Plan – is required of all electric utilities in Indiana**
- **The IRP process includes an extensive analysis of a range of resource options evaluated against objectives for portfolios to be reliable, affordable, sustainable, diverse and flexible**




**Requires Careful Planning and Consideration for:**
- NIPSCO's employees
- Environmental regulations and market rules
- The local economy

# NIPSCO RESOURCE PLANNING APPROACH

***NIPSCO's five-step process is consistent with its approach from the 2018 and 2021 IRPs***

1. **Identify Planning Objectives and Key Questions**
2. **Develop Market Perspectives (Scenarios)**
3. **Develop Integrated Resource Strategies (NIPSCO Portfolios)**
4. **Portfolio Modeling and Analysis**
5. **Evaluate Tradeoffs and Select Preferred Plan**

***Emerging issues for 2024***

- *Evolving reliability and social impact objectives*

- *Environmental policy*
- *Emerging load trends*
- *MISO market trends*

- *New technology options*

- *MISO market design evolution*
- *Enhanced reliability analysis*



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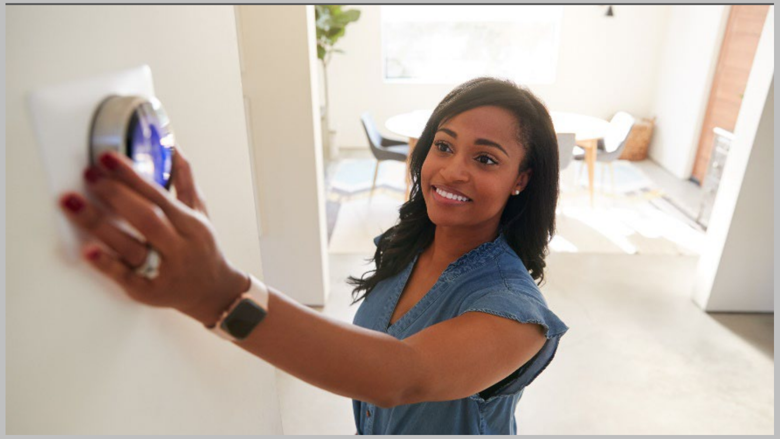
# STATE AND FEDERAL DEVELOPMENTS SINCE THE 2021 IRP & ENVIRONMENTAL POLICY REVIEW



Fred Gomos, Director Strategy, NiSource

Pat Augustine, Vice President, CRA

Stephen Holcomb, Director Environmental Policy & Sustainability, NiSource



# STATE POLICY CHANGES – FIVE PILLARS OF LONG-TERM PLANNING

- *House Enrolled Act 1278 led to the creation of the Indiana 21st Century Energy Task Force, which has established* ***five pillars that utilities must consider when undertaking long-term planning in the state***
- *The Five Pillars are* ***Reliability, Resilience, Affordability, Stability****, and* ***Environmental Sustainability,*** *which are consistent with the criteria NIPSCO uses for resource planning decisions*

### Reliability

- Resource adequacy
- Operating reliability

### Resilience

- Respond to catastrophic events

### Affordability

- Affordability across all customer classes
- Diverse resource mix

### Stability

- Ability to deliver stable electric service to all customers

### Environmental Sustainability

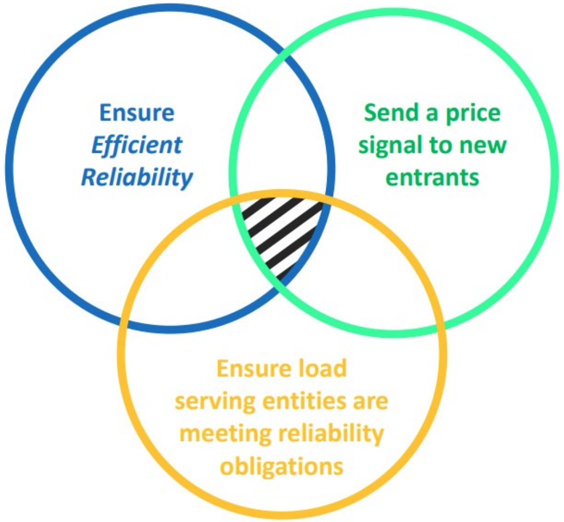
- Account for both environmental regulations and consumers' demands

# SIGNIFICANT CHANGES IN THE MIDCONTINENT INDEPENDENT SYSTEM OPERATOR (MISO) RESOURCE MIX ARE DRIVING NEW RESOURCE ADEQUACY CHALLENGES

- *MISO's Reliability Imperative is the term MISO uses to describe the shared responsibility of MISO, its members and states to address the urgent and complex challenges to electric system reliability in the MISO region*
- *MISO's Reliability Imperative calls out "Market Redefinition" as a Key Pillar*

## *Key Initiatives in MISO's Reliability Imperative:*

- *Ensure resources are accurately accredited*
- *Identify critical system reliability attributes*
- *Ensure accurate pricing of energy & reserves*




> *"Resource accreditation is the process of accurately measuring and assigning a capacity value to a resource based on its contribution to system reliability during periods of highest risk."*

Sources:
Resource Accreditation White Paper Version 1.1 https://cdn.misoenergy.org/Resource%20Accreditation%20White%20Paper%20Version%201.1630728.pdf
Ensuring Efficient Reliability NEW DESIGN PRINCIPLES FOR CAPACITY ACCREDITATION https://www.esig.energy/wp-content/uploads/2023/02/ESIG-Design-principles-capacity-accreditation-report-2023.pdf
MISO's Response to the Reliability Imperative, Updated February 2024. https://cdn.misoenergy.org/2024%20Reliability%20Imperative%20report%20Feb.%2021%20Final504018.pdf?v=20240221104216

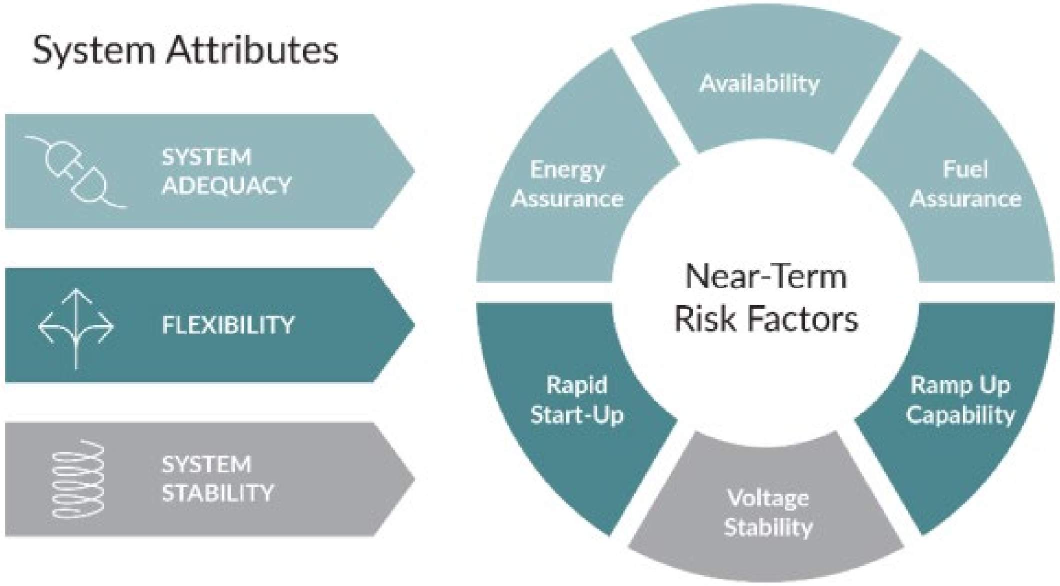
# RECENT MISO RESOURCE ADEQUACY DEVELOPMENTS AND MARKET REFORMS

- **2023** – MISO implemented a **4-season capacity construct** with obligations and resource accreditations varying by the four seasons across the *MISO Planning Year*

- **2025** – MISO plans to implement a **"downward sloping"** reliability-based **demand curve** to value capacity across a range of reserve margin levels

- **2028** – MISO filed its **Direct Loss of Load ("D-LOL")** market design proposal on March 28, 2024 with the FERC, driving towards marginal capacity accreditation, with obligations and resource accreditations focused on **performance during tight margin hours**

- Other metrics and markets could be developed for other desired system attributes




*Sources:*
https://cdn.misoenergy.org/20240228%20RASC%20Item%2005c%20RA%20Model%20Enhancement%20Presentation631891.pdf
https://cdn.misoenergy.org/2023%20Attributes%20Roadmap631174.pdf

# D-LOL KEY TAKEAWAYS

***NIPSCO's 2024 IRP will evaluate the potential impacts associated with D-LOL implementation***

### MISO made its filing on March 28, 2024

FERC approval is still required, and stakeholders have raised several questions and concerns

### Performance during tight hours will matter more

Strong incentive to perform during hours when net load *and* outages are high

### Highly dependent on LOLE* assumptions

Based on historical weather data and may not capture all future trends

### Accreditations will likely change

MISO has signaled significant drops for certain technology types, but future market conditions will matter

### NIPSCO Obligation likely to decline

Shift in timing of tight hours likely to lead to obligation declines, but magnitude is uncertain

** LOLE = Loss of load expectation*

# INFLATION REDUCTION ACT (IRA)

***The Inflation Reduction Act, containing several incentives related to the power sector, was signed into law in August 2022.***

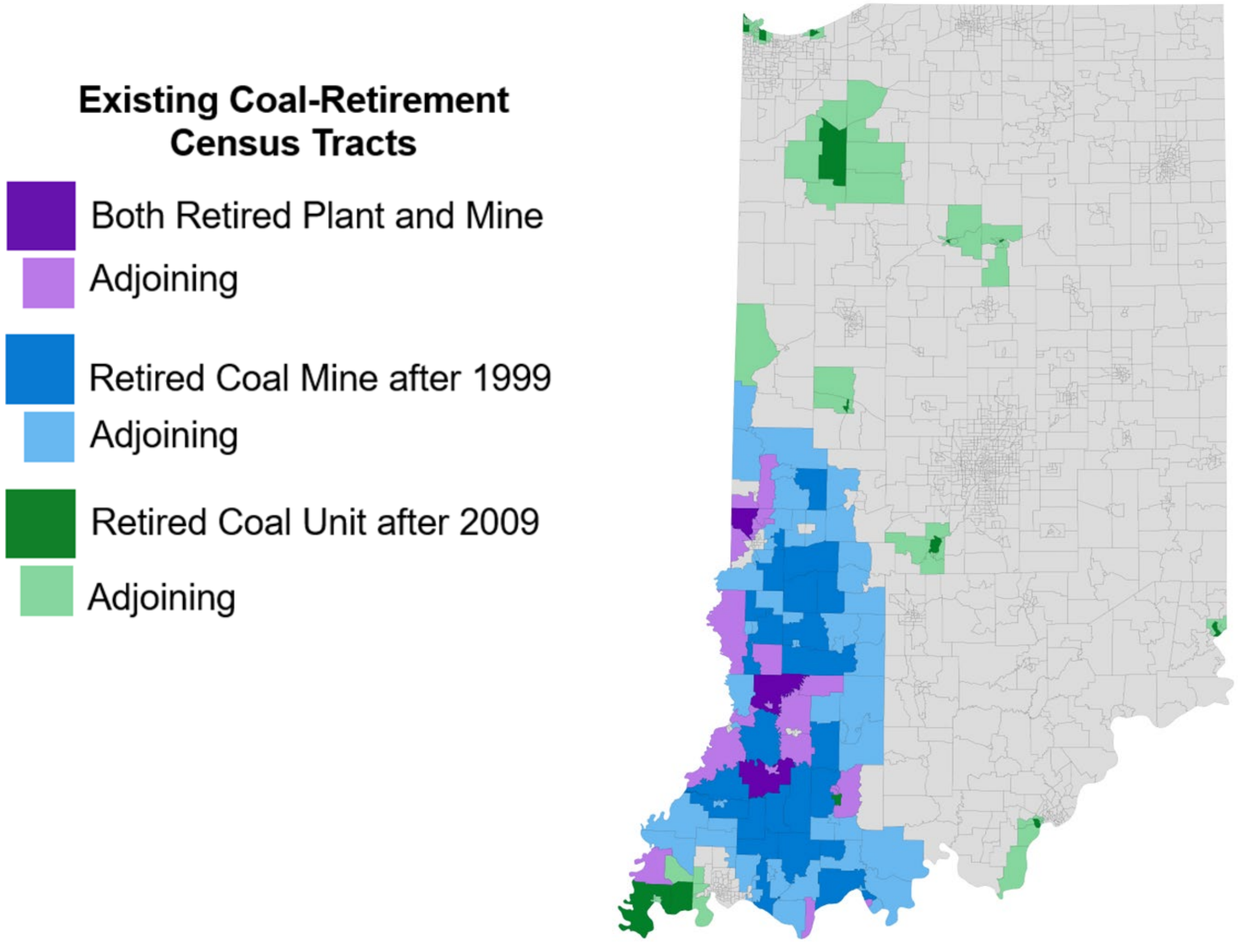
- **Production Tax Credit (PTC)**
  - 10-year credit of $27.5/MWh (growing with inflation)*
  - Re-introduced the PTC for solar and created new universal clean energy PTC
  - Eligibility through 2035**
- **Investment Tax Credit (ITC)**
  - Upfront credit equal to 30% of qualifying investment*
  - Extended the ITC to stand-alone storage
  - Eligibility through 2035**
- **New Hydrogen PTC** (up to $3/kg)
- Increased 12-year **CCUS^ credit** value to $85/ton

- New "bonus" credit opportunities exist:
  - 10% additional credit if cited in **an "energy community"**
  - 10% additional credit for facilities constructed with **domestically manufactured components**
  - 20% additional credit for **low-income benefit projects** at small-scale
- New monetization opportunities via **tax credit transfer**: tax credits can be directly sold to other parties if original beneficiary lacks a tax liability

**Assuming apprenticeship and prevailing wage requirements are met*
*** Credit availability could be extended longer if U.S. power sector emission reduction targets are not achieved*
*^ CCUS = Carbon capture utilization and storage*

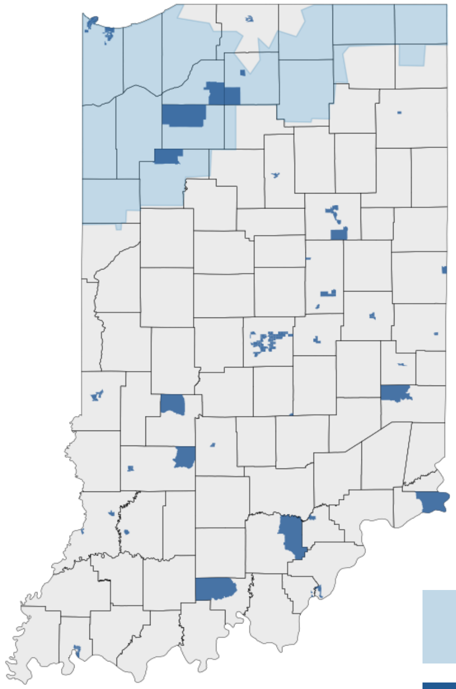
# IRA ENERGY COMMUNITY OPPORTUNITIES IN INDIANA

- Many Energy Community locations exist in Indiana, largely due to retired coal generating units or coal mines in the state
- NIPSCO is currently taking advantage of the bonus credits that are available for multiple solar and solar + storage projects currently under construction and in development



# IRA LOW-INCOME ECONOMIC BENEFIT PROJECTS (LIEBPs)

- LIEBPs provide 20% ITC credit adders for a limited number of **small-scale (5MW or less)** clean energy projects each year
- Projects must reduce bills for low-income customers and must pass through a competitive US Dept of Energy application process, though strategic site selection and financial benefit allocations could increase likelihood of acceptance
- LIEBPs located in climate justice census tracts will receive priority consideration in the application process, greatly improving chances of project qualification



NIPSO Service Territory

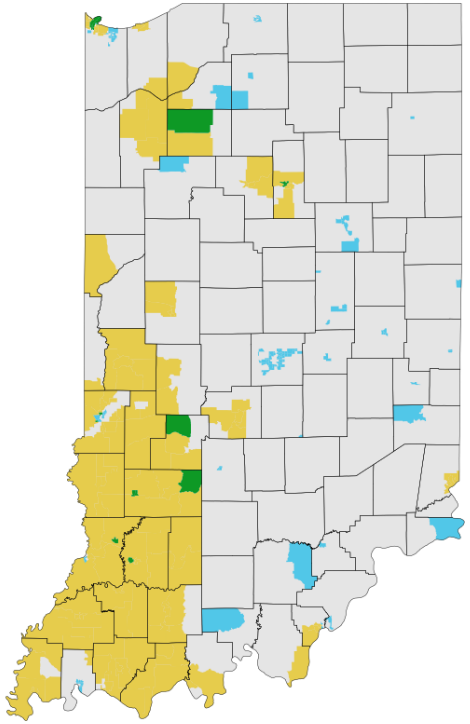
Climate Justice Census Tracts

**Climate Justice Census Tracts Definition**

Census Tracts with both:

a) ≥ 65th percentile of low-income households
b) ≥ 90th percentile for PM2.5 exposure ***or*** ≥ 90th percentile for energy burden

*Projects located in persistent poverty counties also receive priority consideration. However, there are currently no counties in Indiana under this classification.*



30% ITC

40% ITC (energy community only)

50% ITC (LIEBP only)

60% ITC (LIEBP and energy community)

# ENVIRONMENTAL POLICY: PROPOSED CLEAN AIR ACT SECTION 111(b) AND (d) RULES

- On May 11, 2023, EPA proposed greenhouse gas standards and guidelines for fossil fuel-fired power plants. This set of proposed rules was published in the Federal Register on May 23, 2023.
- The rule is the latest EPA effort to regulate greenhouse gases from the power sector, following the Clean Power Plan (CPP) and the Affordable Clean Energy Rule (ACE)
- EPA expects to issue a final rule this Spring

**EPA Proposed Rule under Clean Air Act Section 111**

Existing Coal Units

- Long term operations: CCS at 90% capture rate by 2030
- Retire prior to 2040: Co-fire 40% natural gas by 2030
- Retire prior to 2035: Limit operations to 20% capacity factor
- Retire prior to 2032: No restrictions

Existing Gas Units

- Draft rule initially indicated that existing gas units above a certain size and capacity factor would be subject to CCUS or hydrogen blending requirements
- EPA has now indicated that existing gas units will **not** be covered by **this** rulemaking, but will be covered by another rule

New Gas Units

- Low load: 20% capacity factor max if burning natural gas
- Medium load: Blend 30% H2 by 2032
- High load: Use CCS to achieve 90% reduction by 2035 or blend 30% H2 by 2032 ramping to 96% by 2038

# ENVIRONMENTAL REGULATIONS IMPACT PORTFOLIO OPERATIONS AND PLANNING

***NIPSCO's coal fleet remains in compliance with several key environmental regulations, including Effluent Limitation Guidelines (ELG), the Coal Combustion Residuals (CCR) Rule, Mercury and Air Toxics Standards (MATS), and the Good Neighbor Rule***

- Retirement of Schahfer Units 17 and 18 by 2025 avoids significant capital costs needed to comply with the ELG and CCR Rules and NPDES permit, as well as future potential costs to comply with the Good Neighbor Rule and the proposed MATS update

| | ELG Rule | Schahfer NPDES Permit | CCR Rule |
|---|---|---|---|
| **Purpose** | Establishes national standards for treatment of wastewater streams | Authorization from IDEM to discharge wastewater in accordance with effluent limitations, monitoring requirements, and other conditions | Regulates new and existing coal ash landfills and certain surface impoundments |
| **Regulated** | Wastewater streams associated with bottom ash, boiler slag, FGD, fly ash, flue gas mercury control waste, landfill leachate, and non-chemical metal cleaning waste | Wastewater discharge from Schahfer Generating Station | CCRs from bottom ash, boiler slag, fly ash and certain FGD solids |
| **Compliance Plan** | • Michigan City Unit 12 zero liquid discharge<br>• Schahfer Unit 17 & 18 retirement by 2025 | • Comply with effluent limitations and monitoring requirements<br>• Closed-cycle cooling via cooling towers<br>• Schahfer Unit 17 & 18 retirement by 2025 | Phased Compliance 2015 – 2053+<br>• Phase I: Separate ponds from generation<br>• Phase II: Close CCR ponds<br>• Phase III: Implement groundwater remedy and monitoring Schahfer Unit 17 & 18 retirement by 2025 |

# ENVIRONMENTAL REGULATIONS IMPACT PORTFOLIO OPERATIONS AND PLANNING

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| | MATS | Good Neighbor Rule | Power Plant GHG Rule |
|---|---|---|---|
| **Purpose** | Regulates mercury emissions and other hazardous air pollutants from coal-fired power plants | Eliminate significant contributions to nonattainment, or interference with maintenance of, the 2015 ozone NAAQS in downwind states | Limit greenhouse gas emissions from power plants under Clean Air Act Section 111 |
| **Regulated** | Mercury and other hazardous air pollutants | Regulates NOx emissions from emission sources in the electric power and other sectors | Existing coal units plus new gas units (best system of emission reduction based on capacity factor) |
| **Compliance Plan** | Operation of existing pollution control technology<br>Facility averaging for Schahfer Unit 17 & 18 mercury emissions<br>Schahfer Unit 17 & 18 retirement by 2025 | Operation of existing pollution control technology<br>EPA allocation of emission allowances<br>Schahfer Unit 17 & 18 retirement by 2025 | New gas peaker expected to comply, whether by normal operation, by limiting capacity factor below 20%, or by co-firing hydrogen at capacity factors above 20% in 2032+<br>No impact expected for Sugar Creek Generating Station and NIPSCO's coal plants. |

# WE ARE COMMITTED TO MEETING OUR ENVIRONMENTAL IMPROVEMENT TARGETS

*On Track to Meet Our Targets Through the Operation of Pollution Control Technology and the Retirement of Coal by 2028*

| | PROGRESS THROUGH **2023** % REDUCTIONS FROM 2005 LEVELS | TARGET **2025** % REDUCTIONS FROM 2005 LEVELS | TARGET **2030** % REDUCTIONS FROM 2005 LEVELS |
|---|---|---|---|
| CARBON DIOXIDE ($CO_2$) (ELECTRIC GENERATION, SCOPE 1 EMISSIONS) | 75% | 50% | 90% |
| NITROGEN OXIDES ($NO_X$) EMISSIONS | 94% | 90% | 99% |
| SULFUR DIOXIDE ($SO_2$) EMISSIONS | 98% | 90% | 99% |
| MERCURY EMISSIONS | 96% | 90% | 99% |
| WATER WITHDRAWAL | 92% | 90% | 99% |
| WATER DISCHARGE | 94% | 90% | 99% |
| COAL ASH GENERATED | 68% | 60% | 100% |

**In 2022, we furthered our commitment to sustainability by announcing a 2040 Net Zero Goal for greenhouse gas emissions**

SCOPE 1 & 2
NET ZERO
BY 2040

**Committed to Protecting Human Health and the Environment**



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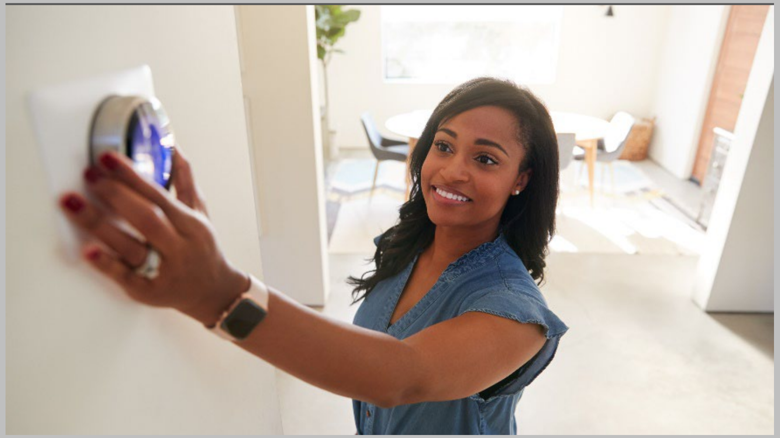
## BREAK







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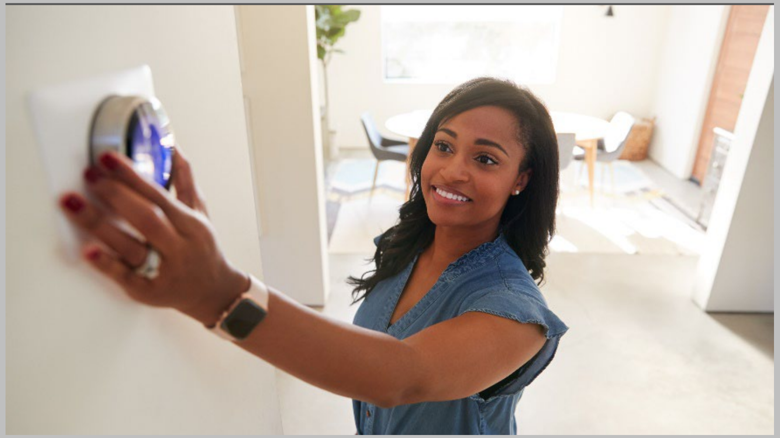
# 2021 SHORT-TERM ACTION PLAN UPDATE



Fred Gomos, Director Strategy, NiSource
Pat Augustine, Vice President, CRA



# PROGRESS ON ADVANCING THE 2021 IRP PREFERRED PLAN AND SHORT-TERM ACTION PLAN

*Non-Exhaustive*

| | 2021 Short Term Action Plan | Progress To Date |
|---|---|---|
| **Retirement** | • Retire Schahfer Coal Units 17/18 by 2023[1]<br>• Retire Michigan City Unit 12 and Schahfer 16A/B by 2028<br>• Identify and implement required reliability/ transmission upgrades resulting from the retirement of the units | • Completed transmission upgrades to support the retirement of Schahfer, with the last phase planned completed in June 2023<br>• Schahfer Units 17/18 on track to retire in 2025[1] |
| **Replacement** | • Deeper diligence on gas peaker and storage projects<br>• Conduct subsequent RFPs<br>• File CPCNs and other necessary approvals for replacement projects | • Completed technoeconomic and engineering studies to inform gas peaker asset mix that meets portfolio needs<br>• Conducted an RFP for All Source and Schahfer replacement capacity in Fall 2022<br>• Seeking approval for new and restructured projects |
| **Continue To Monitor** | • Continue to actively monitor technology and MISO market rends | • Performed refreshed 2023 portfolio analysis integrating dynamic market changes impacting the energy industry |

[1]*In 2022 the retirement date for the remaining coal units at Schahfer was moved to 2025 from the previously planned 2023 as a result of various factors impacting the supply chain for NIPSCO's solar projects needed to replace the capacity of the coal units*

# EVOLUTION OF NIPSCO'S PREFERRED PLAN

- The latest MISO market rules updates, passage of the IRA, and 2022 RFP data resulted in a slight pivot towards resources that can provide more winter capacity and an opportunity to shift the highest-cost solar energy towards incremental wind energy
- As laid out in NIPSCO's 2021 IRP Short-Term Action Plan, flexibility in procurement activities and short-term capacity purchases remain important

| Portfolio Components | 2021 IRP Preferred Plan | Latest Progress | | |
|---|---|---|---|---|
| Schahfer 17/18 Retirement Date | Mid-2023 | Late 2025 | | *Coal retirement dates pushed, and short-term capacity contract amounts vary according to annual needs* |
| Michigan City 12 Retirement Date | Between 2026 and 2028 | 2028 | | |
| Short-Term Capacity Contracts | 150 MW | 100 MW (10-yr) plus 300 MW+ for nearer-term, as needed | | |
| New Gas Peaking | Up to 300 MW | ~400 MW | ↑ | *Winter capacity more valuable and wind energy more competitive relative to solar due to IRA production tax credits* |
| 2018-19 RFP Renewable Projects | As per CPCN approvals | Dropped ~600 MW of solar projects with escalating costs | ↓ | |
| New Solar | 100 – 250 MW | 200 MW | = | |
| New Wind | Up to 200 MW | 400 MW | ↑ | |
| Sugar Creek Uprate | 30 – 53 MW | ~30 MW[1] | | *Stable components of IRP preferred plan* |
| DSM | ~68 MW at summer peak | ~68 MW at summer peak | | |
| New Storage | 135 – 370 MW | 125 – 200 MW | | |

*[1] Sugar Creek received additional capacity in January 2024*

# SUMMARY OF THE STATUS OF NIPSCO PORTFOLIO ADDITIONS SINCE 2018 IRP – FACILITIES IN SERVICE

***Since the 2018 IRP, NIPSCO has acquired and placed into service four wind farms and two solar farms through PPA or Joint Venture Tax Equity Partnership***

| In-Service Projects | Technology | Structure | Capacity (MW ICAP) | In-Service Date |
|---|---|---|---|---|
| Jordan Creek | Wind | PPA | 400 | 12-2020 |
| Rosewater | Wind | Tax Equity Partnership | 102 | 12-2020 |
| Indiana Crossroads Wind I | Wind | Tax Equity Partnership | 302 | 12-2021 |
| Indiana Crossroads Solar | Solar | Tax Equity Partnership | 200 | 06-2023 |
| Dunns Bridge I | Solar | Tax Equity Partnership | 265 | 06-2023 |
| Indiana Crossroads Wind II | Wind | PPA | 204 | 12-2023 |

***~1,000 MW of wind generation capacity placed into service since the 2018 IRP***

***465 MW of solar capacity placed into service since the 2018 IRP***

# SUMMARY OF THE STATUS OF NIPSCO PORTFOLIO ADDITIONS – ACTIONS SINCE THE 2021 IRP FOR FACILITIES IN DEVELOPMENT

- *An additional 400 MW of wind capacity, 1,035 MW of solar capacity, and 135 MW of storage capacity have been approved by the Commission and are expected to be in service in 2024 and 2025.*
- *NIPSCO currently has 450 MW of solar capacity and 400 MW of peaking capacity in active proceedings before the IURC.*

| | Project | Technology | Structure | Capacity (MW ICAP) | Regulatory Activities Since 2021 IRP | Expected In-Service Date |
|---|---|---|---|---|---|---|
| Approved | Cavalry | Solar + Storage | Full Ownership | 200 + 60 | Change in cost / ownership structure *Approved 01-2024* | 05-2024 |
| Approved | Dunns Bridge II | Solar + Storage | Full Ownership | 435 + 75 | Change in cost / ownership structure *Approved 01-2024* | 12-2024 |
| Approved | Green River | Solar | PPA | 200 | Cost update *Approved 07-2023* | 12-2024 |
| Approved | Appleseed | Solar | PPA | 200 | New CPCN *Approved 09-2023* | 12-2025 |
| Approved | Templeton | Wind | PPA | 200 | New CPCN *Approved 09-2023* | 12-2025 |
| Approved | Carpenter | Wind | PPA | 200 | New CPCN *Approved 10-2023* | 12-2025 |
| Active Proceedings | Fairbanks | Solar | Full Ownership | 250 | Change in cost / ownership structure *Active proceeding* | 05-2025 |
| Active Proceedings | Gibson | Solar | Full Ownership | 200 | Change in cost / ownership structure *Active proceeding* | 06-2025 |
| Active Proceedings | New Peaker | Frame + Aero | Full Ownership | ~400 | New CPCN *Active proceeding* | 12-2027 |

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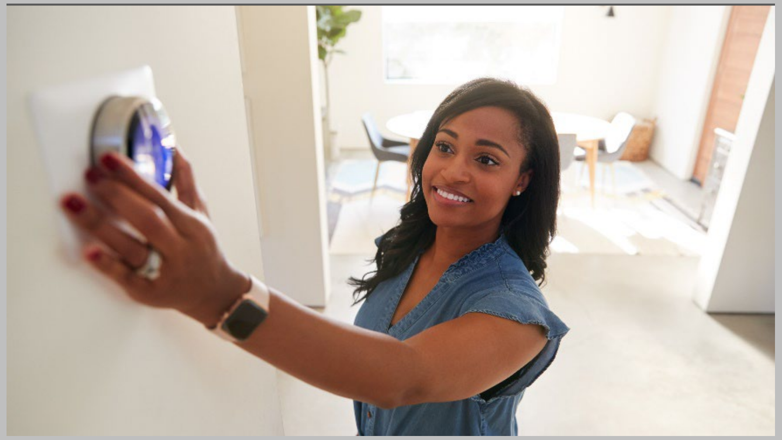
# CONTINUOUS IMPROVEMENTS FOR THE 2024 IRP




Fred Gomos, Director Strategy, NiSource

Pat Augustine, Vice President, CRA


# 2021 IRP FEEDBACK AND CONTINUOUS IMPROVEMENT PLAN FOR 2024

| Category | 2021 IRP Feedback | 2024 Improvement Plan |
|---|---|---|
| 1 Load Forecast | • More detail on Electric Vehicle (EV) forecast; for example, penetration has not been able to separate non-NIPSCO-serviced light-duty vehicles (LDVs) from total counts in counties served by more than one utility<br>• Clearer analytic methods regarding forecasting demand from large industrial customers | • More rigorous EV modeling with focus on vehicle counts within service territory and by class and separate truck corridor analysis<br>• Additional econometric analysis of industrial loads, as well as review of potential additional emerging industrial load types (i.e., data centers) |
| 2 Demand-Side Resources | • Interaction between energy efficiency (EE) and demand response (DR) resources require further consideration; more attention to meter-based pay-for-performance program designs | • Additional DSM evaluation, including integration with AMI and EV charging management<br>• Continued assessment of distributed energy resources (DERs) |
| 3 Portfolio Analysis | • Positive feedback on reliability assessment:<br>  ◦ "Based on this initial effort, [NIPSCO] is well positioned to provide future analytical improvements"<br>• Other stakeholders remain interested in various alternative technologies (RICE, storage, grid-forming inverter-based technology SMR) | • Advance continuous improvement around reliability analysis and quantification of risk<br>• Ensure full evaluation of a wide range of new technologies either via the RFP or other means (CCS at Sugar Creek, hydrogen, SMR, LDES) |
| 4 Stakeholder Collaboration | • Joint Commenters requested increased collaboration in the IRP process and the RFP process<br>  ◦ "…comments emphasized the need for continued collaboration and improvement between stakeholders and NIPSCO for the next IRP filing" | • Facilitate the procurement of Aurora Energy Forecast Software licenses to interested stakeholders to enable visibility into certain modeling files<br>• Provide opportunity for feedback on upcoming RFP for interested stakeholders under a Non-Disclosure Agreement |

# 1 LOAD FORECASTING IMPROVEMENTS

- **Enhancements to EV modeling**
  - Fuller historical data sets for current vehicles in the NIPSCO footprint
  - Class-level assessment (light, medium and heavy duty vehicles, *including a detailed transportation corridor assessment for heavy duty vehicles*)
  - Deeper assessment of hourly charging shapes based on type of charger, location of charger (public/private), temperature, etc.
  - Integration with DSM analysis on unmanaged vs. managed charging for light duty vehicle class
- **Updated Distributed Energy Resource (DER) modeling**
  - Incorporation of historical customer data across NIPSCO footprint
  - More rigorous uncertainty analysis based on system costs, federal tax credit policy, wholesale and retail rates, and policy construct
- **More rigorous hourly shape analysis for electrification loads**
  - Deeper assessment of MISO Futures study with hourly load impacts by season and time of day
- **New considerations for emerging economic development and data center loads**

# 2 ADDITIONAL DSM AND DER ASSESSMENTS

- **Evaluating integration of Advanced Metering Infrastructure (AMI) with EV charging management as part of the DSM study**
  - "Managed" charging potential will be incorporated in DSM "bundles"
- **Integrating customer-owned DER analysis with DSM study to assess opportunities for incentives for customer-owned storage installations**
  - Integration with AMI and rate design to evaluate customer-owned storage economics (to improve capacity value of DER resources)
- **Additional integration of DERs with RFP with potential evaluation across various scorecard elements (cost, reliability, environmental justice)**
  - Potential special study around DER values

# 3 PORTFOLIO OPTIONS

- **Ensuring broad coverage of resource options**
  - Multiple RFP events to assess the landscape of options that might provide different attributes and fulfill different needs
  - Emerging technologies will be encouraged to participate in the RFP, and NIPSCO will also assess options like carbon capture utilization and storage (CCUS), small modular reactions (SMR), long-duration storage, hydrogen, among others
  - Tax credit opportunities will be evaluated for utility scale and distributed energy resources (DER), as appropriate
- **NIPSCO will continue to use a combination of least-cost optimization analysis and thematic portfolio design to assess a range of options to evaluate performance across a range of objectives associated with cost, environmental sustainability, and reliability**

# 3 RELIABILITY CONSIDERATIONS WITHIN THE PORTFOLIO ANALYSIS

- Continued attention to the three reliability pillars identified in 2021 IRP, with a more robust quantitative framework to evaluate uncertainties in resource adequacy and energy adequacy, **particularly in light of ongoing MISO market design and rule developments**

| | Resource Adequacy | Energy Adequacy | Operating Reliability |
|---|---|---|---|
| **Definition** | Having sufficient resources to reliably serve demand | Ability to provide energy in all operating hours continuously throughout the year | Ability to withstand unanticipated component losses or disturbances |
| **IRP Considerations** | • Co-optimized capacity expansion analysis across **all four seasons**<br>• Considerations around market design changes to **accreditations** and **obligation** | • More robust **hourly analysis for new loads**<br>• Enhanced stochastic reliability assessment to evaluate **correlations between load, renewable output, thermal availability** | • Ensure key "non-economic" reliability attributes are present<br>• Assess ancillary services value |

# 4 NIPSCO TO SHARE AURORA MODELING INFORMATION WITH STAKEHOLDERS

- **Aurora Modeling License For Stakeholders:** As a result of the 2021 IRP Stakeholder Advisory Process, NIPSCO committed to facilitating the procurement of Aurora Energy Forecasting Software special use licenses for stakeholders*

- **Purpose:** In order to increase collaboration and allow interested stakeholders to use Aurora modeling files to perform their own analysis with certain shared inputs

- **Software Provider:** Energy Exemplar

- **IRP Use:** NIPSCO and CRA use Aurora for multiple purposes during the IRP process, including to:

  (i) Develop perspectives and power price forecasts for the wider MISO market

  (ii) Perform detailed portfolio optimization and production cost/dispatch analysis for the NIPSCO system

  *Note: The MISO-level databases are proprietary to CRA and cannot be shared with stakeholders, but all information associated with NIPSCO-level analysis will be made available*

- **Duration of Use:** the limited license agreement will be 12 months, allowing for stakeholders to use the model as NIPSCO develops the IRP and for several months after NIPSCO's expected submission date during the comment period.

