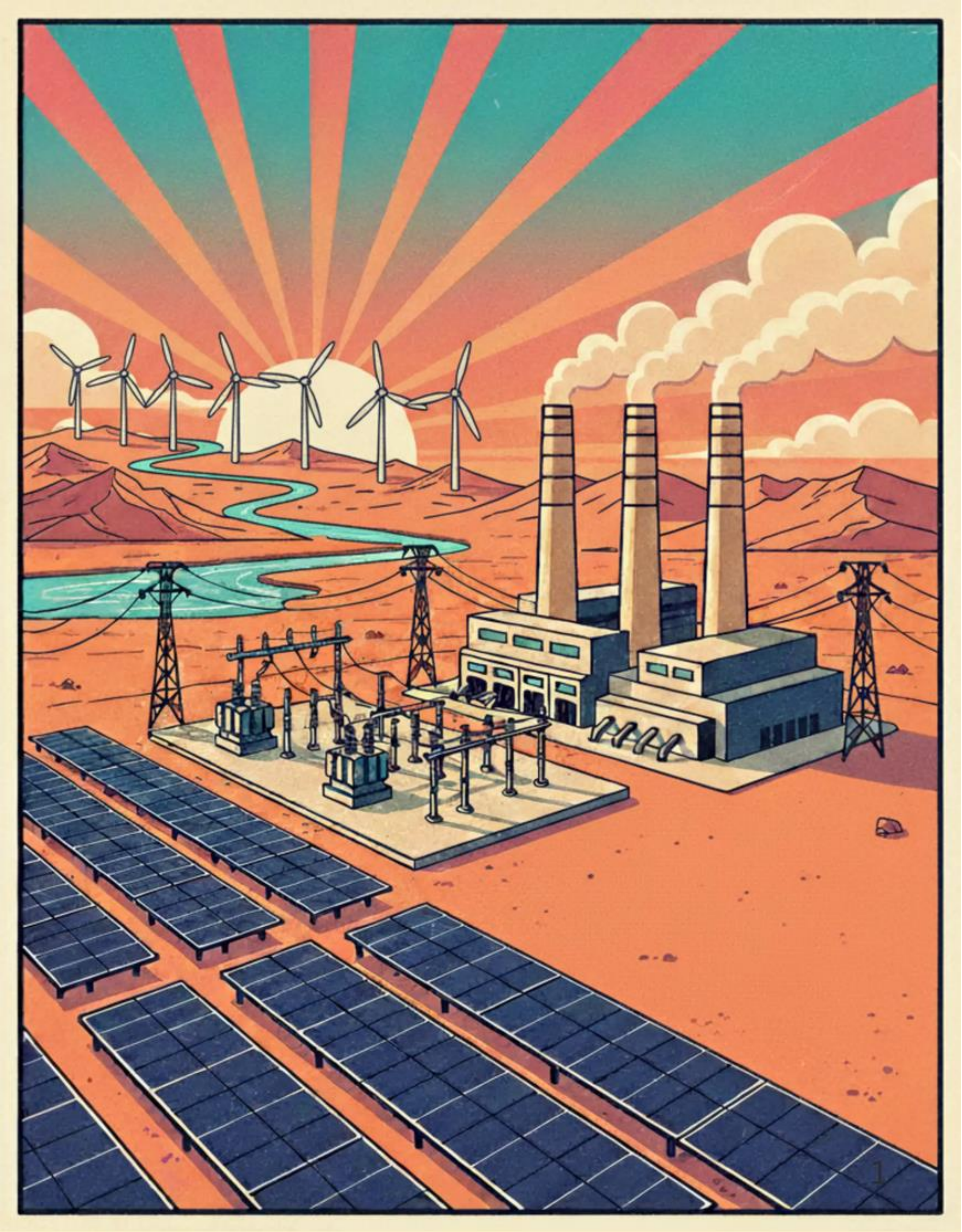

Existing Power Plants Sharing Grid Access with New Resources Can Lower Costs and Double Indiana's Generation Capacity

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Working Paper 2025

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This working paper is circulated for discussion and comments. The paper has not been peer-reviewed or been subject to review by any editorial board.

Fast-tracking 39 GW of new capacity using existing grid with $3B+ savings

The Challenge

- Indiana has ~24 GW of active projects in interconnection queues (MISO and PJM), with average connection timelines exceeding 6 years—over 40 months to reach interconnection agreement, plus 2+ years for construction.
- Capacity market prices have surged dramatically: MISO's summer 2025/26 capacity cleared at $666.50/MW-day (22x increase from 2024/25), while PJM's 2026/27 capacity reached the price cap at $329.17/MW-day (11.4× increase from 2024/25 baseline of $28.92/MW-day).
- New gas plants ordered today won't come online until 2030-2031 at earliest, with capital costs surging from $1,116-1,427/kW to over $2,000/kW for recent combined-cycle projects (GridLab, 2025).
- U.S. electricity demand is projected to increase 25% by 2030 and 78% by 2050 (ICF, 2025). Power availability is now the primary site selection factor for data centers. Indiana's position in both MISO and PJM creates opportunities, but extended interconnection timelines limit competitiveness for these high-value investments.

The Solution

- 3.1 GW of Indiana's thermal capacity operates at less than 15% capacity factor, with 43.8% operating below 30% CF. Similarly, solar plants (13.2% CF) and wind plants (28.1% CF) severely underutilize their interconnections, leaving expensive grid infrastructure idle most of the time.
- Deployment of new generation at these existing underutilized plants can provide cost-effective energy and capacity without building new transmission infrastructure, bypassing lengthy interconnection queues.
- Indiana can add 39 GW of clean energy capacity through surplus interconnection, including ~21 GW at thermal plants (20 GW solar + 1 GW wind) and ~12 GW at renewable plants enabled by ~6 GW of 6-hour battery storage.
- Surplus interconnection can save $3.3 billion in interconnection costs, equivalent to $1,222 per Indiana household. Projects can be completed in 12-18 months compared to 4-5 years for standard queue projects.

Policy Recommendations

- Require utilities to assess Surplus Interconnection Service opportunities in Integrated Resource Plans (IRPs) and include cost-effective projects in Short-Term Action Plans. Develop procurement strategies including self-build, RFPs with Purchase and Sale Agreement structure, and renegotiation of existing offtake agreements.
- Expand SB 425 energy production zone eligibility to include Surplus Interconnection Service projects for streamlined siting and permitting. SIS projects at existing sites have inherently lower land-use impacts and deserve expedited approval pathways.
- Incorporate SIS into IEDC site selection and incentive programs, and OED state energy planning initiatives. Highlight available grid capacity at existing interconnection points to attract data centers and industrial investment seeking speed-to-power.

Source: Miles Farmer et al., Indiana's Surplus Interconnection Opportunity, 2025

Thermal Plants constitute 80% of Indiana’s installed capacity

Capacity Breakdown

Thermal capacity dominates at 79% of total installed capacity, with coal being the largest single source at 51% of total capacity.

Total Capacity: 27,385 MW

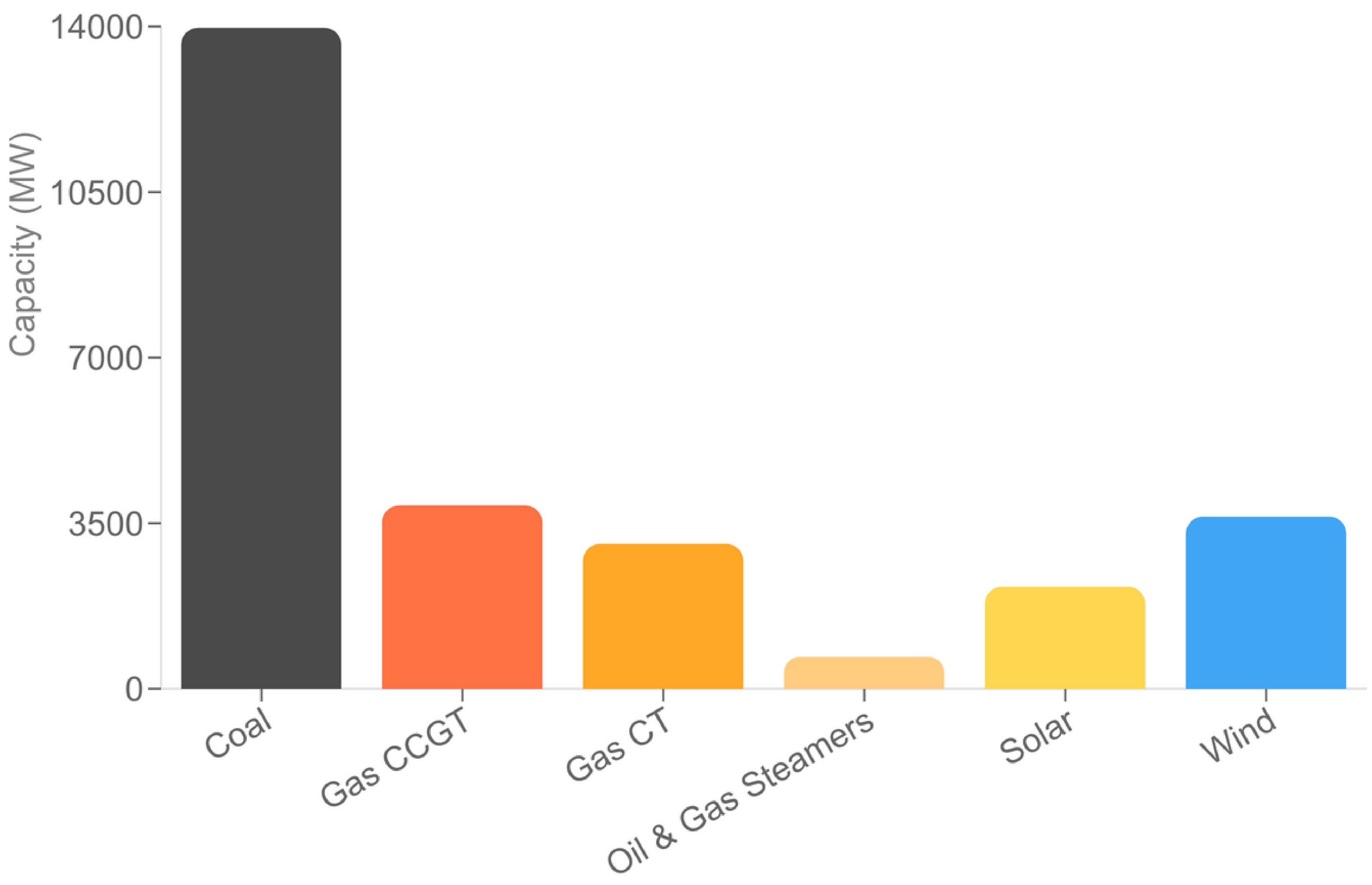
Thermal: 21,587 MW

- Coal: 13,973 MW (65%)
- Gas CCGT: 3,875 MW (18%)
- Gas CT: 3,065 MW (14%)
- Oil & Gas Steamers: 674 MW (3%)

Renewable: 5,798 MW

- Wind: 3,641 MW (63%)
- Solar: 2,157 MW (37%)

Installed Capacity by Technology (MW)



Thermal technologies account for 79% of installed capacity, while renewables represent 21%

Indiana has 25 GW capacity stuck in interconnection queues

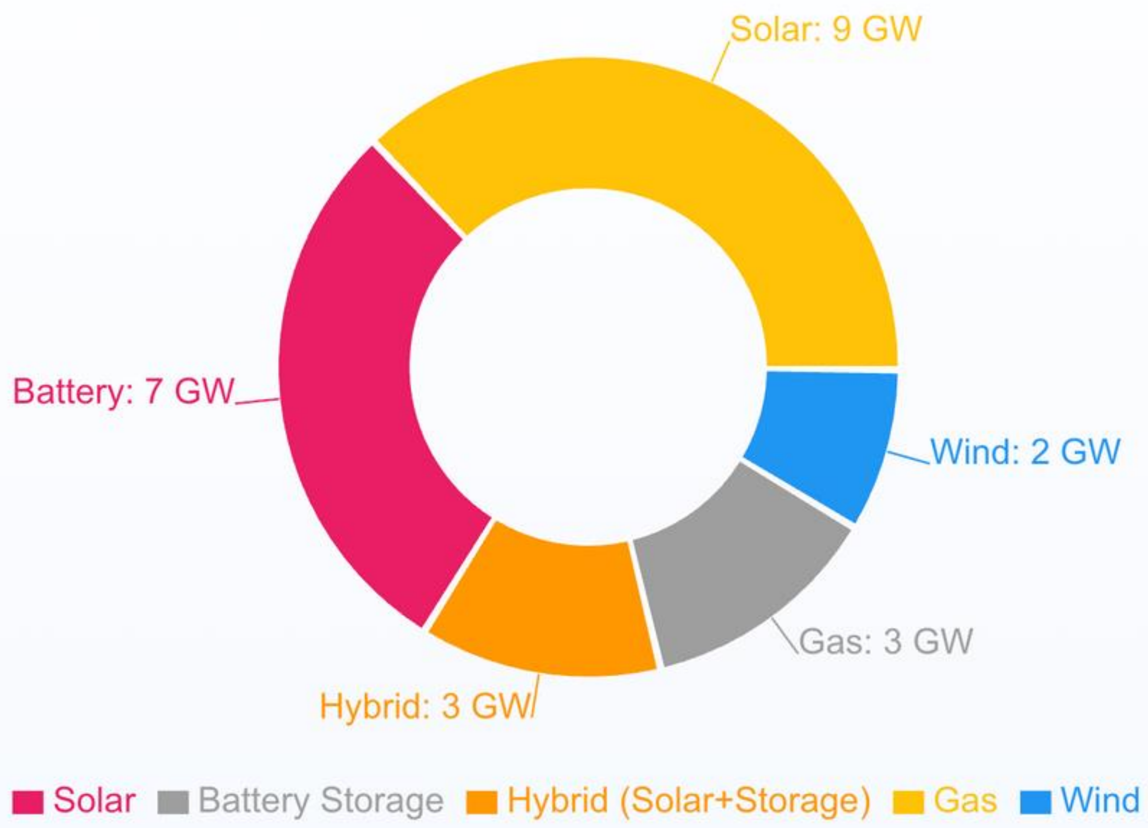
24 GW
Total active capacity in Indiana queue

87%
Renewable & storage share of queue

123
Active projects in queue

31%
Battery storage share of queue

Technology Distribution (Active Projects)



Total Active Queue Capacity: **24 GW**

Clean Energy Dominates Indiana's Queue

- **Solar capacity:** 9 GW (37.5%) of standalone solar across 49 projects, reflecting Indiana's growing solar development momentum.
- **Battery storage:** 7 GW (29.2%) across 44 projects, the highest project count indicating strong interest in grid flexibility solutions.
- **Hybrid projects:** 3 GW (12.5%) of solar+storage hybrid systems across 16 projects, providing both generation and storage capabilities.
- **Gas projects:** 3 GW (12.5%) represents traditional thermal generation, only 6 projects indicating shift toward renewables.
- **Wind projects:** 2 GW (8.3%) across 8 projects, relatively small compared to solar reflecting Indiana's solar resource advantage.
- **Queue status:** 123 active projects totaling 24 GW represents significant pipeline of new generation capacity awaiting interconnection approval.

Source: MISO Generator Interconnection Queue - December 2024 (Active Projects Only)

Capacity Market Prices Increasing Signaling Capacity Crunch

$ Capacity Market Dynamics

Indiana's electricity territory is predominantly served by MISO, with only the northeastern region operated by PJM. Both RTOs are experiencing significant capacity market price increases, signaling tightening supply-demand balances and growing reliability challenges across the state.