*See NIPSCO's "NIPSCO's Response Comments to Stakeholder Comments." https://www.in.gov/iurc/files/NIPSCO_2021-IRP_Responses-to-Stakeholder-Comments.pdf Submitted on May 24, 2022



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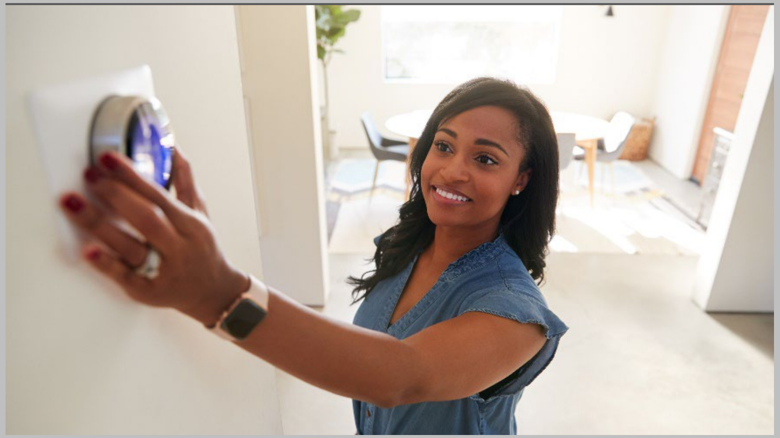


# 2024 IRP ANALYTICAL FRAMEWORK

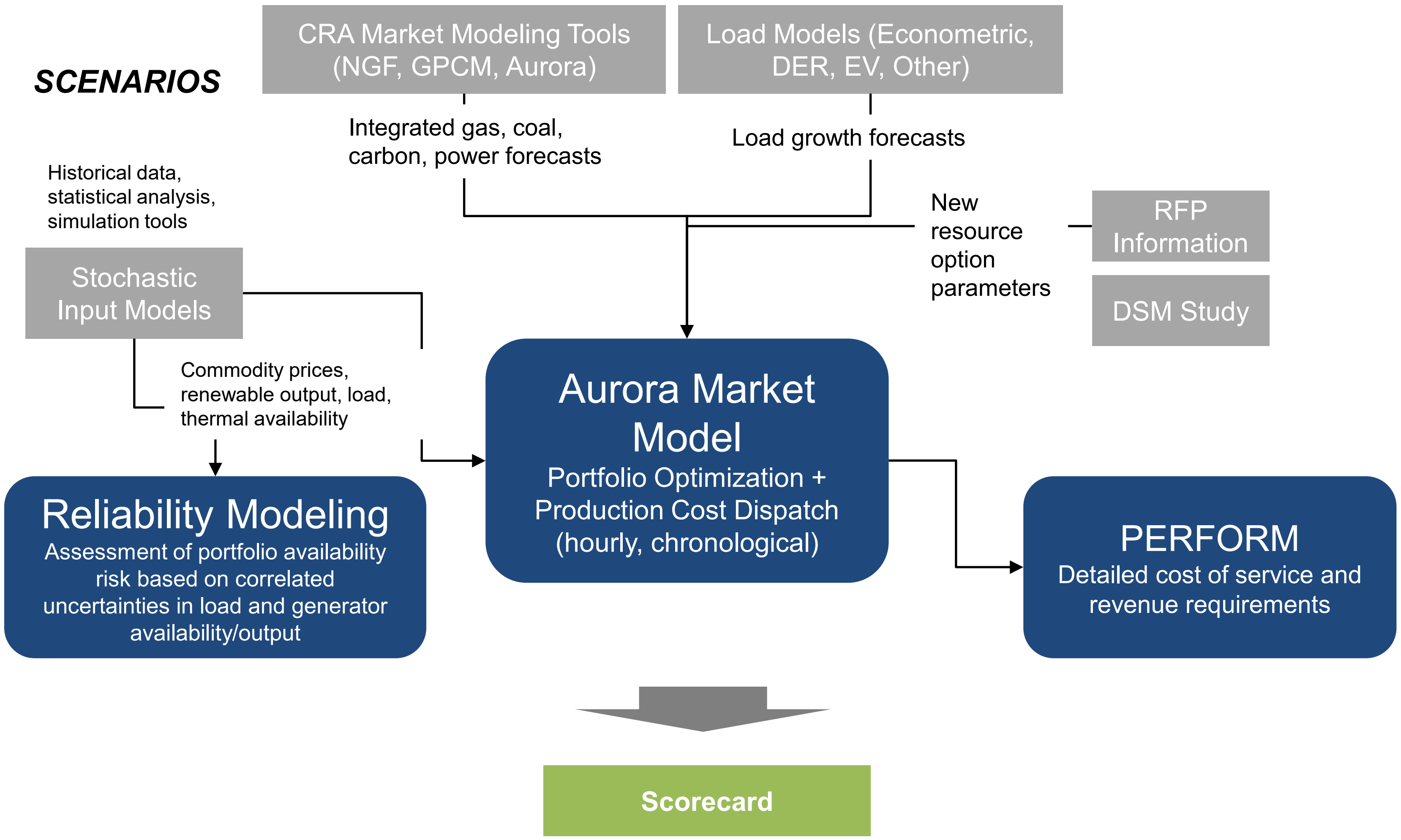

Fred Gomos, Director Strategy, NiSource

Pat Augustine, Vice President, CRA




# RESOURCE PLANNING APPROACH

*Key Modeling and Analysis Tools*




1. **Identify key planning questions and approach**
2. **Develop market perspectives (scenarios)**

*Today's meeting will start*

3. **Develop integrated resource strategies (NIPSCO portfolios)**
4. **Portfolio modeling and analysis**
   - **Detailed scenario dispatch**
   - **Stochastic simulations**
5. **Evaluate trade-offs and select preferred plan**

# ANALYTICAL FRAMEWORK FOR EVALUATING FUTURE UNCERTAINTY

- Because resource decisions are generally long-lived, understanding and incorporating future risk and uncertainty is critical to making sound decisions
- NIPSCO's IRP analysis will use both scenarios and stochastic analysis to perform a robust assessment of risk

## *Scenarios*
***Single, Integrated Set of Assumptions***

- **Can be used to answer the "What if…" questions**
  - Major events can change fundamental outlook for key drivers
    - New policy or regulation (carbon emissions regulation, tax credits)
    - Fundamental gas price change
    - Major load shifts
- **Can tie portfolio performance directly to a "storyline"**

## *Stochastic Analysis:*
***Probabilistic Distributions of Inputs***

- **Can evaluate volatility and "tail risk" impacts**
  - Uncertainty in renewable resource output, generator availability, and load can impact portfolio costs and key reliability metrics
- **For the 2024 IRP, this analysis will be expanded to include more robust treatment of the correlations between renewable generation, load, resource availability, and commodity prices**

## *Special Studies:*
***Focused Research on a Single Topic or Trend***

- **Can be used to give an enhanced view of specific trends around policy, consumer preferences, or the economics of emerging technologies**
  - Potential studies for this IRP include:
    - EV transitory charging
    - Long-duration energy storage (LDES) technology
    - Congestion studies
    - Hydrogen generation market research study
    - Other emerging technology studies

# 2024 IRP SCENARIOS

## Reference Case (REF)

- The MISO market continues to evolve based on current expectations for load growth, commodity price trajectories, technology development, and policy change (IRA incentives continue, EPA power sector rules advance, and MISO resource adequacy enhancements proceed)

## Slower Transition (ST)

- IRA incentives are reduced or ended early, and EPA power sector rules are overturned or rescinded; natural gas prices remain low and result in new gas additions remaining competitive versus renewables in the broader region, as coal capacity more gradually fades from the MISO market

## Domestic Resiliency (DR)

- Continued geopolitical uncertainty and volatility drives a focus on "domestic energy independence"; electric power demand grows because of onshoring and other industrial growth (data centers); gas prices are higher due to strong demand

## Aggressive Environmental Regulation (AER)

- Carbon emissions from the power sector are regulated more heavily, including through a $CO_2$ price; restrictions on natural gas production increase gas prices

## Accelerated Innovation (AI)

- Federal subsidies continue as a bridge until technology breakthroughs drive broad economy-wide decarbonization (including via electrification); new power sector technologies are commercialized, and DER, EV, microgrid, and EE adoption all increase, transforming wholesale load requirements as "Grid Edge" innovations and enabling policy advance

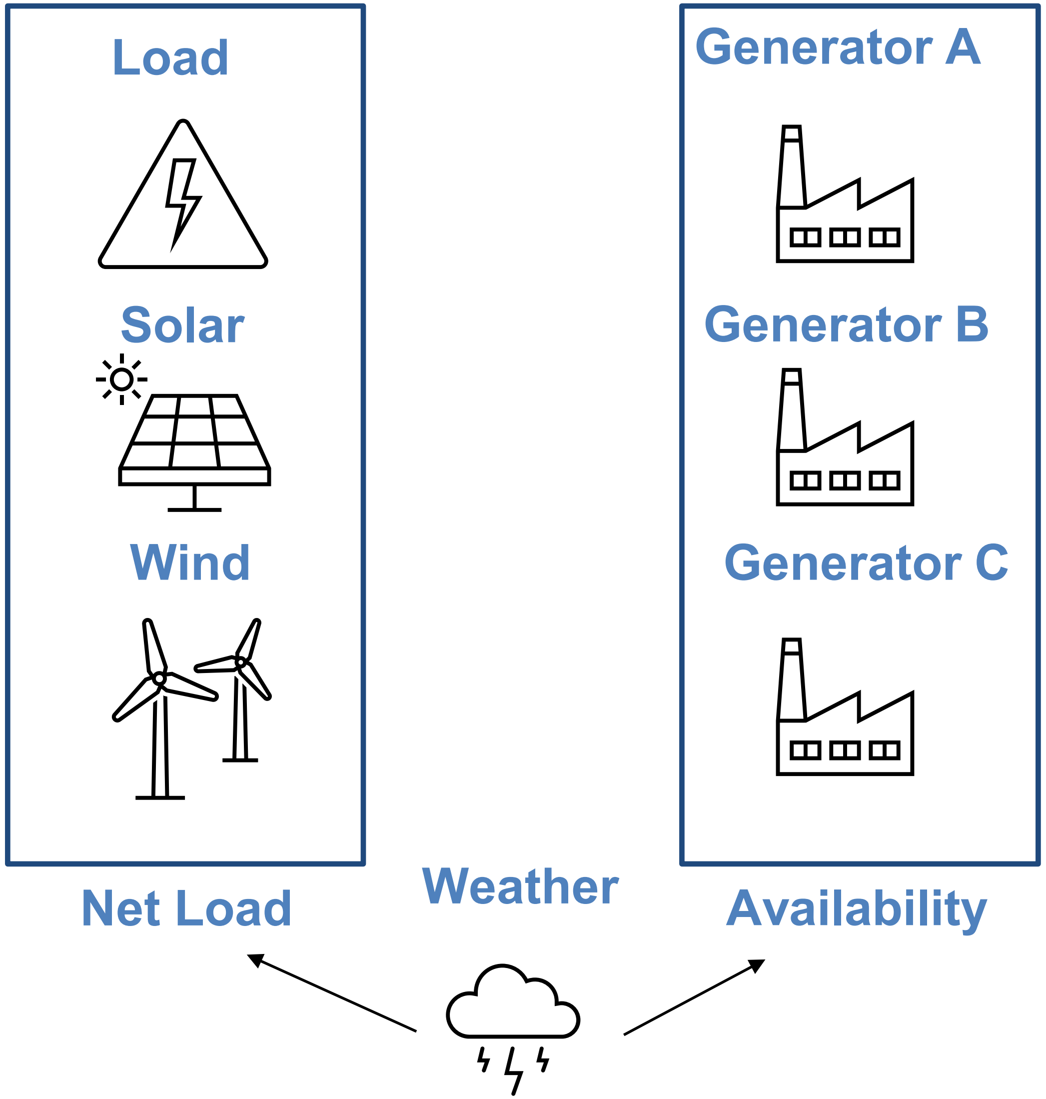
# DIRECTIONAL SCENARIO VARIABLE INPUTS

| Scenario | Commodity Prices | Carbon Policies | Technology Costs | Demand | Market Design |
|---|---|---|---|---|---|
|  **Reference Scenario (REF)** | Baseline | Current Policy, including EPA power sector CO2 emission rules | Baseline | Baseline | Examine alternative capacity accreditation and obligation requirements across alternative market design concepts and based on MISO market outcomes |
|  **Slower Transition (ST)** | Low gas price due to abundant resource | IRA pull-back and withdrawn EPA power sector rules | Slower decline for new tech costs; stable IC costs | Low DER and EV | |
|  **Domestic Resiliency (DR)** | Higher gas price due to strong demand | Current policy, including EPA power sector CO2 emission rules | Higher due to supply chain constraints, onshoring | New large loads (data centers, industrial onshoring) | |
|  **Aggressive Environ. Regulation (AER)** | Highest gas price due to production restrictions | EPA power sector CO2 emission rules *plus* carbon price | Baseline | Higher DER and EV; some electrification | |
|  **Accelerated Innovation (AI)** | Lower gas price due to demand erosion | Current policy, including EPA power sector CO2 emission rules | New tech. advancement and decline in costs; IC cost pressures | High EV and electrification plus new large loads; higher DER | |

**Note that NIPSCO portfolio-level technology costs will be heavily informed by RFP data*

# STOCHASTIC RELIABILITY ANALYSIS

- Stakeholder feedback from the 2021 IRP and ongoing reliability analysis activities at MISO have influenced NIPSCO's decision to make **enhancements to its stochastic analysis process for the 2024 IRP, focused on economic *and* reliability metrics**
- In addition to key economic metrics associated with cost to customer, NIPSCO's reliability analysis will assess how often NIPSCO *must* rely on external resources to meet load requirements
- Key enhancements to the process will tie net load (system load and wind and solar output) and generator availability back to weather to **capture correlated events**
- Measures of the **frequency and duration of market exposure**, along with economic impacts, will be evaluated across portfolios



# PORTFOLIO PERFORMANCE WILL BE DISTILLED INTO A PROPOSED INTEGRATED SCORECARD

| Objectives | Indicators | Proposed Metrics for 2024 | Notes |
|---|---|---|---|
| **Affordability** | **Cost to Customer** | • Near-term and long-term Impact to customer bills<br>• Metric: 10-year and 30-year NPV of revenue requirement (Reference Case scenario deterministic results) | • Near-term and long-term perspectives |
| **Rate Stability** | **Cost Certainty** | • Certainty that revenue requirement within the most likely range of outcomes<br>• Metric: Scenario range NPVRR and 75th% | |
| | **Cost Risk** | • Risk of unacceptable, high-cost outcomes<br>• Metric: Highest scenario NPVRR and 95th% | |
| | **Lower Cost Opportunity** | • Potential for lower cost outcomes<br>• Metric: Lowest scenario NPVRR and 5th% | |
| **Environmental Sustainability** | **Carbon Emissions** | • Carbon intensity of portfolio<br>• Metric: Cumulative carbon emissions (2024-40 short tons of CO2) from the generation portfolio | |
| **Reliable, Flexible, and Resilient Supply** | **Reliability, Flexibility** | • The ability of the portfolio to provide reliable and flexible supply for NIPSCO in light of evolving market conditions and rules<br>• Metric: Loss of load expectation (LOLE) or expected unserved energy (EUE) metrics for NIPSCO system to assess market dependence risk<br>• Metric: MW black start and fast start capability | • New metrics from fuller reliability analysis based on MISO market rules evolution |
| **Positive Social, & Economic Impacts** | **Local Investment in Economy** | • The effect on the local economy from new projects and ongoing property taxes and targeted investment<br>• Metric: NPV of property taxes from the entire portfolio<br>• Metric: NPV of potential investment in Justice40/Energy Communities | • New environmental justice metric considerations, particularly tied to IRA opportunities |

Proposed changes from 2021 Scorecard highlighted in blue

# NEXT STEPS FOR SCENARIO AND STOCHASTIC ANALYSIS

- **Developing integrated fuel, carbon, load, and power market outlooks for all five scenarios, detailed outcomes will be provided in the *next* stakeholder meeting:**
  - NIPSCO load scenario projections
  - Natural gas prices
  - Environmental policy drivers
  - MISO resource mix and power price range (annual, monthly, and hourly impacts)
- **Developing integrated commodity price, weather, load, renewable output, and thermal resource availability stochastic simulations for the *next* stakeholder meeting**
- **NIPSCO welcomes stakeholder input on proposed scenario concepts and probabilistic analysis approach**
  - NIPSCO is open to one-on-one calls with stakeholders to discuss analysis in more detail



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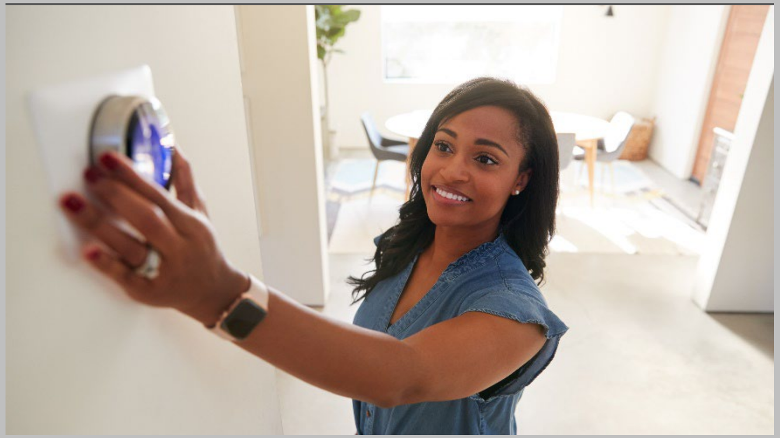
# LUNCH







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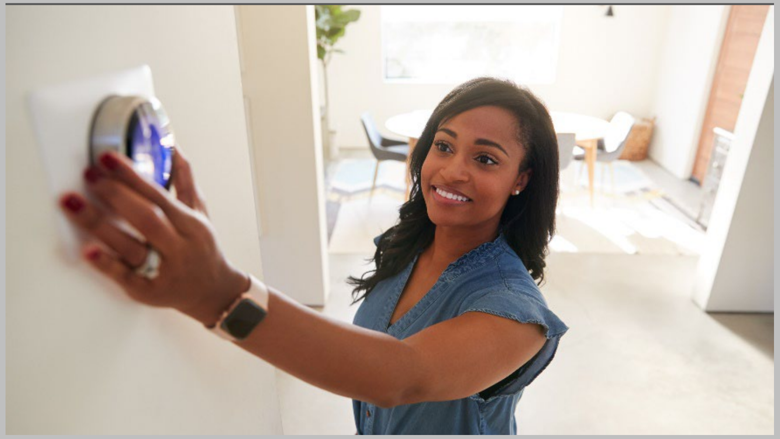
# REFERENCE CASE LOAD FORECAST UPDATE

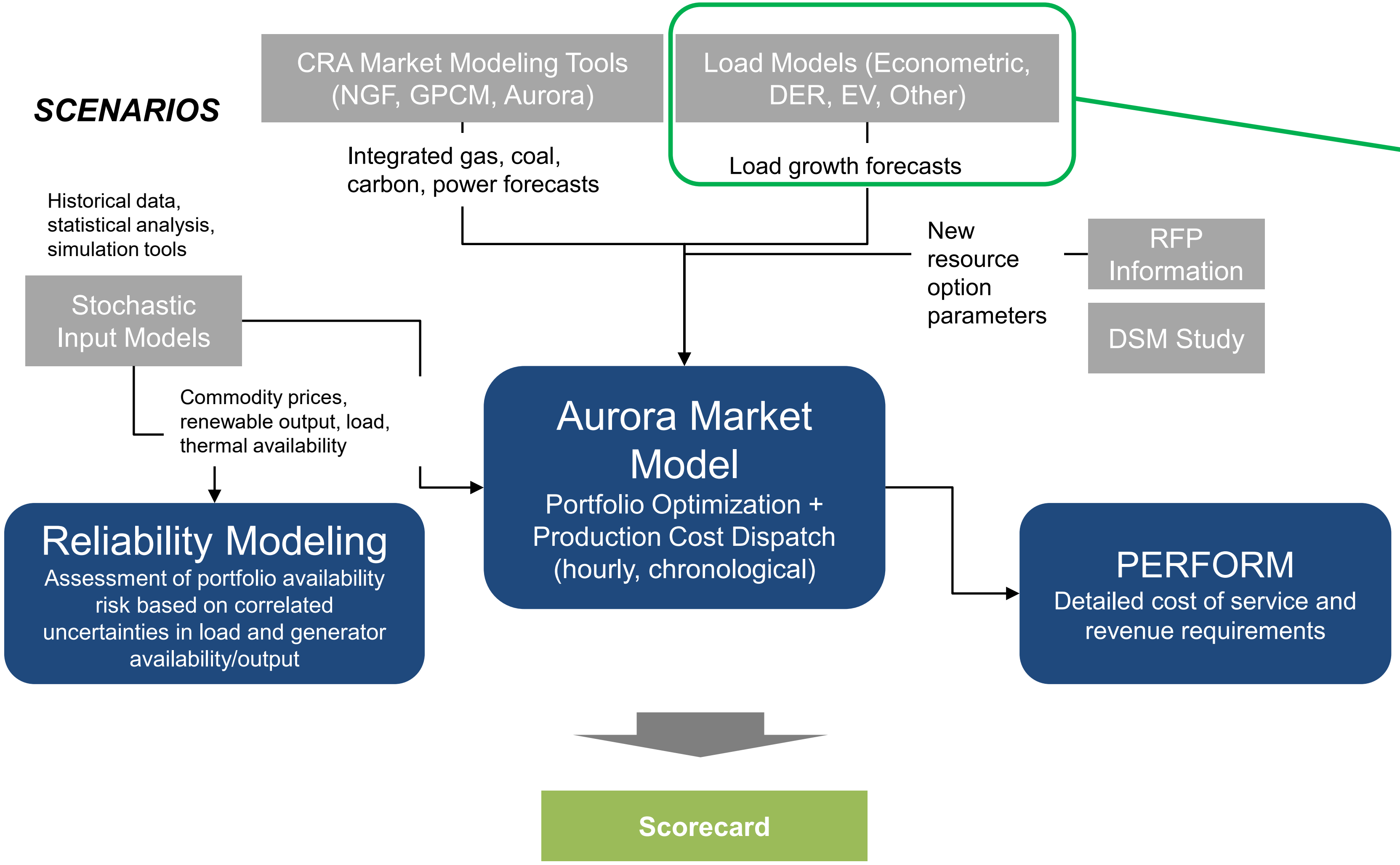



Pat Augustine, Vice President, CRA
Fred Gomos, Director Strategy, NiSource




# RESOURCE PLANNING APPROACH: LOAD GROWTH FORECASTS

***Key Modeling and Analysis Tools***




1. **Identify key planning questions and approach**
2. **Develop market perspectives (scenarios)**
3. **Develop integrated resource strategies (NIPSCO portfolios)**
4. **Portfolio modeling and analysis**
   - **Detailed scenario dispatch**
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5. **Evaluate trade-offs and select preferred plan**

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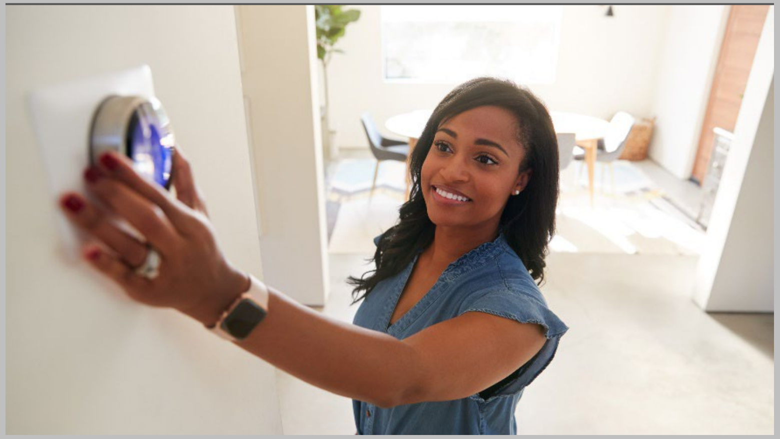
# LOAD FORECAST METHODOOLGY OVERVIEW



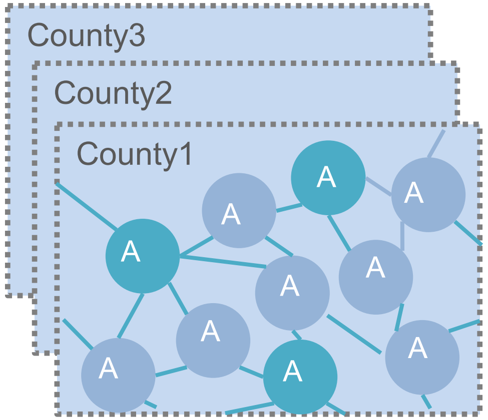
# FORECASTING METHODOLOGY OVERVIEW

| *Inputs* | *Core Forecast and Validation* | | | *Forecast Adjustments* | *Scenarios* |
|---|---|---|---|---|---|
| **Data Gathering** | **Econometric Modeling by Customer Class** | **Baseline Energy Forecast** | **Peak Load Forecast** | **DER, EV, Electrification, and Emerging Large Load Adjustments** | **Develop Scenarios for Future** |
| • Energy consumption and number of customers by class<br>• Moody's macroeconomic variables (household income, employment, etc.)<br>• Weather (heating/cooling degree days)<br>• Historical DSM programs | • Test all economic and demographic "driver" variables<br>• Perform post-estimation tests on econometric models' specification and forecasting performance (e.g., Adjusted R-Square, Mean Absolute Percentage Errors) | • Develop baseline customer count and energy forecasts for each NIPSCO customer rate class<br>• Adjust load forecasts for DSM programs (historical)<br>• Develop accompanying peak load forecasts using energy forecast and load factors by customer rate class | | • Perform customer-owned DER and EV analysis using penetration models<br>• Adjust load forecasts for electrification and large economic development load growth potential | • Evaluate alternative economic growth in econometric model<br>• Develop ranges for DER, EVs, electrification, data centers based on fundamental analysis and other inputs |

# DER MODELING OVERVIEW: DER PENETRATION (PENDER) MODEL

***PenDER is an Agent-based model (ABM) that considers NIPSCO customer (“agents”) characteristics, economic decision-making, and social interactions to drive projections of the adoption of DER systems by county***

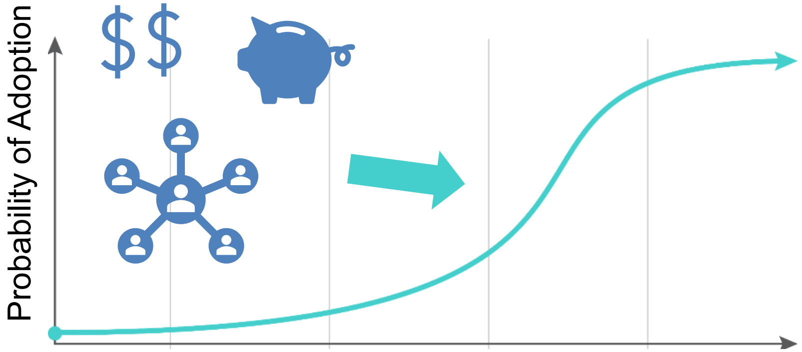
## Agent and Network Representation




Agents defined by:

| | |
|---|---|
| **Customer Level Data** | Individual customer information about DER adoption, location, and customer class (R/C/I) |
| **Socio-Economic Data** | Individual customer information on socio-economic status, business type, energy usage |

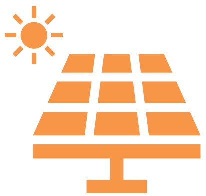
## Adoption Decision




Probability of adoption threshold is met based on:

- Payback period
- Customer budget
- Social network adoption rate

## Cumulative DER Adoption



**Individual adoption decisions aggregated to NIPSCO service territory by customer class**

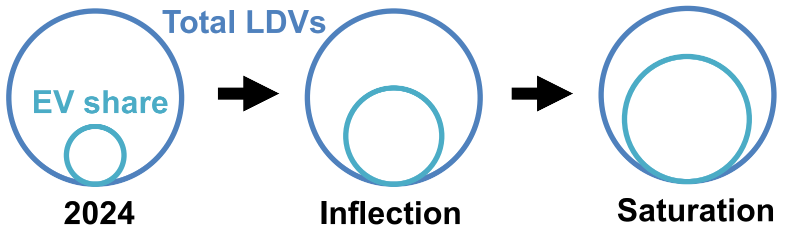
# EV FORECASTING OVERVIEW

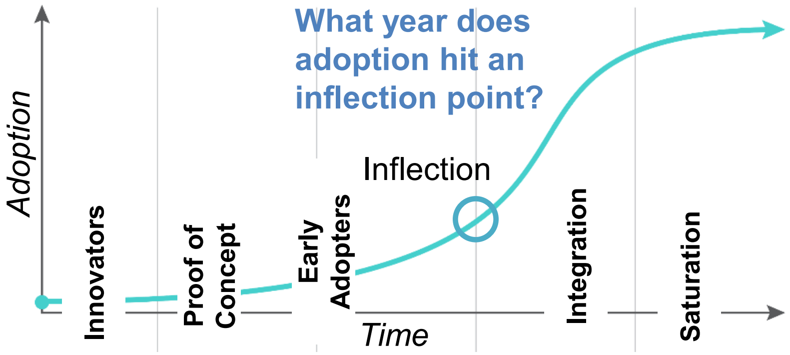
*Penetration Models with Local Datasets*

*Truck Corridor Charging Tool*

| Light Duty Vehicle (LDV) | Medium Duty Vehicle (MDV) | Heavy Duty Vehicle (HDV) |
|---|---|---|
| **<10,000 lbs** | **10,001 – 26,000 lbs** | **>26,001 lbs** |

1. Develop growth estimates based on adoption rates applied to S-curve




2. NREL's EVI-Pro-Lite tool and other sources to develop hourly shapes

3. Develop final hourly load forecast based on adoption rates, temperature, efficiency assumptions, and other variables

Analysis includes data from:

- National Performance Management Research Data Set (NPMRDS) via U.S. Dept of Transportation
- Highway traffic counts from Indiana Dept of Transportation
- Freight Analysis Framework
- Institute of Transportation Engineers Trip Generation Database

# DRIVERS OF LOAD UNCERTAINTY

| | Scenario Name | Description | Economic Growth (C&R, I Count) | EV Penetration | DER Penetration | Electrification (MISO Futures Report) | Large Econ. Development (Data Center) Load |
|---|---|---|---|---|---|---|---|
| **Today's Focus**  | **Reference Case** | Reference Point | **Base** Moody's Baseline forecast | **Base** Rate of Adoption | **Base** Expected Rate of Adoption | **Limited (Future 1)** | **Base** None |
|  | **Slower Transition** | Environmental policy incentives reduce; economic slowdown in region | **Low** Moody's Low forecast | **Low** Rate of Adoption | **Lowest** High capital costs, low tax credits, low wholesale prices | **Limited (Future 1)** | **Base** None |
|  | **Domestic Resiliency** | Influx of new economic development load (data center focus) | **Base** Moody's Baseline forecast | **Base** Rate of Adoption | **Lower** High capital costs | **Limited (Future 1)** | **High** |
|  | **Aggressive Environmental Regulation** | Aggressive decarbonization policy, moderate electrification | **Base** Moody's Baseline forecast | **High** Rate of Adoption | **High** Net metering policy change | **High (Future 2)** | **Base** None |
|  | **Accelerated Innovation** | Faster energy transition, high electrification with additional econ. dev. (data center) load | **Base** Moody's High forecast | **High** Rate of Adoption | **High** Low capital costs, larger installation sizes | **Highest (Future 3)** | **High** |



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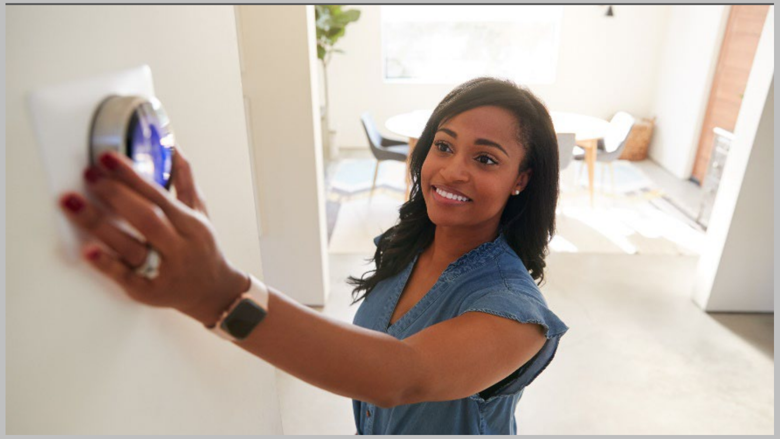
# REFERENCE CASE LOAD FORECAST




# CORE ELECTRIC SALES FORECAST – ECONOMETRIC PARAMETERS

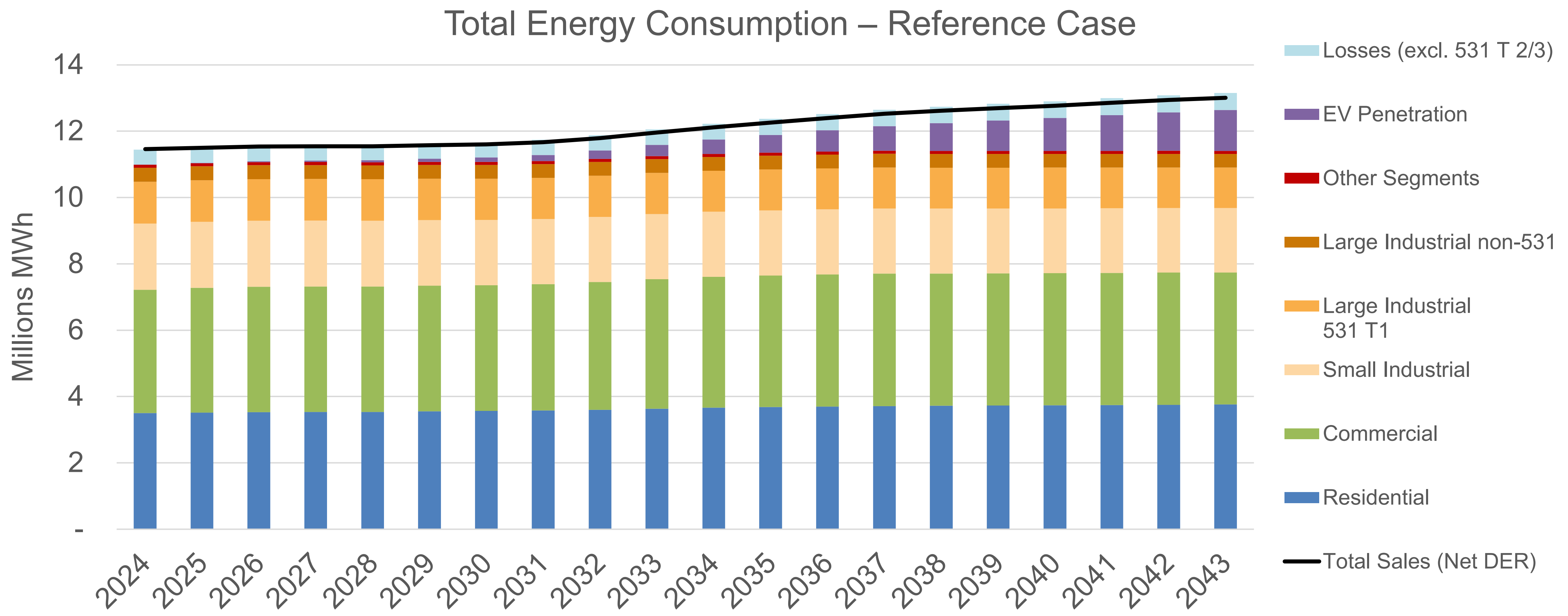
- Baseline customer count and sales per customer energy forecasts by class are projected with best fitting variables
- CRA tested various macroeconomic variables using Moody's historical and forecast data and selected the presented model based on R-squared, adjusted R-squared, Root Mean Squared Error (RMSE), and Mean Absolute Percentage Error (MAPE)

| | Residential | Commercial | Industrial |
|---|---|---|---|
| Customer Count Forecast | Household Income | Household Income, Employment | Manufacturing employment, Metals employment |
| Baseline Sales per Customer Forecast | Household income, HDD, CDD, seasonal monthly dummies, 2020 and after indicator function | Employment, Manufacturing, CDD, seasonal monthly dummies, 2020 and after indicator function | Seasonal average → decomposed by rate class |