MISO (LRZ 6 / North-Central)

- 2023/24: $9.25/MW-day (baseline)
- 2024/25: $19.96/MW-day (+116%)
- 2025/26: $217/MW-day (annualized)

23.5× increase over 2 years

PJM (Rest of RTO)

- 2024/25: $28.92/MW-day
- 2025/26: $269.92/MW-day (+833%)
- 2026/27: $329.17/MW-day (at cap)

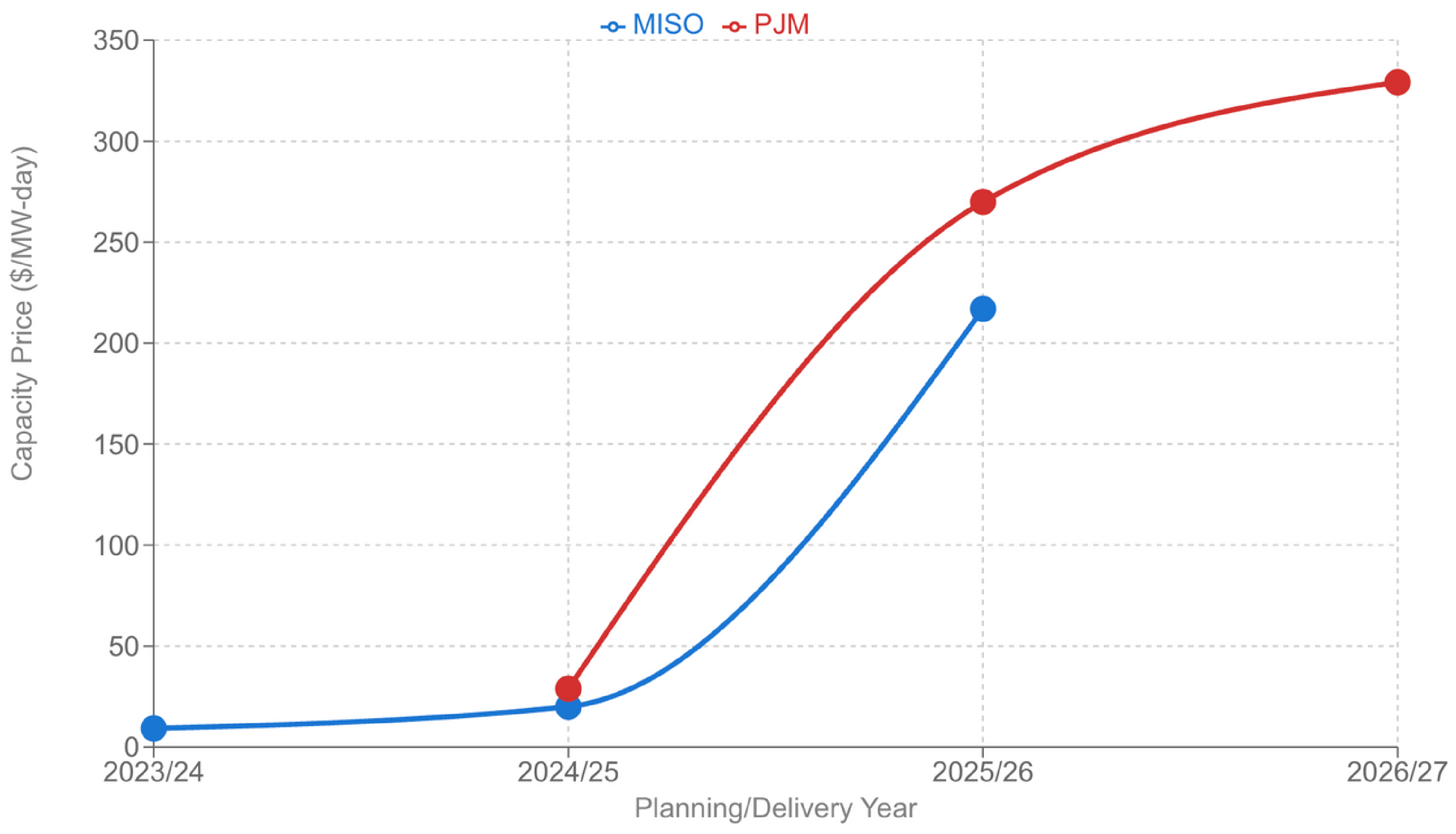
11.4× increase, hitting price cap

Peak Season Extremes

- MISO Summer 2025/26: $666.50/MW-day
- 7.3× higher than winter prices

These price levels reflect market signals for new capacity investment opportunities

Annualized Capacity Market Prices ($/MW-day)



Thermal plants are underutilizing their interconnection capacity

Interconnection Underutilization

Thermal plants like peaker gas plants and oil/gas steamers operate at extremely low capacity factors. In Indiana, peaker gas plants operate at 12% capacity factor and oil/gas steamers operate at 41% capacity factor, meaning for 88% of the time and 59% of the time, respectively, the interconnection capacity sits idle.

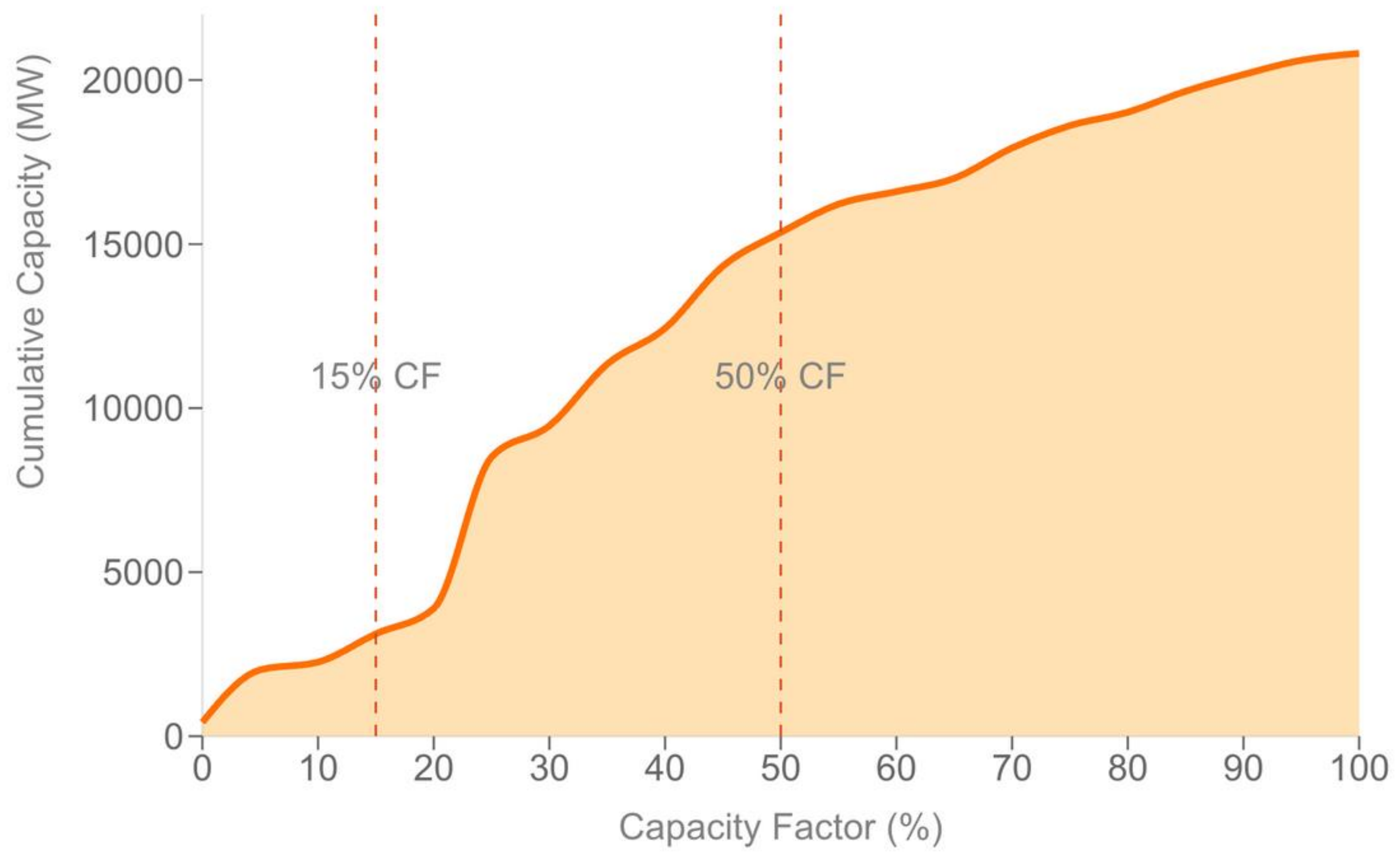
2024 Thermal Capacity Factors

- Gas CCGT: 73%
- Oil/Gas Steam: 51%
- Coal: 31%
- Gas CT: 12%

Underutilized Interconnection Capacity

- **3.1GW** operates at <15% capacity factor
- 43.8% of capacity operates below 30% CF

Cumulative Thermal Capacity by Capacity Factor



Steep rise shows majority of capacity concentrated in low-utilization plants

Marginal Cost of Thermal Generation

$ Thermal Generation Economics

Indiana's 21.6 GW installed thermal capacity shows clear variable cost stratification by technology. Coal (14.0 GW) and Gas CCGT (3.9 GW) dominate the low-cost range below $40/MWh, while Gas CT peakers (3.1 GW) operate in the $45-70/MWh range, and oil & gas steamers (674 MW) cluster around $45-90/MWh. This cost structure determines dispatch order—higher variable cost units remain idle unless market prices justify their operation.

Capacity-Weighted Average Variable Costs

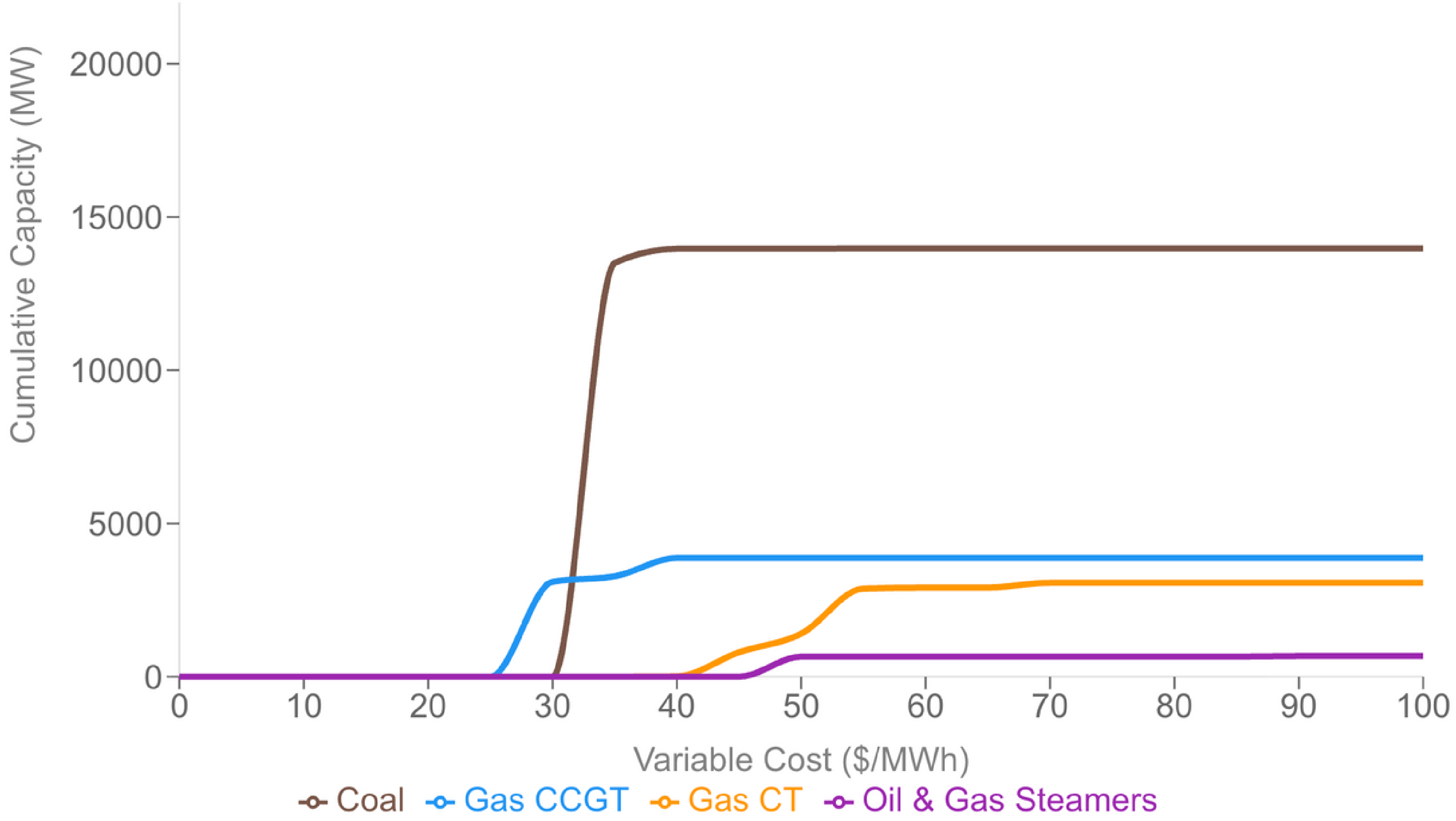
Variable costs include fuel and variable O&M—the marginal cost to generate each MWh

- Coal: $32.20/MWh (14.0 GW installed)
- Gas CCGT: $29.97/MWh (3.9 GW installed)
- Gas CT: $49.37/MWh (3.1 GW installed)
- Oil & Gas Steamers: $47.95/MWh (0.7 GW installed)

Economic Dispatch Impact

- Total Thermal Capacity: 21.6 GW
- Weighted Average VC: $40.29/MWh
- 14.4% of capacity competes economically at <$30/MWh

Cumulative Thermal Capacity by Technology & Variable Cost



Coal and Gas CCGT dominate low-cost ranges while peakers (Gas CT) cluster in $50-70/MWh range

Renewables are underutilizing their interconnection capacity

Two Dimensions of Underutilization

Indiana renewables underutilizing interconnection capacity from both firm capacity and energy perspectives

RE Energy Production Gap

Solar operates at 13.2% and wind at 28.1% capacity factor, leaving 86.8% and 71.9% of interconnection capacity idle respectively

ELCC Value Disparity

MISO assigns only 30% ELCC for solar and 15.3% for wind, compared to 89% for nuclear and 85.5% for gas combined cycle

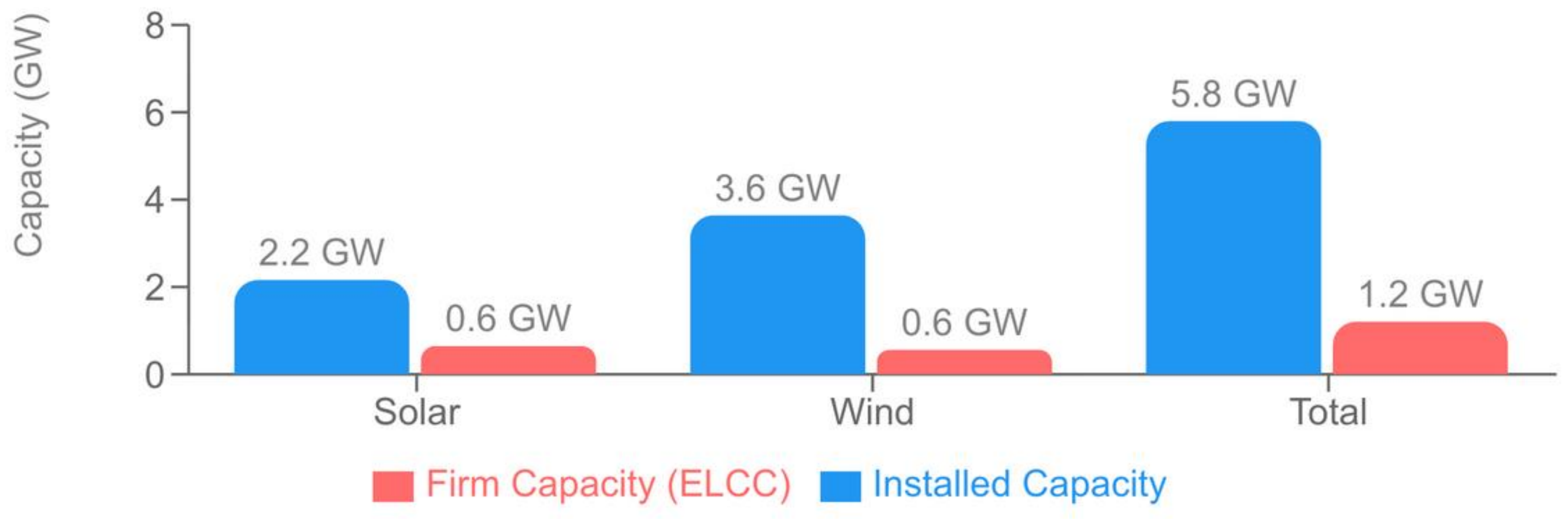
Firm Capacity Shortfall

5.8 GW of installed renewable capacity provides only 1.2 GW of firm capacity — just 21% of nameplate capacity

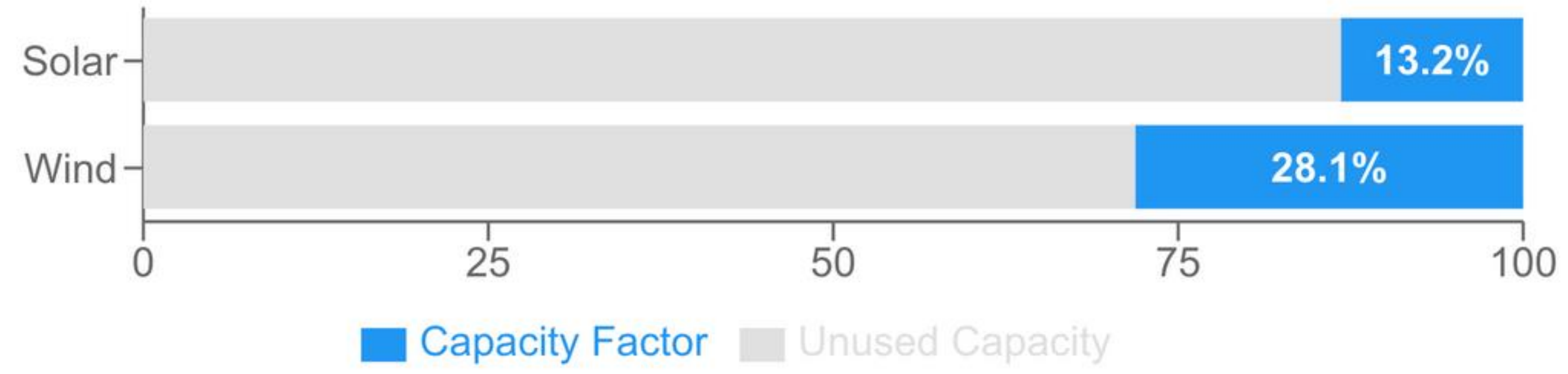
Storage as the Solution

4-hour storage receives 81% ELCC — significantly higher than standalone renewables

Firm Capacity vs. Installed Capacity (GW)



Renewable Energy Capacity Factors (%)



Project Pipeline in Indiana : Even share of RE and Gas

Project Pipeline

Pipeline Summary:

- Total Projects: 76
- Total Capacity: 13,619 MW
- 50% increase from current capacity

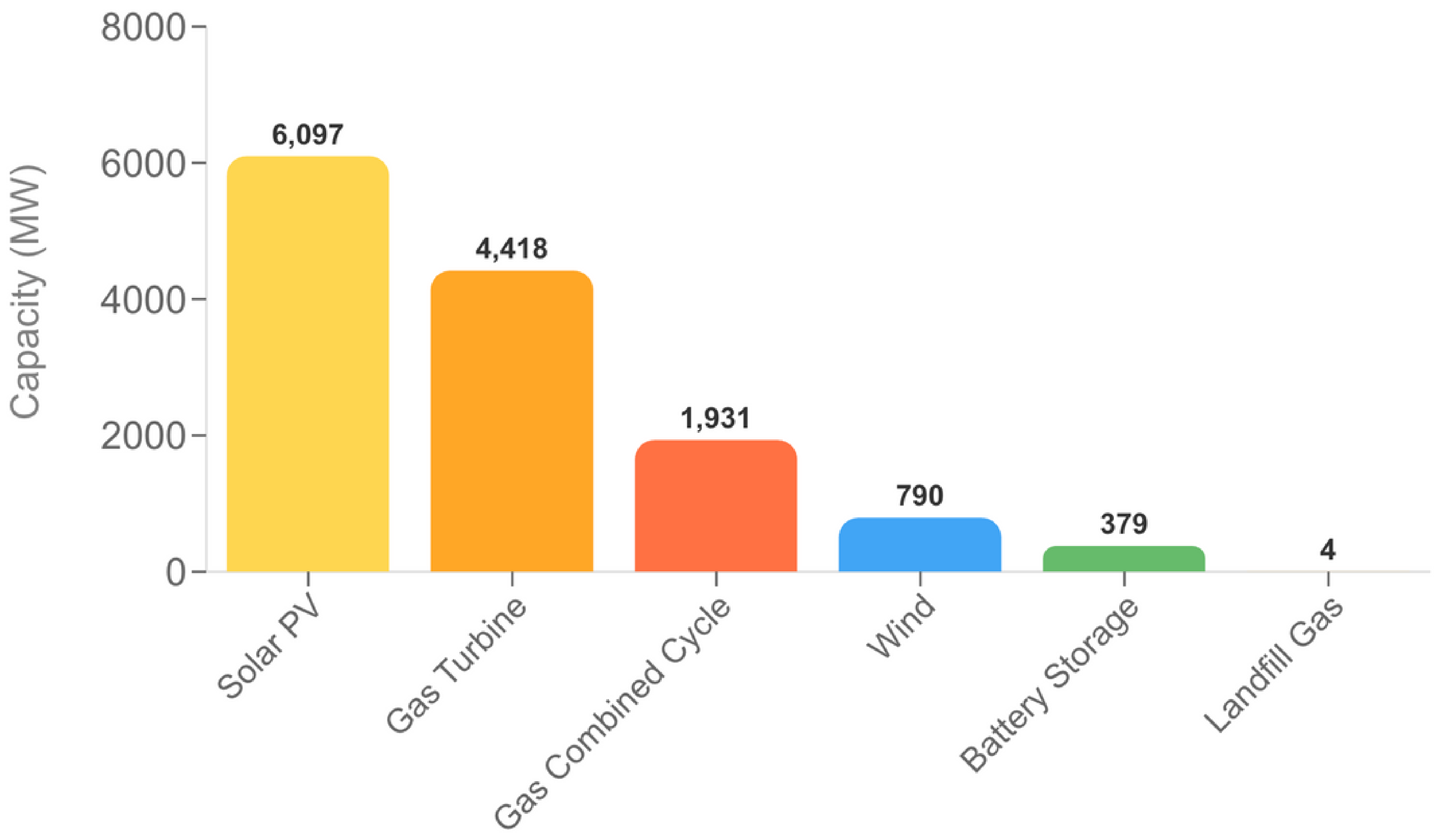
Capacity by Category:

Renewables: 7,266 MW (53%)
Solar, wind, and hybrid projects

Storage: 379 MW (3%)
Battery energy storage systems

Natural Gas: 6,349 MW (47%)
CCGT and combustion turbines

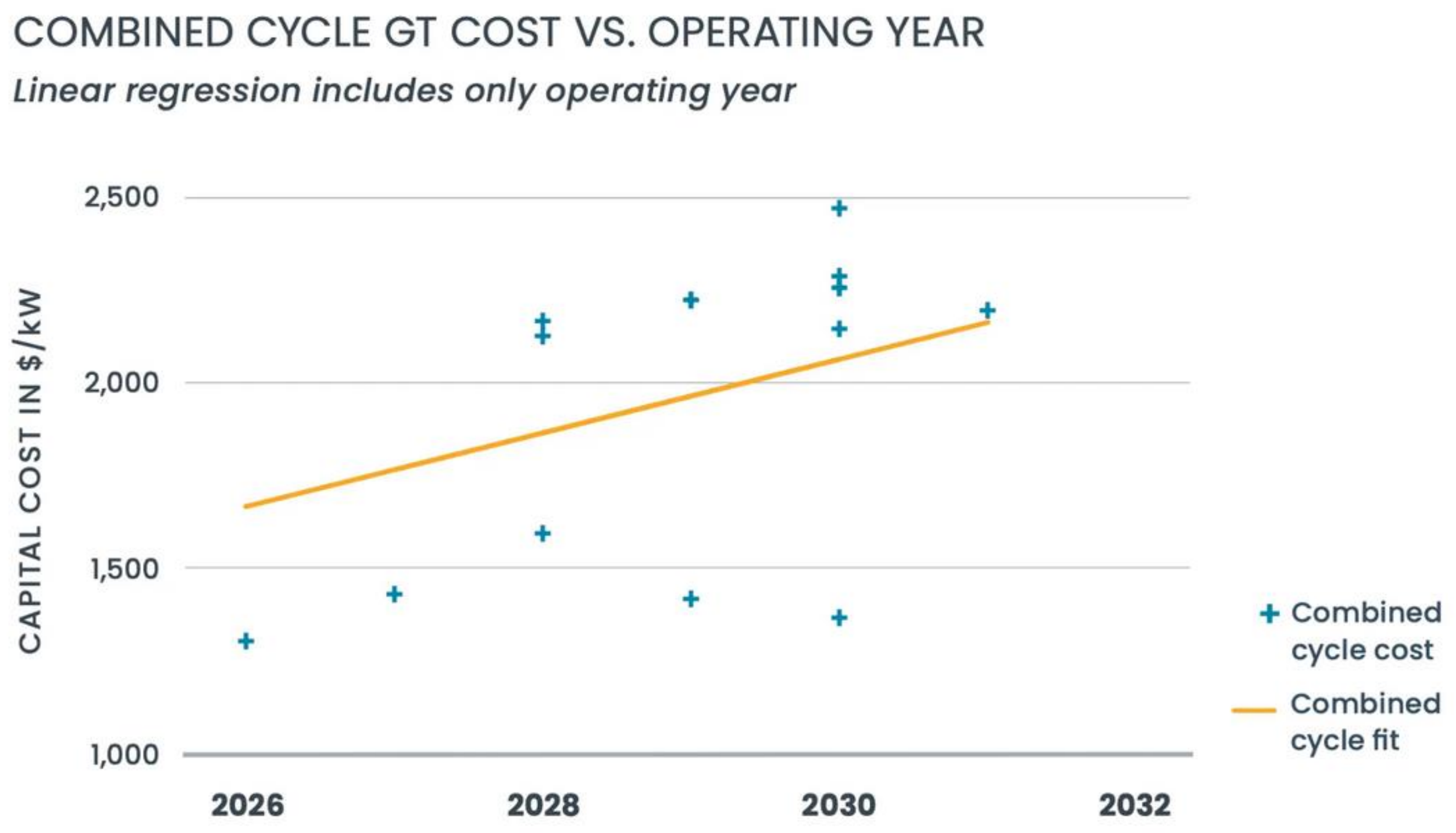
Upcoming Capacity by Technology Type (MW)



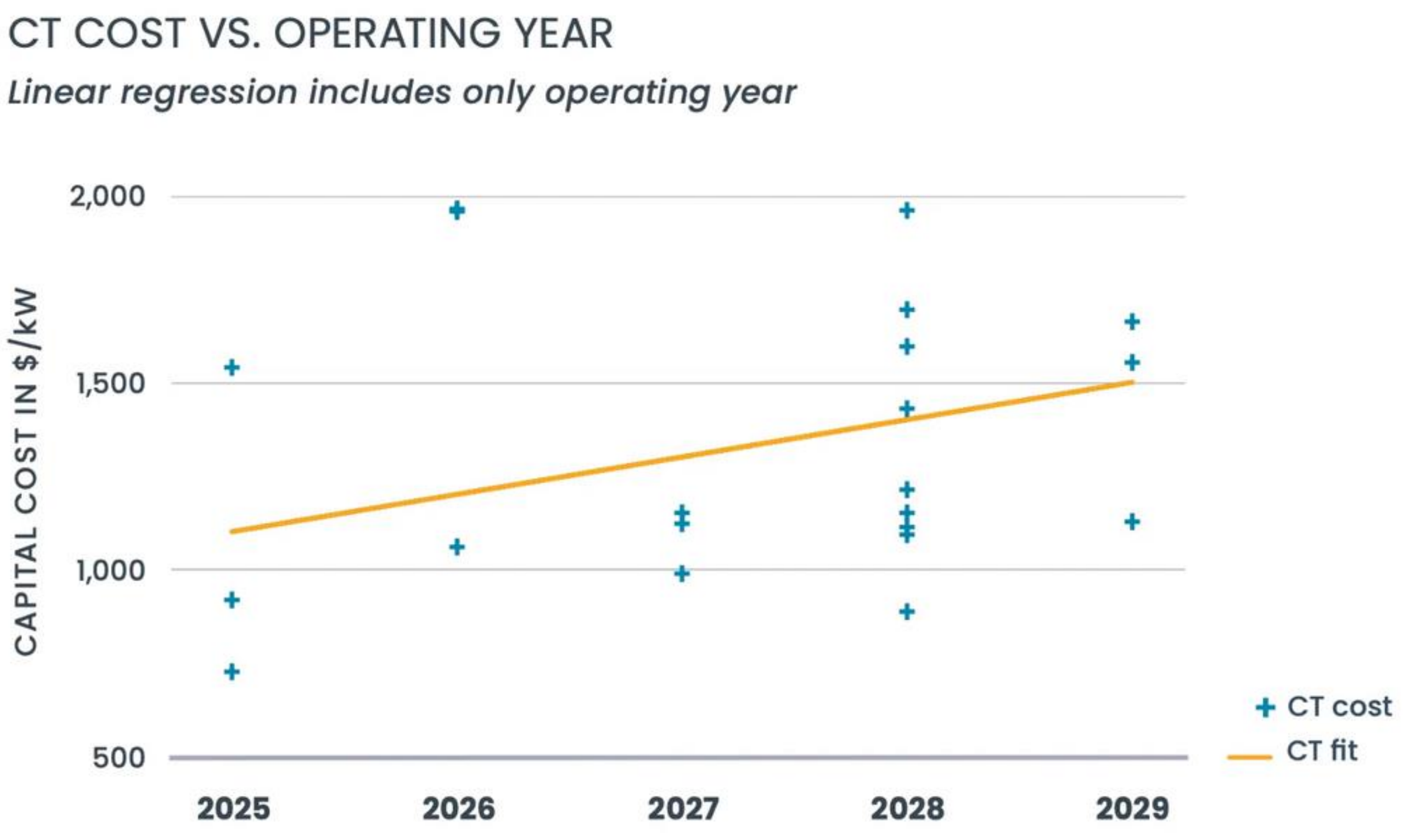
Total pipeline represents 50% of Indiana's existing capacity

Gas Capital Costs and Timelines have increased significantly

Combined Cycle (CCGT) Capital Costs



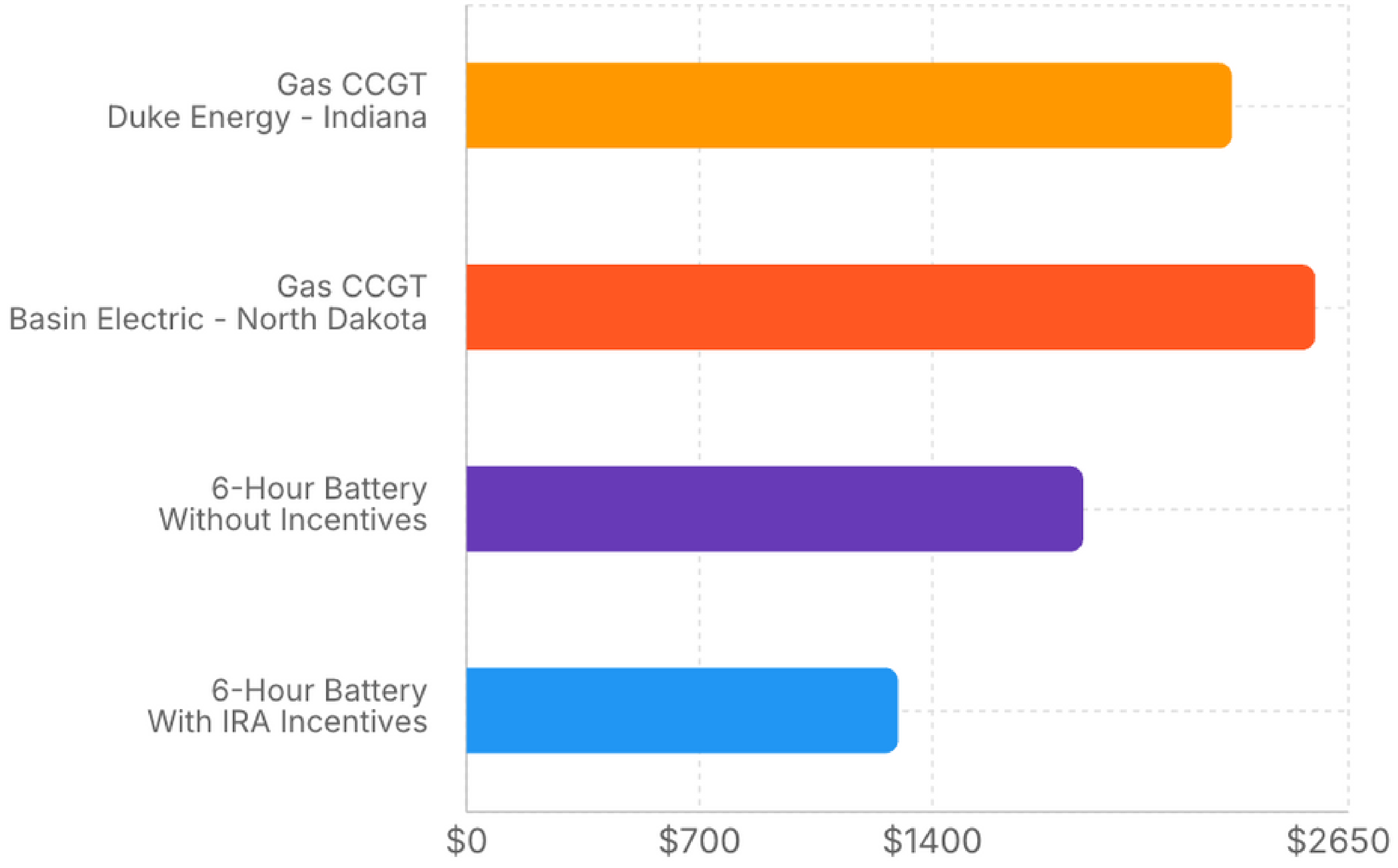
Simple Cycle (CT) Capital Costs



Storage capital costs are cheaper than gas

Capital Cost Comparison ($/kW)

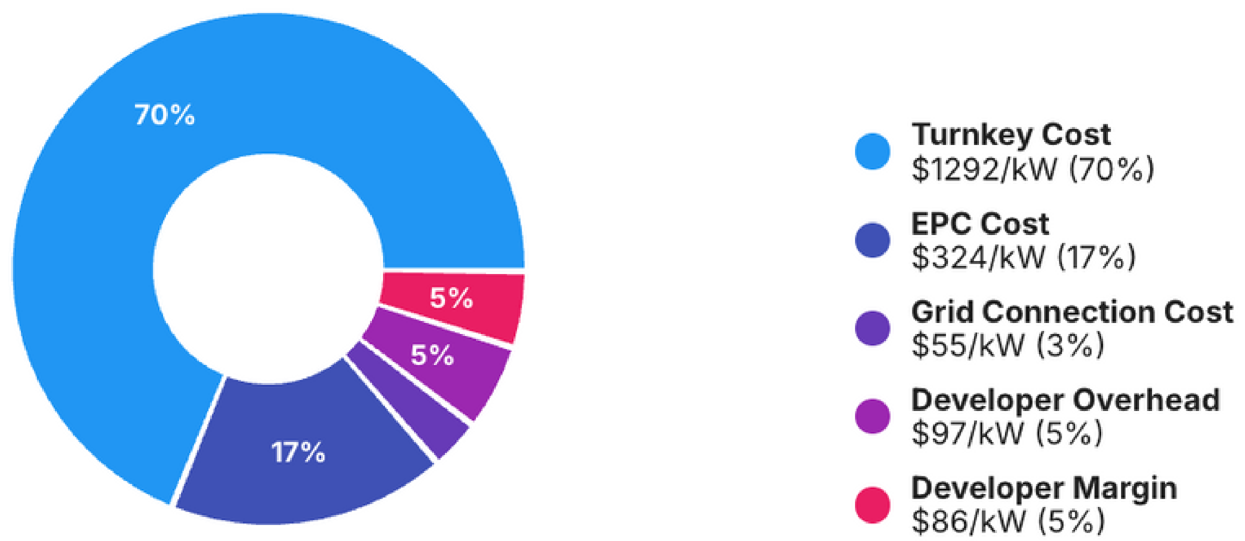
6H Battery with IRA: $1297/kW



Source: BNEF 2025 and PUC Filings

6H Battery Cost Components (wo Incentives)

Total: $1853/kW



Source: BNEF 2025

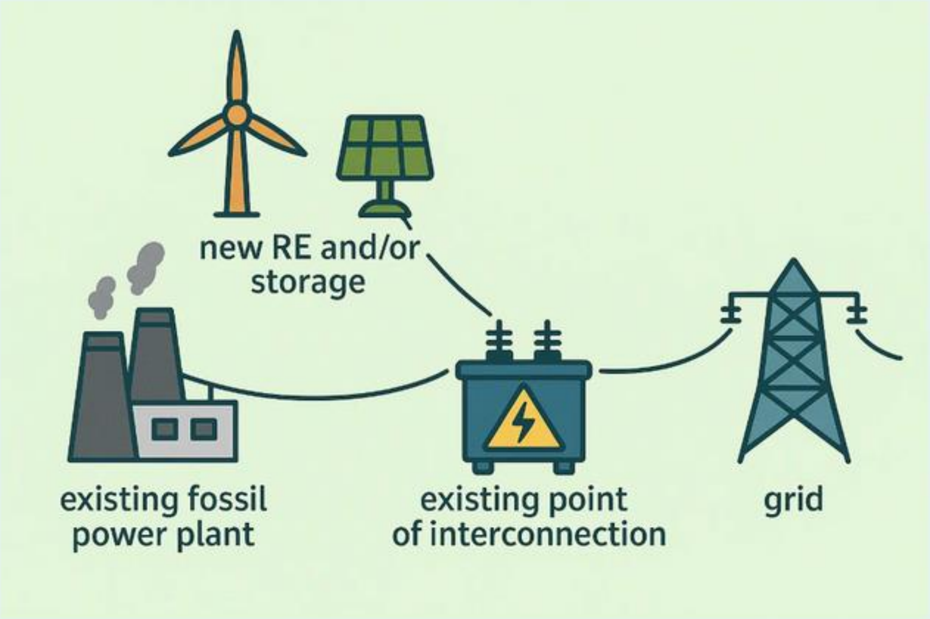
Battery Storage Outperforms Gas Plants

- Gas costs rising ($2,300-2,550/kW)
- Battery costs dropping every year
- Battery supply chain advantages over gas

- 2018: 2,000 cycles (6-year life)
- 2024: 10,000-15,000 cycles (20+ years)

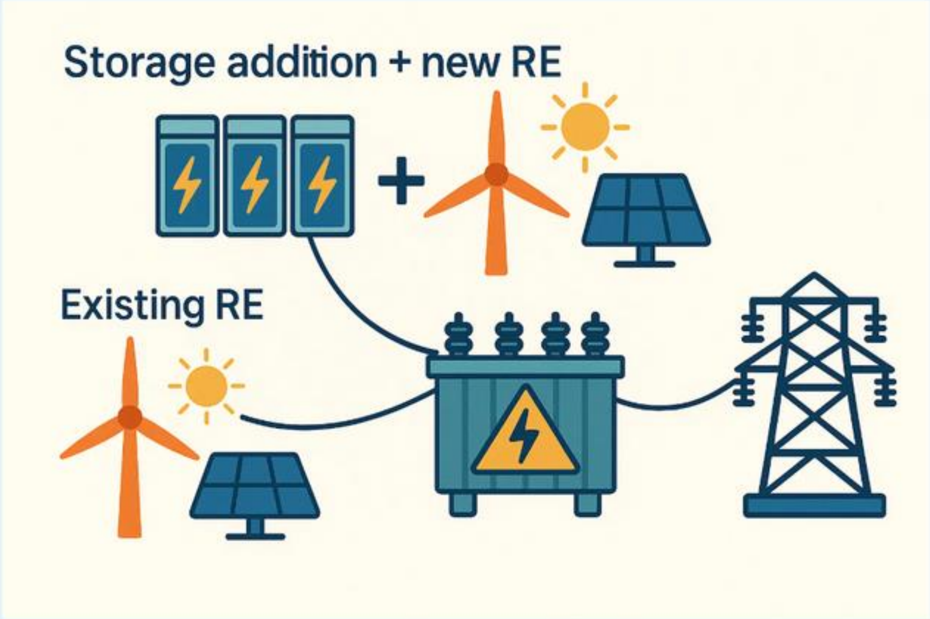
Maximizing efficiency of existing assets: Surplus Interconnection

Renewables at Thermal Plants



- Thermal plants (especially peakers) significantly underutilize their interconnection capacity
- Cheaper solar and wind resources can be added at the underutilized thermal plant
- FERC Order 845 provides regulatory pathway for surplus interconnection
- Bypasses lengthy interconnection queues for faster deployment
- Reduced costs through shared infrastructure and site development
- Creates transition pathway beyond fossil generation assets

Storage at Renewable Plants



- Battery storage can be added at existing renewable plants using surplus interconnection capacity
- Batteries absorb excess generation that would otherwise be curtailed
- Energy dispatched even when renewables aren't generating, smoothing output
- Batteries shift generation from low-value to high-value hours
- With batteries managing generation profiles, more renewables can be added
- FERC Order 845 provides regulatory pathway for surplus interconnection

Surplus Interconnection Projects

🏭 Thermal

Crete Energy Venture

🏢 Earthrise Energy
📍 Will County, IL - PJM

🏭 Original Capacity	➕ Added Capacity
301MW Gas	**250MW Solar (2 projects)**
Online: Operating	Online: In Development

Source: Earthrise Portfolio

Gibson City

🏢 Earthrise Energy
📍 Ford County, IL - MISO

🏭 Original Capacity	➕ Added Capacity
237MW Gas	**270MW Solar (2 projects)**
Online: Operating	Online: In Development

Source: Earthrise Portfolio

Shelby County

🏢 Earthrise Energy
📍 Shelby County, IL - MISO

🏭 Original Capacity	➕ Added Capacity
352MW Gas	**360MW Solar (2 projects)**
Online: Operating	Online: In Development

Source: Earthrise Portfolio

☀️ RE

Polaris Solar

🏢 DTE Energy
📍 Michigan - MISO

🌬️ Original Capacity	➕ Added Capacity
168MW Wind	**100MW Solar**
Online: Operating	Online: 2025

Source: DTE Solar

Pine River Solar

🏢 DTE Energy
📍 Michigan - MISO

🌬️ Original Capacity	➕ Added Capacity
161.4MW Wind	**80MW Solar**
Online: Operating	Online: April 2025

Source: DTE Announcement

Scott Solar + Storage

🏢 Dominion Energy + RES
📍 Powhatan County, VA

🔆 Original Capacity	➕ Added Capacity
12MW Solar	**12MW/48MWh Storage**
Online: 2019	Online: May 2022

Source: Scott Solar

Maximizing efficiency of existing assets: Surplus Interconnection

Resource Assessment

- Assessed RE resource availability within a 6 mile buffer zone around each thermal and renewable plant in Indiana
- Applied 50+ exclusion criteria including physical constraints (land cover, slope, etc.), environmental protections (protected areas, national parks, etc.), and local ordinances
- Estimated local solar and wind potential using suitable area and average solar and wind generation density

Economic Analysis

- Estimated local hourly solar and wind generation near each power plant in Indiana using meteorological data from ERA5
- Estimated local solar and wind LCOE using capaital cost data from BNEF and compared with the variable costs of thermal plants to identify economic crossover points
- Applied relevant IRA incentives including energy community bonus tax credits at power plant locations

Portfolio Optimization

- Estimated optimal mix of soalr, wind and storage which maximizes interconnection use while limiting curtailment below 5%
- For thermal plants, estimated optimal solar and wind capacity that can be added, and for renewable plants, estimated additional solar and wind capacity that can be enabled by adding 6-hour storage.
- Selected high-quality resources with capacity factors above 30% for wind and 20% for solar to ensure economic viability

Load Growth Analysis

- Compared surplus interconnection potential with Indiana's peak and energy load growth projections for 2030
- Estimated interconnection utilization increase for renewable plants through battery storage and renewable additions
- Quantified avoided interconnection and network upgrade costs based on historical cost data from Indiana

Case Study: Indiana Crossroads Wind Farm II

Facility Information

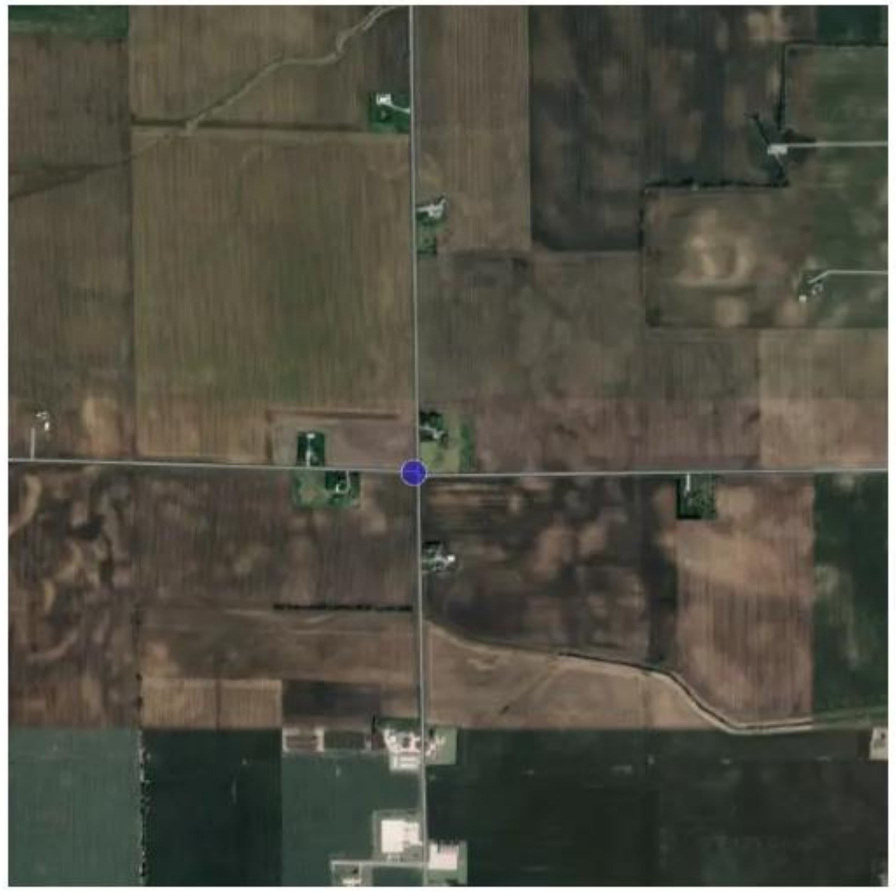
LOCATION
White, Indiana

INSTALLED CAPACITY
201.6 MW

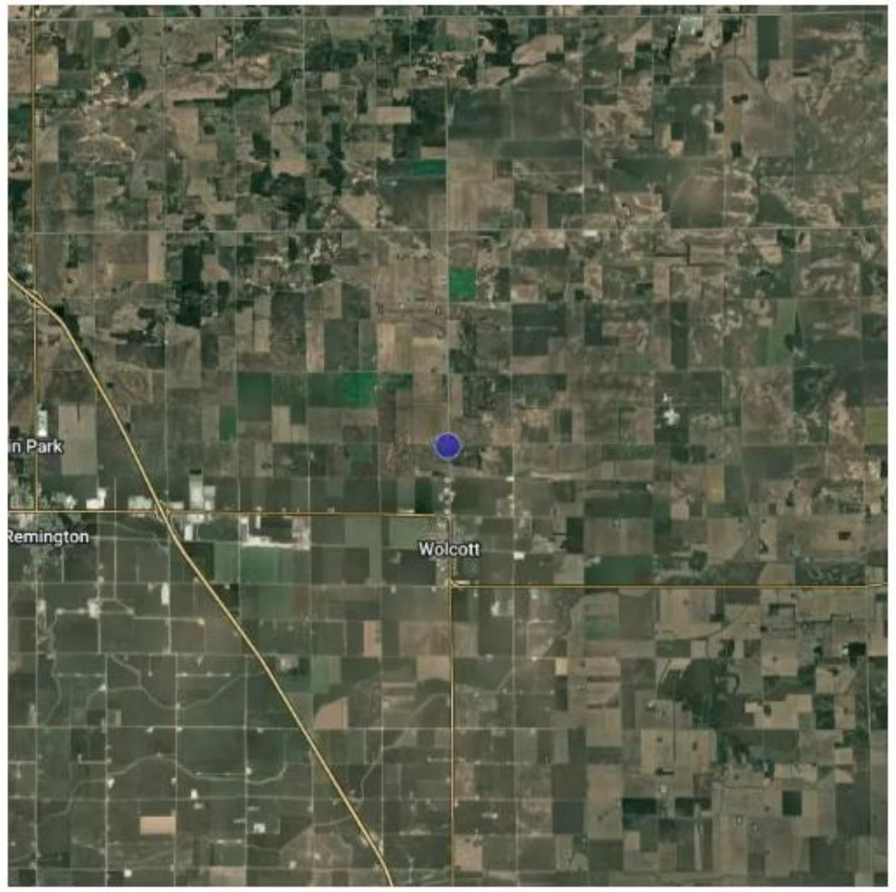
OWNER
EDP Renewables

COD
2024

Satellite View

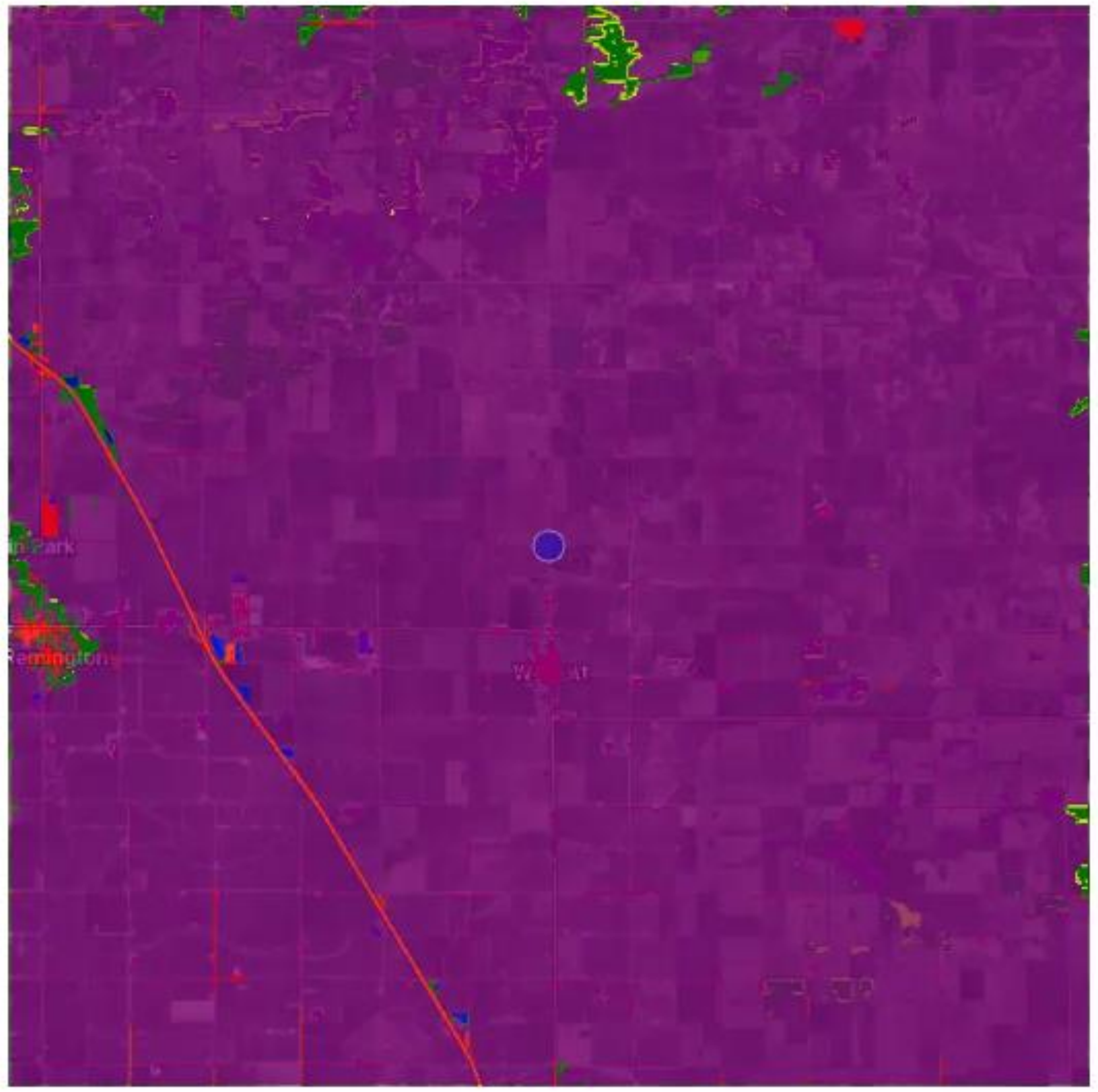


6x6-Mile Buffer Zone



Indiana Crossroads Wind Farm II: Local Solar and Wind Potential

Classification Map



Sensitive Habitat · Water/Ice Covered · Urban Area · Unfavorable Topography · Buildable · Other