*Note that large industrial, railroad, street lighting, public authority, and company use forecasts are based primarily on historical trends extrapolated forward*

# REFERENCE CASE ENERGY SALES / CONSUMPTION

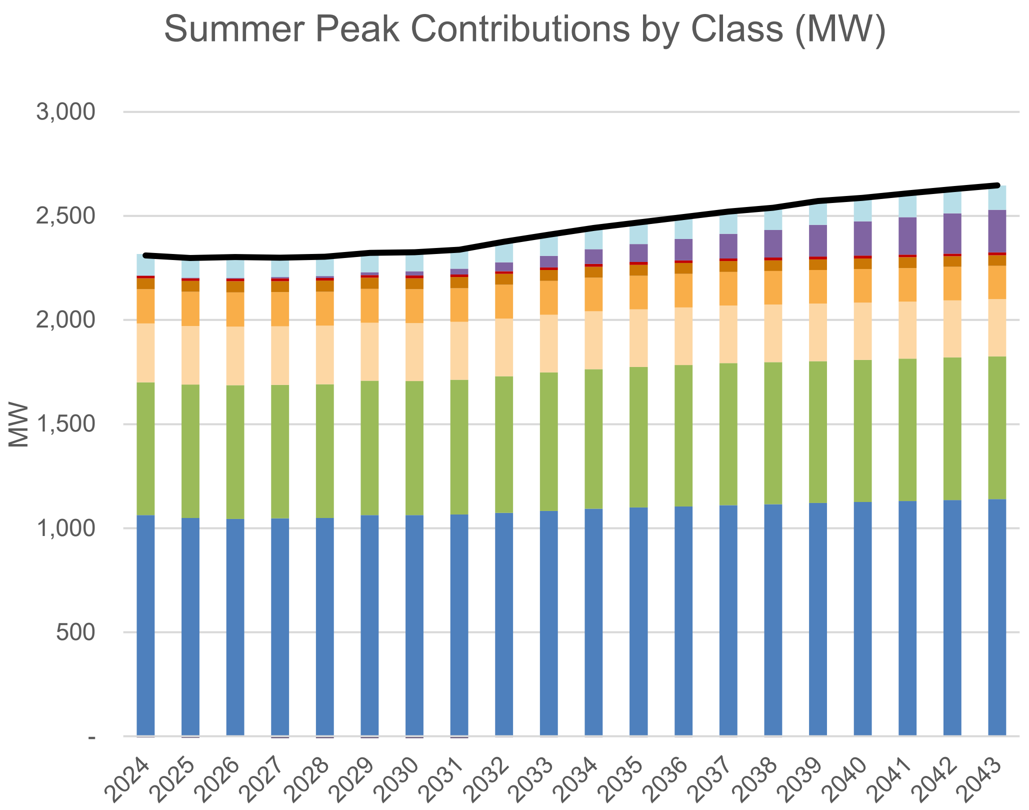
***Residential, Commercial, and Industrial customers comprise most energy sales in the Reference Case***

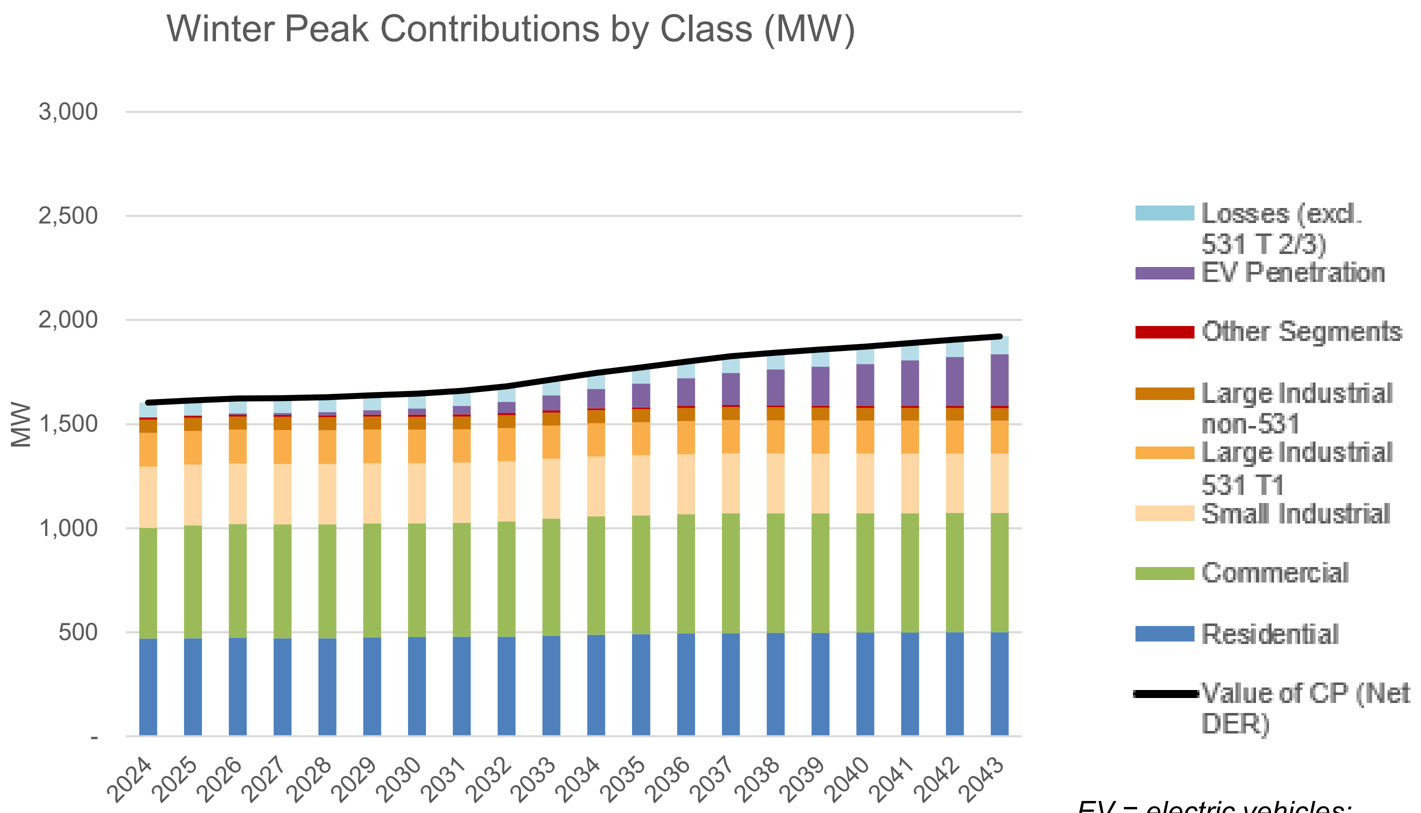



*EV = electric vehicles; DER = customer-owned distributed energy resources*

# PEAK LOAD FORECAST – FOUR MISO PLANNING SEASONS

## *NIPSCO is expected to remain summer peaking in the Reference Case*

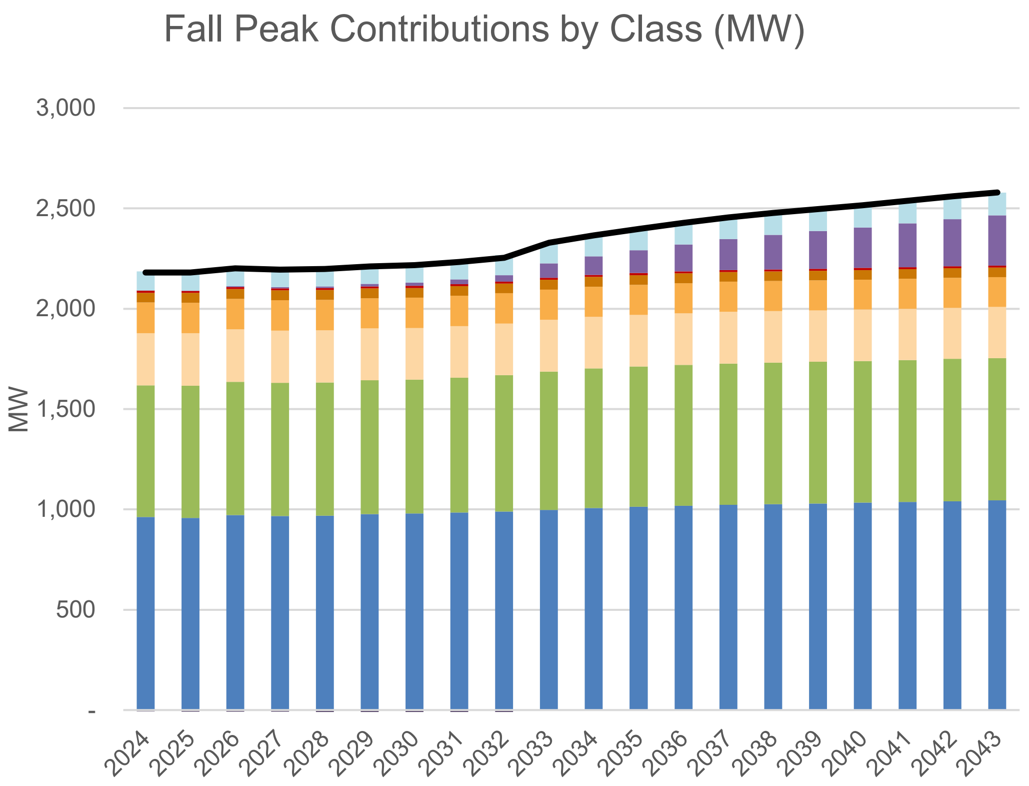


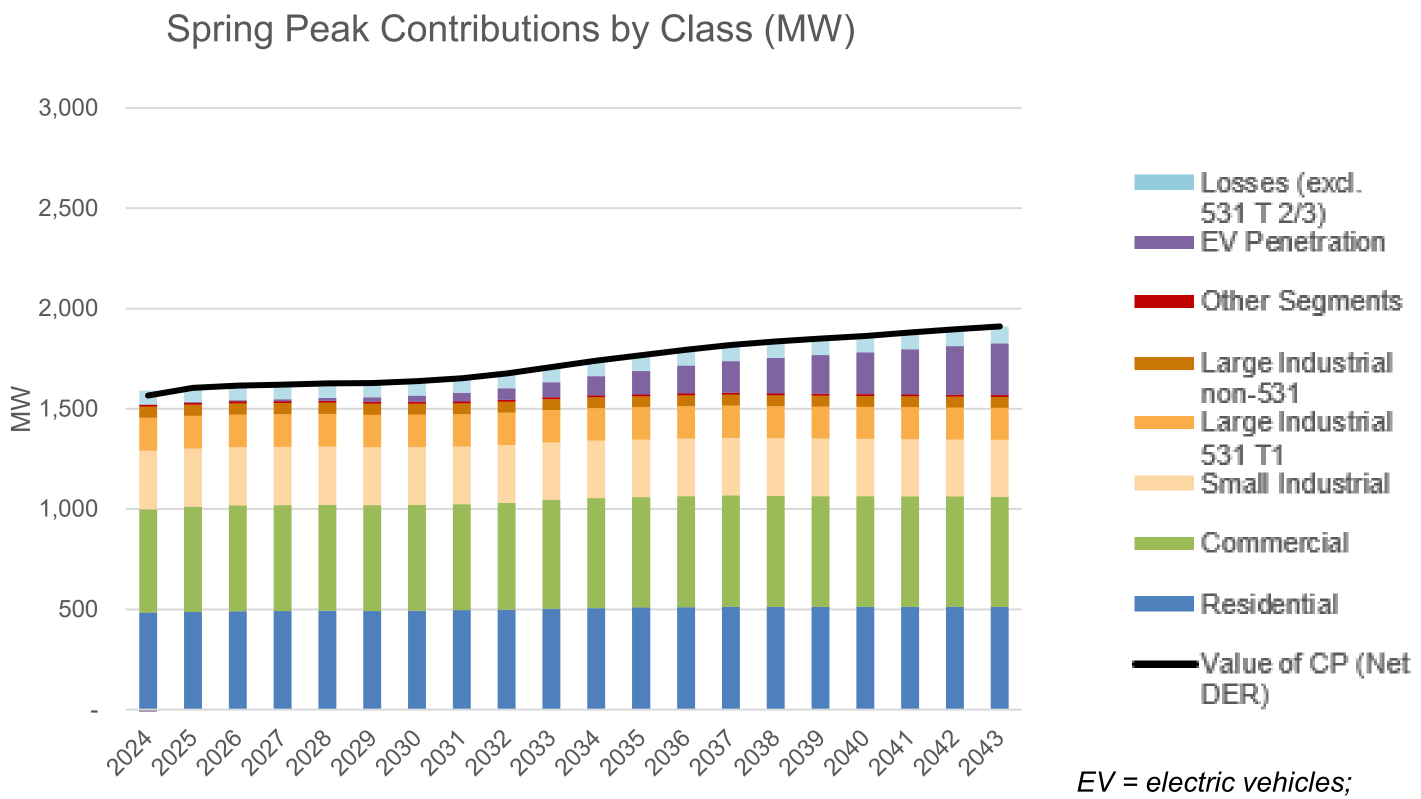




*EV = electric vehicles;*
*DER = customer-owned distributed energy resources*
*CP = coincident peak for NIPSCO system*

# PEAK LOAD FORECAST – FOUR MISO PLANNING SEASONS

## *Fall loads (September) are likely to be much closer to summer peaks than those in Spring*




*EV = electric vehicles;*
*DER = customer-owned distributed energy resources*
*CP = coincident peak for NIPSCO system*

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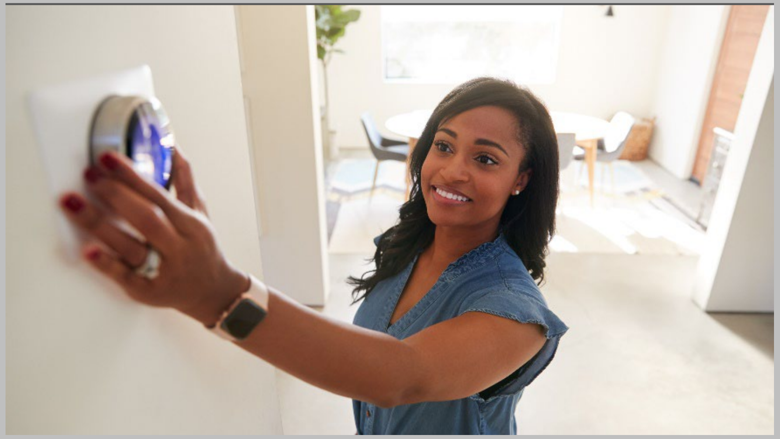
# LOAD FORECAST: CUSTOMER-OWNED DER REFERENCE CASE




# DER MODELING OVERVIEW: PENDER

## PenDER is an Agent Based Model (ABM)

**Actions (*adoption decisions*) and interactions (*via social networks*) of thousands of autonomous "agents" are simulated to study their effects on DER adoption by customer class**

***PenDER is designed to:***

- Provide granular forecasting of *DER adoption by demographics*
  - By socioeconomic variables (income, age, etc.) that characterize customer groups
  - By technology index of DER adoption (innovators, early adopters, imitators)
  - By region (county/neighborhood or distribution system designation)
- Simulate adoption *response to DER system costs*
  - Cost of DER is a key determinant of adoption decisions
- Simulate adoption *response to utility or market pricing*
  - Expected retail or wholesale rate growth
  - Financial incentives and costs

# PENDER MODEL: KEY ASSUMPTIONS

**Avoided Costs / Revenues –** Estimated as annual production (based on expected solar capacity factor), in kWh, multiplied by avoided retail rate consumption or the **Excess Distributed Generation (EDG)** rate for excess generation, in $/kWh.

**PV Costs –** Estimates rely on National Renewable Energy Laboratory's (NREL) *Annual Technology Baseline* (ATB) capital cost assumptions for Class 5 –PV Residential and Commercial Solar technologies– and are inclusive of expected ITC benefits.

**Customer Budget –** Assigned to each agent via probability distribution informed by the 2022 American Community Survey (ACS) 5-year census estimates. Customer budget is omitted from commercial forecasts, as agents are assumed to act in best economic interest and can utilize loans.

**Payback Time –** Based on the upfront capital cost, the cash flow from renewable energy incentives (i.e. EDG rates), discount rate, and solar PV lifetime, the payback period is determined by the number of years of discounted annual revenues that are required to cover the upfront PV system cost.

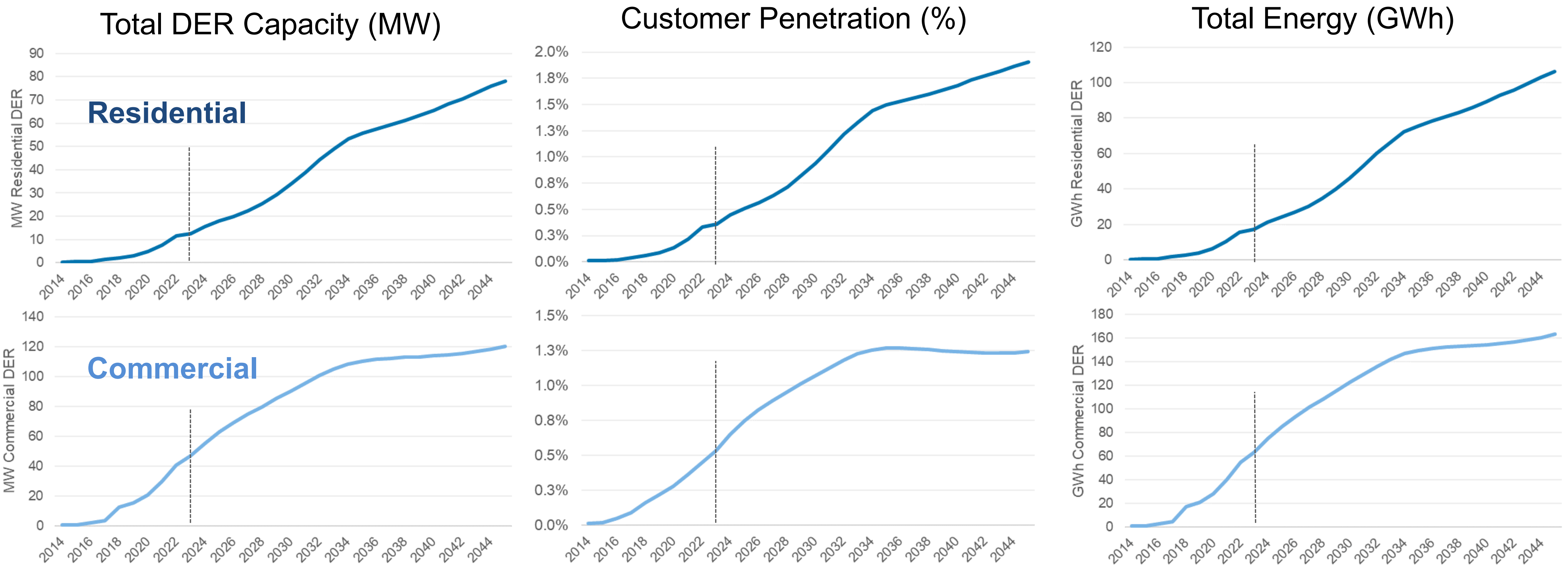
# PENDER MODEL: SUMMARY OF MAJOR ASSUMPTIONS

| | Residential | Commercial |
|---|---|---|
| **Solar Costs** | NREL Curve w/ ITC | NREL Curve w/ ITC |
| **Solar Capacity Factor** | 15.5% | 15.5% |
| **Solar Lifetime** | 25 years | 25 years |
| **Avg. System Size** | 8 kW | 125 kW |
| **Discount Rate** | 7.0% | 6.0% |
| **Inflation Rate** | 2.1% | 2.1% |

- Solar System Characteristics: NIPSCO-approximated capacity factor assumption for a typical DER solar system is based on NREL data and an assumed 25-year life for solar projects.
- Average Solar System Size: assumption based on average system size from NIPSCO historical solar DER adoption by customer class.
- Financial Inputs: assumes that small customers (i.e. residential) have higher financing costs than larger-scale customers with better access to capital

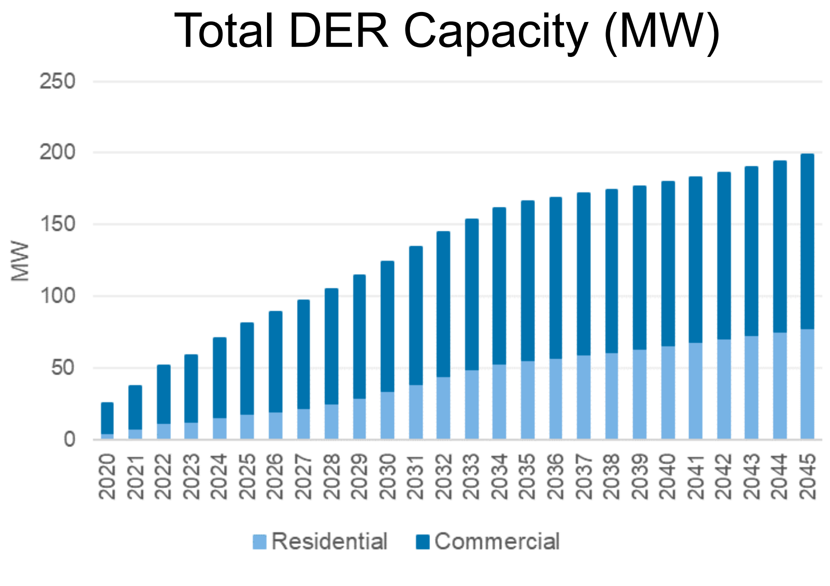
# REFERENCE CASE PROJECTIONS

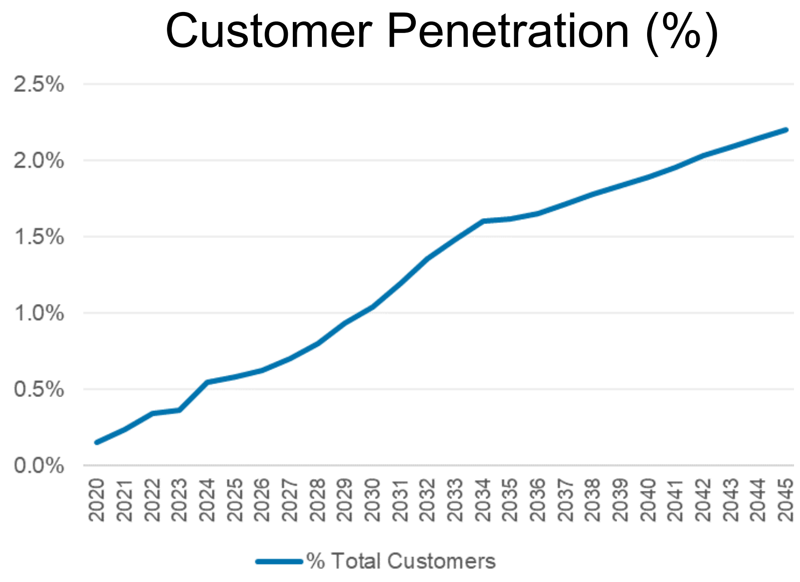
- Among residential customers, a total of 80 MW of installed Solar DER capacity is projected by 2045
- Among commercial customers, a total of 120 MW of installed Solar DER capacity is projected by 2045

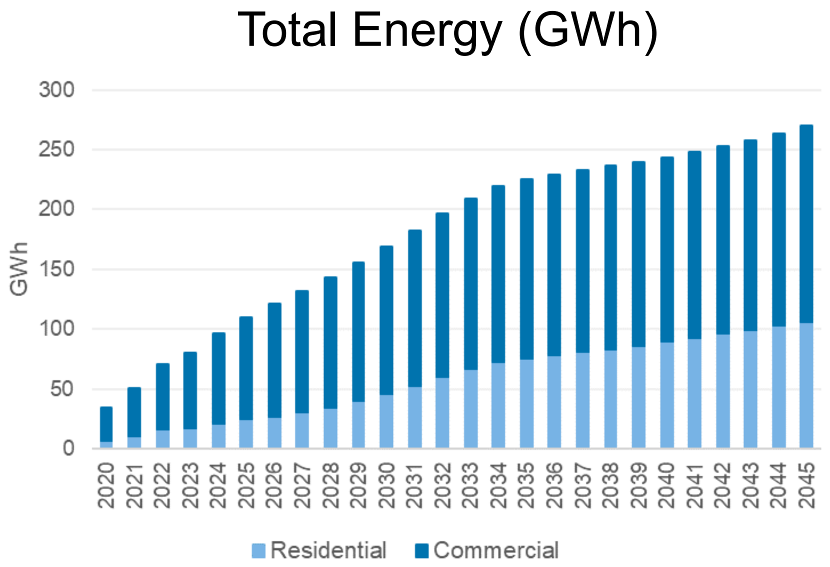


# REFERENCE CASE SUMMARY

- Overall, for the Reference Case, a total of 166 MW of installed Solar DER capacity is projected by 2035, 180 MW by 2040, and 200 MW by 2045.



# DER SCENARIO CONSIDERATIONS





| Scenario Name | Description | Capital Cost for Solar | ITC Incentives | Wholesale Rate Growth | Incentive Structure | DER Installation Size |
|---|---|---|---|---|---|---|
| **Reference Case** | Reference Point | **Base**<br>*NREL Reference* | **Base**<br>*IRA through 2035* | **Base** | **EDG Program**<br>*Program continues unchanged through the planning horizon* | **Base**<br>*Historic socioeconomic trends continue* |
| **Slower Transition** | Environmental policy incentives reduce; economic slowdown in region | **High**<br>*NREL Conservative* ↑ | **Low**<br>*IRA phase-out* ↓ | **Low**<br>*Lower commodity prices* ↓ | **EDG Program**<br>*Program continues unchanged through the planning horizon* | **Base**<br>*Historic socioeconomic trends continue* |
| **Domestic Resiliency** | Influx of new economic development load (data center focus) | **High**<br>*NREL Conservative* ↑ | **Base**<br>*IRA through 2035* | **High**<br>*Higher commodity prices.* ↑ | **EDG Program**<br>*Program continues unchanged through the planning horizon* | **High**<br>*Increasing underlying load growth* ↑ |
| **Aggressive Environmental Regulation** | Aggressive decarbonization policy, moderate electrification | **Base**<br>*NREL Reference* | **Base**<br>*IRA through 2035* | **Highest**<br>*Highest gas prices; environmental regulation (high $CO_2$ price)* ↑ | **EDG → Net Metering**<br>*DER adoption encouraged through net metering, or another innovative design* ↑ | **Base**<br>*Historic socioeconomic trends continue* |
| **Accelerated Innovation** | Faster energy transition, high electrification with additional econ. dev. (data center) load | **Low**<br>*NREL Low* ↓ | **Base**<br>*IRA through 2035* | **Base**<br>*Close to base, but model logic transitions to Net Metering* | **EDG Program**<br>*Program continues unchanged through the planning horizon* | **Highest**<br>*Economy-wide electrification driving larger customer UPC* ↑ |

# NEXT STEPS FOR DER ANALYSIS

- Evaluate DER penetration levels across four alternative scenarios (Slower Transition, Domestic Resiliency, Aggressive Environmental Regulation, Accelerated Innovation)

- Integrate analysis with DSM study to assess opportunities for incentives for customer-owned storage installations (i.e., to improve capacity value of DER resources)



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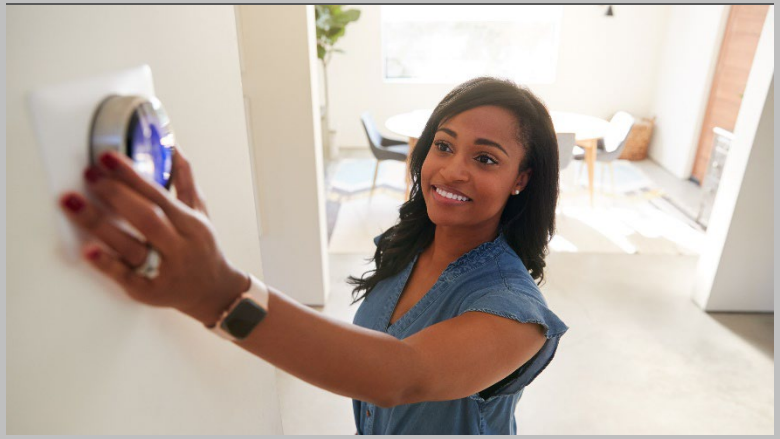
# LOAD FORECAST: ELECTRIC VEHICLES REFERENCE CASE

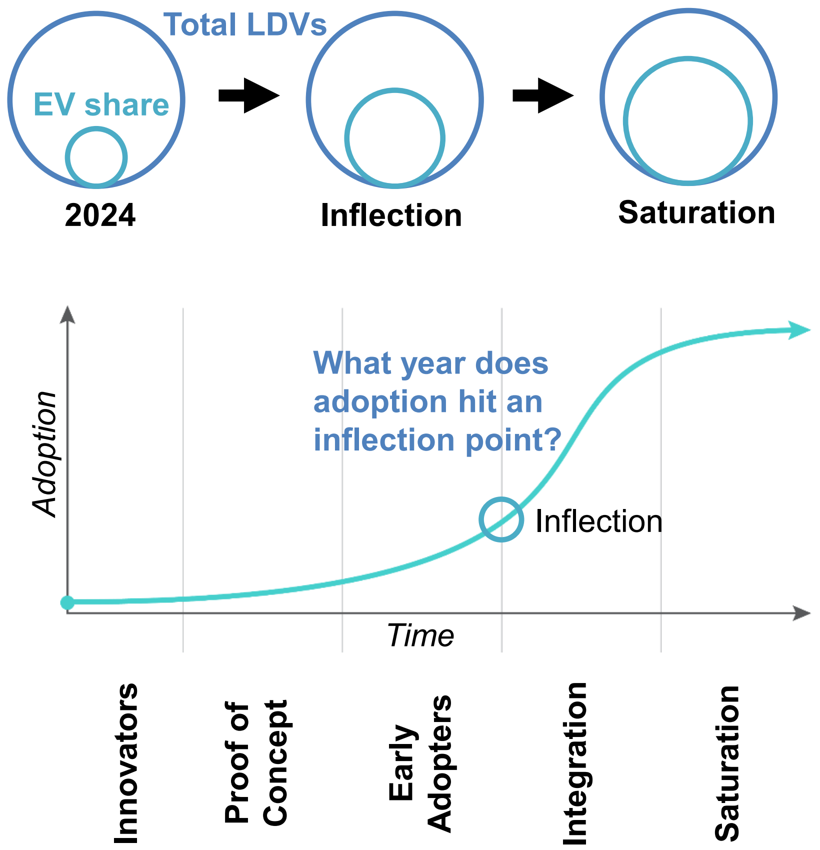




# LDV EV LOAD FORECASTING APPROACH

***Blends econometric forecast with hourly shapes to capture long-term trends in vehicle growth and charging behavior, while accounting for weather conditions***

**1.** Develop growth estimates based on adoption rates applied to S-curve




**2.** NREL's EVI-Pro-Lite tool to develop hourly shapes

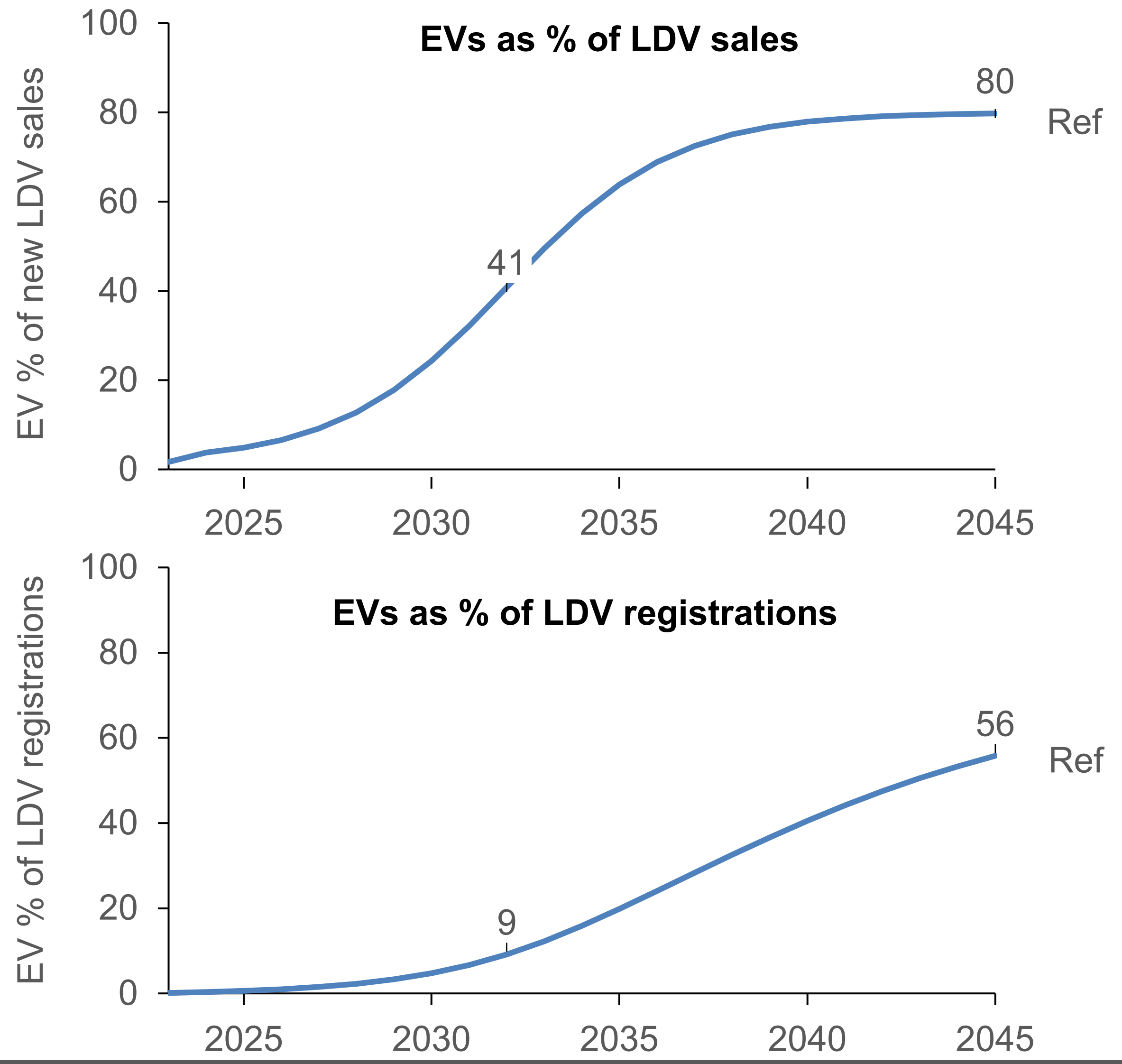
- Utilize NREL's EVI-Pro-Lite tool to develop hourly shapes
- Develop profiles to address long-term trends in vehicle type and charger behavior

**3.** Develop final hourly load forecast based on EV projections and hourly shapes

- Econometric model determines total number of electric vehicles and vehicle efficiency, which will scale total EV demand over each year (Step 1)
- Take seasonal charging profiles and create 8760 shapes

# LDV EV ADOPTION PROJECTIONS

***Reference LDV adoption trajectory would meet New EPA targets***




## Adoption Overview

- NIPSCO has taken views on how adoption may unfold over time, leveraging current EV data and third-party projections
- Current estimated penetration of ~1.6% of new sales in NIPSCO's service territory (estimate based on analysis of IN Fuel Dashboard data from 2018-2023)
- A sigmoid function is used to create intermediate sales values by year, where the Reference Case reaches an 80% of sales target by 2045

# LDV HOURLY SHAPES

***Utilizes NREL's EVI-Pro-Lite tool to develop hourly shapes, blending profiles to address long-term trends in vehicle type***

*As EV adoption becomes more widespread, model forecasts will align with changes in charging behavior and charger / vehicle efficiencies*

**2024 Load Profile**

- Primary home and work charging strategy: *as fast as possible*
- Home charger composition: 20% L1, 80% L2
- Uses EVI-pro default values, assuming same EV efficiency

**2030 Load Profile**

- Home charger composition: 50% L1, 50% L2
- Efficiency factor applied to dampen the kW per EV required

**2040 Load Profile**

- Home charger composition: 50% L1, 50% L2
- Continued efficiency factor applied to dampen the kW per EV even more

Other considerations:
- Distinct patterns applied for weekday versus weekend / holiday
- Hourly profile is temperature dependent (nearest 10 degree C)

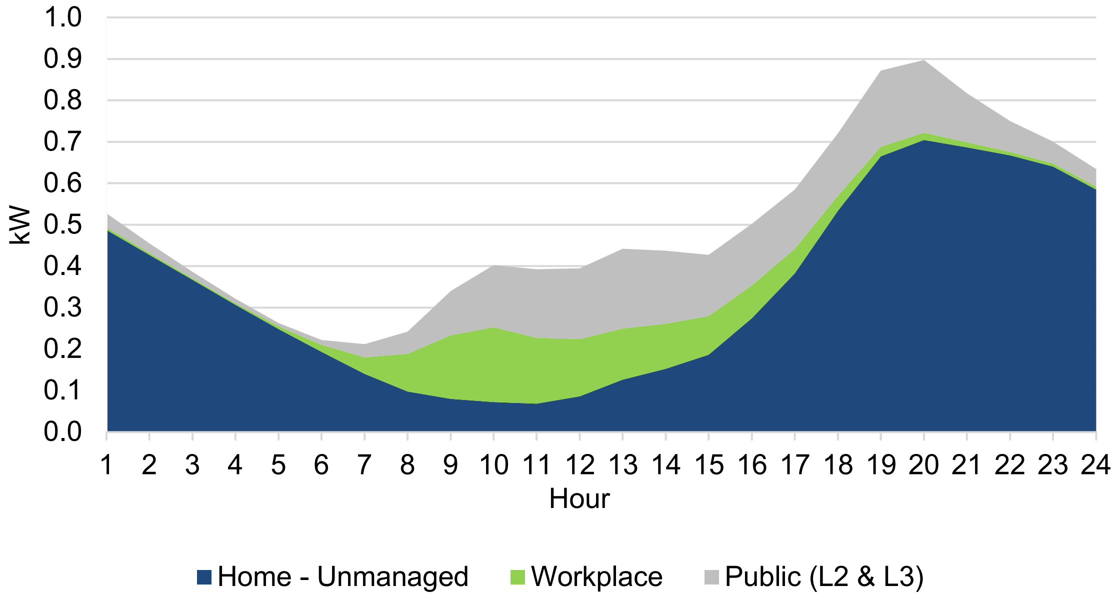
# PROJECTED LDV LOAD IMPACTS OVER TIME

| | 2024 | 2030 | 2040 |
|---|---|---|---|
| Total EVs | 2,006 | 33,016 | 283,967 |
| BEV Sedan Efficiency (mi /kWh) | 2.57 | 3.50 | 5.00 |
| BEV SUV Efficiency (mi / kWh) | 2.30 | 3.00 | 4.50 |
| Annual Sales (MWh) | 8,243 | 129,000 | 866,000 |
| Annual Peak (MW) | 2.15 | 32.3 | 214.5 |

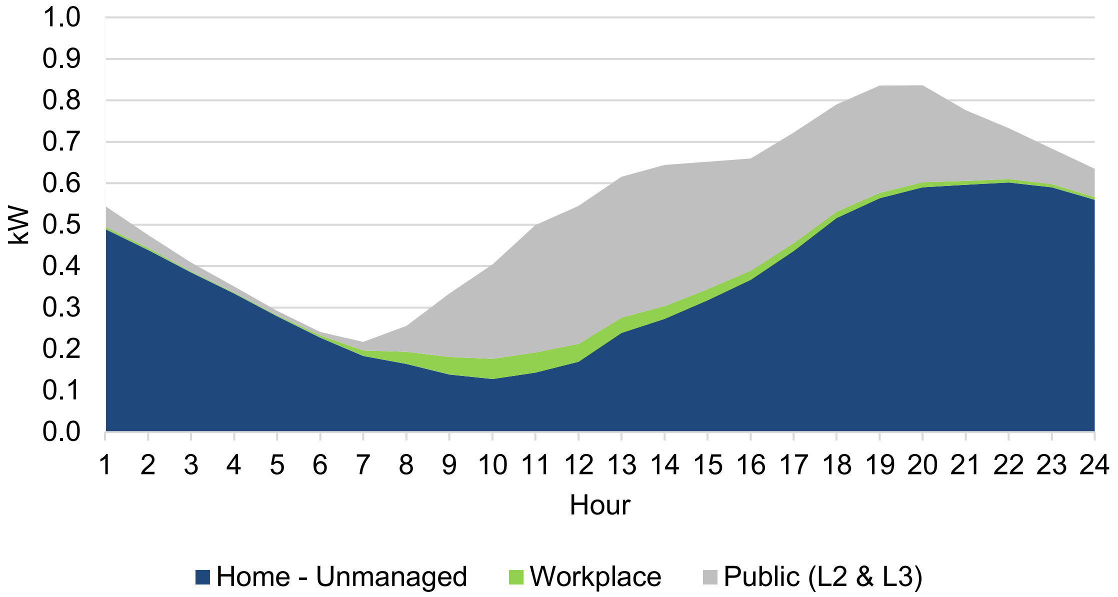
## Seasonal Coincident Peaks (MW)

| | 2024 | 2030 | 2040 |
|---|---|---|---|
| Winter | 1.93 | 28.8 | 189 |
| Spring | 1.93 | 29.6 | 194 |
| **Summer** | **1.34** | **20.2** | **156** |
| Fall | 1.61 | 28.8 | 189 |

2030 weekday profile (kW / vehicle)



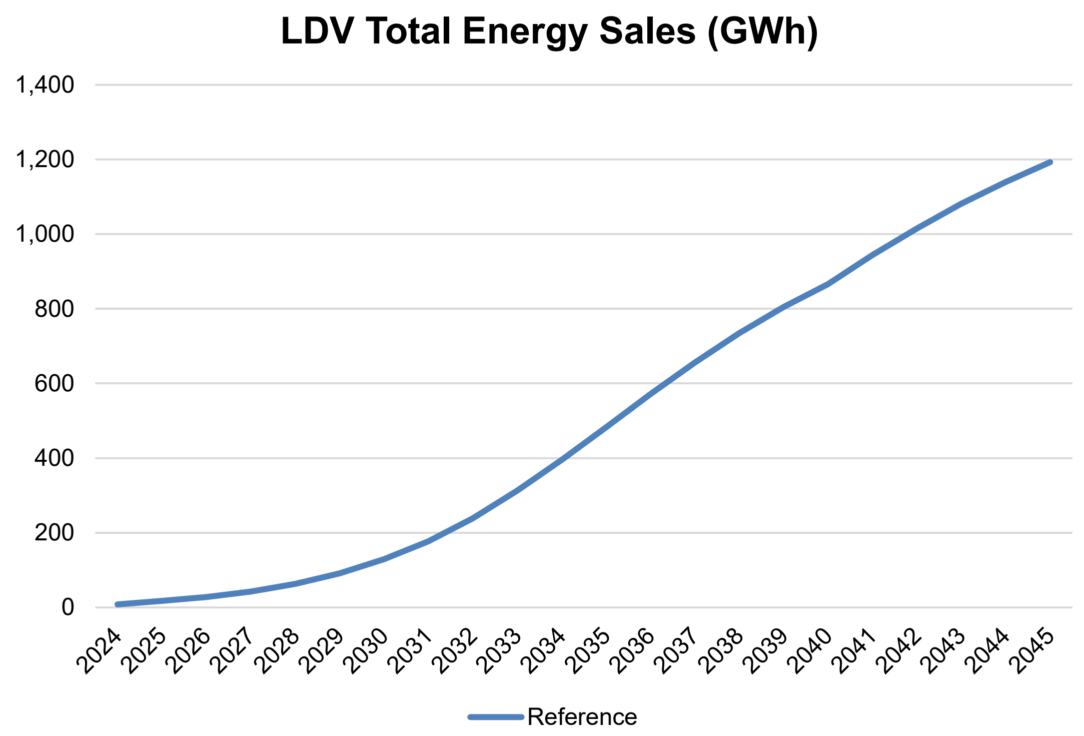

2030 weekend profile (kW / vehicle)

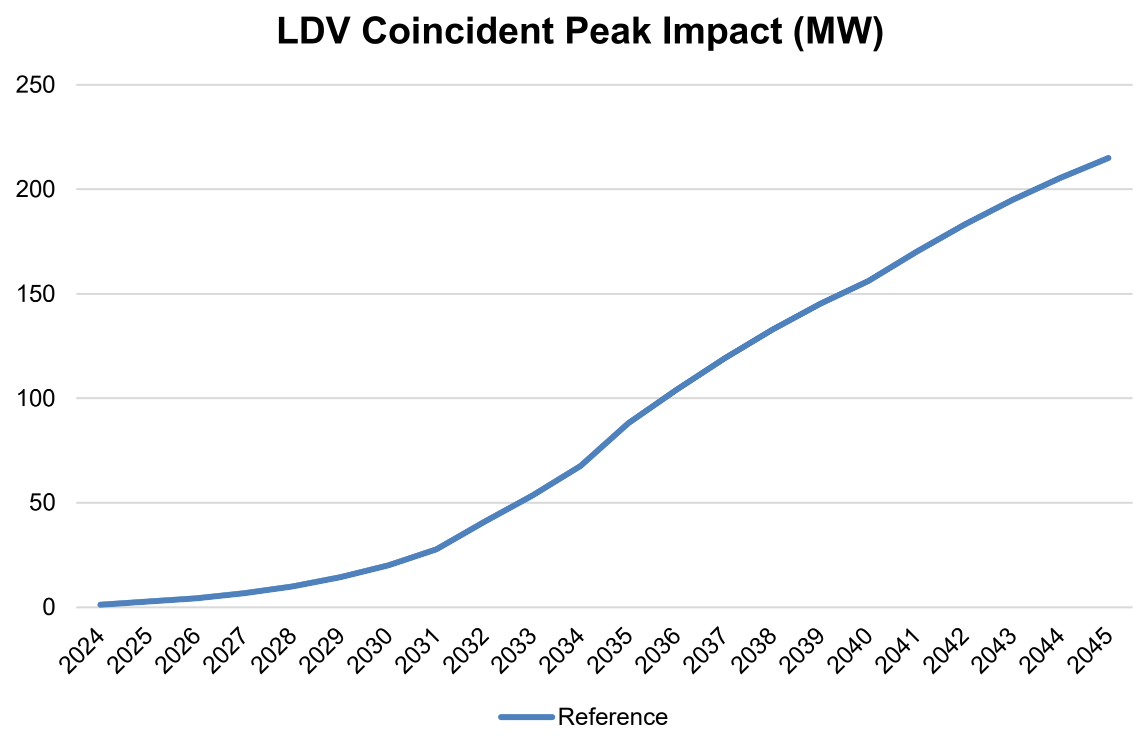



**Note that charging is assumed to be "unmanaged" for LDV segment. DSM analysis will evaluate managed charging programs*

# LDV SALES AND COINCIDENT PEAK GROWTH, ASSUMING NO INTERVENTION TO ENCOURAGE MANAGED CHARGING

- A relatively modest peak load impact is expected (<20 MW) until 2030, when an inflection in EV sales heightens overall impact of LDV segment
- Steady growth expected to raise peak contributions to more than 150 MW in the reference case by 2040
- Energy sales roughly mirror peaks, with similar dampening of per vehicle kWh contribution driven by higher vehicle efficiencies



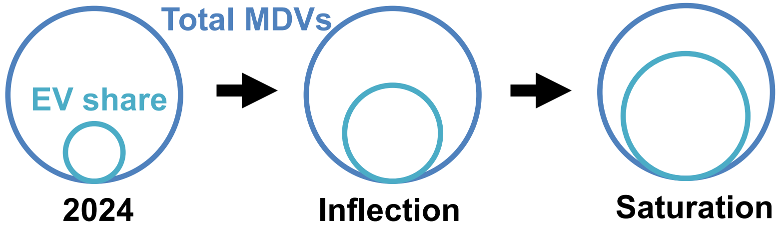



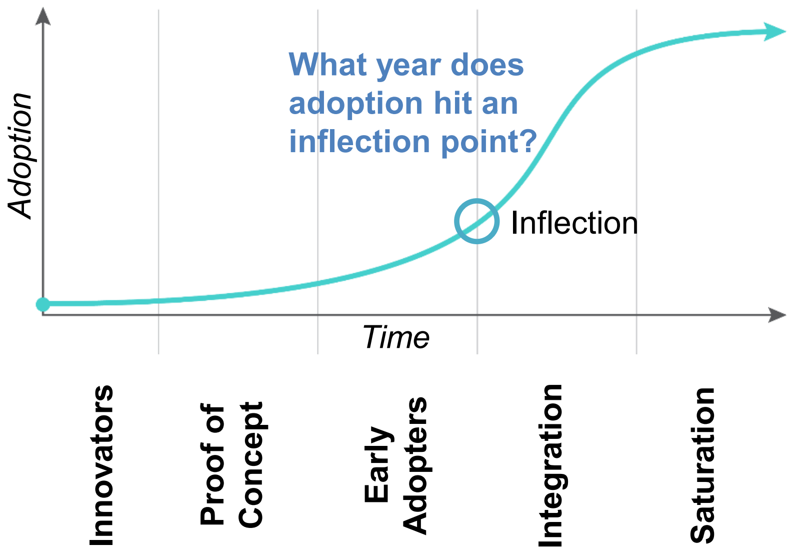

**Note that charging is assumed to be "unmanaged" for LDV segment. DSM analysis will evaluate managed charging programs*

# MDV EV LOAD FORECASTING APPROACH

***Blends econometric forecast with hourly shapes to capture long-term trends in vehicle growth and charging behavior, while accounting for weather conditions***

**1.** Develop growth estimates based on adoption rates applied to S-curve



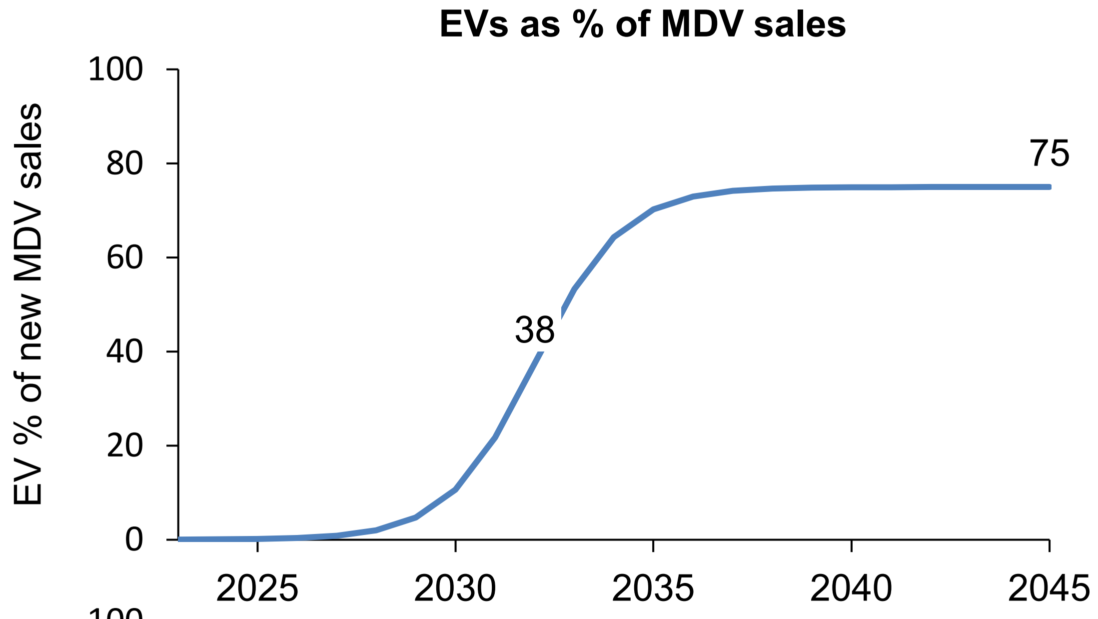

**2.** Generic MDV shapes to capture potential hourly dynamics

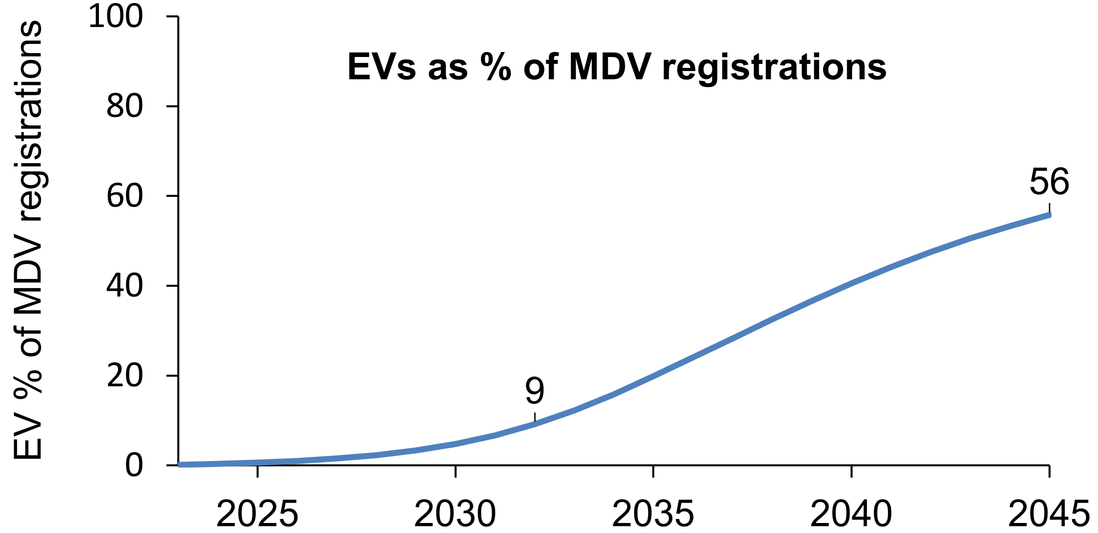
- Utilize charging shapes from existing industry / academic research
- Apply temperature and vehicle efficiency assumptions to create seasonal and long-term adjustments to shape
- Develop profiles to address long-term trends in vehicle type and charger behavior

**3.** Develop final hourly load forecast based on EV projections and hourly shapes

- Econometric model determines total number of electric vehicles and vehicle efficiency, which will scale total EV demand over each year (Step 1)
- Take seasonal charging profiles and create 8760 shapes

# MDV EV ADOPTION PROJECTIONS AIM TO ASSESS CUSTOMER FLEET ELECTRIFICATION




## Adoption Overview

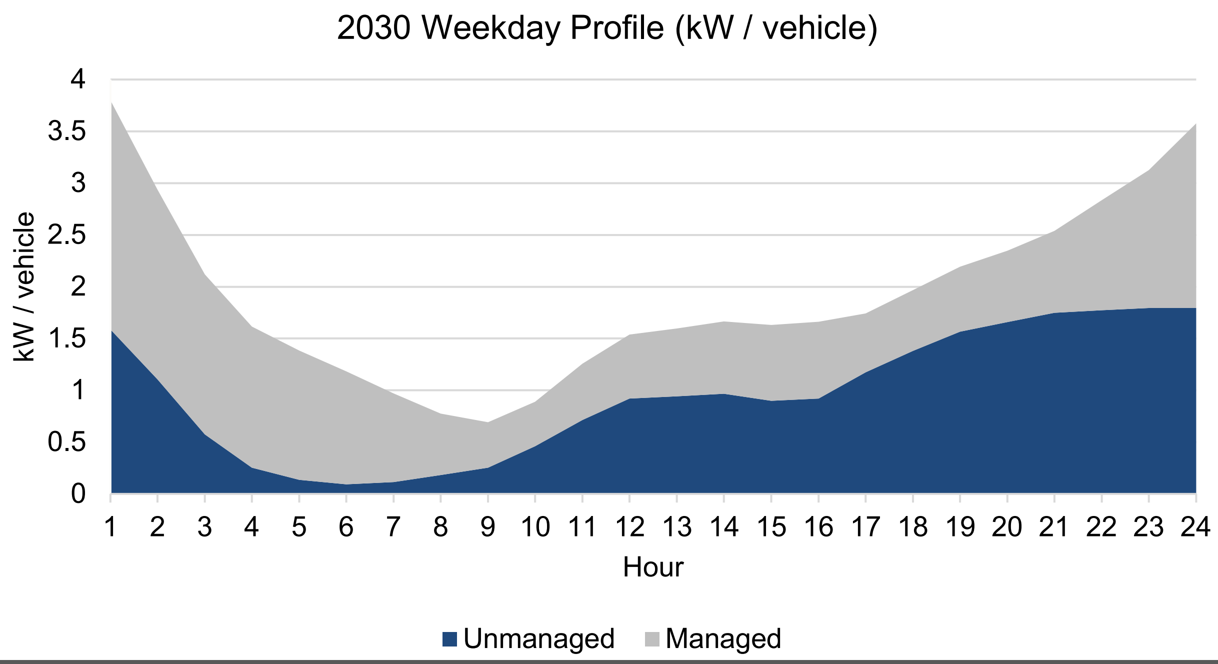
- NIPSCO has utilized IN Fuel Dashboard ICE and EV registration data to develop an estimate of the existing EV penetration and ICE fleet and has taken a view on how adoption may unfold over time, leveraging third-party studies
- Current fleet electrification is very small, based on analysis of IN Fuel Dashboard data from 2018-2023
- A sigmoid function is used to create intermediate sales values by year, where the Reference Case achieves a 75 % of sales target by 2045

# PROJECTED MDV LOAD IMPACTS OVER TIME

| | 2030 | 2040 |
|---|---|---|
| Total Fleet/Delivery Vehicles | 167 | 8,939 |
| Total Transit Vehicles | 4 | 170 |
| Fleet/Delivery Efficiency (kWh / mi) | 1.18 | 1.05 |
| Transit Efficiency (kWh / mi) | 0.81 | 0.73 |
| Fleet/Delivery VMT / day | 37 | 37 |
| Transit VMT / day | 55 | 55 |
| Annual Sales (MWh) | 2,923 | 130,000 |
| Annual Peak (MW) | 0.81 | 40.6 |
| Coincident Peak (MW) | 0.23 | 7.38 |

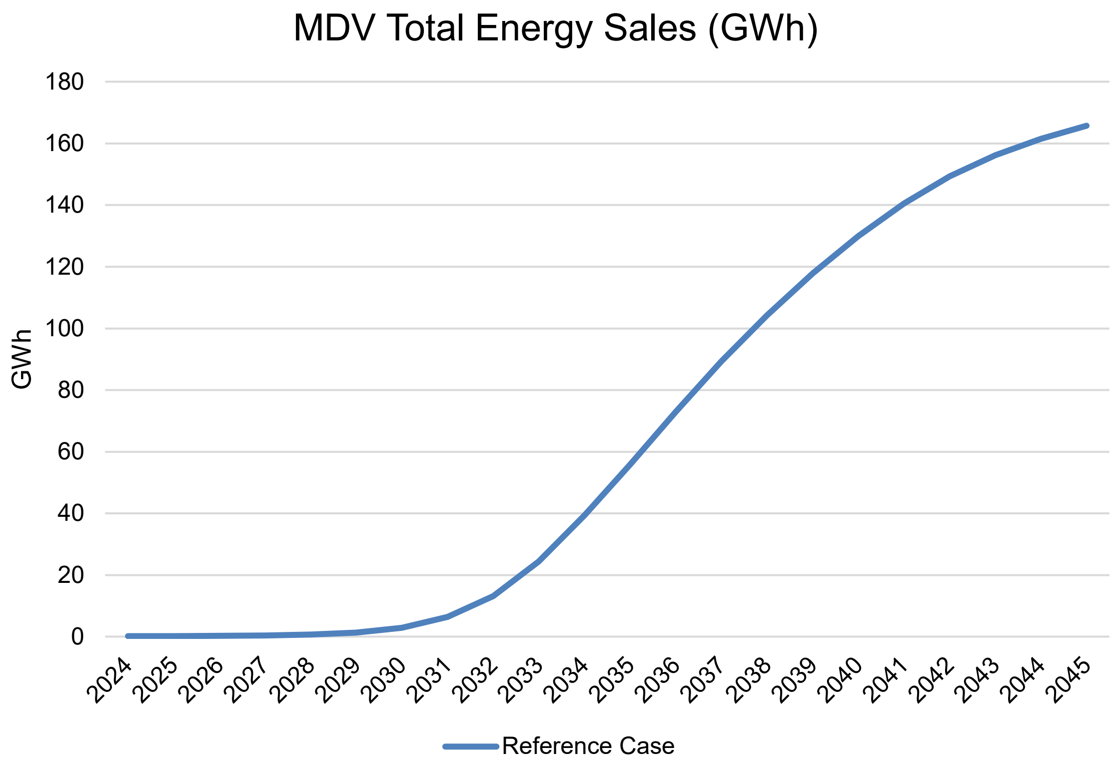
## Takeaways

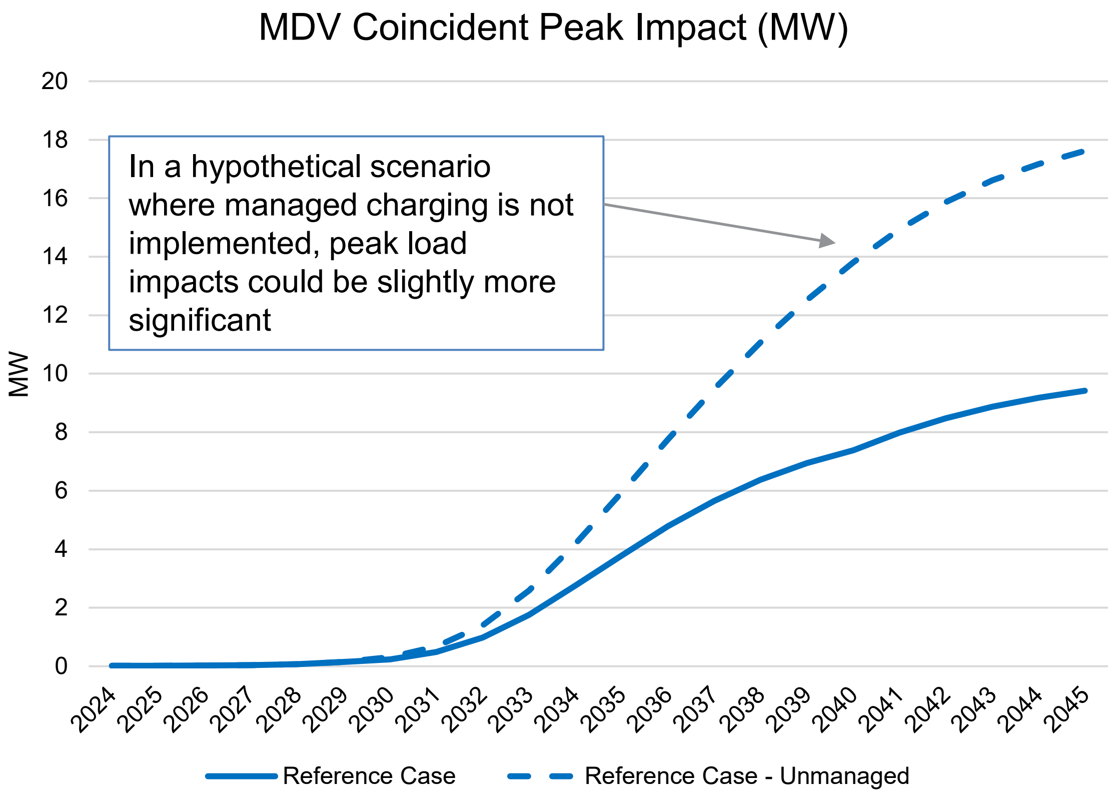
- Overall impacts from MDV fleet likely to be modest until the longer-term
- Some level of managed charging is likely to lower evening peak load, distributing impacts to 12am – 2am



# MDV FORECAST: SALES AND COINCIDENT PEAK GROWTH

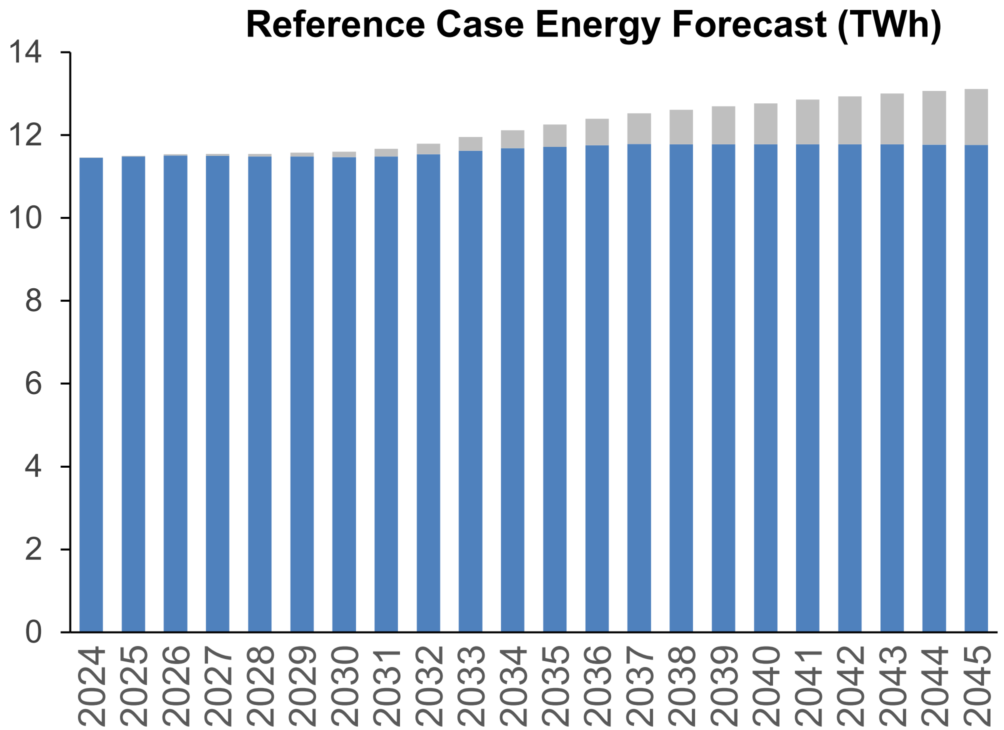
- MDV are expected to have modest energy sales and load impacts, with roughly 10% of the demand seen in the LDV segment
- Energy sales roughly mirror peaks, with similar dampening of per vehicle kWh contribution driven by higher vehicle efficiencies

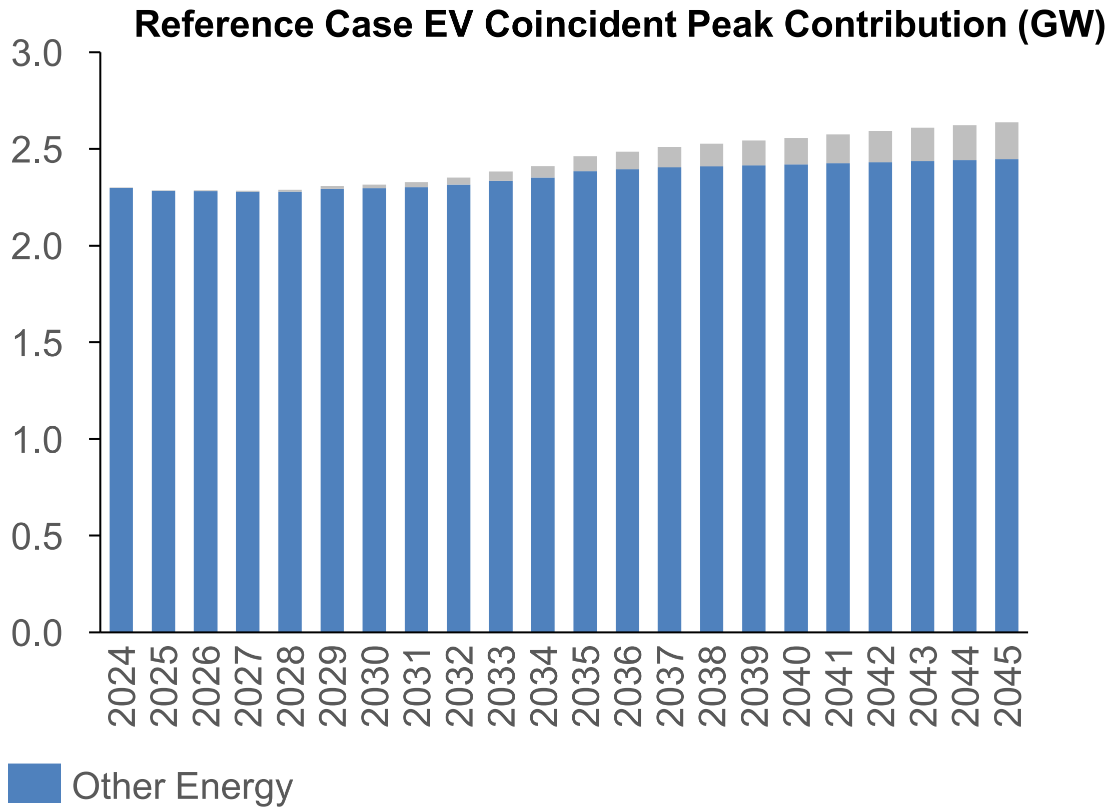


# WHILE EV ADOPTION IS EXPECTED TO MEET EPA TARGETS IN THE REFERENCE CASE, EV'S HAVE A RELATIVELY MODEST IMPACT ON ENERGY AND PEAKS

- EV energy demand is expected to grow modestly through the mid-2020s, taking off more significantly in the 2030s as EV options and charging infrastructure proliferate
- While EV adoption is expected to reach 80% of LDV sales and 75% of MDV sales by 2045, they are only expected to contribute to ~7% of coincident peak by 2045 in the Reference Case



# NEXT STEPS FOR EV FORECAST

- **Evaluate higher and lower EV penetration levels to map to four alternative scenarios (Slower Transition, Domestic Resiliency, Aggressive Environmental Regulation, Accelerated Innovation)**

- **Perform study on heavy duty vehicle charging in major transit corridors**

- **Integrate analysis with DSM study to assess opportunities for managed charging incentives in the LDV segment**

# NEXT STEPS FOR LOAD FORECAST

- **Investigate various levels of DER and EV penetration**
- **Evaluate transitory charging in the NIPSCO service territory associated with heavy duty vehicles on major highways**
- **Investigate new load growth driven by new manufacturing and economic development opportunities**
- **Develop full load forecast scenario range for all key drivers**
- **Coordinate with DSM team so that evaluations of managed EV charging and customer-owned storage incentives can be studied as part of the portfolio analysis**
- **NIPSCO welcomes stakeholder input on analysis approach and scenario considerations**
  - NIPSCO is open to one-on-one calls with stakeholders to discuss analysis in more detail



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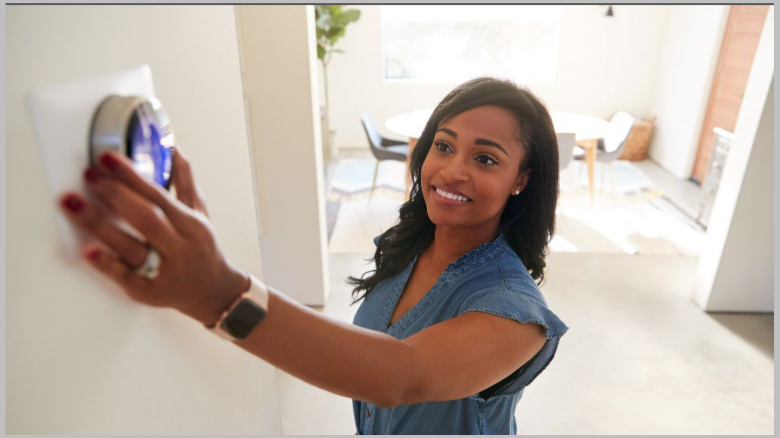
# BREAK







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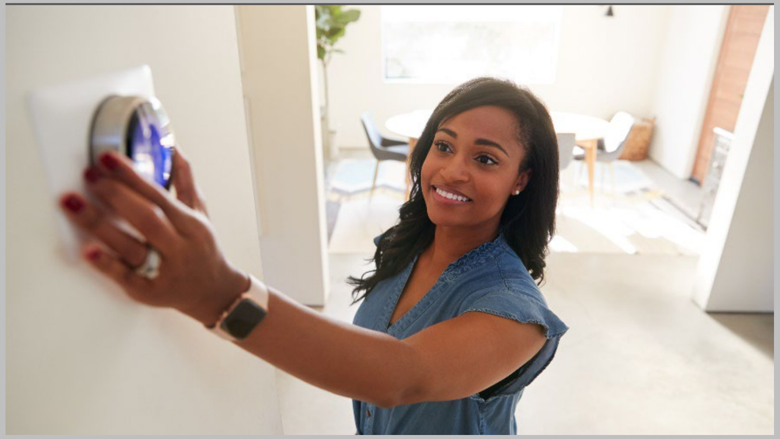
# 2024 REQUEST FOR PROPOSALS (RFP) UPDATE