RE Potential within 6 miles of Indiana Crossroads Wind Farm II

- Assessed RE resource availability within a 6x6 mile buffer zone around the Indiana Crossroads Wind Farm II project
- Applied 50+ exclusion criteria including physical constraints, environmental protections, and local ordinances
- Estimated local solar and wind potential using suitable area and generation density analysis

92% of area within this 6 mile square is buildable

23,663.6 MW Solar Potential

2,839.6 MW Wind Potential

1 TW of solar and wind potential near existing interconnection points

Thermal Plants

115
Facilities

21.6
GW Capacity

Plants in Urban Areas

11
Facilities
10% of Total

1,456
MW Capacity
7% of Total

RE Potential Near Thermal Plants

730.8
GW
Solar Potential

87.7
GW
Wind Potential

Total Potential: 818.5 GW

Renewable Plants

37
Facilities

5.8
GW Capacity

Plants in Urban Areas

0
Facilities
0% of Total

0
MW Capacity
0% of Total

Additional RE Potential Near Renewable Plants

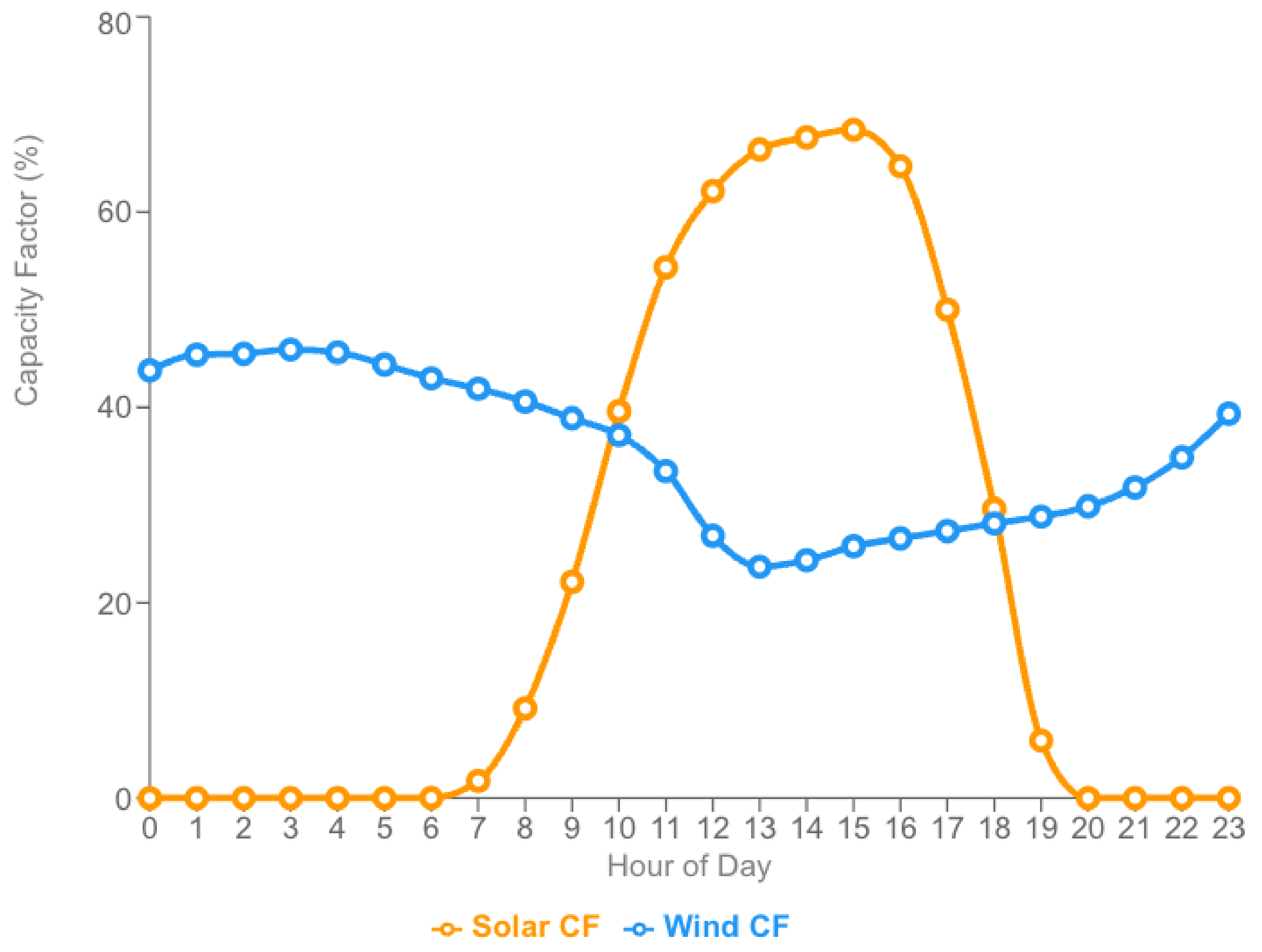
184.3
GW
Solar Potential

22.1
GW
Wind Potential

Total Potential: 206.4 GW

Indiana Crossroads Wind Farm II: Local Solar and Wind LCOE

Diurnal Capacity Factors at Indiana Crossroads Wind Farm II



Hourly average capacity factors showing solar peaks during midday and wind's more consistent generation pattern

Capacity Factors

Solar (AC)	Wind
25.1%	41.8%

Levelized Cost of Energy

Solar

$20.9/MWh 2025 (with IRA) → **$28.2/MWh** 2030 (without IRA)

Wind

$22.9/MWh 2025 (with IRA) → **$35.2/MWh** 2030 (without IRA)

By 2030 most Thermal Capacity Expensive Compared to Local RE LCOE

Economic Crossover

Crossover occurs when renewable LCOE becomes lower than thermal plant variable costs. At this point, it becomes cheaper to build new renewables than to operate existing thermal plants.

☀️ Solar Crossover

GW of thermal capacity with variable costs higher than local solar LCOE

2024	2030
With IRA: **21.6 GW**	With IRA: **21.6 GW**
Without: **3.9 GW**	Without: **18.5 GW**

Wind Crossover

GW of thermal capacity with variable costs higher than local wind LCOE

2024	2030
With IRA: **20.4 GW**	With IRA: **21.6 GW**
Without: **4.8 GW**	Without: **5.1 GW**

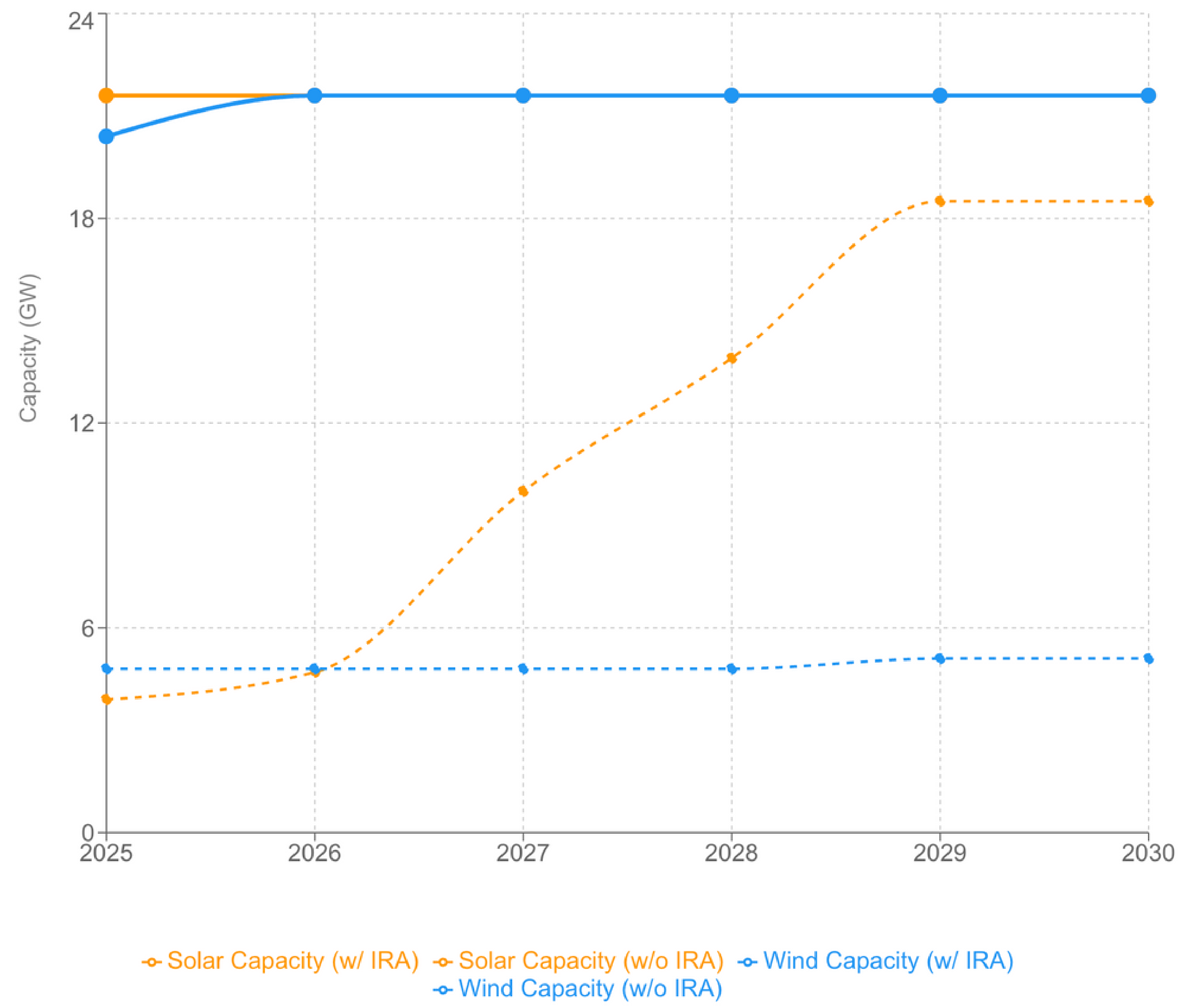
Impact of Losing IRA Tax Credits

With IRA tax credits being repealed under new 2025 legislation, renewable LCOE will increase significantly.

Currently, IRA tax credits enable solar to compete with 21.6 GW of thermal capacity (100% of Indiana's thermal fleet), but without credits this drops to just 3.9 GW—a massive 17.7 GW reduction.

Wind shows similar dramatic impact: competing with 20.4 GW with credits versus only 4.8 GW without, a difference of 15.6 GW.

Renewable Capacity Below Thermal Variable Costs



Solid lines: With IRA incentives I Dashed lines: Without IRA incentives

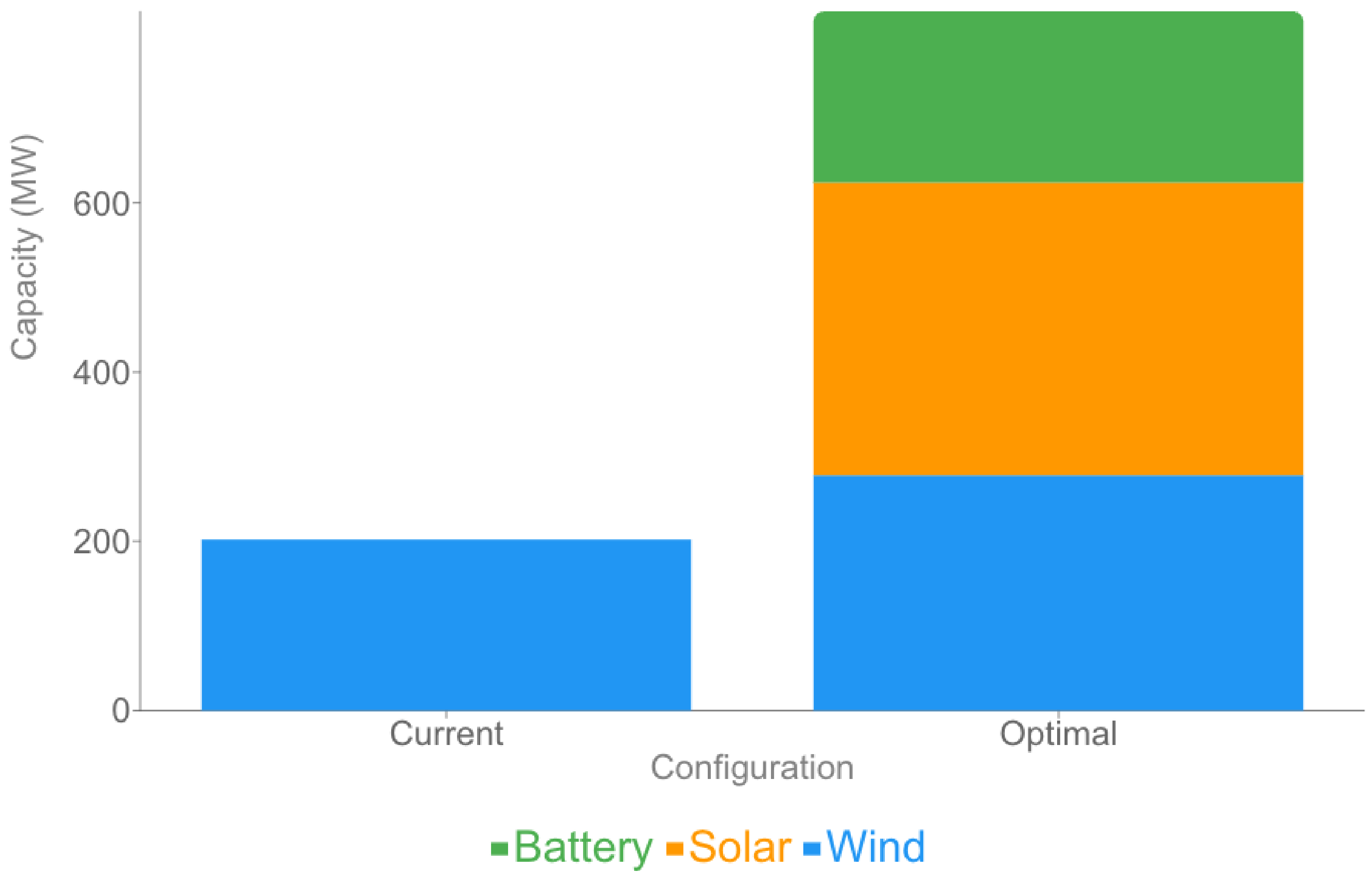
532 MW of Solar and 169 MW Wind enabled by 302 MW of 6H storage

Optimal Capacity Configuration

3.1x
Capacity Increase

39%
CF Improvement

41.8% → 80.8% Capacity Factor
+689 GWh/year additional energy



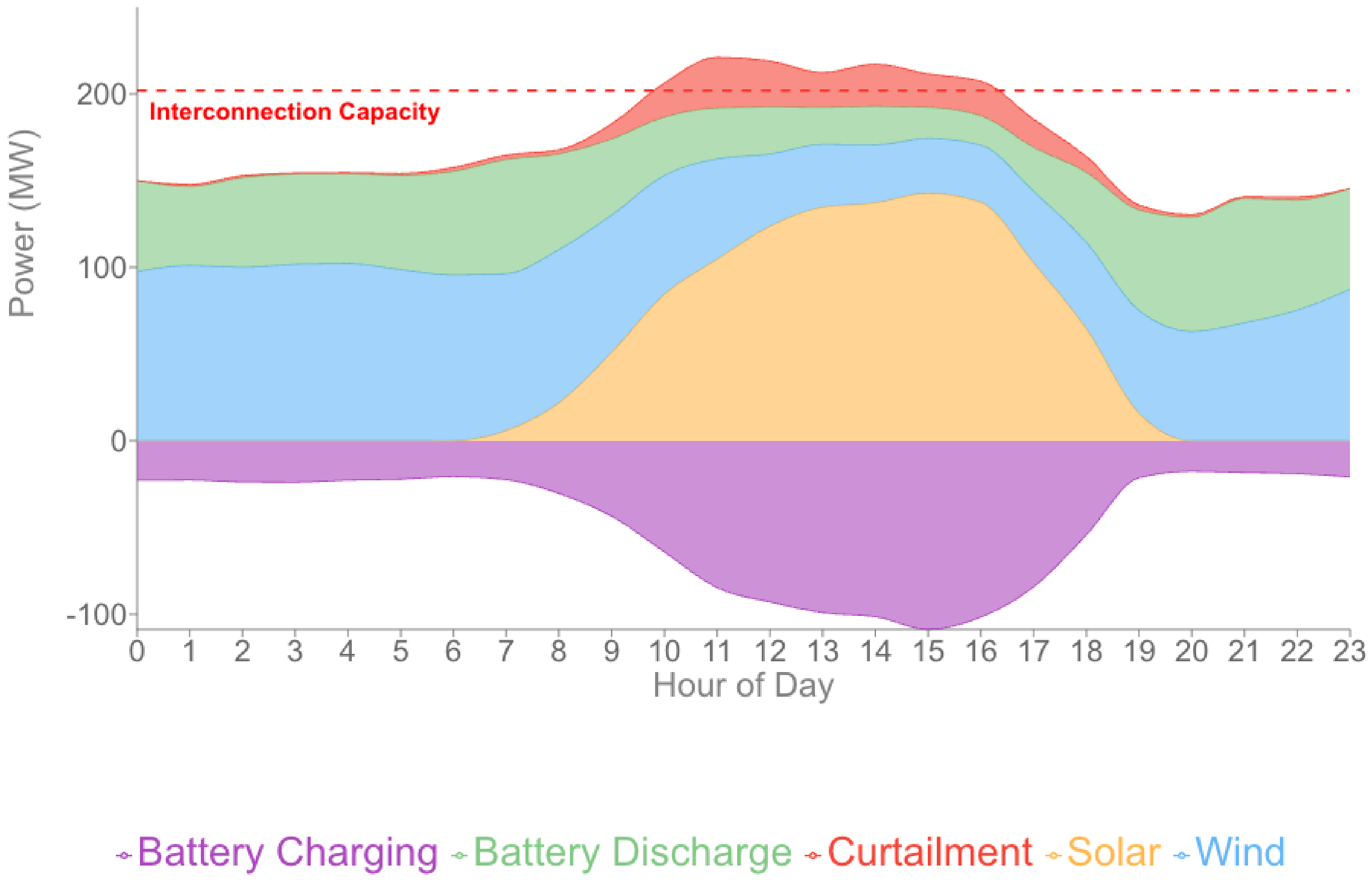
24-Hour Energy Flow Pattern (Annual Average)