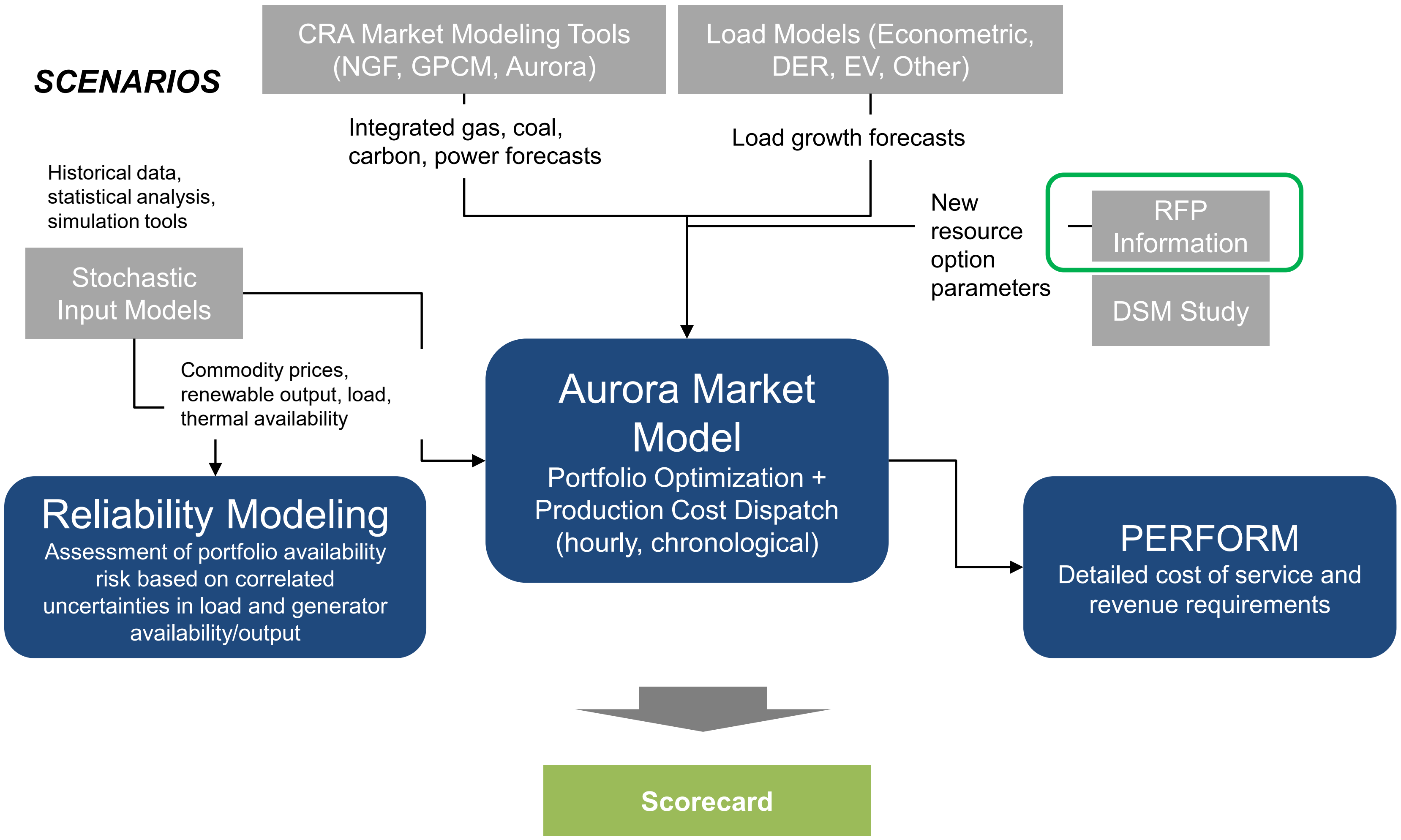


Patrick d'Entremont, Manager Planning Commercial Support, NIPSCO
Bob Lee, Vice President, CRA



# RESOURCE PLANNING APPROACH: RFP INFORMATION

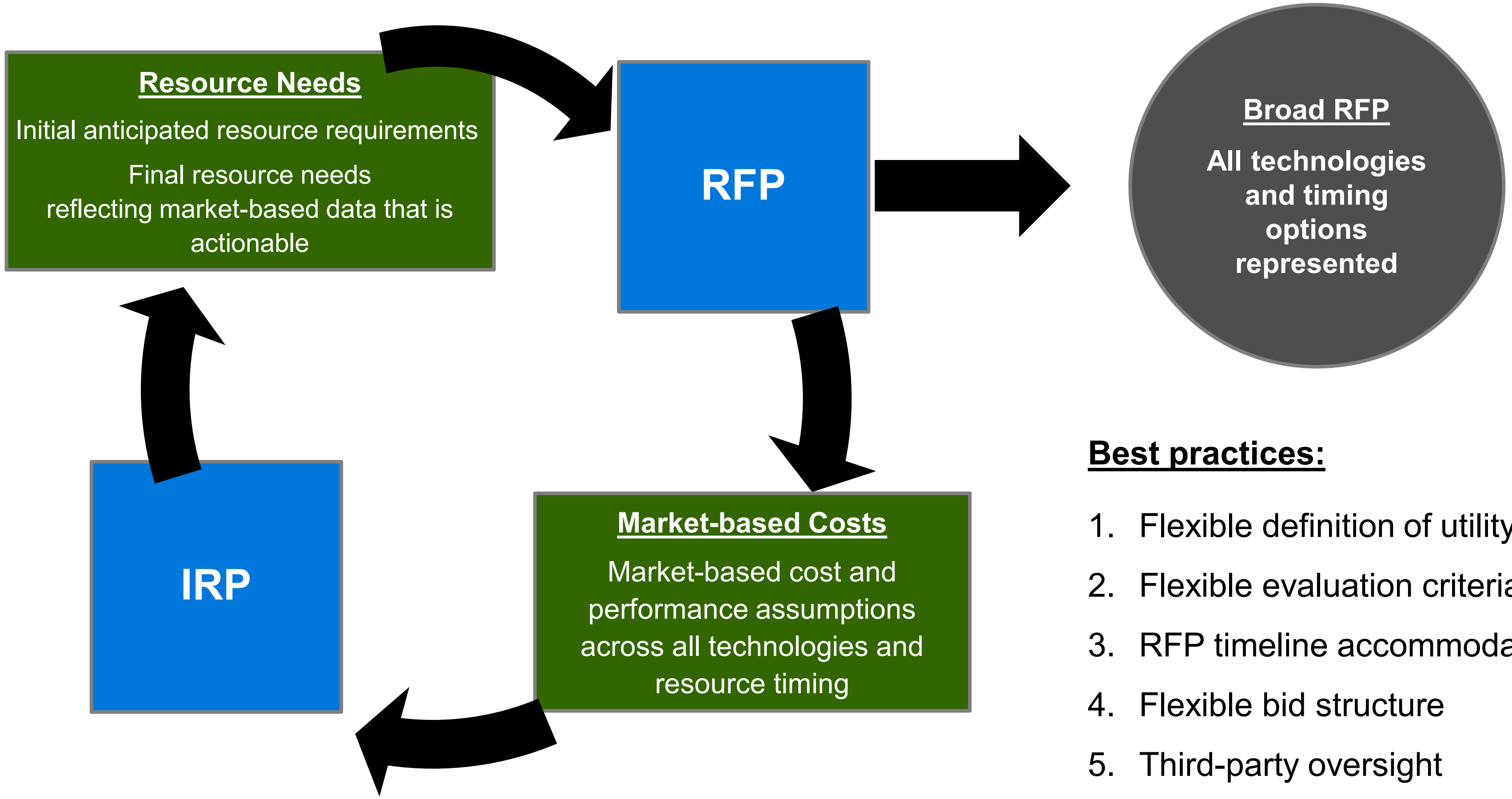
*Key Modeling and Analysis Tools*




1. **Identify key planning questions and approach**
2. **Develop market perspectives (scenarios)**
3. **Develop integrated resource strategies (NIPSCO portfolios)**
4. **Portfolio modeling and analysis**
   - **Detailed scenario dispatch**
   - **Stochastic simulations**
5. **Evaluate trade-offs and select preferred plan**

# RFP PROCESS: CONSISTENT WITH 2018 AND 2021, NIPSCO PLANS TO RUN AN RFP AS A PART OF THE 2024 IRP

## Integrated IRP to RFP structure




**Best practices:**

1. Flexible definition of utility needs
2. Flexible evaluation criteria
3. RFP timeline accommodates IRP modeling requirements
4. Flexible bid structure
5. Third-party oversight

# OVERVIEW OF NIPSCO'S 2024 RFP PROCESS

- During Q2 2024 NIPSCO intends to issue a series of RFP solicitations designed to identify resources positioned to support the Company's near and long-term resource requirements
- Each individual solicitation will be executed in parallel as part of the RFP and will target specific technologies and resource categories
- As has been done in the past, the asset cost data, and performance and resource availability data derived from RFP bids will be used as inputs into the Company's resource planning process to create a "Preferred Plan" informed by actual market data

# PRELIMINARY RFP PLAN

**------------------- All-Source RFP -------------------**

| Element | RFP1 – Intermittent | RFP2 – Dispatchable | RFP3 – Bridge Resources | RFP4 – DER |
|---|---|---|---|---|
| **Technology** | Renewables and hybrid resources | Thermal, standalone storage, emerging technologies and other (including long-duration storage and NIPSCO site-specific storage options) | Near-term bridge resources that provide both energy and capacity solutions designed to respond to large-scale, new customer activity | Distributed energy resources that qualify for IRA incentives and/or provide MISO capacity credit |
| **Event Size** | Up to 400 MW | Up to 600 MW | Between 600-1,000 MW | Up to 10 MW |
| **Ownership Structure** | Unit contingent PPA, BTA, existing asset sales | Unit contingent PPA, system power, BTA, existing asset sales, shaped products. Site-specific storage solutions must be for NIPSCO ownership per MISO generator replacement rules | ZRC, PPA, shaped or financial products, unit contingent PPA, BTA, existing asset sales | Unit contingent PPA, existing asset sales |
| **Duration** | Targeting resources in 36-60 months with 5+ years duration | Targeting resources in 36-60 months with 5+ years duration | Targeting resources in 18-36 months with 3 to 5+ years duration, and long-term resources in the 5+ year horizon | Targeting resources in 36-60 months with 5+ years duration |
| **Deliverability** | LRZ6, NRIS, (N-1-1) | LRZ6, NRIS, (N-1-1) | Flexible | Distribution resources |
| **Qualification Requirements** | Credit worthy counterparties | Credit worthy counterparties | Credit worthy counterparties | Credit worthy counterparties |

# RFP: PRELIMINARY EVALUATION CRITERIA

| | |
|---|---|
| **Project Economics LCOE / LCOC** | The economic analysis will be conducted over a fixed planning horizon and a bid-specific planning horizon for all assets. The analysis will reflect all expected costs related to the bid. The project-level analysis will be based on data submitted with the bids, standard assumptions for key commodity considerations, and may reflect adjustments for material uncertainties associated with a bid |
| **Reliability and Deliverability** | The asset reliability and deliverability evaluation will include an assessment of transmission reliability, facility age and performance, and fuel risk and fuel security. Transmission reliability scoring will be based on transmission infrastructure and location. Facility performance will be based on the EFORd performance or other accreditation expectations. Fuel reliability will consider fuel availability risk and price volatility |
| **Development** | Development risk will consider how many key development milestones have been met to date, as well as the development experience of the potential counterparty |
| **Asset Specific Benefits / Risks** | Asset-specific benefits and risks will consider individual, unique, and project-level risks associated with an individual project or counterparty. CRA will evaluate projects based on community benefits, certain social justice goals, minority and women owned business considerations, unique environmental considerations, specific regulatory risks or other considerations |

# PRELIMINARY RFP TIMELINE

------------------ All-Source RFP ------------------

| Element | RFP1 – Intermittent | RFP2 – Dispatchable | RFP3 – Bridge Resource | RFP4 – DER |
|---|---|---|---|---|
| Issue RFP | May 1, 2024 | May 1, 2024 | May 1, 2024 | May 1, 2024 |
| Bidder Information Session | May 6, 2024 | May 6, 2024 | May 6, 2024 | May 6, 2024 |
| Pre-Qualification Deadline | May 15, 2024 | May 15, 2024 | May 15, 2024 | May 15, 2024 |
| Notification of Pre-Qualification | May 20, 2024 | May 20, 2024 | May 20, 2024 | May 20, 2024 |
| Proposals Due | June 7, 2024 | June 7, 2024 | June 7, 2024 | June 20, 2024 |



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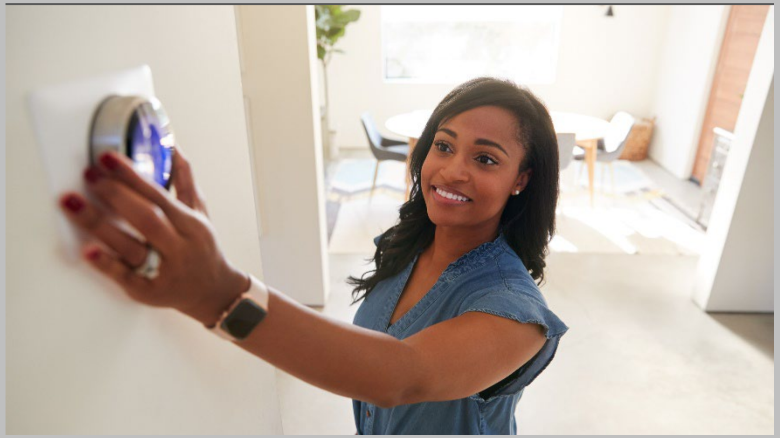
# 2024 STAKEHOLDER ADVISORY PROCESS



Fred Gomos, Director Strategy, NiSource



*Tentative*

# 2024 STAKEHOLDER ADVISORY MEETING ROADMAP

| Meeting | Meeting 1<br>April 23rd | Meeting 2<br>June 24th | Meeting 3<br>August 21st | Meeting 4<br>September 19th | Meeting 5<br>October 8th |
|---|---|---|---|---|---|
| **Content** | • 2021 Short Term Action Plan Update<br>• Resource Planning and 2024 Continuous Improvements<br>• 2024 Public Advisory Process<br>• 2024 Policy Update (incl. IRA and EPA)<br>• Core demand forecast, new considerations for demand<br>• Scenario Themes – Introduction<br>• RFP Overview | • MISO Regulatory Developments and Initiatives<br>• Update on Key Inputs/Assumptions (commodity prices)<br>• Scenarios and Stochastic Analysis Inputs<br>• Preliminary RFP Results | • DSM Modeling and Methodology<br>• DER Inputs | • Modeling Results, Scorecard<br>• DER and Storage Modeling Results, Scorecard | • Preferred replacement path and logic relative to alternatives<br>• 2024 NIPSCO Short Term Action Plan |
| **Meeting Goals** | • Communicate what has changed since the 2021 IRP (incl. IRA changes)<br>• Communicate environmental policy considerations<br>• Communicate updates to key inputs/assumptions<br>• Provide RFP Overview<br>• Communicate the 2024 public advisory process, timing, and input sought from stakeholders | • Common understanding of MISO regulatory updates<br>• Communicate commodity price impacts<br>• Communicate scenario themes and stochastic analysis approach, along with major input details and assumptions<br>• Communicate preliminary RFP results | • Common understanding of DSM modeling methodology<br>• Explain next steps for portfolio modeling | • Develop a shared understanding of economic modeling outcomes and preliminary results to facilitate stakeholder feedback | • Respond to key stakeholder comments and requests<br>• Communicate NIPSCO's preferred resource plan and short-term action plan<br>• Obtain feedback from stakeholders on preferred plan |

# AURORA MODELING LICENSE GUIDELINES

- Any interested stakeholder will need to declare their interest in a special use stakeholder Aurora license by May 15th

- Stakeholders will be able to sign a limited license agreement with Energy Exemplar for the Aurora software

- Stakeholders will be given access to relevant data sets for NIPSCO portfolio modeling as it becomes available



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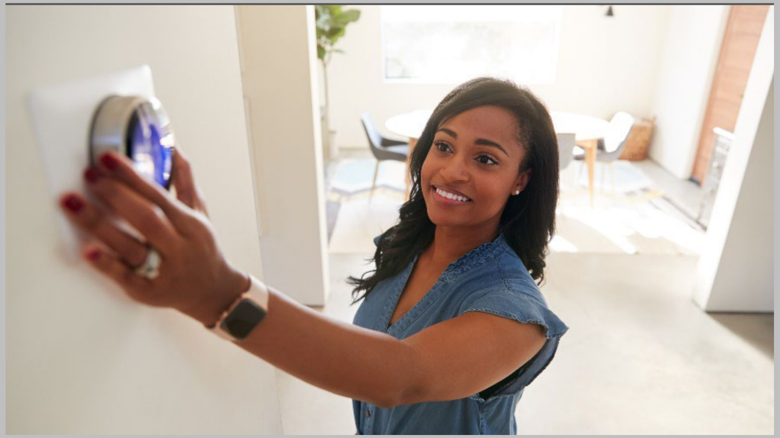
## CLOSING







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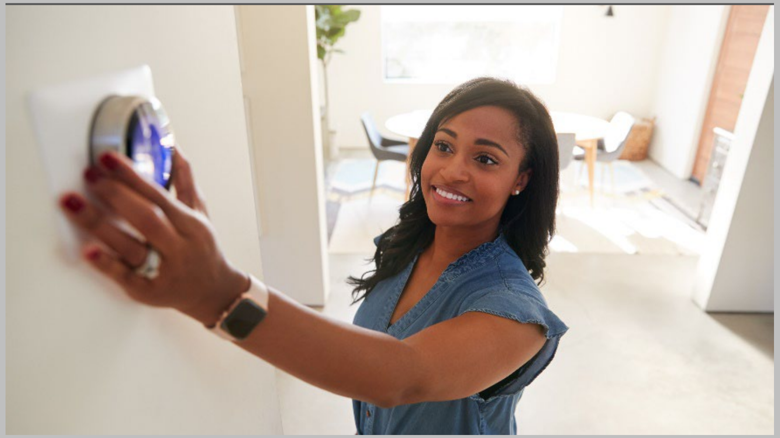
# APPENDIX





# NIPSCO'S CURRENT ENVIRONMENTAL CONTROL OVERVIEW

*NIPSCO has invested in environmental controls across the fleet and continues a transition to low- and zero-emitting resources*

| Unit | Year In Service | Fuel Source | Generating Capacity (MW)[1] | Particulate Matter (PM) Control | Sulfur Dioxide ($SO_2$) Control | Nitrogen Oxide ($NO_x$) Control | Mercury (Hg) Control | Coal Ash | Planned Retirement[4] |
|---|---|---|---|---|---|---|---|---|---|
| MCGS U12 | 1974 | Coal | 455 | Baghouse | Dry FGD | OFA & SCR | ACI & FA | SFC | 2028 |
| RMS U16A | 1979 | Natural Gas | 78 | -- | -- | Water Injection | -- | -- | 2026-2028 |
| RMS U16B | 1979 | Natural Gas | 77 | -- | -- | Water Injection | -- | -- | 2026-2028 |
| RMS U17 | 1983 | Coal | 361 | ESP | Wet FGD | Advanced LNB w/ OFA & SNCR | -- | -- | 2025 |
| RMS U18 | 1986 | Coal | 361 | ESP | Wet FGD | Advanced LNB w/ OFA & SNCR | -- | -- | 2025 |
| Sugar Creek[2] | 2002 | Natural Gas | 563 | -- | -- | SCR | -- | -- | -- |
| Norway | 1923 | Hydro | 7 | -- | -- | -- | -- | -- | -- |
| Oakdale | 1925 | Hydro | 9 | -- | -- | -- | -- | -- | -- |
| Rosewater[3] | 2020 | Wind | 102 | -- | -- | -- | -- | -- | -- |
| Indiana Crossroads Wind[3] | 2021 | Wind | 302 | -- | -- | -- | -- | -- | -- |
| Dunns Bridge I[3] | 2023 | Solar | 265 | -- | -- | -- | -- | -- | -- |
| Indiana Crossroads Solar[3] | 2023 | Solar | 200 | -- | -- | -- | -- | -- | -- |

ESP = Electrostatic Precipitator
SCR = Selective Catalytic Reduction
ACI = Activated Carbon Injection

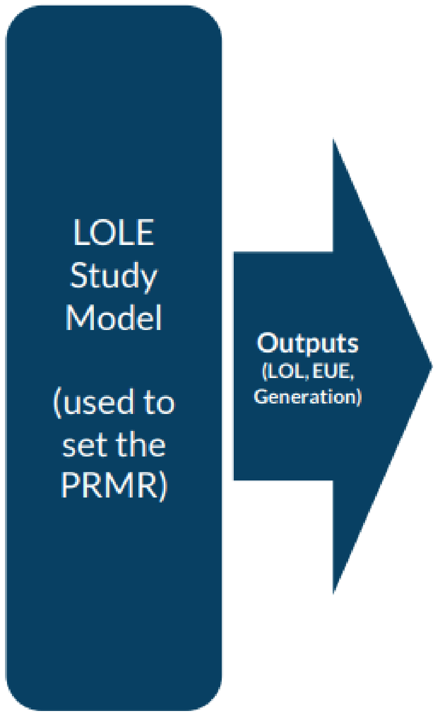
FGD = Flue Gas Desulfurization
LNB = Low NOx Burners
FA = Fuel Additives

OFA = Over-Fire Air System
SNCR = Selective Non-Catalytic Reduction
SFC = Submerged Flight Conveyor



(1) Represents current net generating capability of each fossil fuel and hydro generating facility. Nameplate capacity is listed for wind and solar generating facilities.
(2) Sugar Creek added additional generating capacity in January 2024.
(3) NIPSCO is the managing partner of these Joint Ventures.
(4) As of April 2024.

# MISO'S PROPOSED D-LOL APPROACH USES SAMPLE WEATHER YEARS TO EVALUATE GENERATOR AVAILABILITY DURING PERIODS OF LOSS OF LOAD RISK




**System Unserved Energy**

| | Weather Year 1 | | | Weather Year 2 | | |
|---|---|---|---|---|---|---|
| Hour of Year | Sample 1 | Sample 2 | Sample N | Sample 1 | Sample 2 | Sample N |
| 1 | 0 | 0 | 0 | 10 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 20 | 0 | 0 | 0 | 0 | 0 |
| 5 | 40 | 0 | 0 | 0 | 30 | 0 |
| 6 | 10 | 0 | 0 | 0 | 10 | 0 |
| 7 | 0 | 0 | 0 | 0 | 5 | 0 |
| 8 | 0 | 0 | 0 | 0 | 2 | 0 |
| 9 | 0 | 0 | 0 | 0 | 1 | 0 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 |
| ... | 0 | 0 | 6 | 0 | 0 | 0 |
| 8758 | 0 | 0 | 10 | 0 | 0 | 0 |
| 8759 | 0 | 0 | 2 | 0 | 0 | 0 |
| 8760 | 0 | 0 | 0 | 0 | 0 | 0 |

Two weather years, 6 outage samples
LOLE = 0.67 days/year
LOLH = 2 hours/year
EUE = 24.3 MWh/year

**Generator Availability***
(installed capacity = 10 MW)

| | Weather Year 1 | | | Weather Year 2 | | |
|---|---|---|---|---|---|---|
| Hour of Year | Sample 1 | Sample 2 | Sample N | Sample 1 | Sample 2 | Sample N |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 1 | 1 | 1 | 0 | 0 | 0 |
| 4 | 4 | 4 | 4 | 2 | 2 | 2 |
| 5 | 8 | 8 | 8 | 3 | 3 | 3 |
| 6 | 3 | 3 | 3 | 1 | 1 | 1 |
| 7 | 1 | 1 | 1 | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 1 | 1 | 1 | 2 | 2 | 2 |
| ... | 5 | 5 | 5 | 6 | 6 | 6 |
| 8758 | 10 | 10 | 10 | 0 | 0 | 0 |
| 8759 | 6 | 6 | 6 | 6 | 6 | 6 |
| 8760 | 3 | 3 | 3 | 1 | 1 | 1 |

Average output during events = 3.33 MW
Nameplate Capacity = 10 MW
Capacity Accreditation = 33%

Adapted from: https://www.esig.energy/download/session-5-redefining-capacity-accreditation-derek-stenclik/

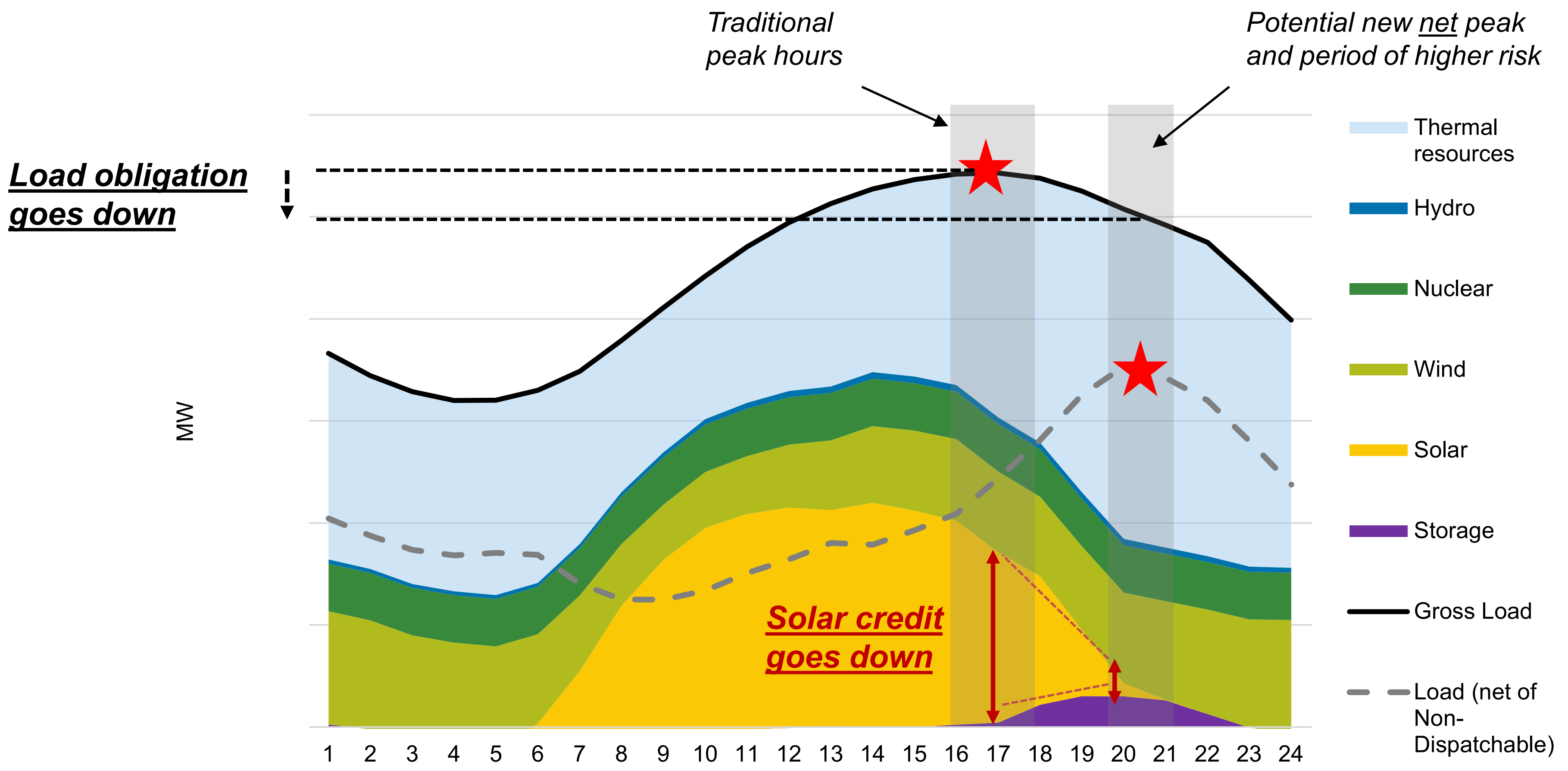
10

LOLH = Loss of Load Hour EUE = Expected Unserved Energy LOLE = Loss of Load Expectation PRMR = Planning Reserve Margin Requirement

MISO

Source:
MISO Accreditation Reform: https://cdn.misoenergy.org/20230117-18%20RASC%20Item%2014b%20Non-Thermal%20Resource%20Accreditation%20(RASC-2020-4,%20RASC-2019-2)%20Presentation627472.pdf

# ALTHOUGH CAPACITY ACCREDITATIONS WILL DECLINE, THE PLANNING OBLIGATION WILL ALSO LIKELY GO DOWN IN MISO'S D-LOL APPROACH

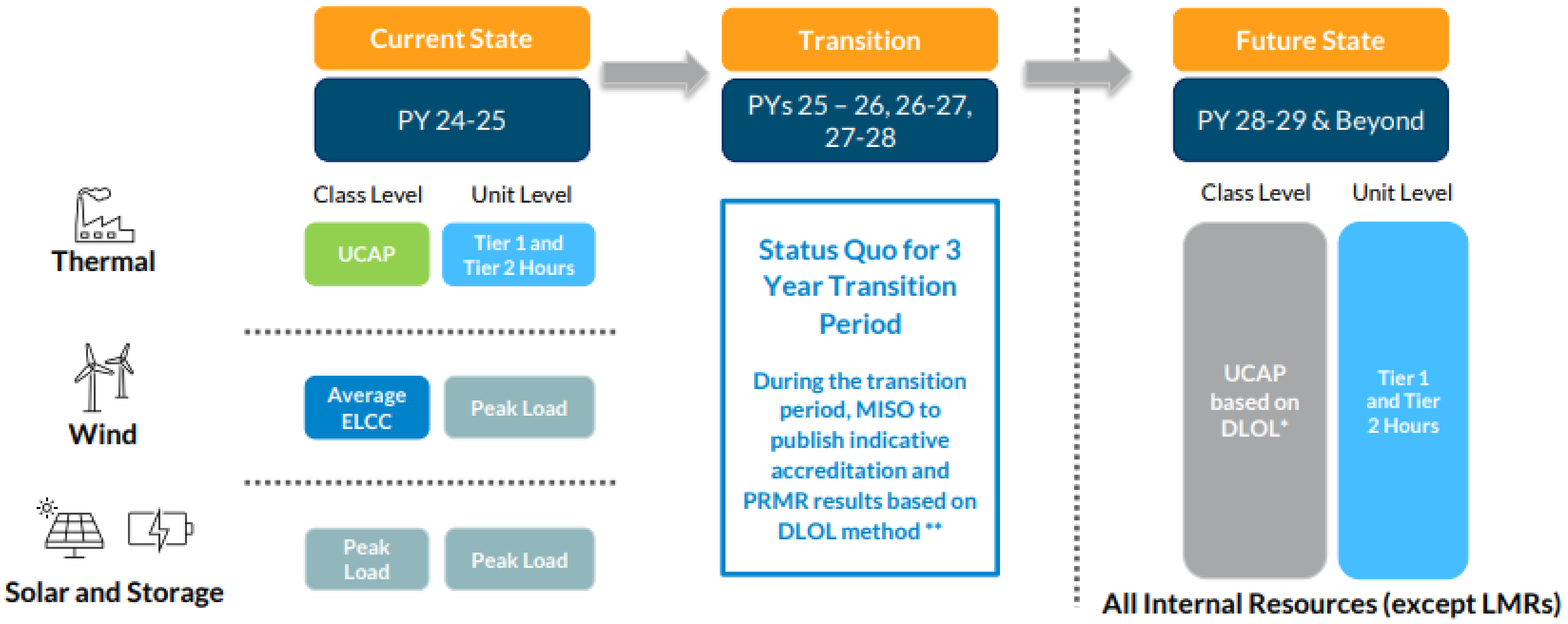



***Representative – For Illustration Purposes***

# A TRANSITION PERIOD IS CONTEMPLATED IN MISO'S D-LOL FILING

- MISO filed its Direct Loss of Load (D-LOL) market design on March 28, 2024 with the FERC
- Stakeholder feedback could still impact final design, and FERC approval is necessary
- MISO would implement a three-year transition period to provide initial market signals before actual market changes are made

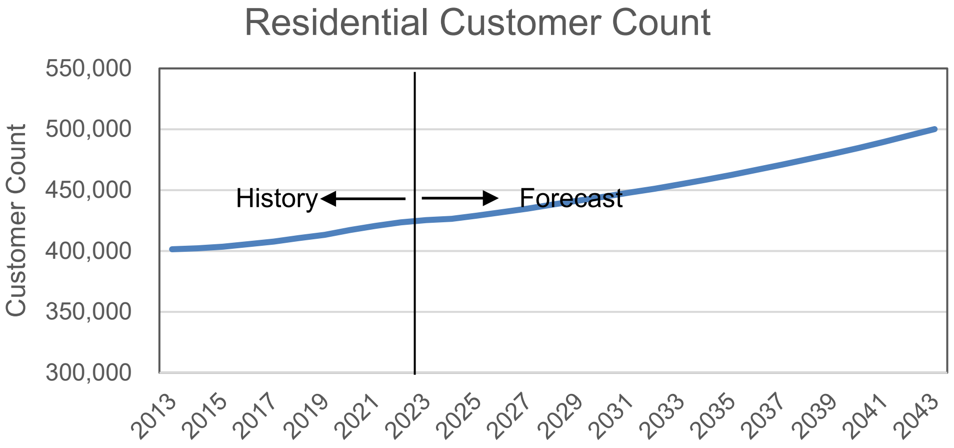
## A three-year transition allows time for stakeholders to better understand and plan for the accreditation and reserve margin calculations based on DLOL approach

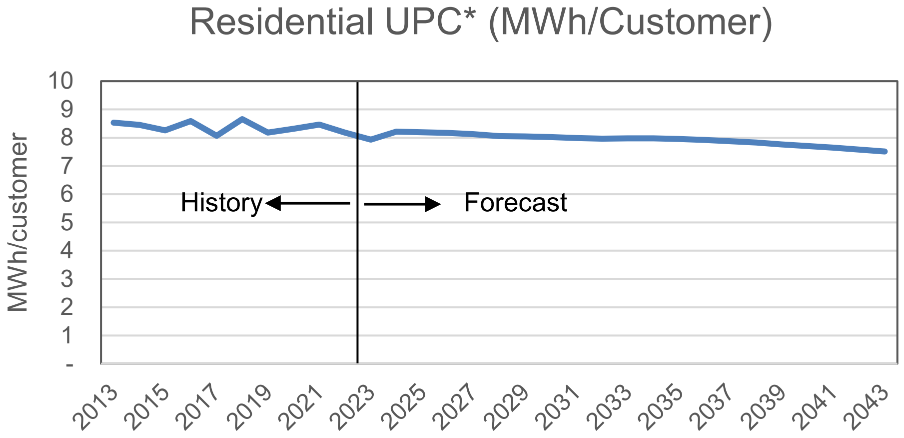


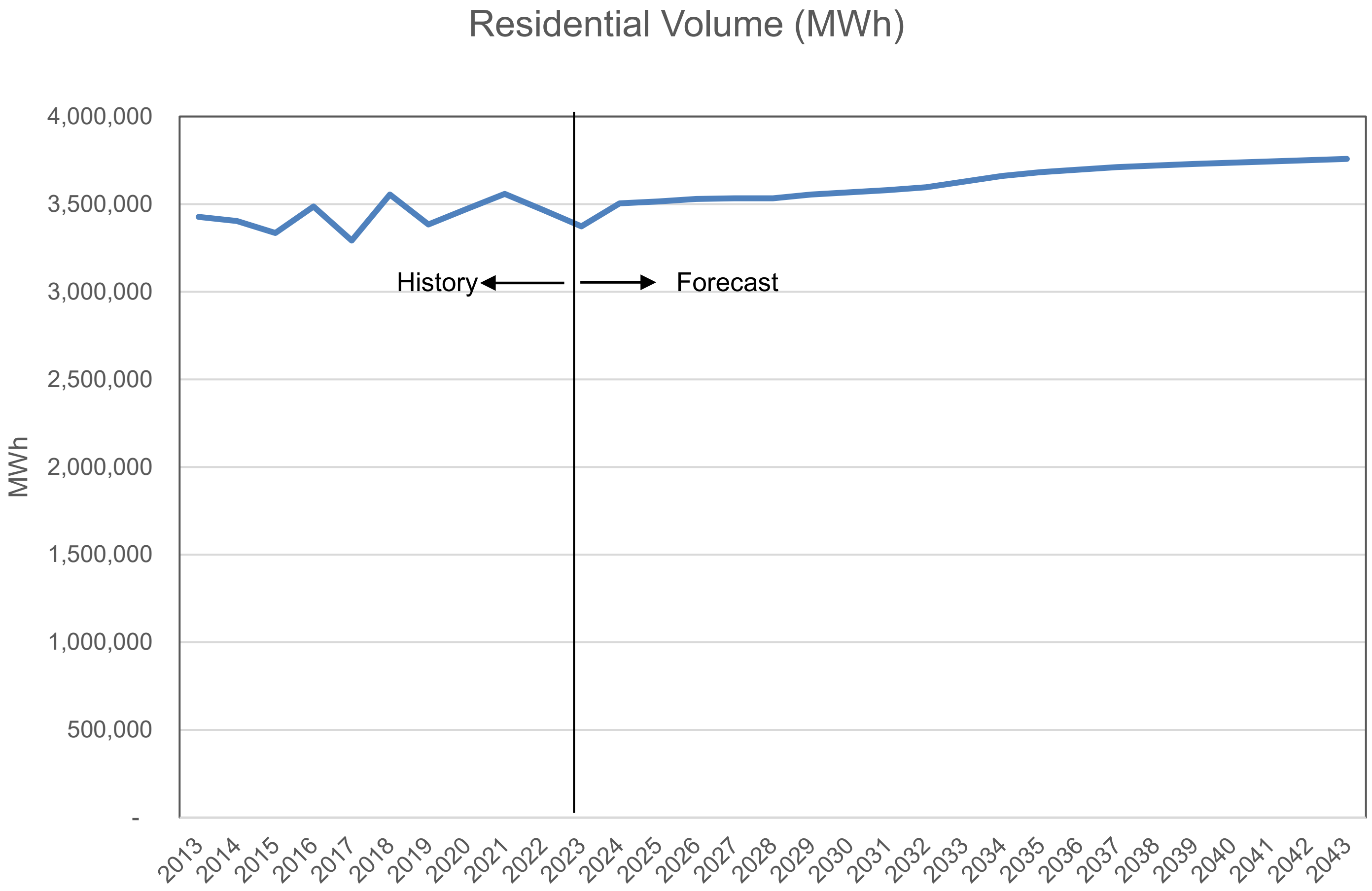
## LOAD FORECAST: ACCOUNTING FOR LOSSES

- Although core historical load data is recorded at the meter, IRP modeling must include "gross-ups"
- From an energy perspective, IRP modeling must incorporate the amount of energy that needs to be generated by resources prior to facing losses associated with transmission and distribution to customers
- For MISO peak planning purposes, peak demand needs to be:
  - Inclusive of distribution losses when reporting coincident peaks
  - Grossed up for transmission losses when calculating the planning reserve margin
- Therefore, projected retail sales totals were grossed up by a factor of 4.62%.

# RESIDENTIAL FORECAST

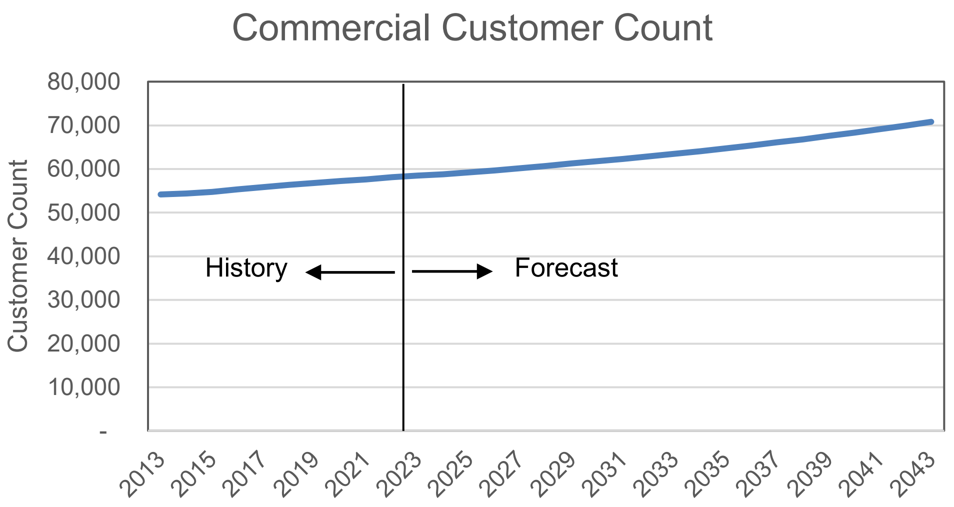


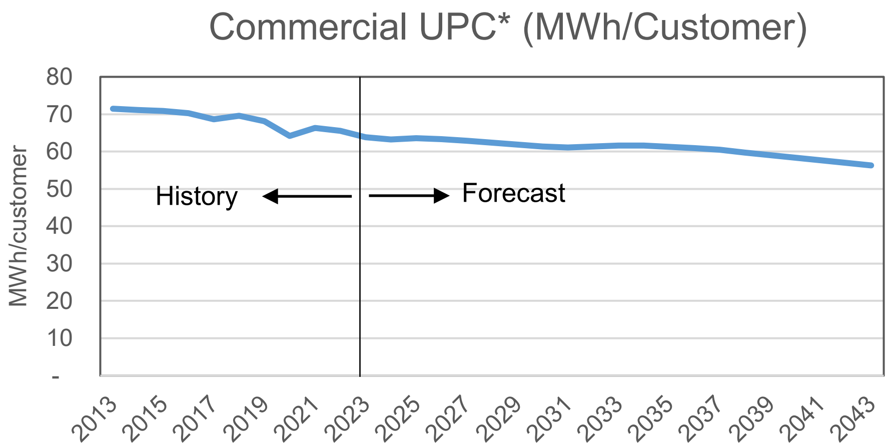



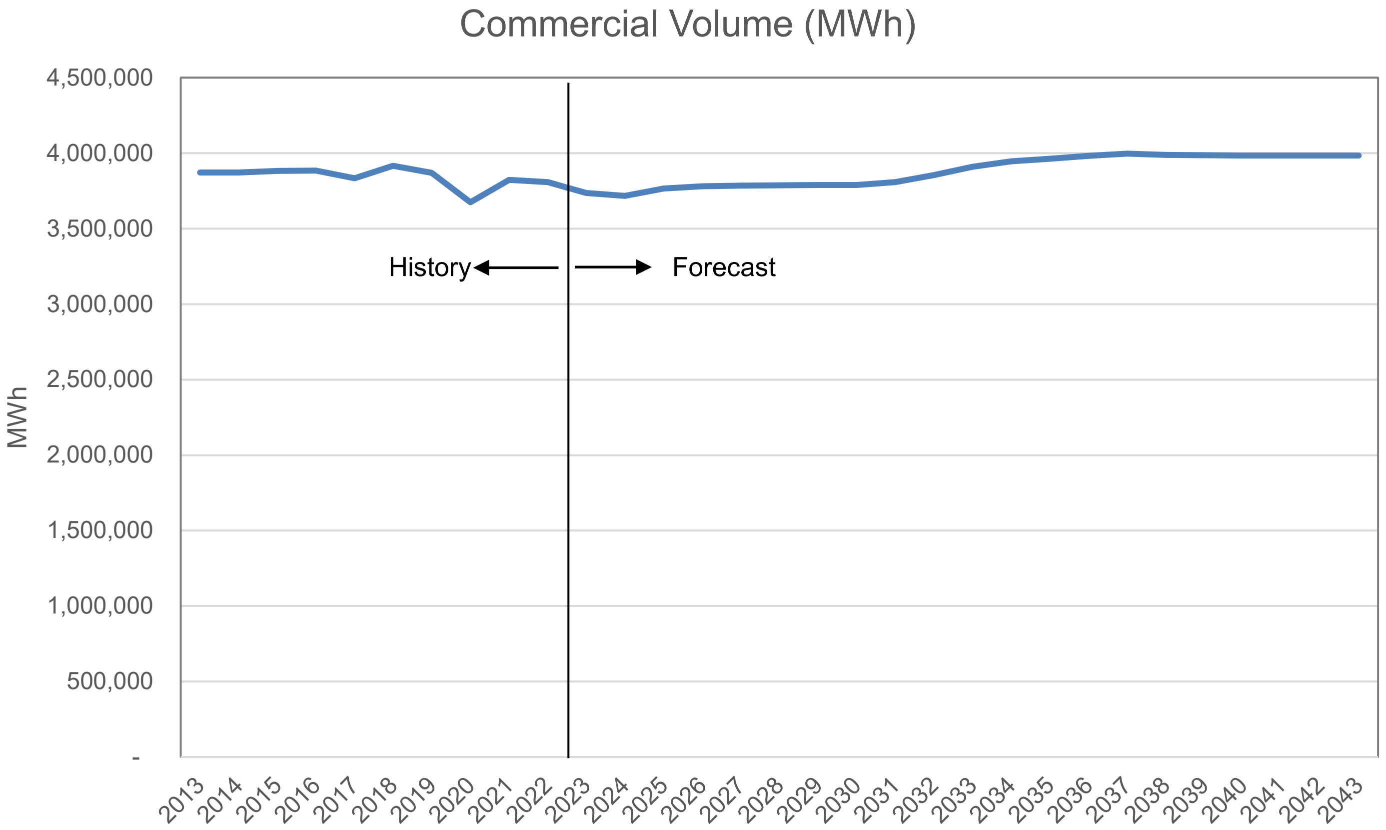




* Annual UPC is calculated as total volume / average monthly customer count

# COMMERCIAL FORECAST

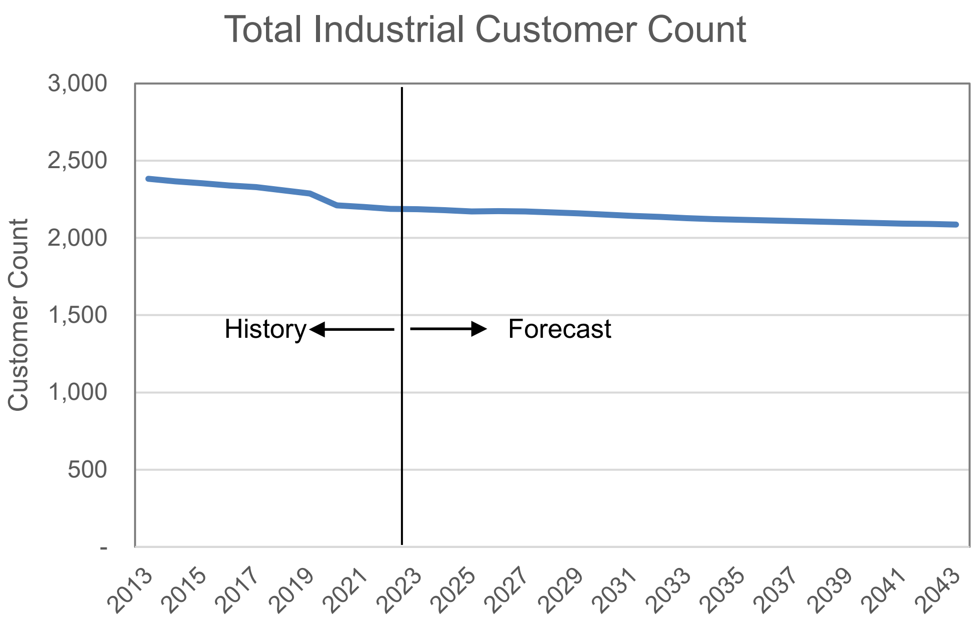


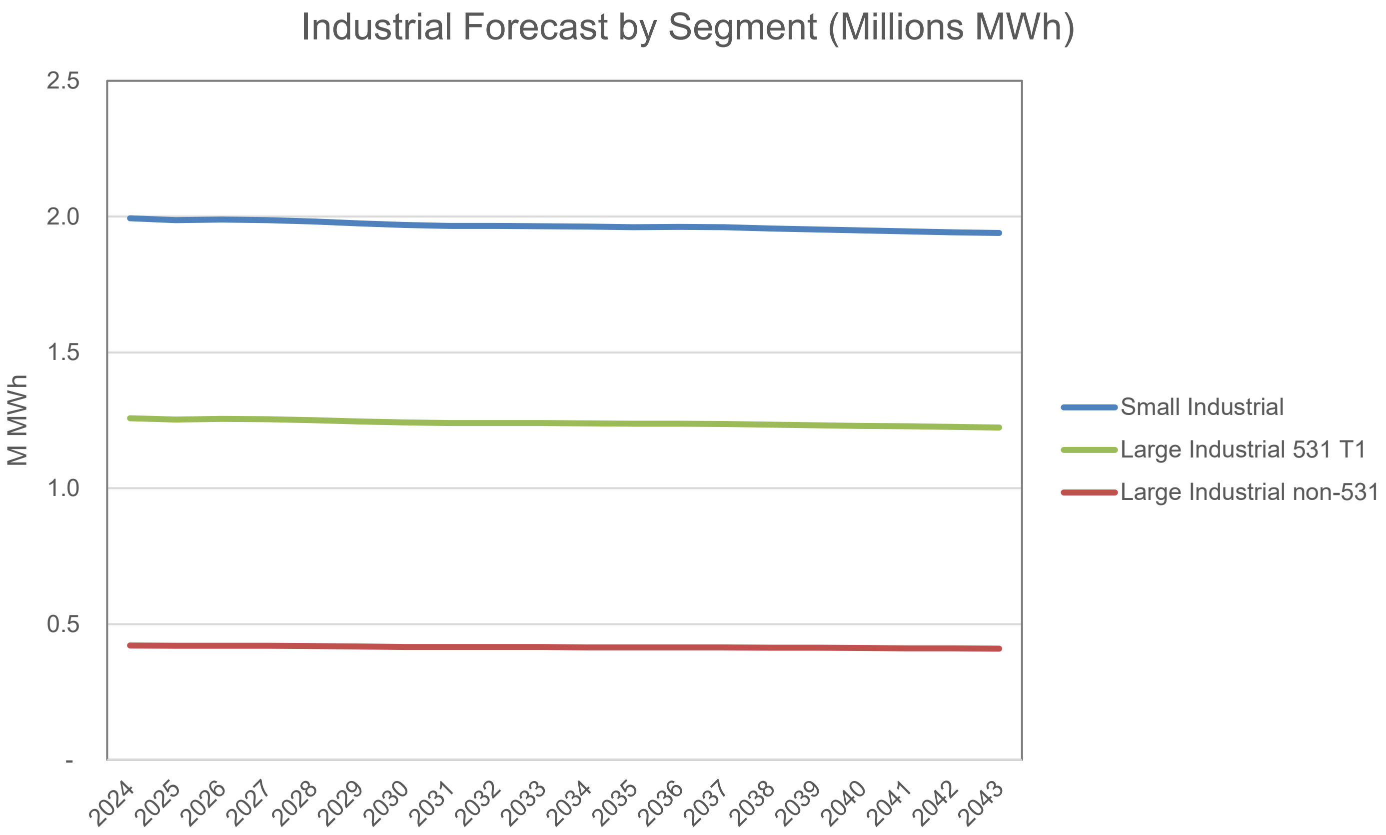




* Annual UPC is calculated as total volume / average monthly customer count

# INDUSTRIAL FORECAST



# FORECASTING COINCIDENT PEAK – CLASS LOAD FACTORS

- Historical sample meter data provides monthly load factor data by customer class, which was used to develop monthly peak forecasts
- Customer-level load factor data for the 15 largest customers was used for large industrial classes

| Class | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Residential | 88.80% | 88.80% | 88.80% | 66.90% | 66.90% | 51.60% | 51.60% | 51.60% | 51.60% | 66.90% | 88.80% | 88.80% |
| Commercial | 81.60% | 81.60% | 81.60% | 75.30% | 75.30% | 75.40% | 75.40% | 75.40% | 75.40% | 75.30% | 81.60% | 81.60% |
| Small Industrial | 83.60% | 83.60% | 83.60% | 80.80% | 80.80% | 83.00% | 83.00% | 83.00% | 83.00% | 80.80% | 83.60% | 83.60% |

Equation:

**Peak Demand kW** = Usage $^{kWh}$ / (LF * **CPF** * 24 $^{hr/day}$ * X $^{days/mo}$)

- As an enhancement to NIPSCO's process, new sources of load (EVs, other electrification, data centers) are evaluated with their own independent load shapes, allowing for modeling of potential changing load factors over time

# PENDER MODEL: METHODOLOGY

## Agent Development

- “Agents” are modeled as representative of NIPSCO’s customers, and each agent is randomly assigned a household income level based on the American Community Survey (ACS) 2022 income distribution across NIPSCO counties;
- Each agent is assigned a propensity to adopt new technology (bass innovation index);
- Relationships between agents are modeled through “social networks,” with an average size of 13 agents belonging to one network

## An agent will adopt DER if:

- the agent’s probability of adoption is sufficiently high *(according to the economics and probability assessment)*
- the agent is an innovator type (if its innovation index surpasses a specified threshold), or a significant portion of the agent’s network has adopted the technology

## DER programs/policies

**Excess Distributed Generation (EDG) program: extra generation receives utility bill credits in the amount of 125% of market priced power*.**

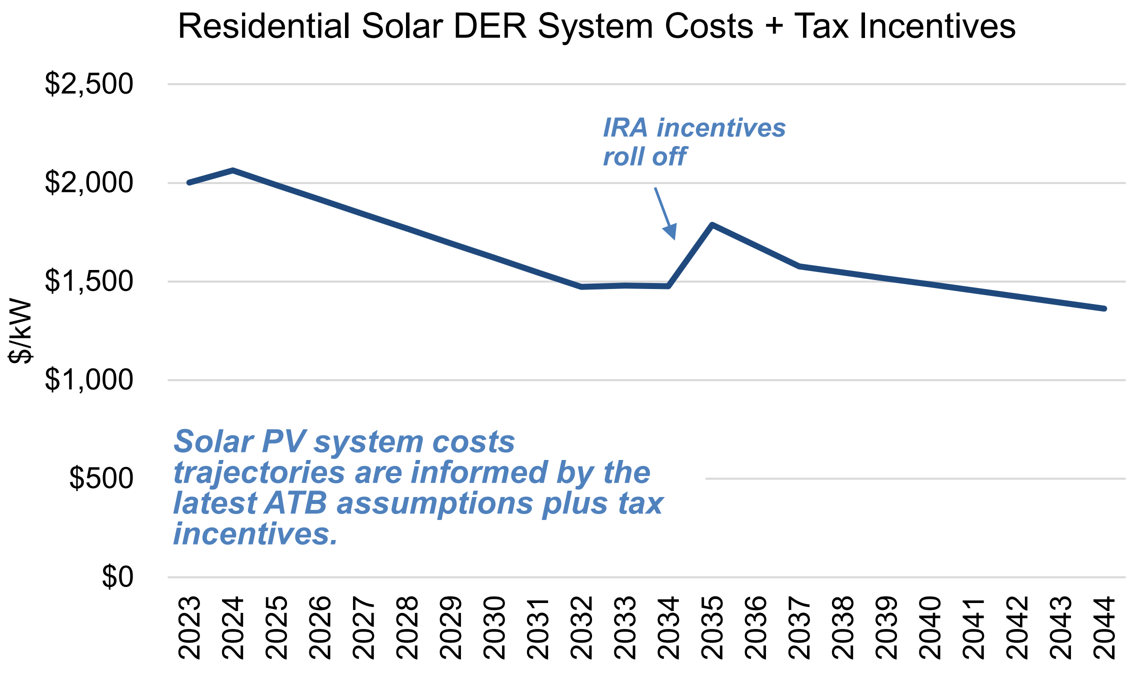
- **Commercial**: Started on October 2, 2021
- **Residential:** Started on July 1, 2022

***Net Metering:* *extra generation received energy credits that can be applied to future usage (no longer applicable to res. or comm. customers in 2024+ beyond)***

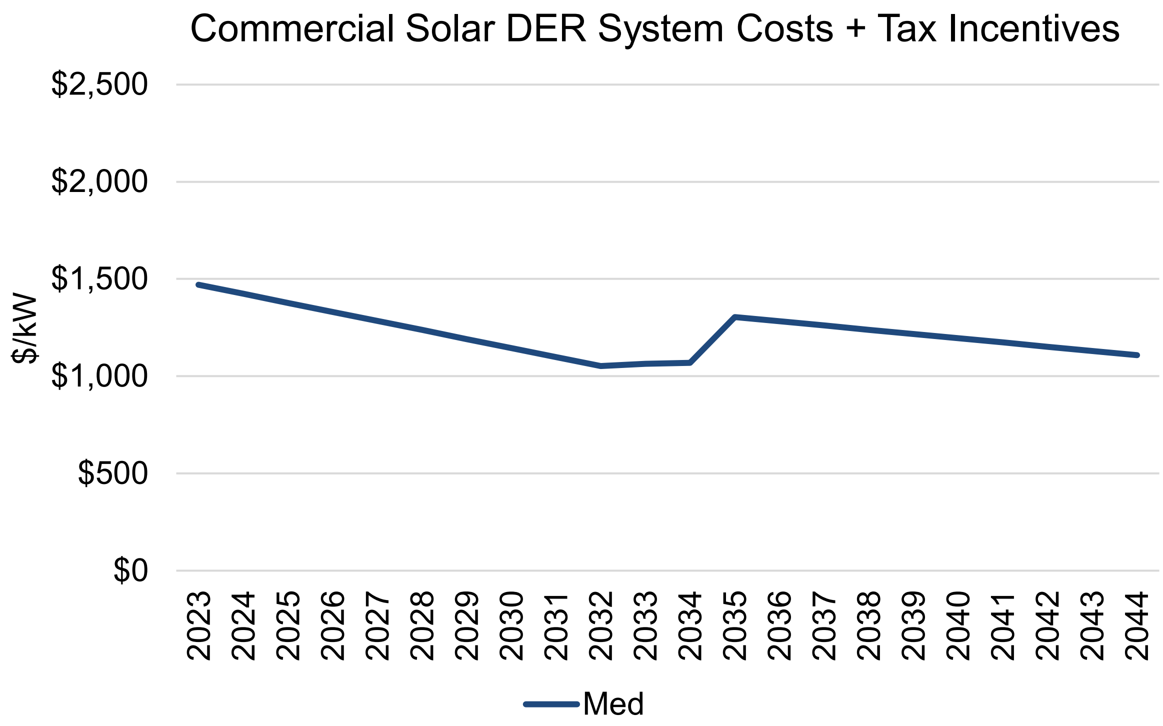
***Feed-in Tariff (FIT) program:* *customer can sell power back to NIPSCO (no longer applicable to res. or comm. customers in 2024+ beyond)***

* Defined in Rider 589 as the Marginal DG Price, the average hourly real-time price of energy paid by the Company in the MISO market at the NIPS.NIPS commercial pricing node during the most recent calendar year, multiplied by one and twenty-five hundredths (1.25).

# PENDER MODEL: SOLAR PV DER COSTS



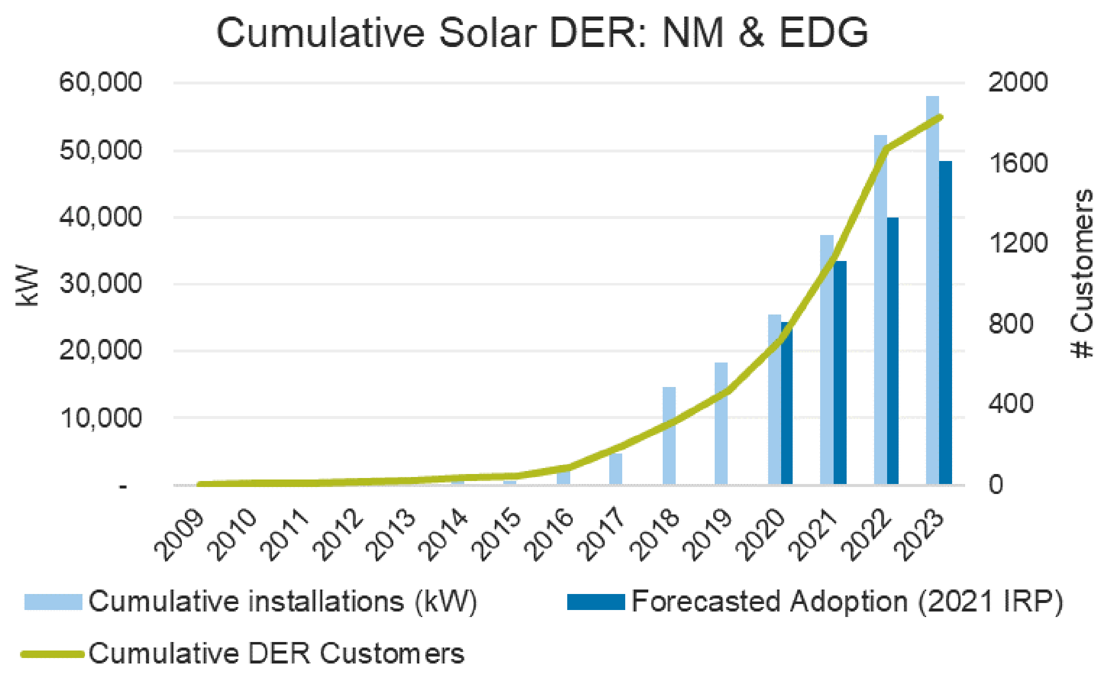

*All dollars in real $2023

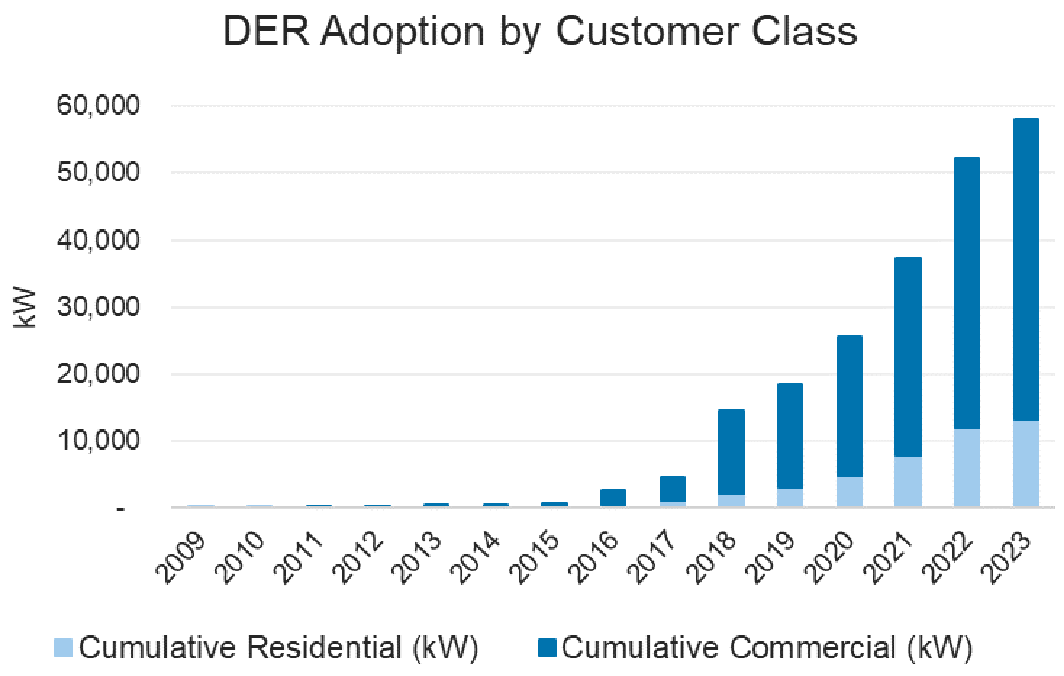



- Assumptions regarding capital cost projections, capacity factor, and system life for solar PV were taken from NREL's 2023 Annual Technology Baseline for both residential and commercial solar PV technologies.

| | Reference Scenario |
|---|---|
| DER System Capex | NREL ATB Moderate (Med) - Class 5 |
| ITC | Current IRA incentives |
| DER Program | EDG ext. through 2040s |

# HISTORICAL DER ADOPTION IN NIPSCO TERRITORY



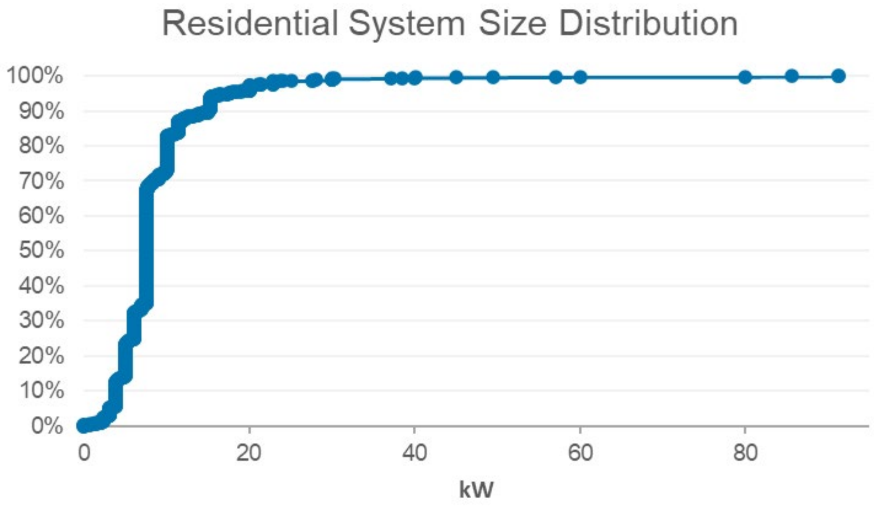



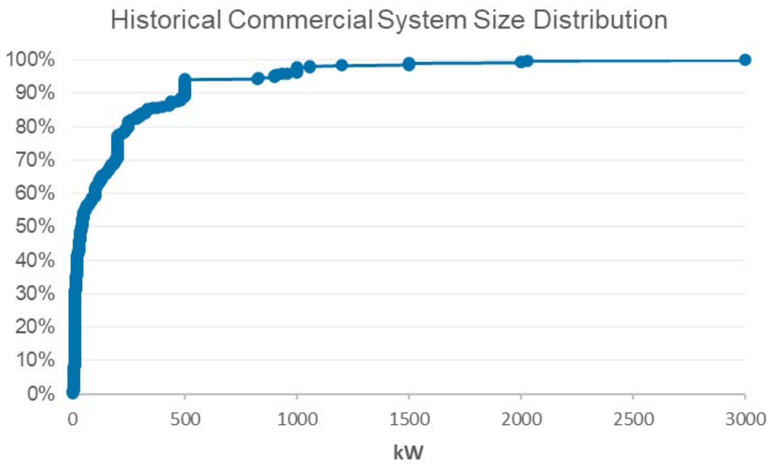

- Since 2020, Solar DER adoption has increased 32% annually.
- After phasing out Net Metering in 2022, growth slowed down.
- To date, 16 customers have adopted battery systems, totaling 98 kW, with an average 2-hour duration.

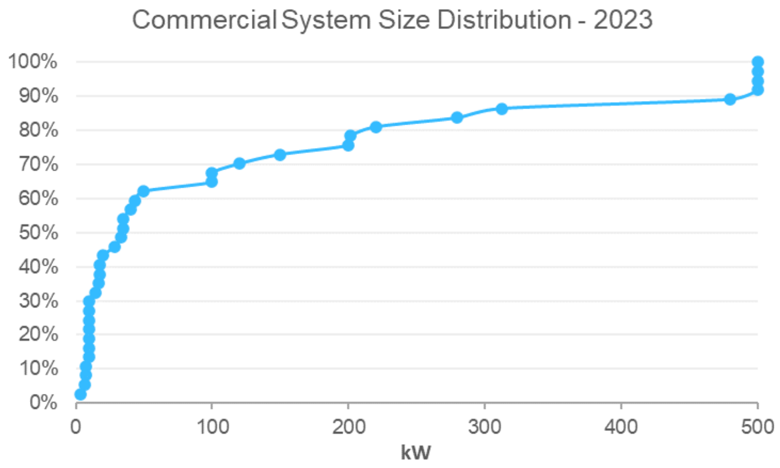
- Since 2020, residential Solar DER adoption has increased 40% annually; the growth for commercial customers has been 30%.
- Most storage systems have been installed by residential customers, with an average solar to storage ratio of 1.5:1

# HISTORICAL SOLAR DER SYSTEM SIZE

- For residential customers, the historical average system size is 8.6 kW (median of 7.6 kW), and around 80% of installed systems are below 10kW
- For commercial customers, the historical system average is 178 kW (median of 40 kW), and around 60% of installed systems are below 100 kW. However, in recent years following the EDG rate program, system sizes have averaged 125 kW (median of 35 kW)



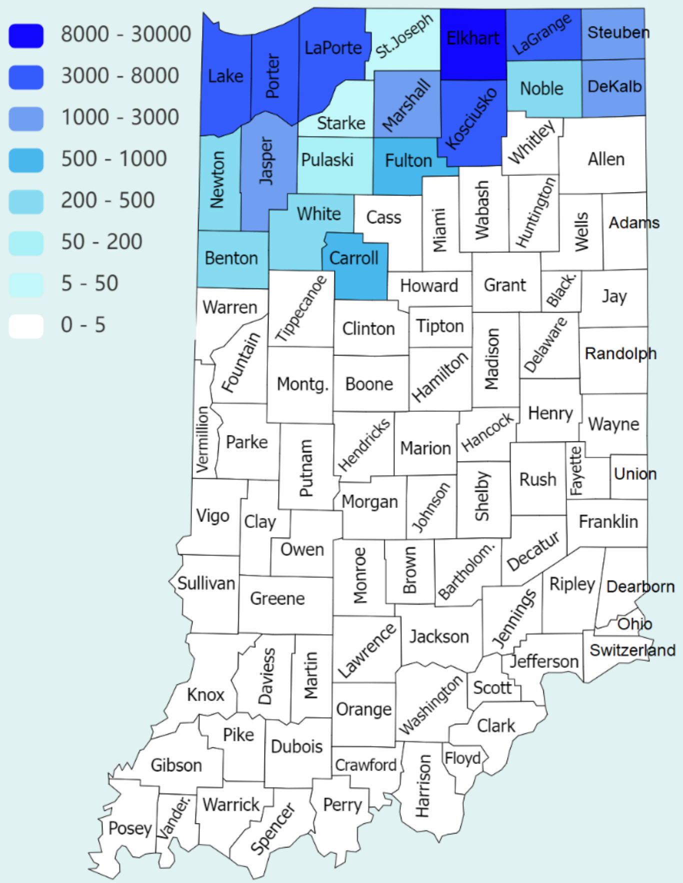



# PENDER MODEL: INPUTS

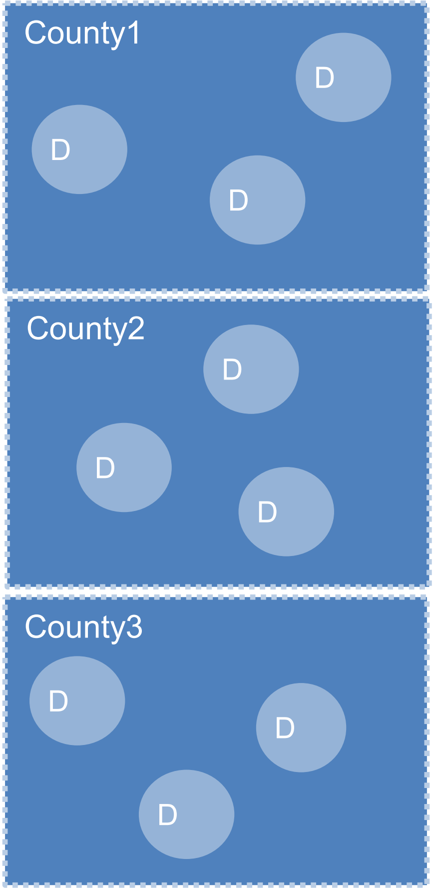
Availability of customer data…

| | |
|---|---|
| Customer Level Data | Individual customer information about DER adoption, DER programs, location, and customer class (R/C/I) |
| Socio-Economic Data | Individual customer information on socio-economic status, business type, energy usage |
| Aggregate NIPSCO Data | Total number of R/C/I customers by geographical grouping |

County DER Adoption by total kW…

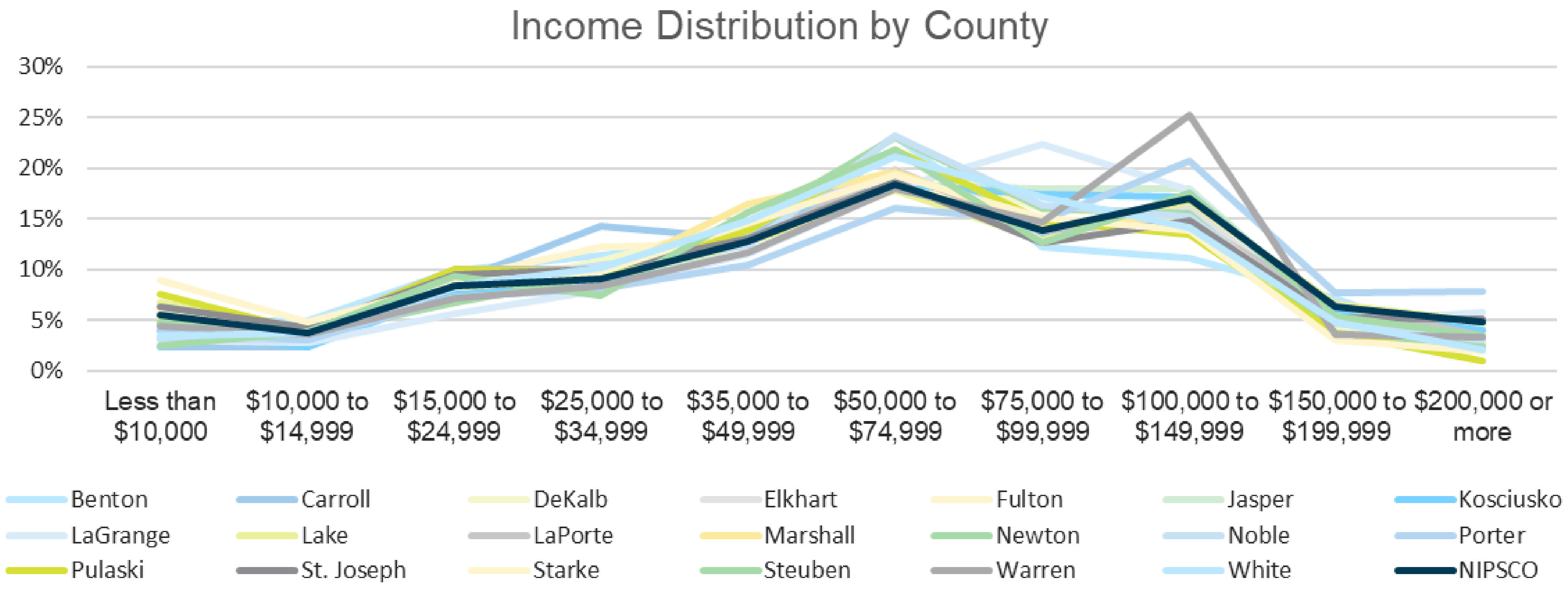



NIPSCO customer-level DER adoption data (D), and average SES* data (S) by county is used to develop *linear regression model for likelihood of adoption*