System Performance Summary

163
MW Avg Output

6
Hour Battery

5%
Curtailment



21 GW of RE can be added at Indiana thermal plants

RE Integration Potential Results

21 GW of renewable energy capacity can be integrated near existing thermal plants in Indiana by 2030

- Solar integration potential: 20 GW
- Wind integration potential: 1 GW

Sensitivity analysis:

We varied the cost of fuel by taking one standard deviation below and above the average fuel prices to test the economics of thermal versus local solar and wind:

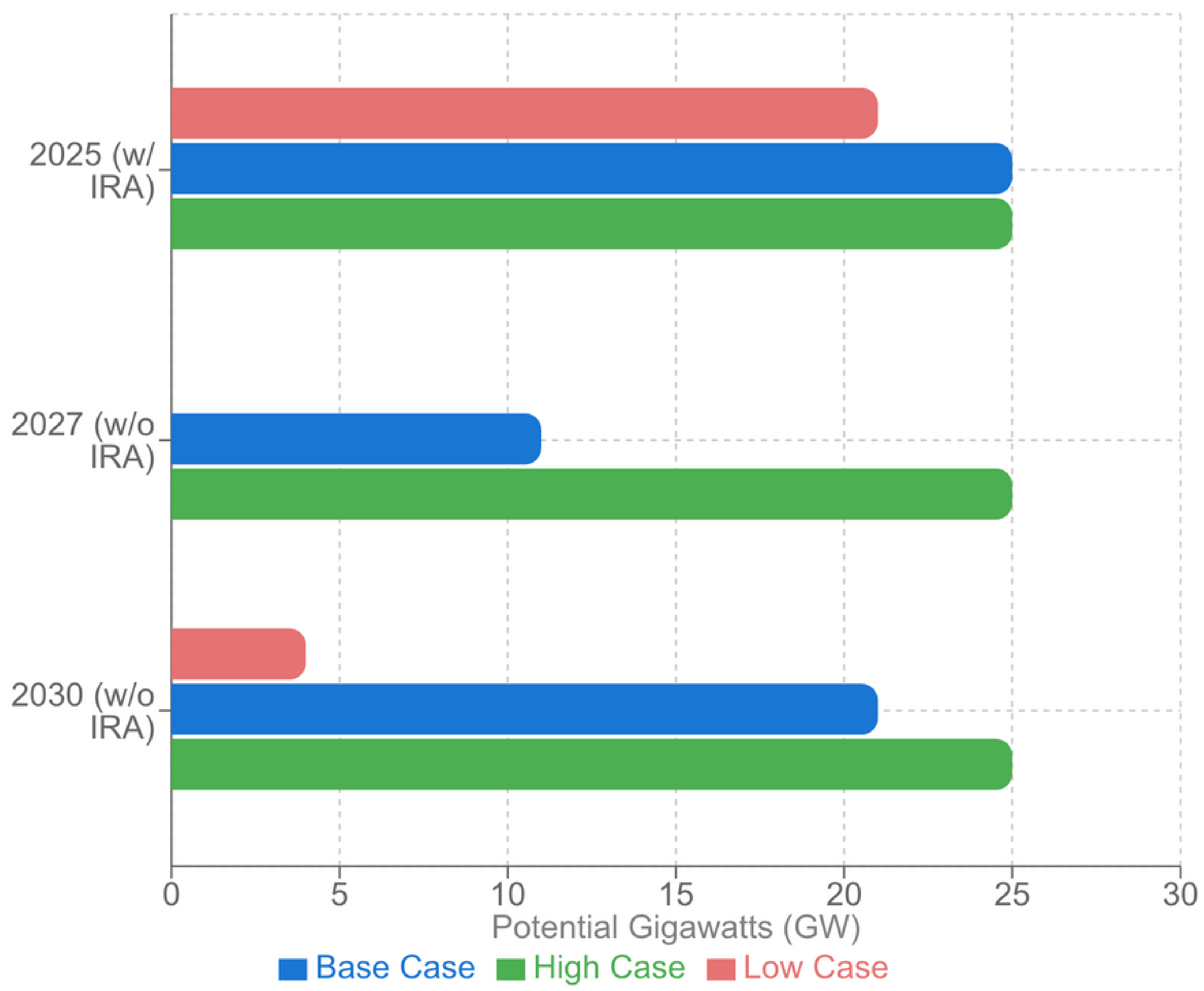
- ○ Low fuel prices (1σ below average): 21 GW (2025) → 4 GW (2030)
- ○ High fuel prices (1σ above average): 25 GW (2025) → 25 GW (2030)

Impact of IRA Tax Credit Removal:

The integration potential starts at 25 GW in 2025 with IRA tax credits. After IRA removal in 2027, potential drops sharply to 11 GW. By 2030, technology cost declines help recover to 21 GW, partially offsetting the 15 GW loss from credit removal.

Total RE Integration Potential by Year

2025: With IRA Tax Credits | 2027 & 2030: Without IRA Tax Credits



Solar only Scenario: 20 GW of Solar can be added at Thermal Plants

Solar-Only Deployment Scenario

We analyzed a solar-only scenario where only solar is installed at existing thermal plants, recognizing that wind development has become increasingly challenging due to permitting and siting constraints.

20 GW of solar can be integrated at existing thermal sites by 2030

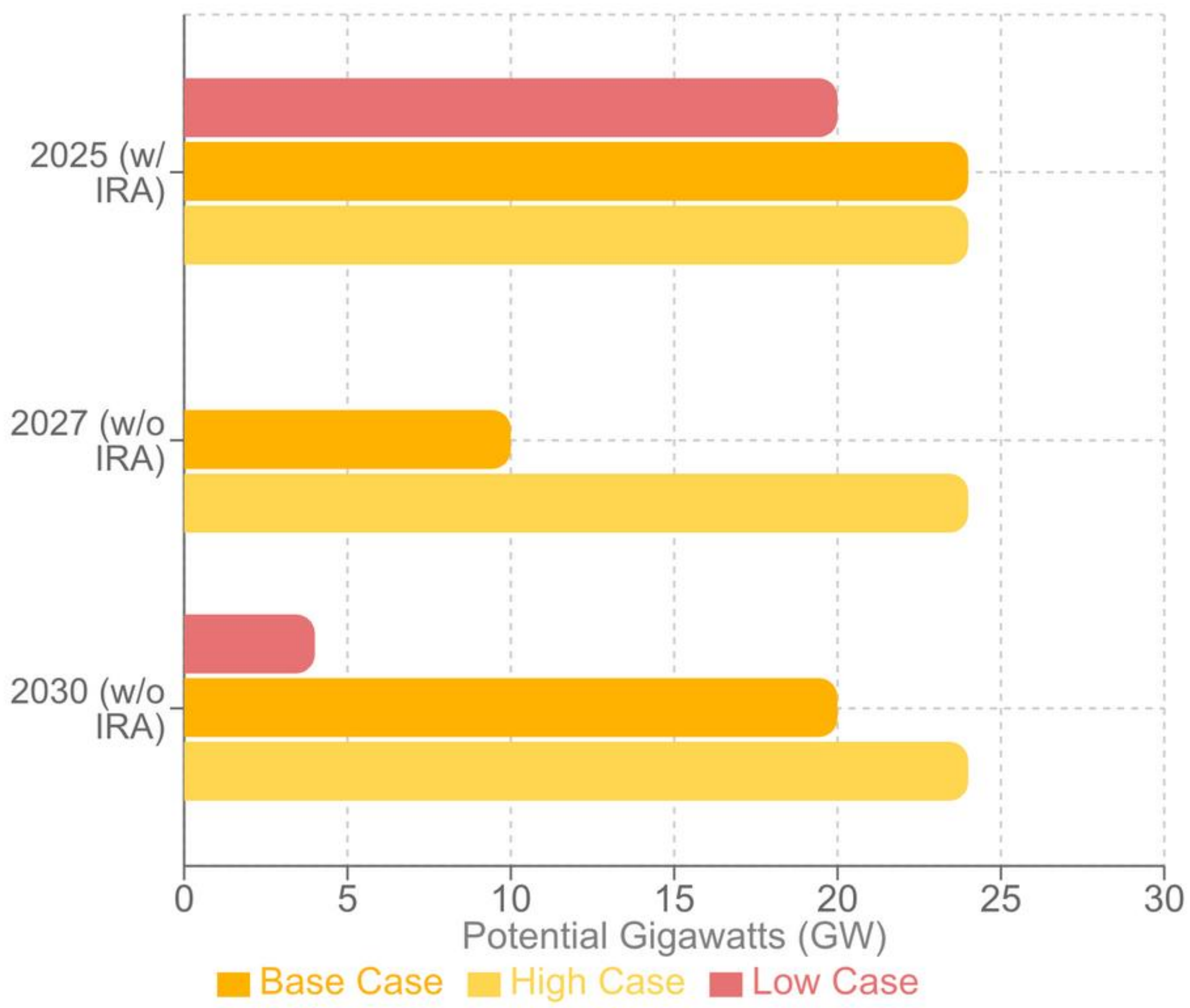
- Base case: **24 GW** (2025) → **20 GW** (2030)
- High fuel prices: **24 GW** (2025) → **24 GW** (2030)
- Low fuel prices: **20 GW** (2025) → **4 GW** (2030)

Impact of IRA Tax Credit Removal:

Solar integration potential starts at 24 GW in 2025 with IRA tax credits. After IRA removal in 2027, potential drops to 10 GW. By 2030, technology cost declines help recover to 20 GW, partially offsetting the 14 GW loss from credit removal.

Solar-Only Integration Potential by Year

2025: With IRA Tax Credits | 2027 & 2030: Without IRA Tax Credits



12 GW of RE enabled by 6 GW of storage can be added at existing RE plants

Enhancing Indiana's Existing Renewable Fleet

We analyzed optimal solar and wind capacity additions at each renewable site when paired with 6-hour battery storage. Battery storage increases interconnection utilization by capturing excess generation during peak production, enabling significantly more renewable capacity without infrastructure upgrades.

The optimization algorithm estimates the solar and wind capacity that maximizes the interconnection utilization while limiting curtailment to below 5%. We analyzed 37 renewable plants (≥10 MW) in Indiana.

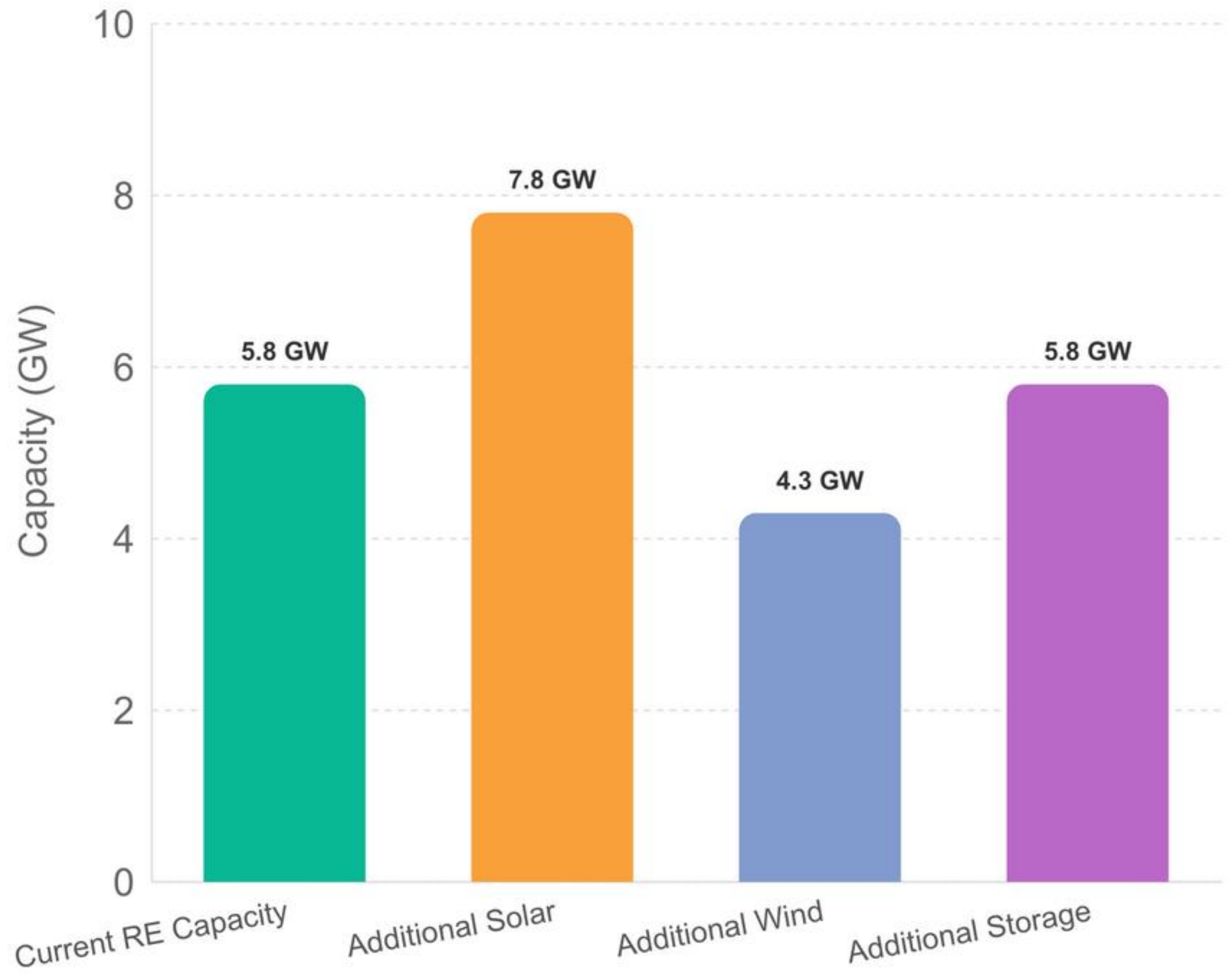
Solar Capacity	Wind Capacity	Storage Capacity
+7.8 GW	**+4.3 GW**	**+5.8 GW**

Current RE Capacity: 5.8 GW

Total After Enhancement: 5.8 + 12.1 = 17.9 GW

209% Overall Increase

Additional Capacity at Existing RE Sites (GW)



Additional capacity potential: 7.8 GW solar + 4.3 GW wind + 5.8 GW storage

MISO ELCC Comparision

MISO ELCC

Effective Load Carrying Capability (ELCC) measures a resource's contribution to meeting peak demand in MISO territory.

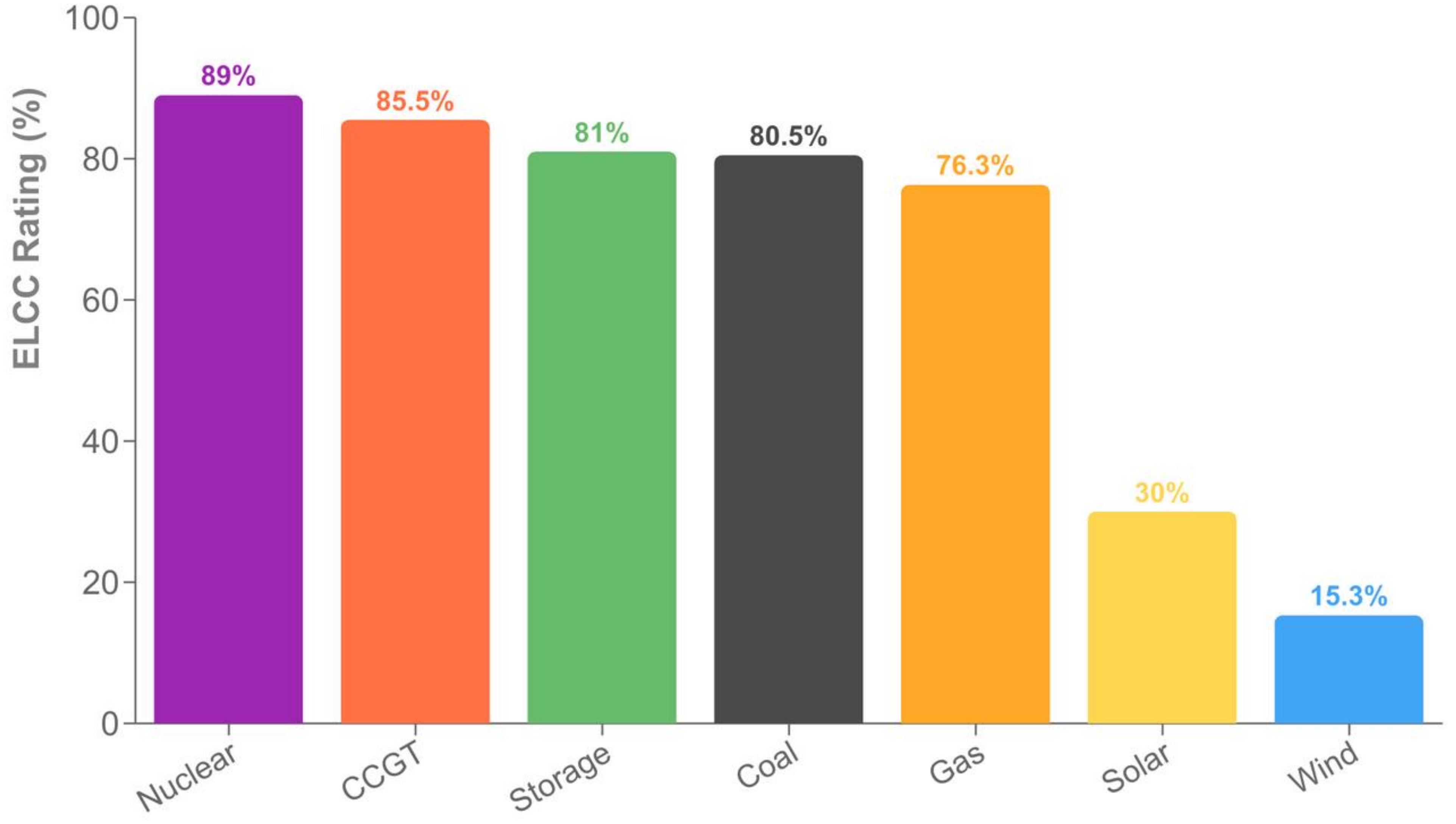
Renewable ELCC by Season

Season	Solar ELCC	Wind ELCC
Summer	45%	8%
Fall	28%	15%
Winter	19%	23%
Spring	28%	15%

- *Solar ELCC highest in summer (45%), lowest in winter (19%)*
- *Wind ELCC peaks in winter (23%) when solar is lowest*

Source: MISO LOLEWG PY 2025-2026 ELCC Values

Annual Average ELCC by Technology Type



PJM 6H Storage ELCC comparable with Gas

PJM ELCC Values

Effective Load Carrying Capability measures a resource's contribution to meeting peak demand. Higher ELCC means more reliable capacity during critical grid hours.

PJM's Methodology: Uses probabilistic analysis to assess resource performance during system stress, considering:

- Output during peak demand periods
- Weather-correlated performance
- Marginal value as more units are added

ELCC by Technology

Solar's Low ELCC (11%): Requires ~9 MW of solar to provide 1 MW of reliable capacity

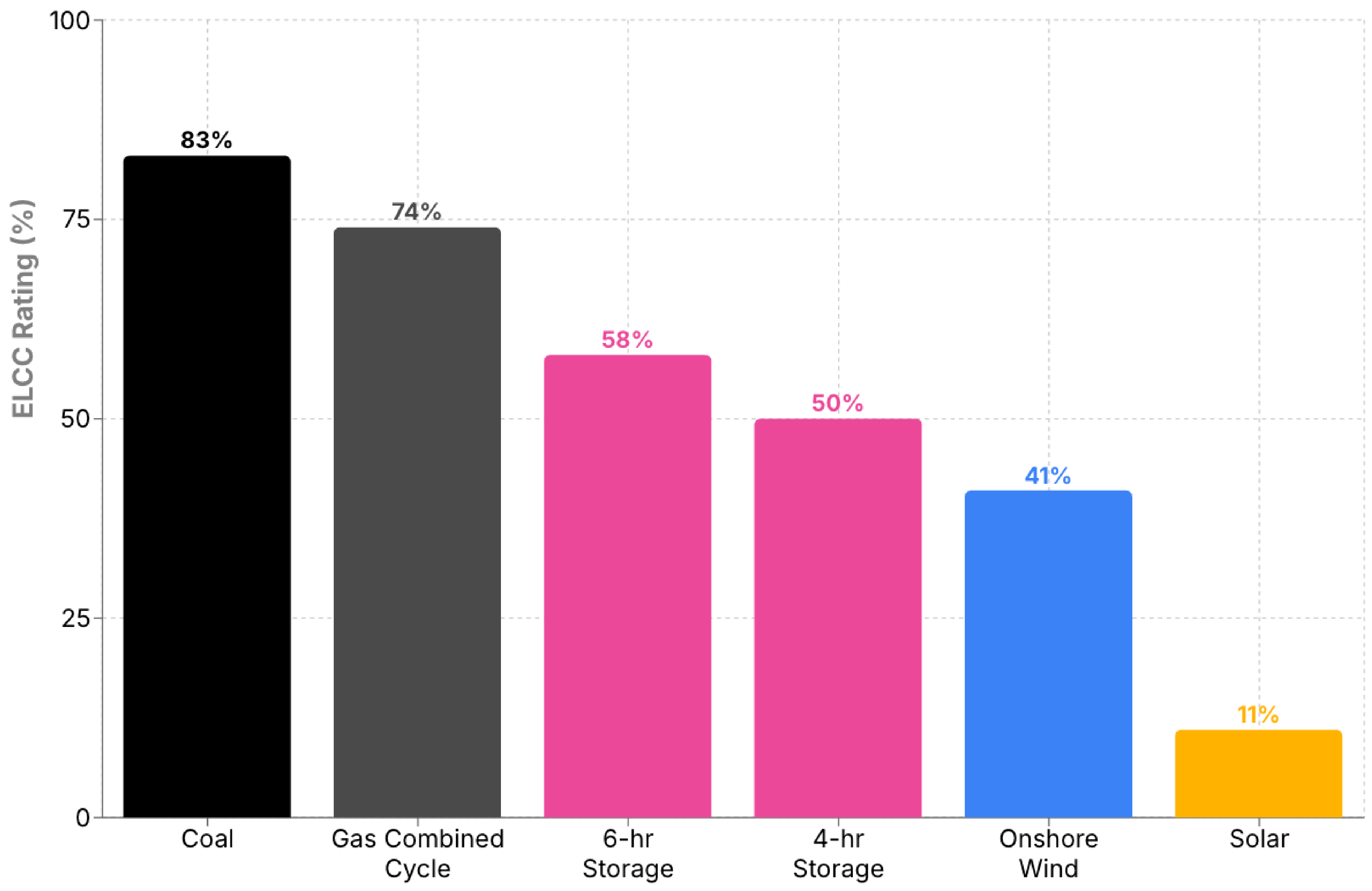
Wind's Better Performance (41%): Nearly 4x more capacity value than solar in PJM

Storage Duration Matters: 6-hr storage (58%) provides 16% more value than 4-hr (50%)

Thermal Advantage: Coal (83%) and Gas CC (74%) still provide highest reliability

Source: PJM, 2026/2027 BRA

Effective Load Carrying Capability (ELCC) - 2026/2027 BRA



Renewables can become firm capacity with capacity factor of 80%

Increasing Renewable Capacity Factors

Adding 6-hour battery storage to existing solar and wind plants enables an additional 12 GW of renewable capacity to be added at the same interconnection points, achieving nearly 2 times the current renewable capacity. This significant increase, combined with the complementarity of solar and wind generation profiles at each location, substantially increases the interconnection utilization and overall capacity factor of the newly hybrid plants.

Solar Assets

Battery capacity required: 2.2 GW (6-hour storage)

Solar assets can more than double utilization from **25%** to **80.1%** capacity factor by adding 6-hour battery storage and more renewable generation.

Wind Assets

Battery capacity required: 3.6 GW (6-hour storage)

Wind assets show a 92% improvement in utilization with strategic 6-hour battery storage, increasing capacity factors from **42.2%** to **81.1%**.

Note: Capacity factors shown are simulated values based on the latest solar panels with fixed-axis tracking and latest wind turbines from Siemens Gamesa, which may be higher than typical values currently observed in the field.

Renewable Asset Capacity Factors with Storage

Solar Capacity Factor

Current Utilization 25.0%

Potential with Storage 80.1%

Improvement 220%

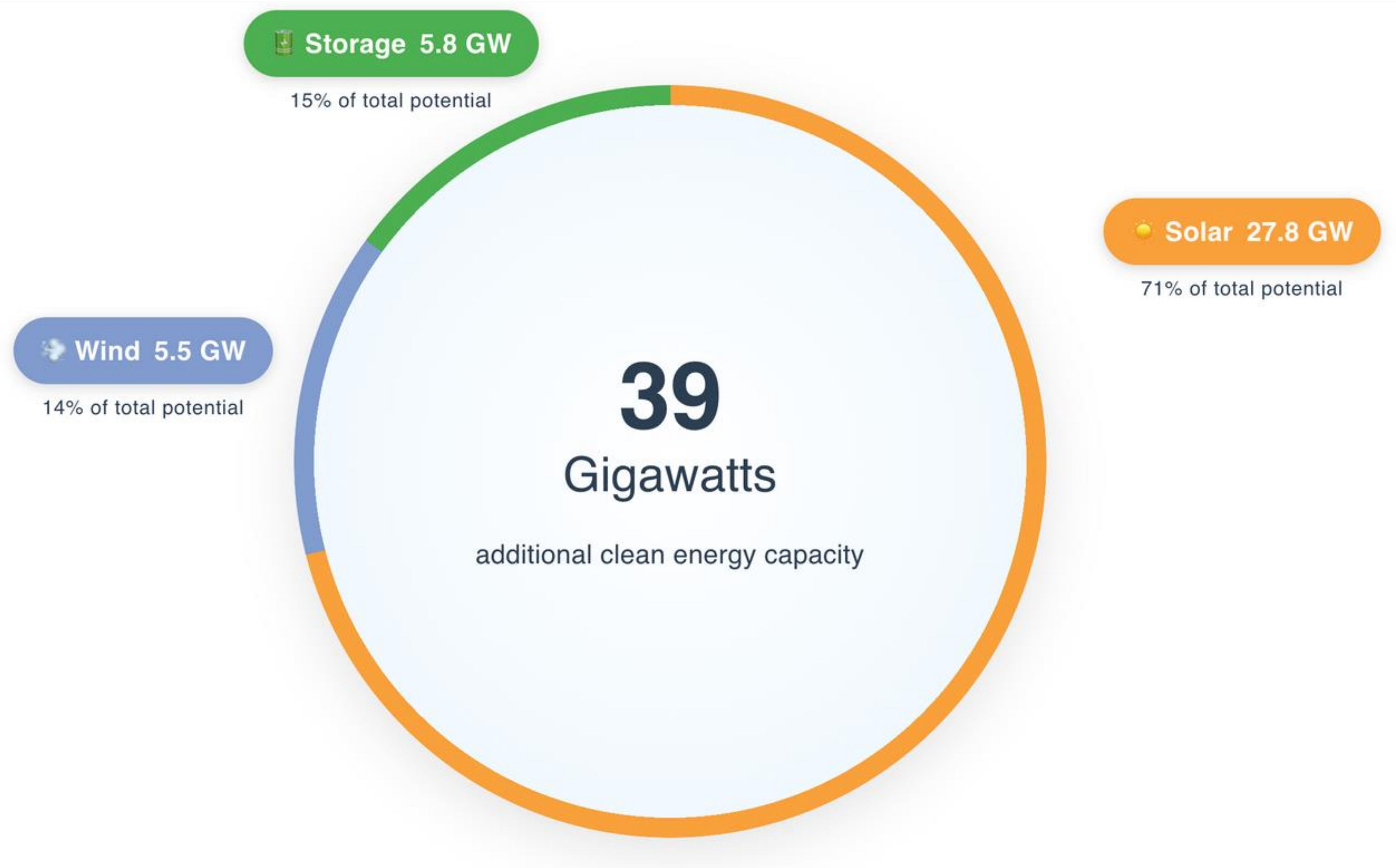
Wind Capacity Factor

Current Utilization 42.2%

Potential with Storage 81.1%

Improvement 92%

39 GW of RE + Storage can be added at existing power plants in Indiana



27.8 GW of additional solar capacity near existing renewable and thermal plants

5.5 GW of additional wind capacity through interconnection sharing

5.8 GW of storage enables higher penetration of renewables

$3.3B of savings in interconnection costs

$ Total Potential Savings

$3.3B

By leveraging existing infrastructure

$1222
Savings per Indiana household

- ✓ Reduces interconnection costs
- ✓ Reduces new transmission infrastructure requirements
- ✓ Cost savings from faster deployment of cheaper clean energy and replacing generation from expensive thermal plants

ⓘ This $3.3B is a conservative estimate that only accounts for interconnection cost savings for 39.1 GW of renewable capacity using an average cost of $85/kW (Queued Up, LBNL 2025). Additional benefits from co-location of solar, wind, and batteries, and increased utilization of bulk transmission would significantly increase the total value of savings, but are not included in this figure.

Shared Benefits Across Stakeholders

Surplus interconnection creates benefits for all stakeholders:

RE Developer	Tax Credit; Reduced Interconnection Costs; Faster Development
Existing Plant Owner	Additional Revenue Streams; Diverse Portfolio
Consumer	Low Cost Electricity; Tax Revenue; Less Pollution
Power System	Reliability; Higher Tx Utilization; Low Capacity Prices
Economy	Reliable Supply; Faster Supply; Low Cost Power

Finding best candidates for surplus interconnection

Thermal Plants Ranking

Weighted scoring to identify best thermal plants for surplus interconnection service

- **25% — Economic Arbitrage**
  Differential between plant variable cost and renewable LCOE
- **30% — Renewable Resource Potential**
  Combined solar and wind capacity within 6-mile radius
- **15% — Underutilization Factor**
  Inverse of capacity factor (lower utilization = higher score)
- **15% — Technical Resource Quality**
  Maximum renewable capacity factor achievable at site
- **10% — Plant Interconnection Capacity**
  Existing thermal plant megawatt capacity
- **5% — Site Development Suitability**
  Percentage of non-urbanized land area

Renewable Plants Ranking

Weighted scoring to identify best expansion candidates

- **30% — Resource Quality Performance**
  Current operating capacity factor of renewable facility
- **30% — Expansion Potential**
  Additional renewable capacity within 6-mile radius
- **20% — Economic Optimization**
  Ratio of optimal to current capacity factor
- **10% — Site Development Viability**
  Percentage of non-urbanized surrounding area
- **10% — Existing Plant Scale**
  Current installed capacity demonstrating viability

Top thermal plants for surplus interconnection

Top Ranked Plants

#1 R M Schahfer
Jasper County • 877 MW • Gas CT
SIS RE Potential: 1082 MW

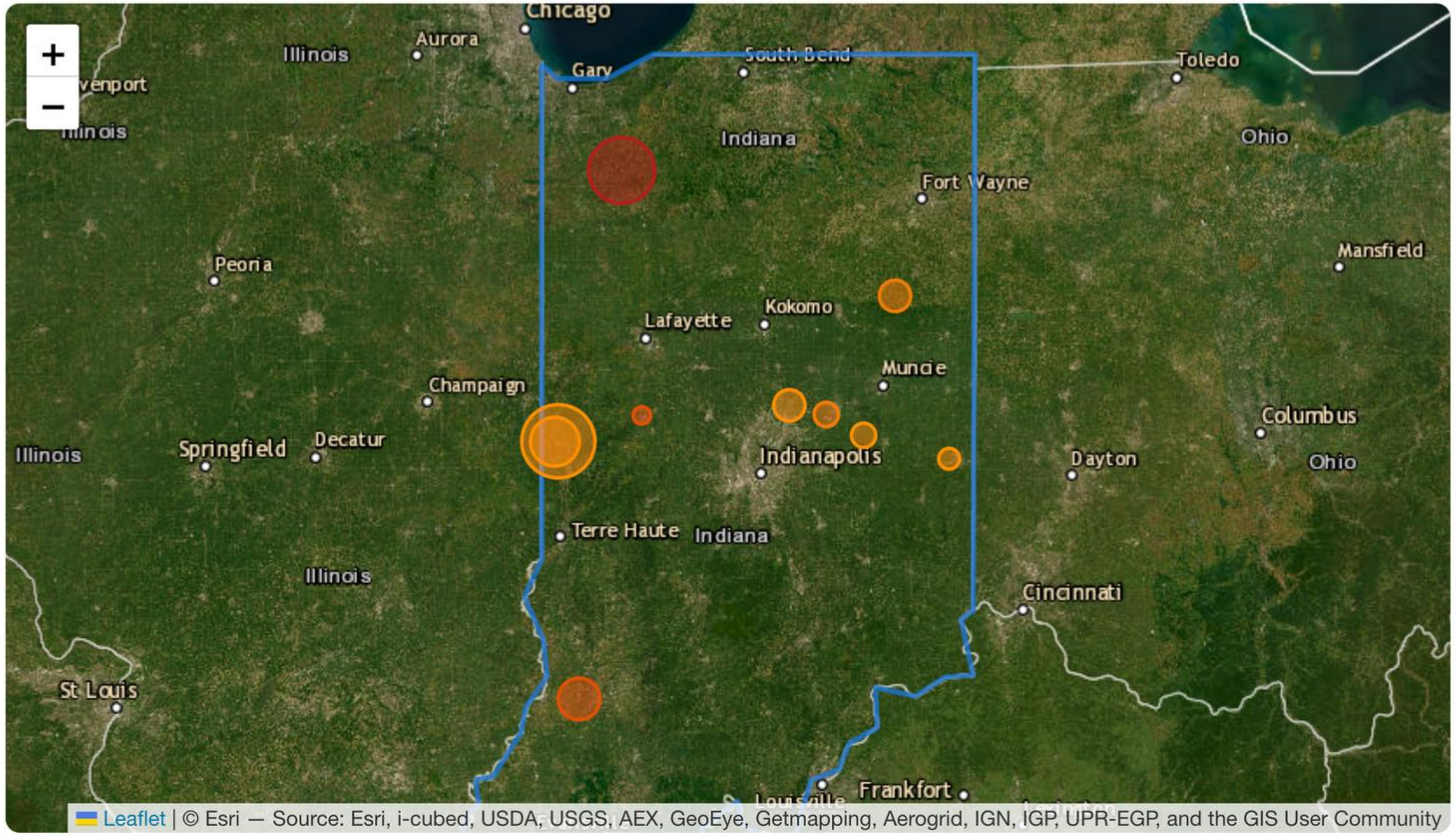
#2 Wheatland Generating
Knox County • 444 MW • Gas CT
SIS RE Potential: 546 MW