* SES = Socioeconomic Status

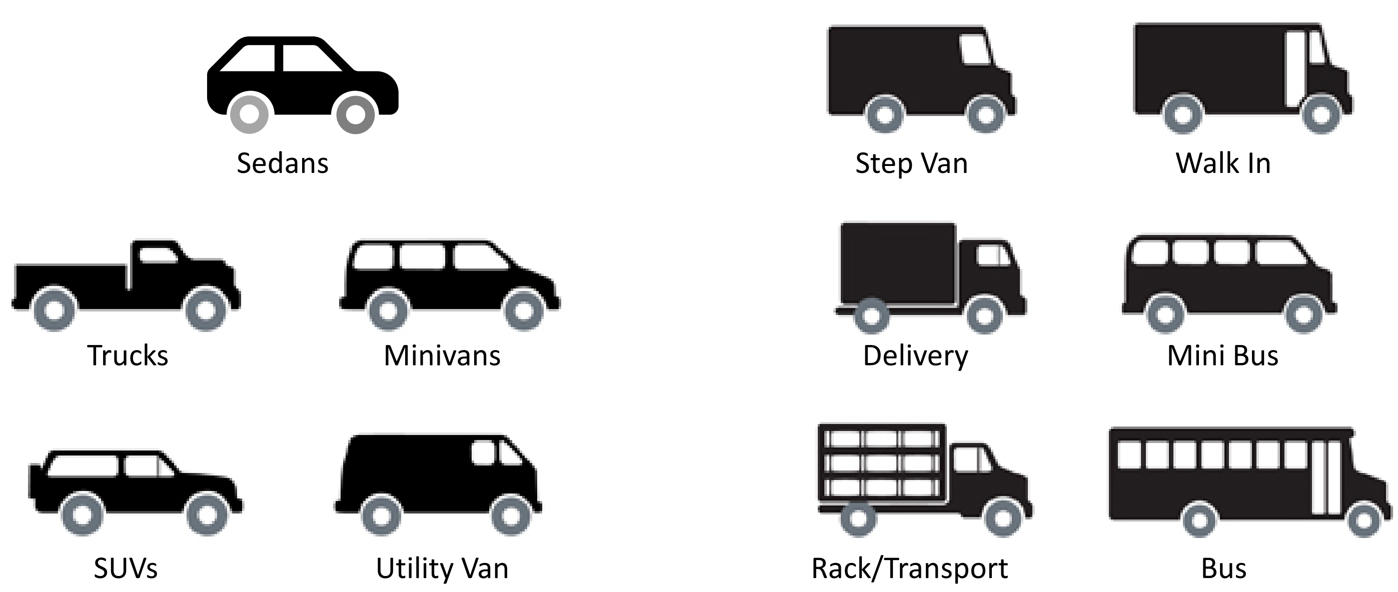
# PENDER MODEL: INCOME DISTRIBUTION

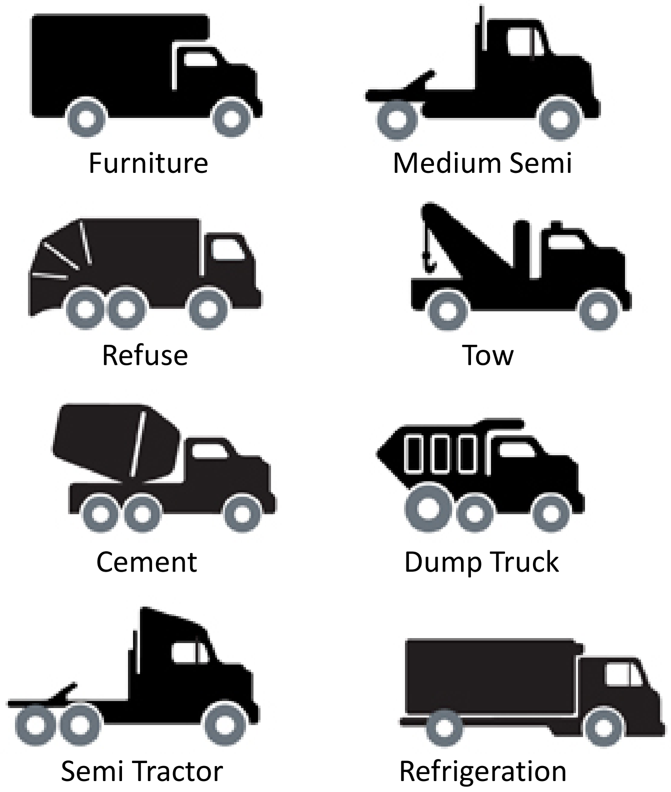



- On average, 42% of residential customers, across counties, report a median income above $75k, with a range between 32% - 51%.

# EV FORECASTING APPROACH

| *Penetration Models with Local Datasets* | | *Truck Corridor Charging Tool* |
|---|---|---|
| Light Duty Vehicle (LDV) | Medium Duty Vehicle (MDV) | Heavy Duty Vehicle (HDV) |
| **<10,000 lbs** | **10,001 – 26,000 lbs** | **>26,001 lbs** |




Source: U.S. DOE, Alternative Fuels Data Center

# LDV EV GROWTH: UTILIZE NIPSCO DATA FOR ICE AND EV REGISTRATIONS TO DEVELOP VIEW OF TOTAL LIKELY LDV EV'S, APPLY TO ADOPTION S-CURVE BASED ON PUBLIC STUDIES OF LIKELY INFLECTION POINTS

*Econometric model determines total number of electric vehicles, which will scale total EV demand over each year*

## 2024/Today

- Historical EV registration data will give a view of EV adoption in recent years and expected 2024 adoption
- Historical ICE registration data will give a view of total vehicle registrations
    - In all scenarios, we expect that the number of total vehicles will remain constant over time
    - Assumption can be flexed in scenarios

## Inflection year

- Determine the year(s) that system integration will begin and how long this will last (based on public studies)
    - Assumption is varied across scenarios

## Saturation year

- Determine the year(s) that system saturation will begin (based on public studies)
    - Assumption can be flexed in scenarios
    - Metric: EVs as % of new registrations

# MDV EV GROWTH: UTILIZE NIPSCO DATA FOR ICE AND EV REGISTRATIONS TO DEVELOP VIEW OF TOTAL LIKELY MDV EV'S, APPLY TO ADOPTION S-CURVE BASED ON PUBLIC STUDIES OF LIKELY INFLECTION POINTS

*Econometric model determines total number of electric vehicles, which will scale total EV demand over each year*

## 2024/Today

- Historical EV registration data will give a view of EV adoption in recent years and expected 2024 adoption
- Historical ICE registration data will give a view of total vehicle registrations
- Transit vehicle counts from 2022 National Transportation Database update
    - In all scenarios, we expect that the number of total vehicles will remain constant over time
    - There may be a case to make that the number increases over time as demand for delivery services rise

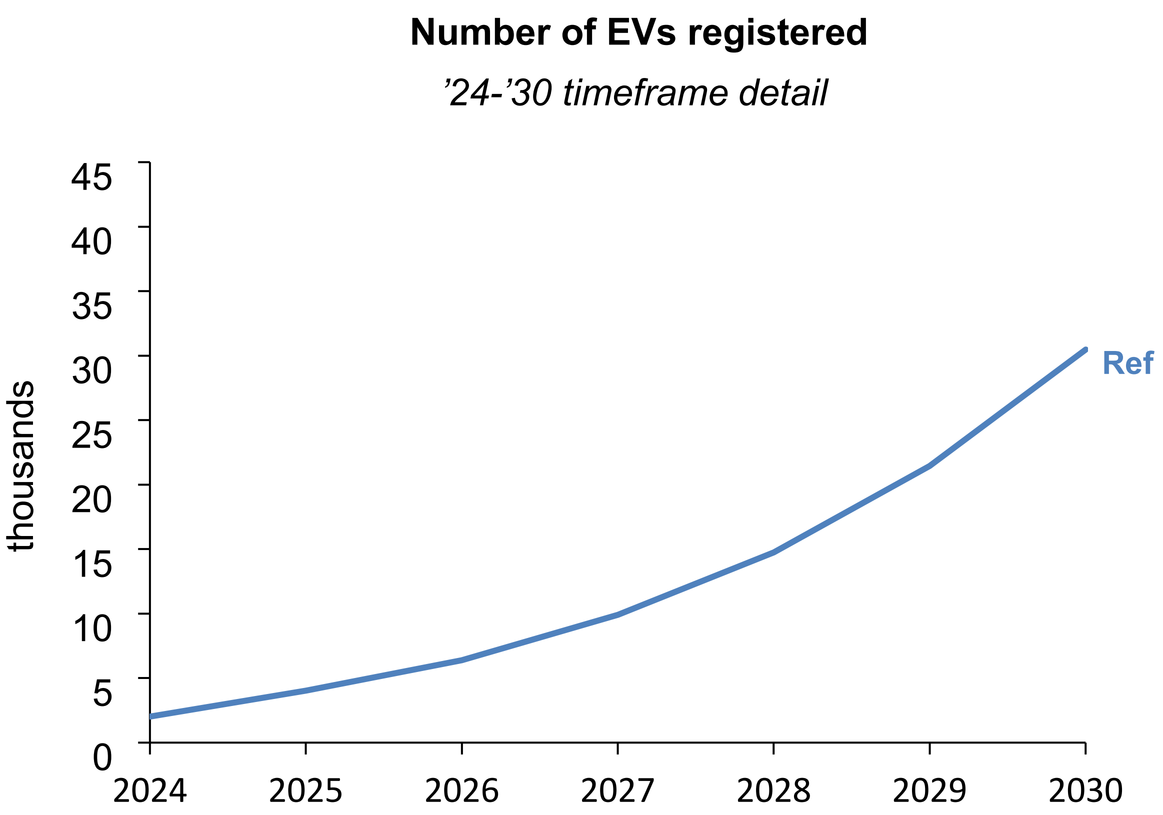
## Inflection year

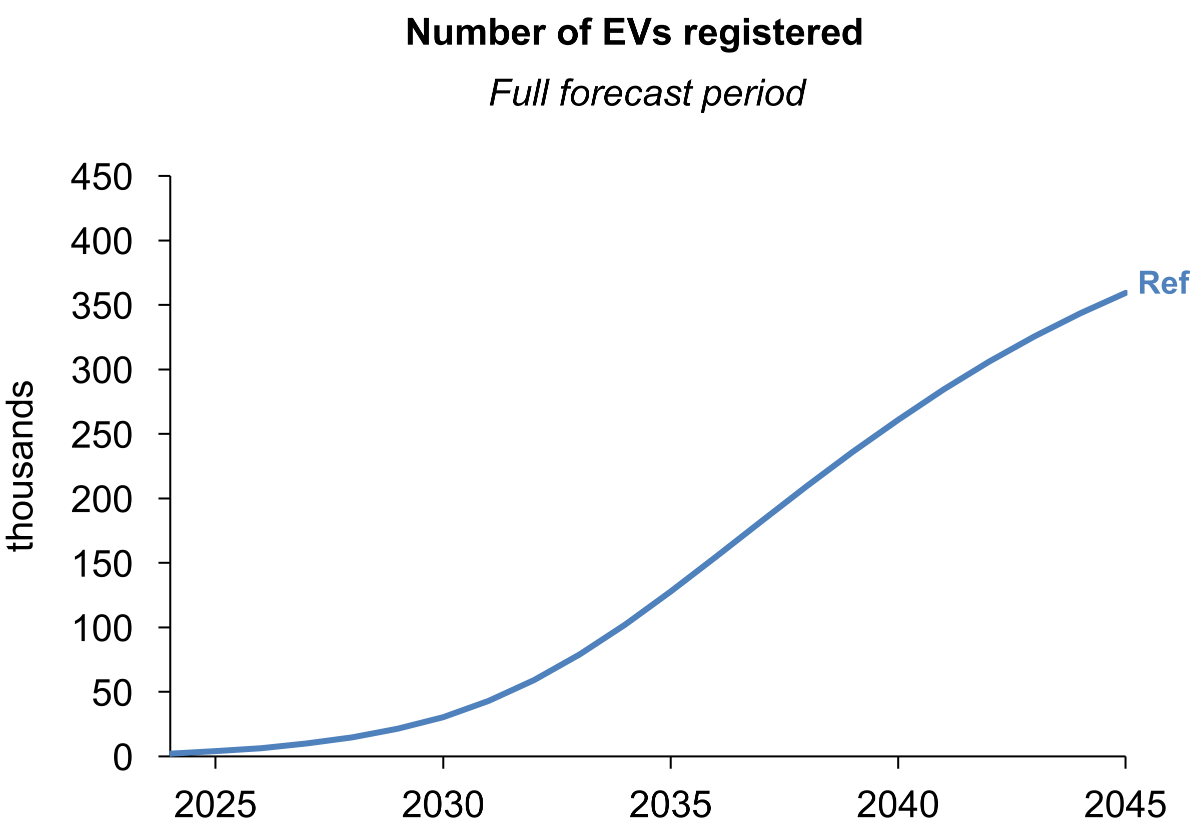
- Determine the year(s) that system integration will begin and how long this will last (based on public studies)
    - Inflection will be steeper in MDV forecast compared to LDV as individual fleets are likely to change over in larger groups

## Saturation year

- Determine the year(s) that system saturation will begin (based on public studies)
    - Assumption can be flexed in scenarios
    - Metric: EVs as % of new registrations

# REFERENCE LDV ADOPTION TRAJECTORY WOULD MEET NEW EPA TARGETS

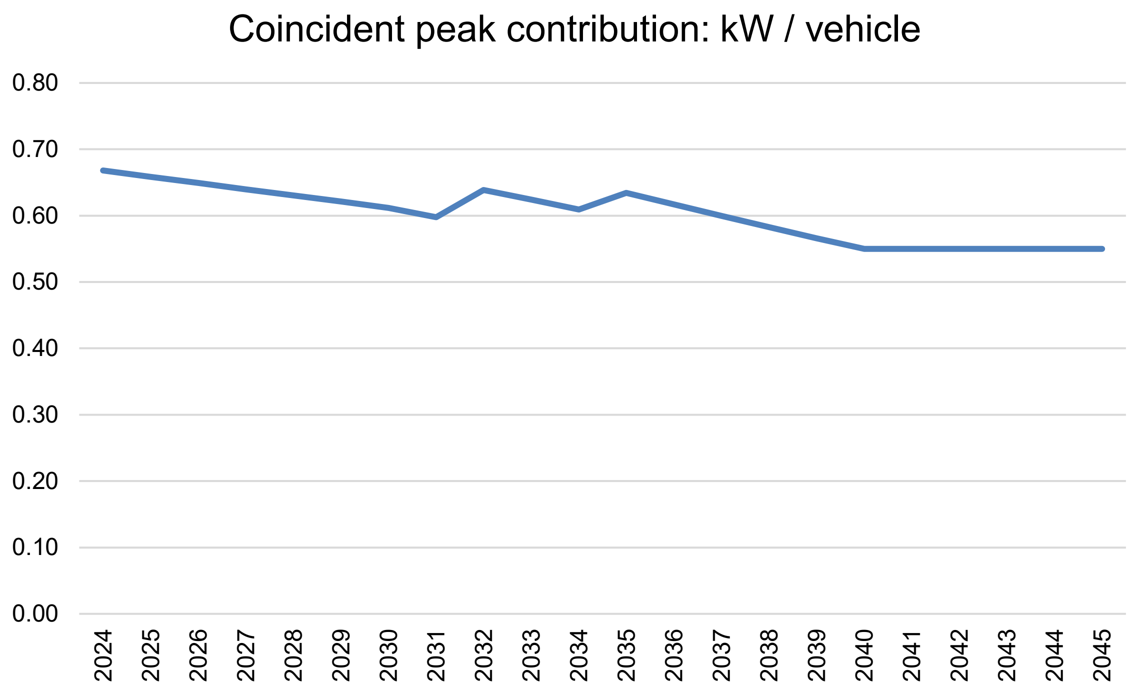


# LDV PEAK IMPACTS AND VEHICLE EFFICIENCY

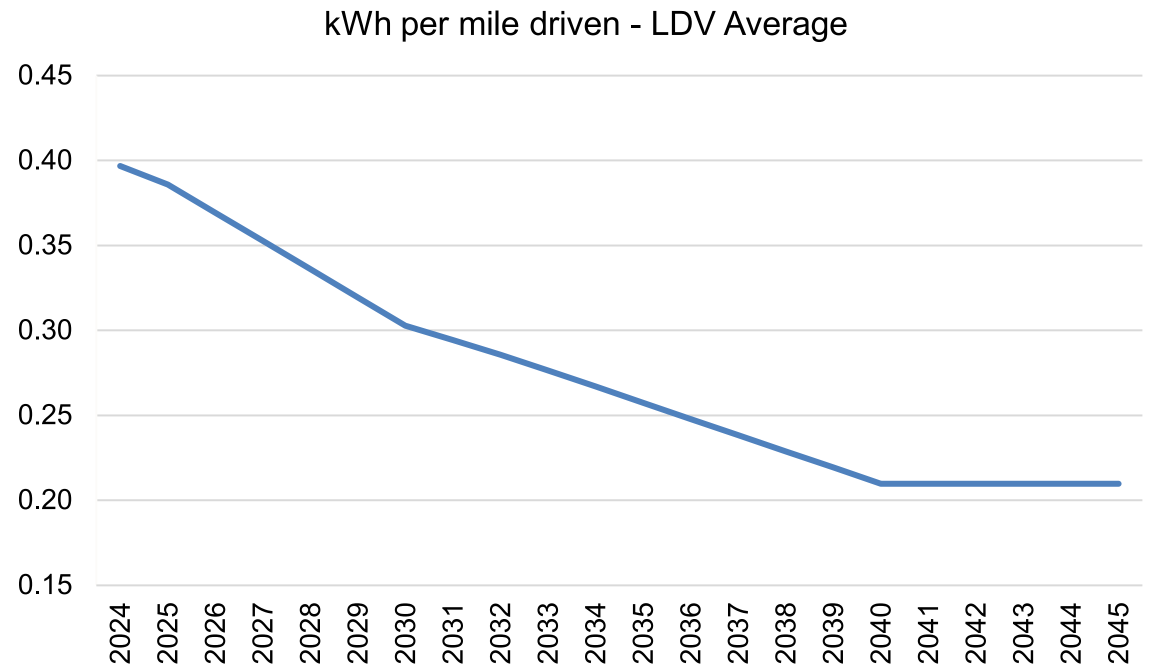
## Peak Impacts

- With the increase in vehicle efficiency, each vehicle's contribution to coincident peak loads is expected to decrease over time
- Coincident peaks are expected to shift towards evenings in future years, limiting the impact of vehicle efficiency gains on peak reduction




## Vehicle Efficiency

- Vehicle efficiency in BEV and PHEVs is forecasted to double by 2040, significantly reducing the per-vehicle impact on total sales
- NIPSCO relied on EV market data and NREL projections to forecast efficiency learning curves
- Despite higher efficiencies, total vehicle miles driven per day is forecasted to increase from 27.5 in 2024 to 40 by 2040



# REFERENCE CASE LDV LOAD SHAPES 2024

## Total registered EVs: 2,006

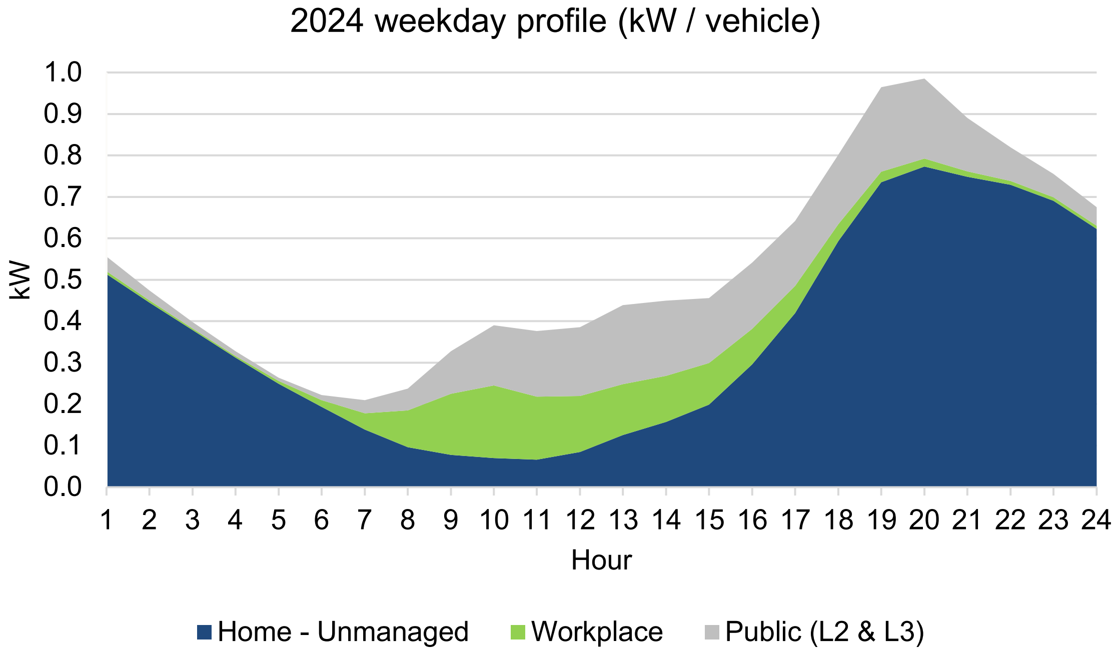
| EV Type | Count | mi / kWh |
|---|---|---|
| BEV Sedan | 882 | 2.57 |
| BEV SUV | 721 | 2.30 |
| PHEV Sedan | 281 | 2.95 |
| PHEV SUV | 120 | 2.40 |

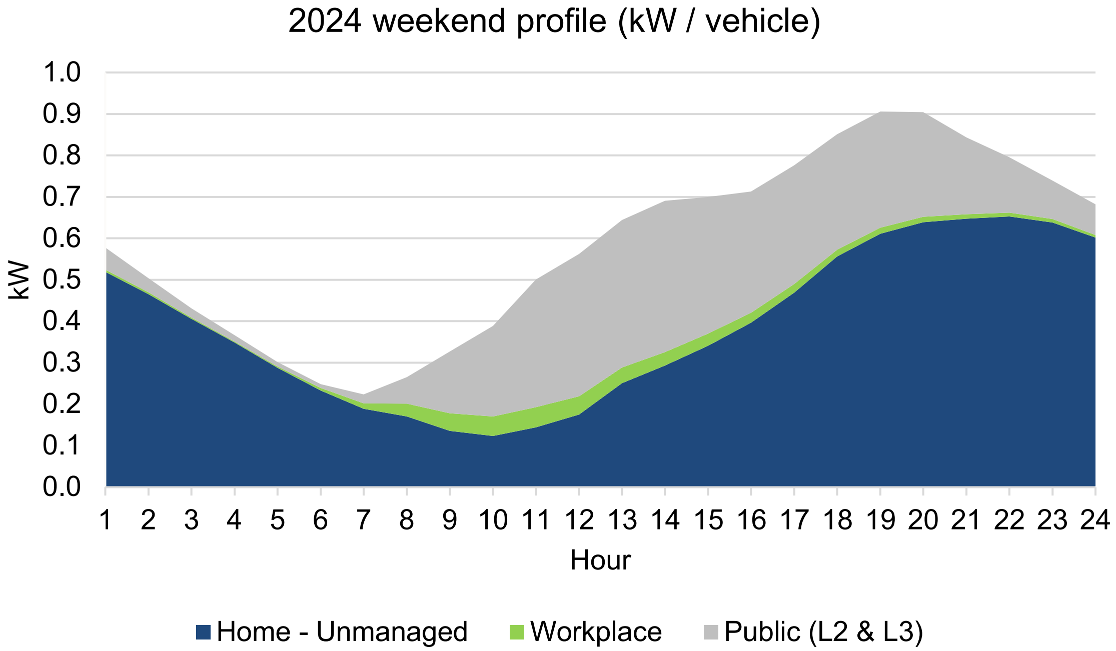
## Grid Impacts

| | |
|---|---|
| Coincident Peak (MW) | 1.34 |
| Coincident Peak Time | August, 3pm |
| Annual Sales (MWh) | 8,243 |
| LDV Annual Peak (MW) | 2.15 |
| LDV Annual Peak Date | Jan 4, 8pm |

## Seasonal Coincident Peaks (MW)

| | |
|---|---|
| Winter | 1.93 |
| Spring | 1.93 |
| Summer | **1.34** |
| Fall | 1.61 |



# REFERENCE CASE LDV LOAD SHAPES 2030

## Total registered EVs: 33,016

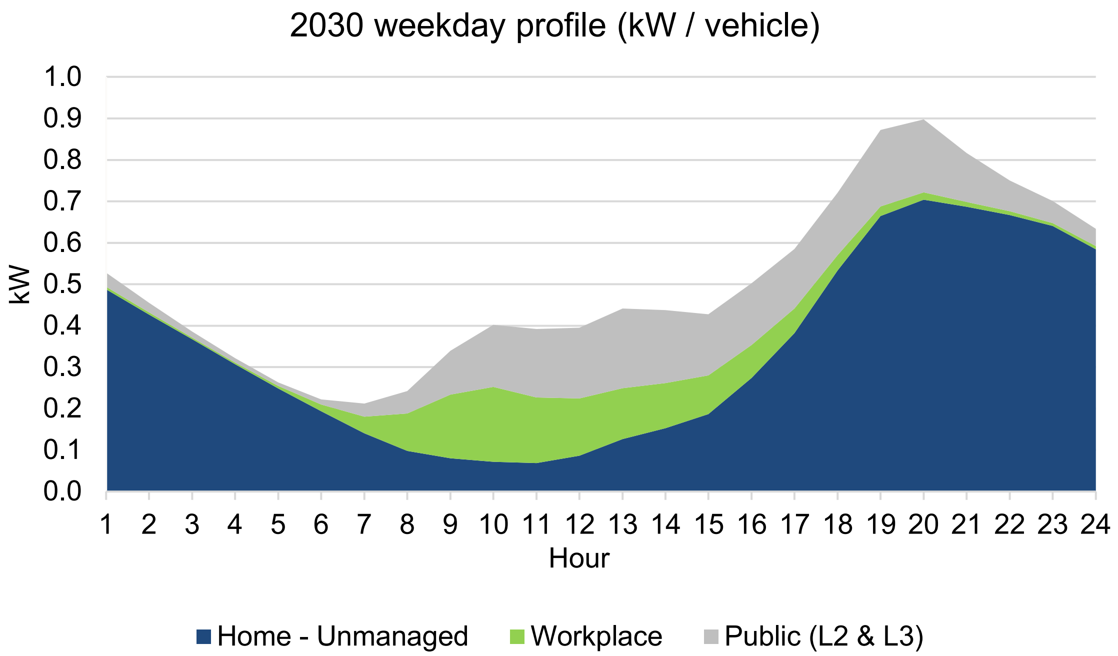
| EV Type | Count | mi / kWh |
|---|---|---|
| BEV Sedan | 16,342 | 3.50 |
| BEV SUV | 13,371 | 3.00 |
| PHEV Sedan | 2,311 | 4.00 |
| PHEV SUV | 990 | 3.25 |

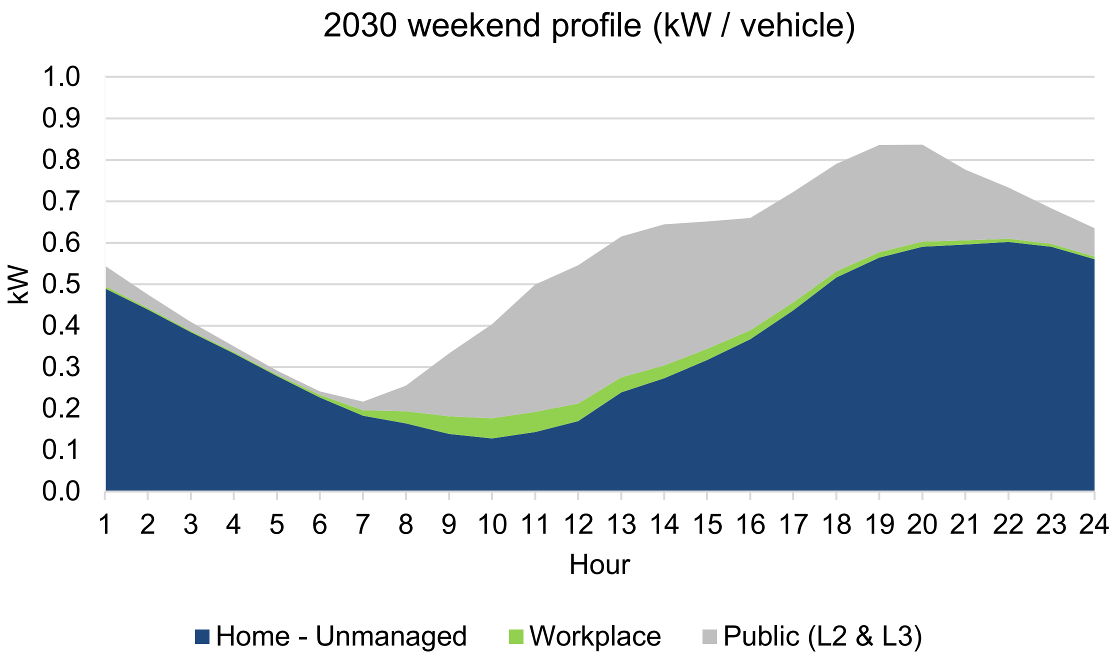
## Grid Impacts

| | |
|---|---|
| Coincident Peak (MW) | 20.2 |
| Coincident Peak Time | August, 3pm |
| Annual Sales (MWh) | 129,000 |
| LDV Annual Peak (MW) | 32.3 |
| LDV Annual Peak Date | Jan 4, 8pm |

## Seasonal Coincident Peaks (MW)

| | |
|---|---|
| Winter | 28.8 |
| Spring | 29.6 |
| Summer | **20.2** |
| Fall | 28.8 |



# REFERENCE CASE LDV LOAD SHAPES 2040

## Total registered EVs: 283,967

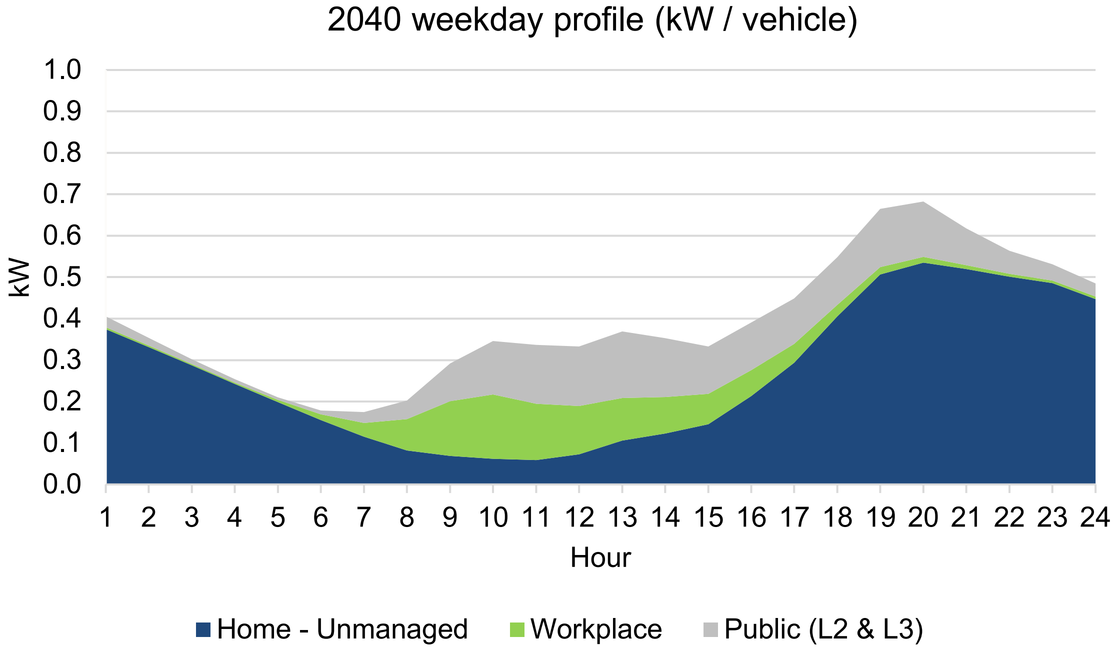
| EV Type | Count | mi / kWh |
|---|---|---|
| BEV Sedan | 148,373 | 5.0 |
| BEV SUV | 121,396 | 4.5 |
| PHEV Sedan | 9,939 | 5.0 |
| PHEV SUV | 4,259 | 4.5 |

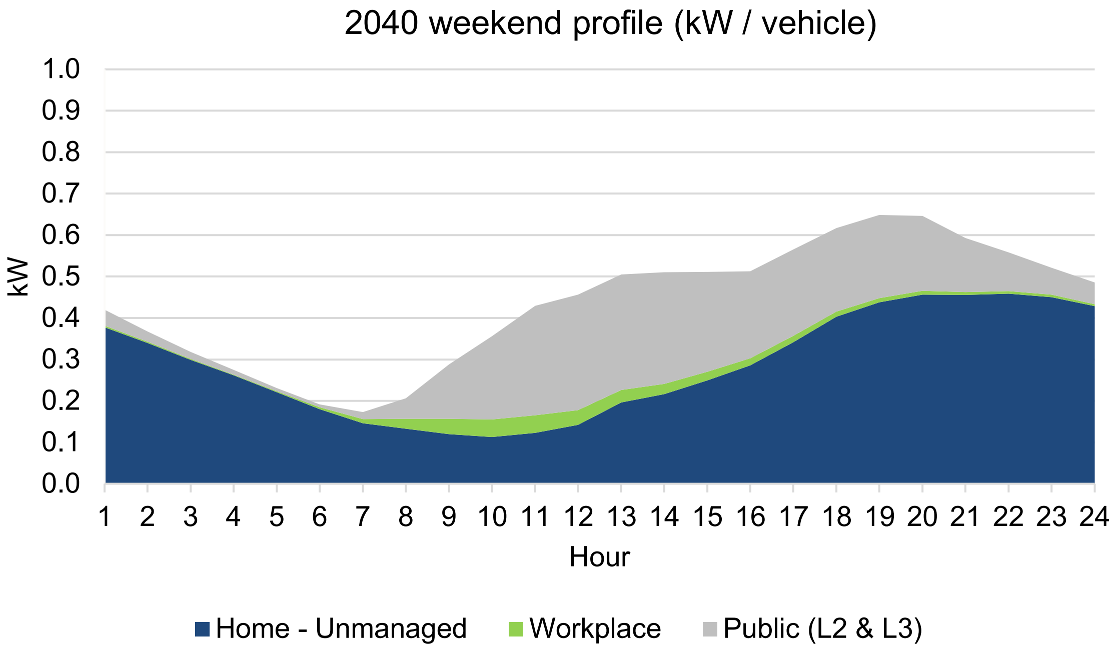
## Grid Impacts

| | |
|---|---|
| Coincident Peak (MW) | 156 |
| Coincident Peak Time | August, 5pm |
| Annual Sales (MWh) | 866,000 |
| LDV Annual Peak (MW) | 214.5 |
| LDV Annual Peak Date | Jan 4, 8pm |

## Seasonal Coincident Peaks (MW)

| | |
|---|---|
| Winter | 189 |
| Spring | 194 |
| **Summer** | **156** |
| Fall | 189 |



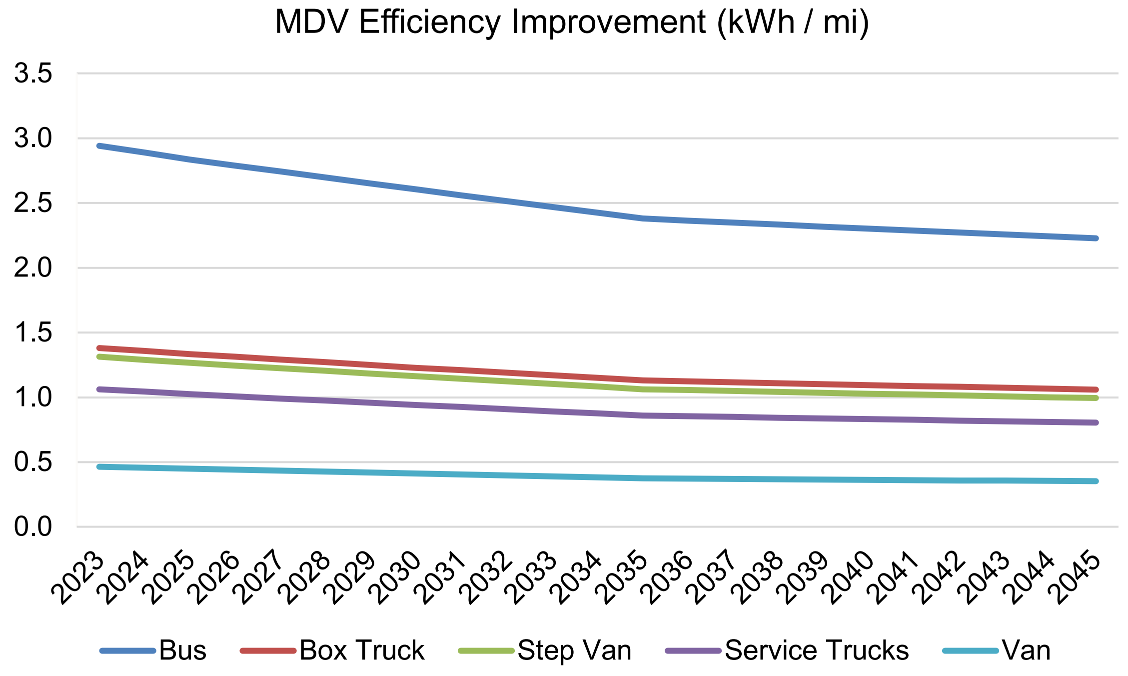
# MDV CHARGING EFFICENCY: TEMPERATURE AND TECHNOLOGY IMPROVEMENT

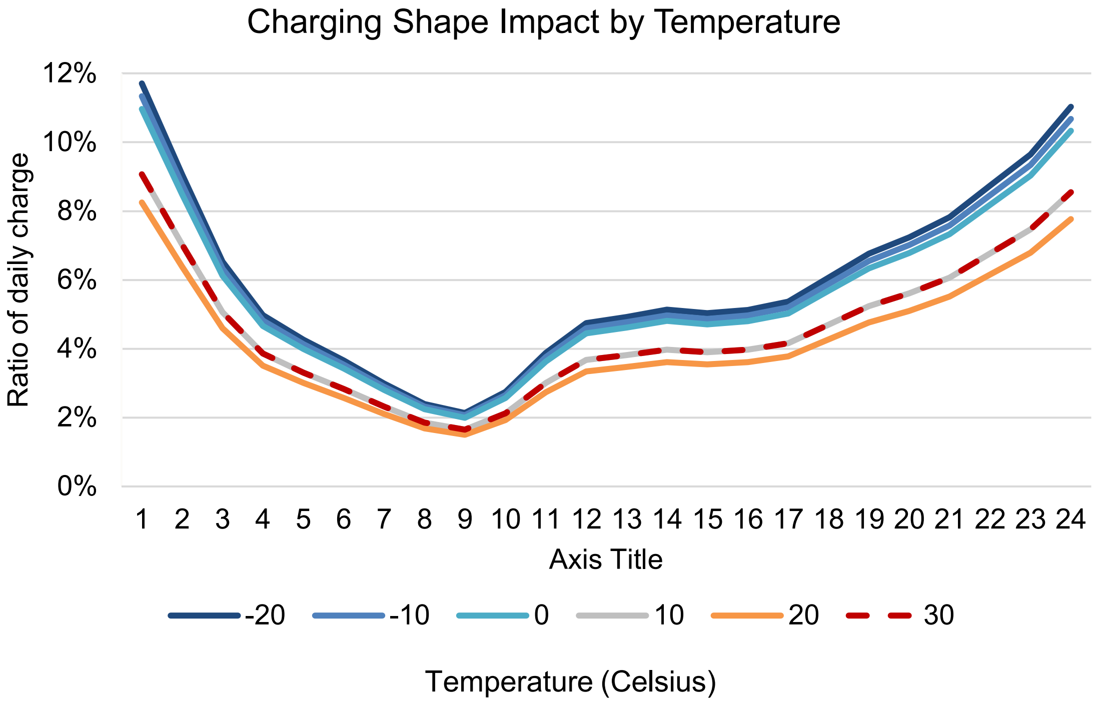
## Technology Improvements – Vehicle Efficiency

- Adapted from NREL transportation baseline technology analysis, CRA determined that a range of MDVs will likely see a ~30% improvement in vehicle efficiency over the forecast period, reducing grid impacts over time

## Temperature Dependence

- Transit vehicles have high temperature dependence, as larger buses require space heating of large areas with high heat loss
- Estimated 44% energy demand increase for coldest hours of the year, and 10% for hottest hours



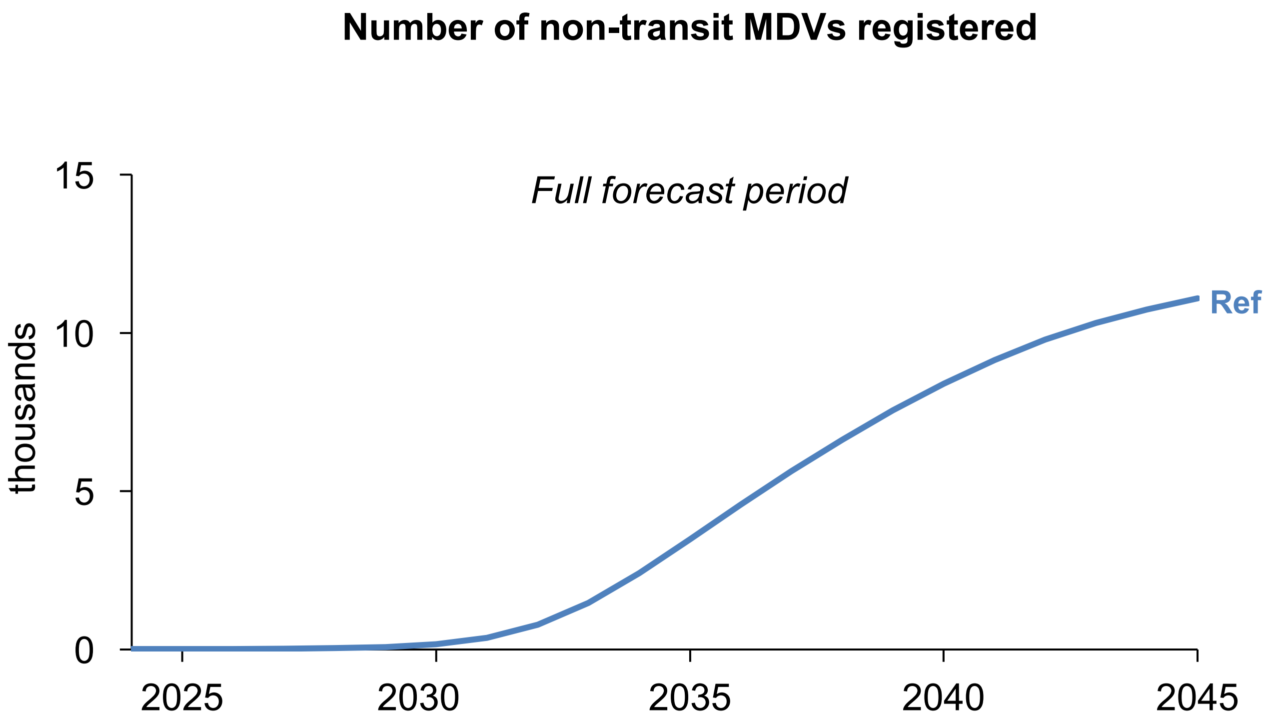
# MDV (NON-TRANSIT) EV FORECAST

## Near-term Trends

- NIPSCO has baselined the existing MDV fleet using EV registration data from the Indiana Fuel Dashboard
- NIPSCO has crafted an approach that uses ICE vehicle turnover (assuming 10-year avg lifespan) and EVs as a % of new MDV vehicle sales to estimate the number of EVs on the road in a given year.

## Long-term Trends

- CRA anticipates moderated adoption compared to LDVs, as some MDVs may be difficult to decarbonize with limited EV options available



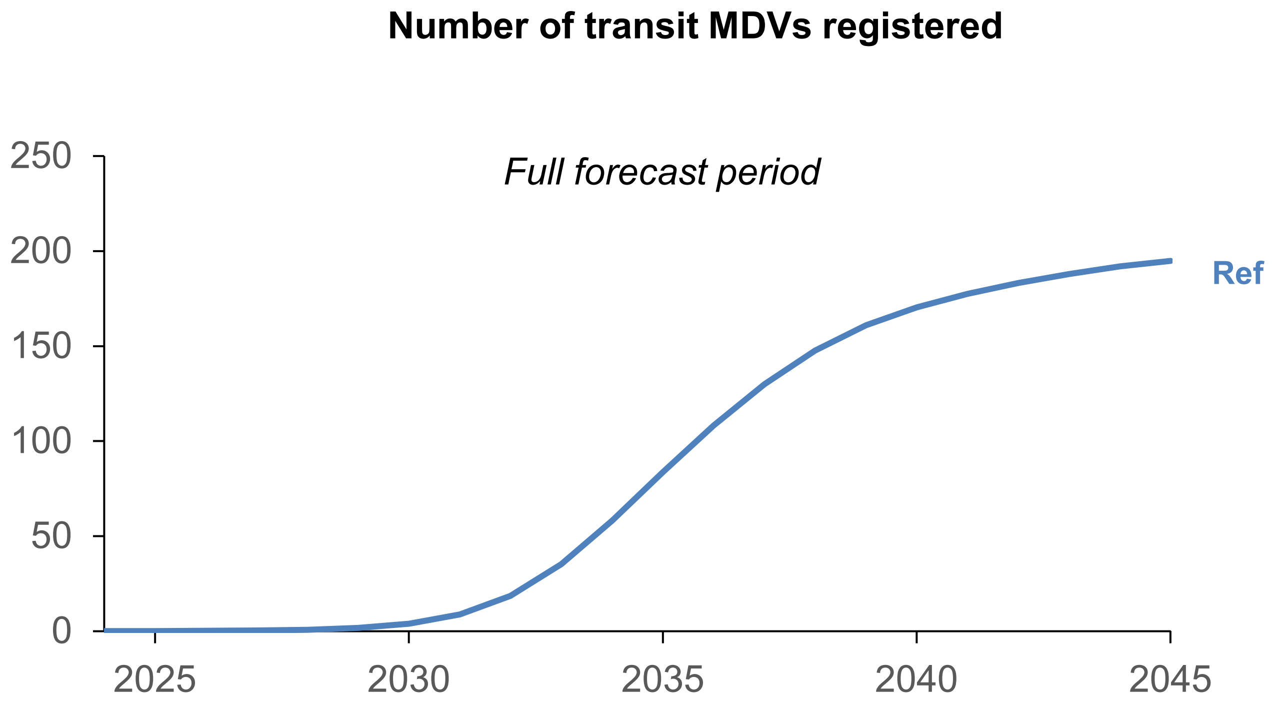
# MDV (TRANSIT) EV FORECAST

## Near-term Trends

- NIPSCO has baselined the existing transit fleet using the 2022 National Transportation Database (NTD)
- NIPSCO has crafted an approach that uses ICE vehicle turnover (assuming avg lifespan by vehicle type from NTD) and EVs as a % of new MDV vehicle sales to estimate the number of transit EVs on the road in a given year.

## Long-term Trends

- NIPSCO anticipates moderated adoption compared to LDVs as some MDVs may be difficult to decarbonize with limited EV options available



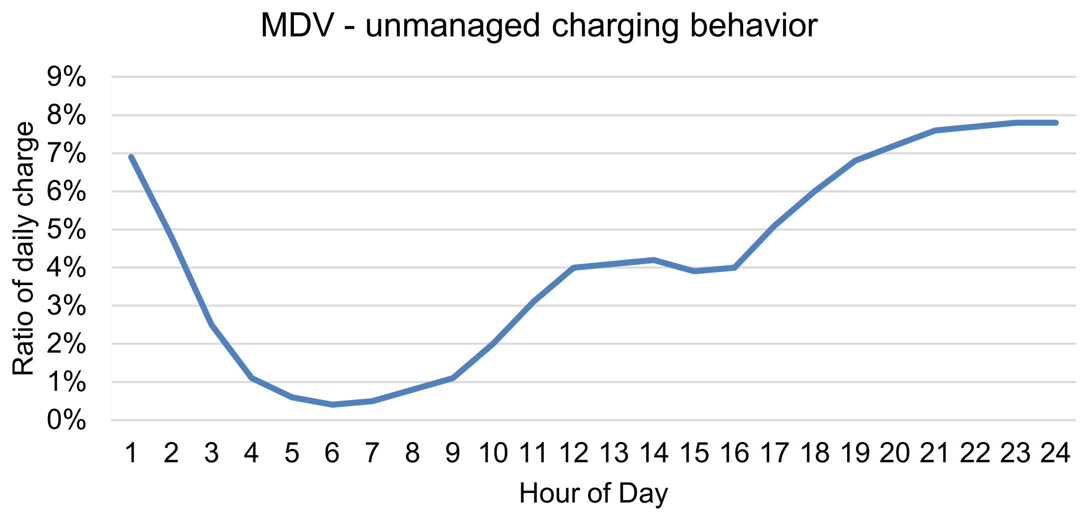
# MDV CHARGING BEHAVIOR: UNMANAGED VS. MANAGED CHARGING

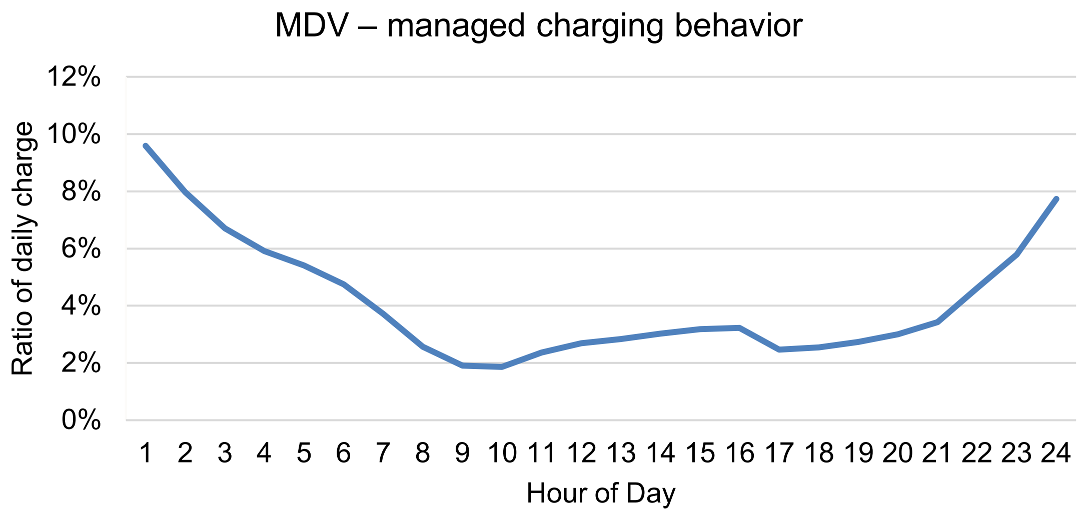
## Unmanaged charging:

- Current methodology is based on an NREL study, *Field Evaluation of Medium-Duty Plug-In Electric Delivery Trucks*
- Utilizes real-meter data (similar approach was taken by NIPSCO in its 2021 IRP)
- Shape is used from 2024 - 2030, when a blend of managed charging loads begins to emerge, based on the assumption that rates and managed charging infrastructure will begin to displace unmanaged behavior in later years

## Managed charging:

- Managed profile adapted from recent data releases from 2021 study from Berkeley Lab
- This approach assumes the adoption of new rate design and managed charging approaches and is used as a baseline future projection for how MDV loads may balance from 2030 – 2045 (although some degree of unmanaged charging remains for the duration of the forecast period)



# REFERENCE CASE EV MDV LOAD SHAPES: 2030 REFERENCE (50% managed)

## Total registered MDVs: 171

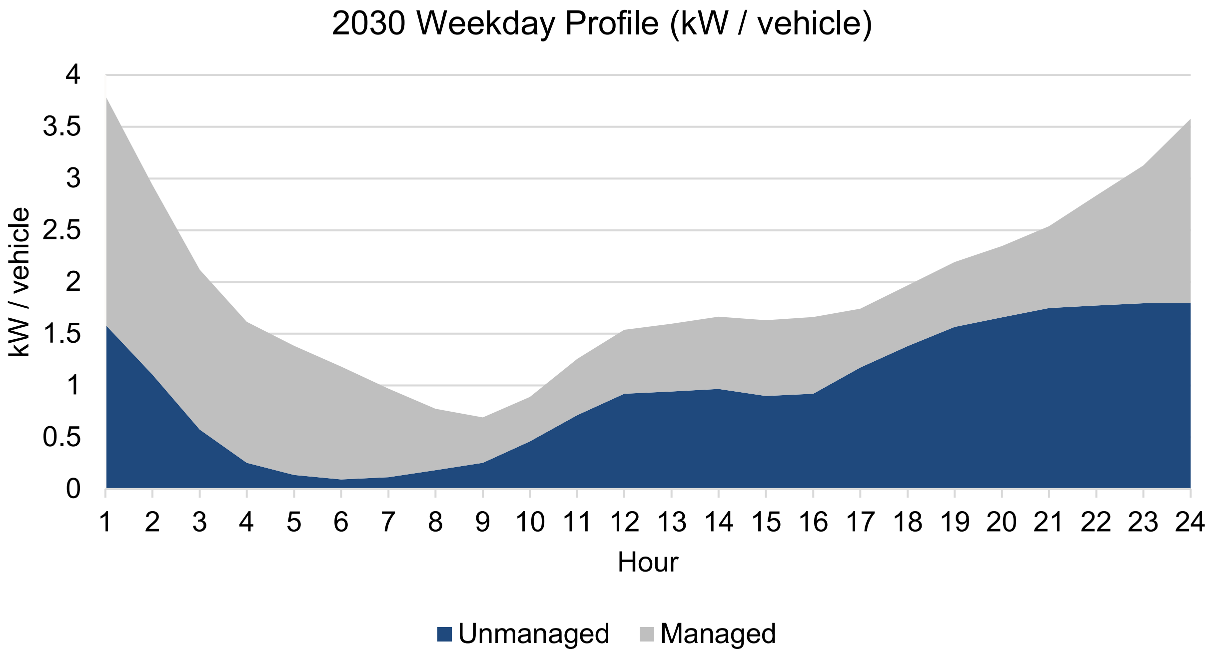
| EV Type | Fleet / Delivery | Transit |
|---|---|---|
| Count | 167 | 4 |
| kWh / mi | 1.18 | 0.81 |
| VMT / day | 37 | 55 |

## Grid Impacts

| | |
|---|---|
| **Coincident Peak (MW)** | 0.23 |
| **Coincident Peak Date** | Aug 5, 6pm |
| **Annual Sales (MWh)** | 2,923 |
| **MDV Annual Peak (MW)** | 0.81 |
| **MDV Annual Peak Date** | Jan 4, 1am |

## Takeaways

- Low adoption of MDVs in 2030 will lead to negligible grid impact from a transmission-level perspective
- Managed charging will lower evening peak load, and distribute to 12am – 2am



# REFERENCE CASE EV MDV LOAD SHAPES: 2040 REFERENCE (90% MANAGED)

## Total registered MDVs: 8,563

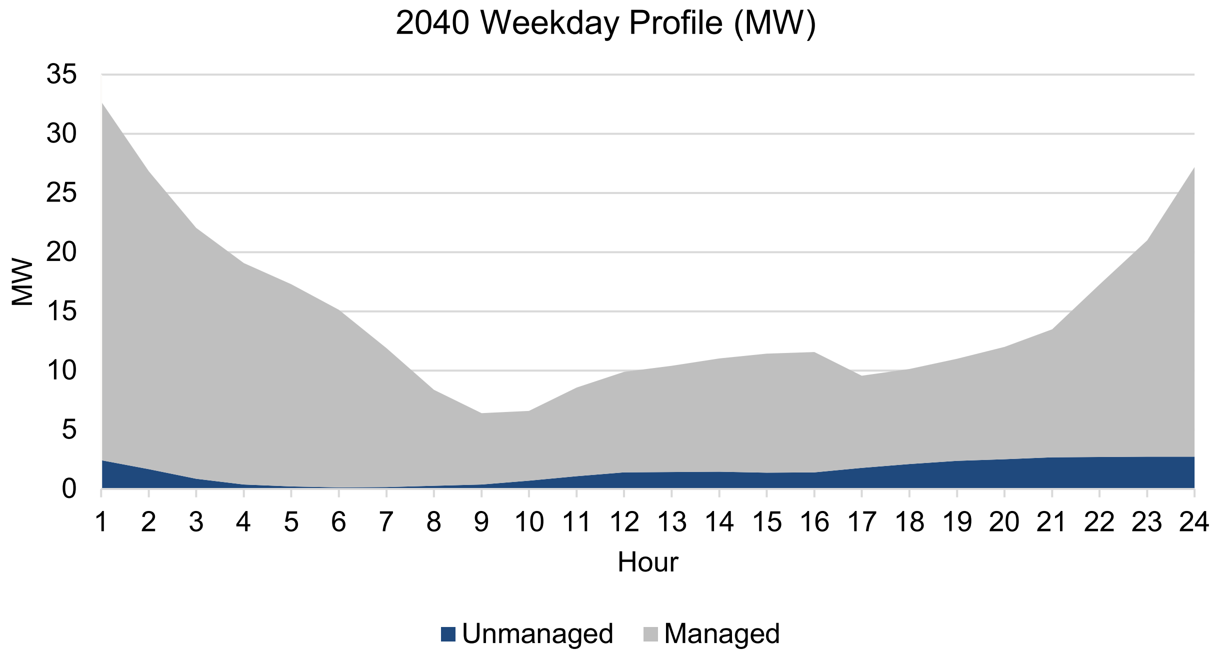
| EV Type | Fleet / Delivery | Transit |
|---|---|---|
| Count | 8,939 | 170 |
| kWh / mi | 1.05 | 0.73 |
| VMT / day | 37 | 55 |

## Grid Impacts

| | |
|---|---|
| Coincident Peak (MW) | **7.38** |
| Coincident Peak Date | Aug 5, 6pm |
| Annual Sales (MWh) | 130,000 |
| MDV Annual Peak (MW) | 40.6 |
| MDV Annual Peak Date | Jan 4, 1am |

## Takeaways

- Growth in managed charging behavior as commercial customers adopt time-shifting techniques and concentrate almost 50% of daily charging demand between 10pm – 5am
- High growth of fleet vehicles will drive majority of MDV load impacts, with coincident peak impacts estimated around 7 MW



# EV POLICY INCENTIVES, TARGETS, AND FEES WILL IMPACT EV ADOPTION RATES IN INDIANA

| | Federal | Indiana State & Utilities |
|---|---|---|
| EV Tax Credits | • Up to $7,500 tax credit for new EV and PHEV vehicles<br>• Up to $4,000 or 30% of the price[1] on used EV and PHEVs | • Indiana does not have tax credits for new or used EVs |
| EV Charger Tax Credits | • 30% of the cost of hardware and installation, up to $1,000, through 2032 (applies to residential and commercial) | • Various utilities have TOU rates and charging station rebates for LDVs and MDVs but there is no centralized state program |
| Targets | • EVs to be 50% of all vehicle sales by 2030 | • Indiana does not have electric vehicle targets |
| Other | | • In 2024, EVs and PHEVs will be subject to an additional annual registration fee of $221 and $74[2], respectively. After 2024, fees will be indexed to inflation. |

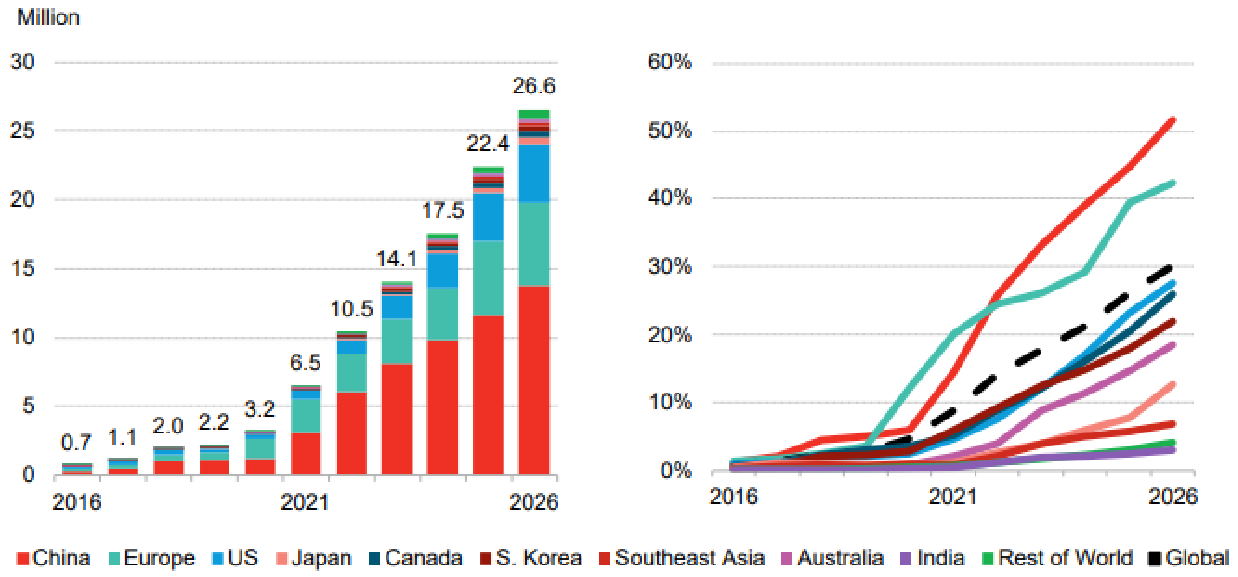
[1] Used tax credit is for whichever amount is less
[2] Source: https://www.in.gov/bmv/files/Fee_Chart.pdf

# BLOOMBERG NEW ENERGY FINANCE (BNEF) EXPECTS RAPID EV ADOPTION IN THE NEXT 3 YEARS

## Overview

- BNEF assumes U.S. EV share of LDV sales to reach nearly 30% by 2026
- The EV share of global new passenger vehicle sales jumps from 14% in 2022 to 30% in 2026.
- In the US, the Inflation Reduction Act causes EVs make up nearly 28% of passenger vehicle sales by 2026, up from 7.6% in 2022.

**Figure 1: Global near-term passenger EV sales and share of new passenger vehicle sales by market**



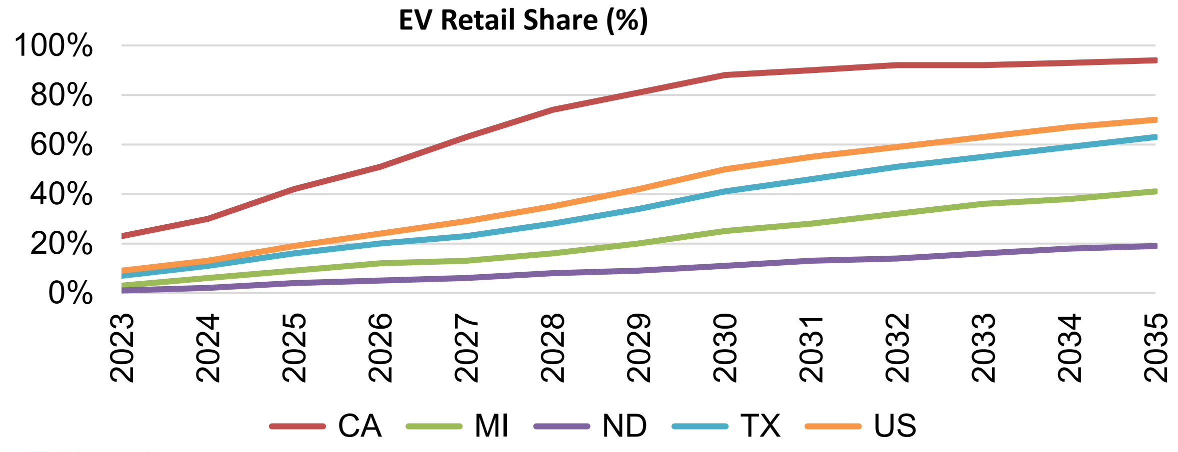

*Source: BloombergNEF. Note: Europe includes the EU, the UK and EFTA countries. EV includes BEVs and PHEVs.*

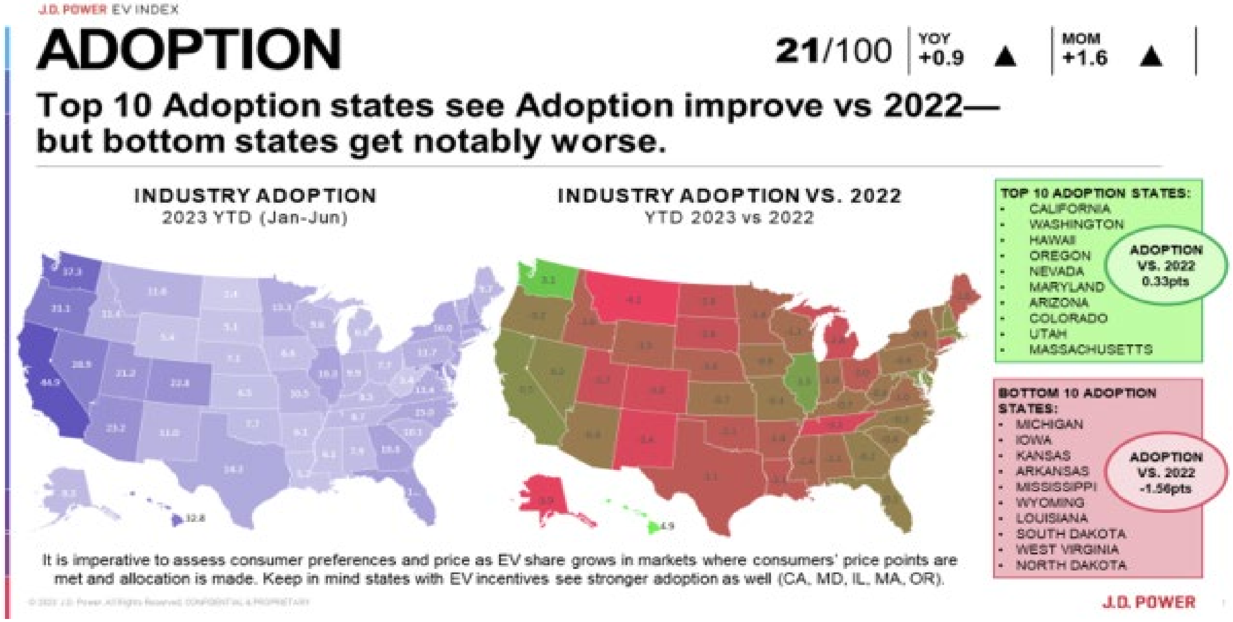
Source: BNEF, *Electric Vehicle Outlook 2023, Exec Summary* (2023)

# JD POWER EXPECTS EV ADOPTION TO GROW DISPARATELY ACROSS THE STATES BUT TO REACH 70% BY 2035 AT A NATIONAL LEVEL

## Overview

- **A JD Power September 2023 report shows that nationwide, electric vehicle (EV) adoption is up 1 index point through the first half of 2023 vs. the same period a year ago**
  - At the state level, however, a stark division is emerging between the **top 10 states** for EV adoption, where **EV adoption rates are growing steadily**, and the **bottom 10 states** for EV adoption, where **year-over-year average adoption rates are declining**
- **They forecast that through 2035, state EV adoption will grow increasingly divided**
- **At a national level, JD Power estimates 70% EV market share by 2035**



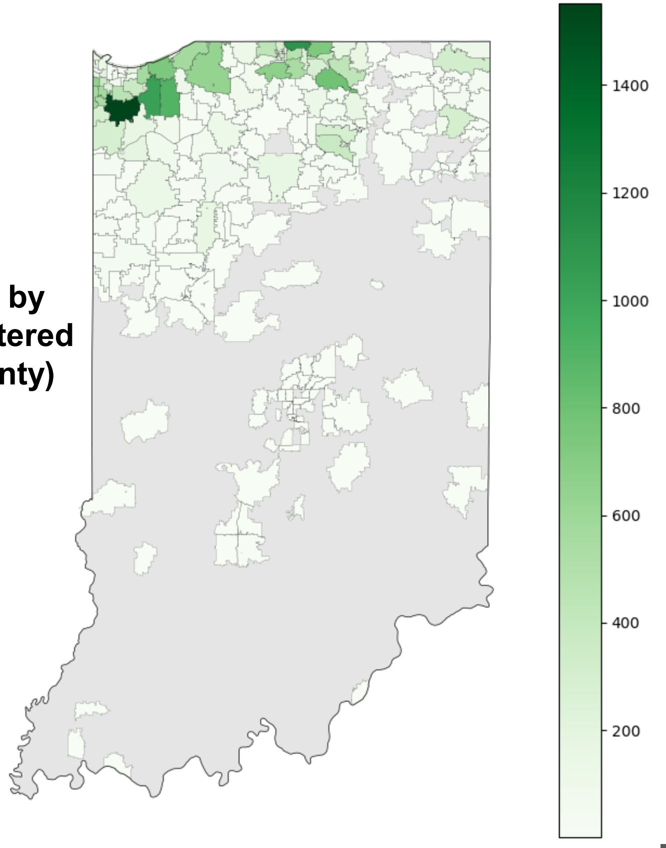

Source: JD Power, [America Grows Increasingly Divided on EV Adoption ](#)(Sept 2023)

# EV: DATA ASSUMPTIONS – VEHICLE TRAVELING DISTANCE

## Average daily miles traveled per vehicle: 43 miles

- Bureau of Transportation Statistics data from 2009 shows Indiana vehicle trips ranged from 32 – 55 miles per day, varying by urban / suburban / rural distinction, 43 miles per day used as midpoint
- **No change forecasted in average vehicle miles traveled between 2024 and 2040**

**EV Penetration by zip code (registered in NIPSCO county)**

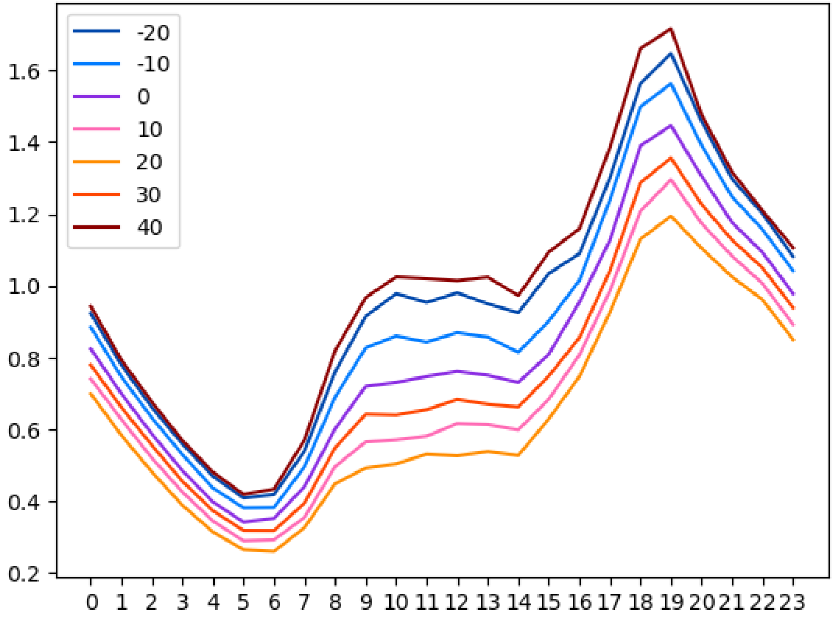



| State | Mean Census Tract estimate by urban group | | | | | |
|---|---|---|---|---|---|---|
| | Vehicle miles traveled | | | Vehicle trips | | |
| | Urban | Suburban | Rural | Urban | Suburban | Rural |
| Indiana | 32.89 | 42.99 | 55.36 | 4.99 | 5.60 | 5.78 |

# EV: DATA ASSUMPTIONS – TEMPERATURE

**Temperature: Variable**

- Average temperature data taken from Michigan City weather station
- EVI Pro-Lite takes in increments of 10 degrees Celsius, so it is not essential to perfect this data point, but rather use it to shape seasonal trends




EV shape can vary substantially by temperature, with lowest load in 20 degree Celsius weather.

Given 10 deg C granularity of model, changes in climate patterns **do not** currently appear to have a major impact on long-term EV load