#3 Crawfordsville Power
Montgomery County • 11 MW • Coal
SIS RE Potential: 22 MW

#4 Montpelier Electric
Wells County • 233 MW • Gas CT
SIS RE Potential: 491 MW

#5 Anderson
Madison County • 140 MW • Gas CT
SIS RE Potential: 297 MW

Geographic Distribution



Rank #1 Top 3 Top 5 6-10 *Circle size = Plant capacity*

Top renewable plants for surplus interconnection

Top Ranked Plants

#1 **Indiana Crossroads Wind Farm II**
White County • 202 MW • Wind
SIS RE Potential: 422 MW

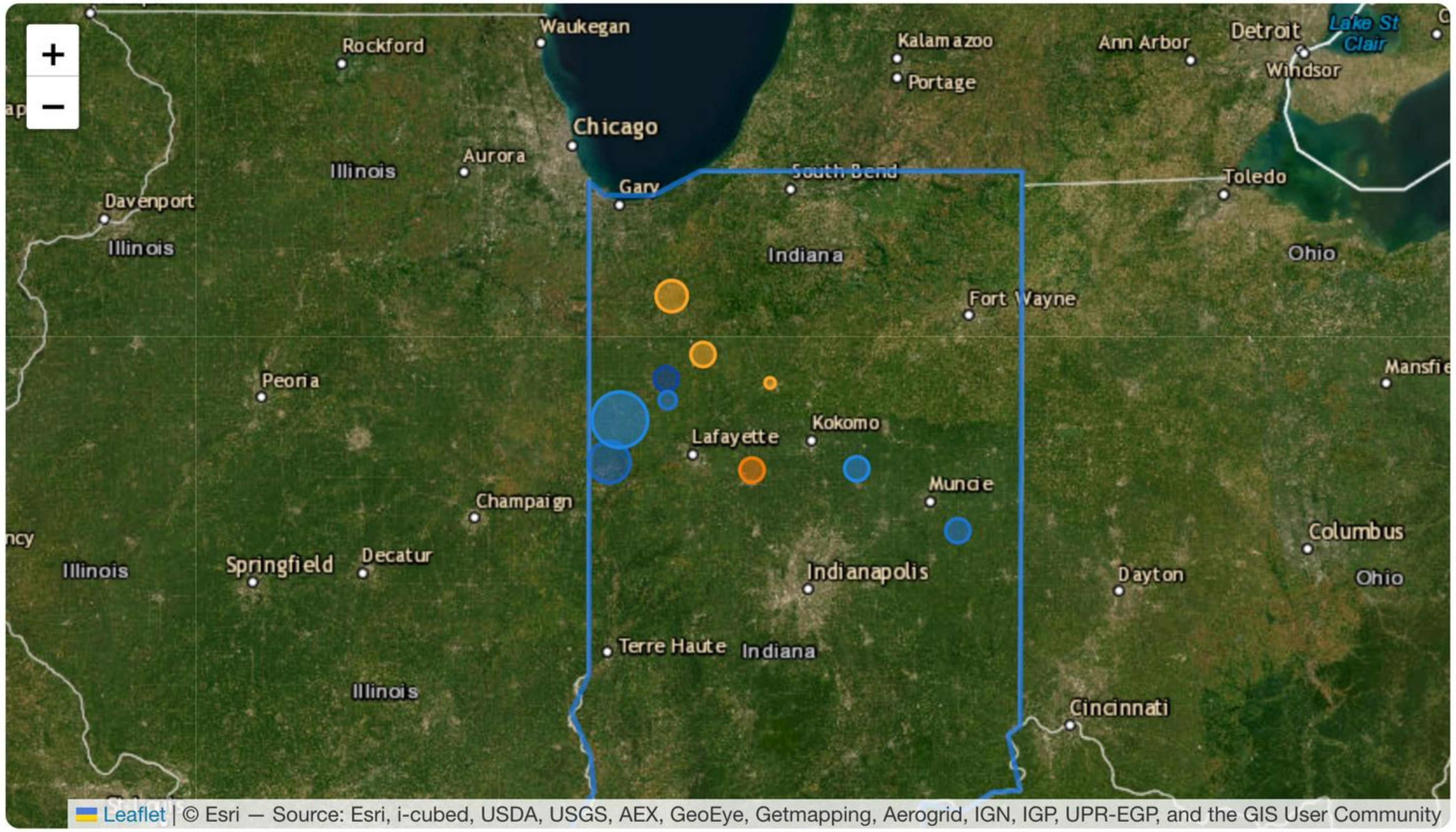
#2 **Jordan Creek Wind Farm, LLC**
Warren County • 399 MW • Wind
SIS RE Potential: 831 MW

#3 **Hardy Hills Solar Energy LLC**
Clinton County • 195 MW • Solar
SIS RE Potential: 405 MW

#4 **Meadow Lake Wind Farm IV**
White County • 106 MW • Wind
SIS RE Potential: 221 MW

#5 **Headwaters Wind Farm II LLC**
Randolph County • 200 MW • Wind
SIS RE Potential: 411 MW

Geographic Distribution



Solar: #1 Top 3 Others **Wind:** #1 Top 3 Others *Circle size = Plant capacity*

Quick deployment and incremental scaling reduce stranded asset risk

Uncertain Demand Growth Drivers

AI & Data Centers
Explosive growth with unpredictable timing - some facilities need 1GW+

Manufacturing Reshoring
Policy-driven industrial expansion with uncertain location and scale

Transportation Electrification
EV adoption varies 10x between forecasts - massive grid impact uncertainty

Grid planners face unprecedented uncertainty in timing, location, and magnitude of new loads - traditional planning breaks down

Deployment Strategy Comparison

Traditional New Generation

- 5-7 year development timeline
- Large upfront commitment (500MW+)
- High stranded asset risk
- Requires accurate long-term forecasts

SIS + Battery Storage

- 12-18 month deployment
- Modular additions (50-200MW blocks)
- Deploy capacity as demand materializes
- Leverages existing interconnection

The "Build As You Need" Advantage with SIS

Surplus Interconnection Service transforms how utilities can respond to uncertain demand growth by enabling incremental, just-in-time capacity additions:

Risk Mitigation Benefits:

- Match CAPEX deployment to actual load growth
- Avoid overbuilding in uncertain markets
- Preserve optionality as forecasts evolve
- Minimize stranded asset exposure

Operational Flexibility:

- Start with 100MW, scale to 500MW+ over time
- Respond to surprise data center announcements
- Adjust to actual EV adoption rates
- Redeploy assets if local demand shifts

SIS enables utilities to transform stranded asset risk into strategic flexibility - critical for navigating the unprecedented uncertainty of the energy transition

Surplus Interconnection Process in MISO

Process Timeline

1 **$ Submit Request** — Immediate

IC submits Surplus Interconnection Request to MISO

Study Deposit = $60,000

2 **Study Commencement** — 30 Calendar Days

MISO begins Interconnection Study for Surplus Service

Study duration: 90 Calendar Days

3 **Impact Assessment** — 30 Calendar Days

IC decides to proceed or withdraw based on results

No material adverse impacts required

4 **Facility Study** — 90 Calendar Days

Interconnection Facility Study (if needed)

Detailed technical requirements

5 **GIA Tender** — 30 Calendar Days

MISO tenders draft GIA after Final Facility Study

Generator Interconnection Agreement

Understanding the Process Flow

MISO's Surplus Interconnection Service enables new generation to connect using unused capacity from existing interconnections.

Step 2: Interconnection Study (90 Days)

- **Reactive Power Analysis:** Voltage stability assessment
- **Short Circuit/Fault Duty:** Protection system coordination
- **Stability Analysis:** Transient and dynamic stability

Step 3: Impact Assessment Decision (30 Days)

Interconnection Customer evaluates study results:

- No material adverse impacts identified → Proceed to next phase
- Material adverse impacts found → Project withdrawal required

Step 4: Facility Study Requirements (90 Days)

Required: When POI modifications or new equipment needed

Bypassed: When utilizing existing infrastructure without changes

FERC Approves PJM Surplus Interconnection Service Reforms

Four Key Changes Approved by FERC

PJM filed tariff revisions on December 20, 2024 to remove restrictions and expand surplus interconnection service access

1. Additional Interconnection Facilities

Explicitly allows construction of new physical interconnection facilities where needed. Enables parallel operation of surplus unit with existing generator - critical for solar+storage configurations. Previously unclear if additional facilities were permitted.

2. Removes "Material Impact" Restrictions

Strikes language that terminated requests for ANY impact on queue determinations or material impacts on system limits. Now only blocked if new network upgrades required. This "materiality review" previously killed most surplus requests.

3. Earlier Access to Surplus Service

Expands eligibility to projects with executed ISA/GIA but not yet built. Previously only operational facilities could offer surplus. Allows requests during construction phase - aligns with FERC Order 2023 requirements.

4. Energy Storage Eligibility

Clarifies that resources "seeking to receive electric energy from the grid and store it for later injection" can use surplus service. Removes ambiguity about storage eligibility that existed in prior tariff language.

Previous Restrictions Removed

PJM would automatically terminate surplus requests if:

- Any impact on network upgrade determinations for queued projects
- Material impacts on short circuit capability limits
- Material impacts on steady-state thermal and voltage limits
- Material impacts on dynamic system stability

Result: "Materiality review" effectively blocked most surplus requests

Expected Benefits

- Faster deployment of new capacity without queue delays
- Existing solar can add batteries using surplus service
- Better utilization of existing interconnection capacity
- May help reduce capacity prices
- Aligns PJM with MISO's more flexible approach

Behind-the-Meter Data Centers: Leveraging Surplus Interconnection

Innovative Behind-the-Meter Solution

Configuration Setup

Data center is located behind-the-meter of an existing gas peaker plant, with new oversized solar arrays + 16-hour battery storage added on-site

How It Works

95% of the time: Data center receives power from solar + battery storage.
5% of the time: When solar/battery unavailable, gas plant provides backup power

Gas Plant Dual Role

1) Provides electricity to grid during peak demand when needed
2) Acts as backup power source for data center (5% of time)

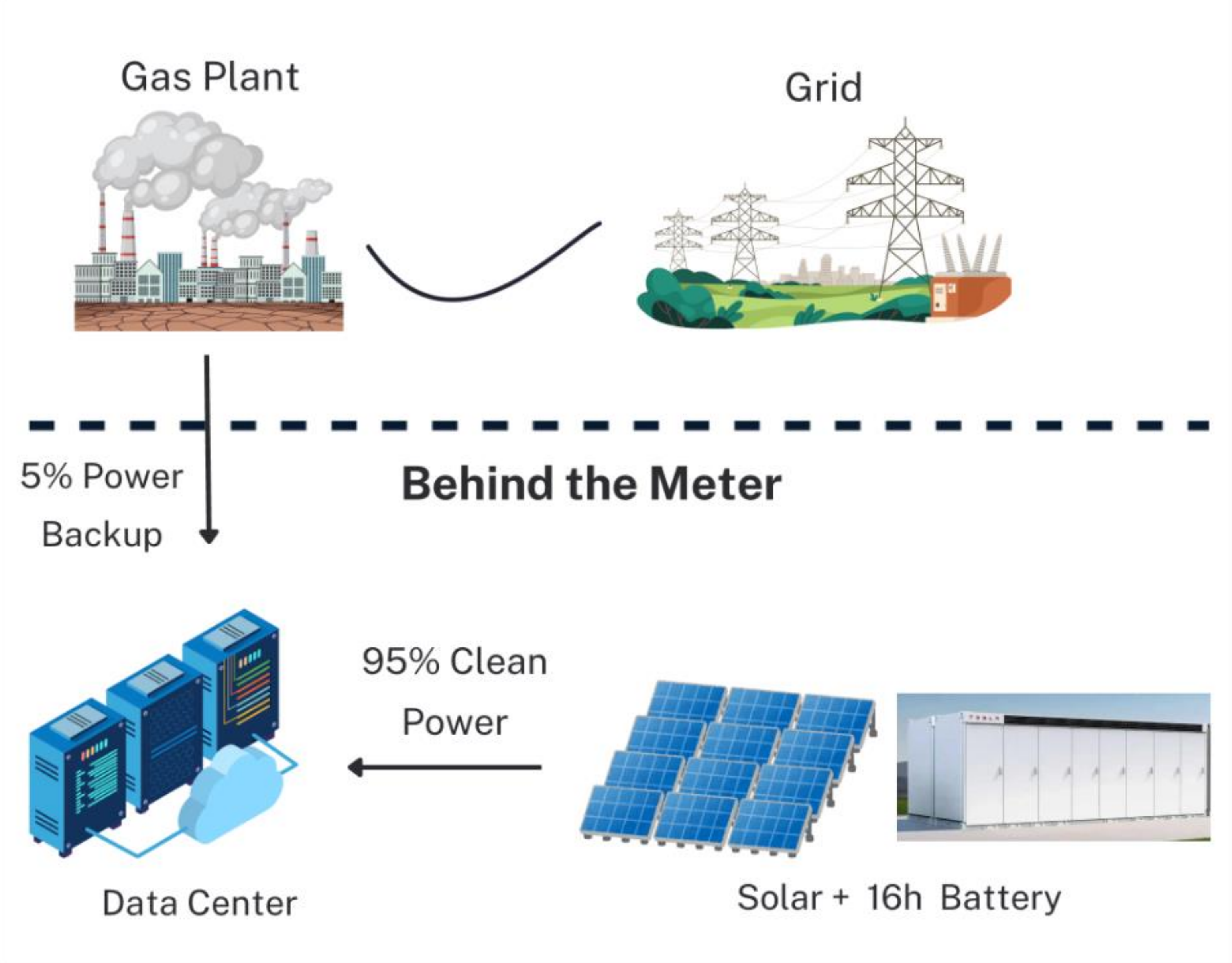
Fast Implementation

Complete build in 1-2 years (vs 5-6 years for new gas plant or grid connection)

Key Benefits

- Uses existing gas plant interconnection (no new transmission)
- 95% carbon-free operation with solar + battery
- Gas plant remains available for grid emergencies

Surplus Interconnection to Power Data Centers



Thank you!

New gas is unlikely come online before 2030

Gas Plant Development Timeline

For a gas plant ordered February 2025, the projected online date is 2030-2032

1

Phase 1

Turbine Delivery

4-5 Years

- GE Vernova: 48-60 month lead times
  Limited to manufacturing 20 GW annually by 2027
- Siemens: Backlogged to 2029
  Limited expansion plans despite high demand
- Mitsubishi: J-series queued to 2029
  Plans only 'very planned expansion with discipline'

2

Phase 2

Interconnection

3-5 Years

- PJM's queue now takes 4-5+ years, 286 GW backlogged as of 2024
- Grid upgrades add another 1-2 years, Additional time if significant transmission upgrades required

3

Phase 3

Construction

2-3 Years

- Combined-cycle plants: 24-36 months
- Simple-cycle (peaking): 18-24 months

Best Case	Likely Case	Worst Case
5 years	**6-7 years**	**8+ years**
Online by Feb 2030	Online by Feb 2031-2032	Online after 2033

Industry Dynamics: Long Lead Times and Turbine Shortages

Gas turbine shortages and capacity constraints create extended timelines

Industry Leaders Confirm Long Lead Times

> *"New gas projects won't be available at scale until 2030, and then only in certain pockets of the U.S. This is an industry that really hasn't seen any active development or construction in years... all of that puts pressure on cost."*
>
> — John Ketchum, NextEra Energy CEO (2024)

> *"We have to be very thoughtful to make sure that we don't add too much capacity, even though we are starting to sell slots into 2029. We're going to continue to be very sequential on how we invest."*
>
> — Scott Strazik, GE Vernova CEO (2024)

Turbine Shortage: Market Impacts

- Engie withdrew Texas gas plant applications due to "equipment procurement constraints"
- GE Vernova limiting $300M investment to improving existing plants, not expansion
- Industry analysts project turbine shortage will continue through 2030 due to manufacturing constraints

Conclusion

Existing gas plants already in development can only meet approximately 25% of projected peak capacity needs by 2030. New gas plants ordered today would not come online until after 2030.

Source - HeatMap News 2025

Renewables plants are underutilizing their interconnection capacity

Renewable Interconnection Underutilization

Because of the intermittency, renewables utilize their interconnection only when the sun is shining or wind is blowing. The average capacity factor in Utah for solar is 27.9%, for wind is 22%. This means solar plant interconnection is idle 72.1% of the time, and wind plant interconnection is idle 78% of the time.

Technology Capacity Factors

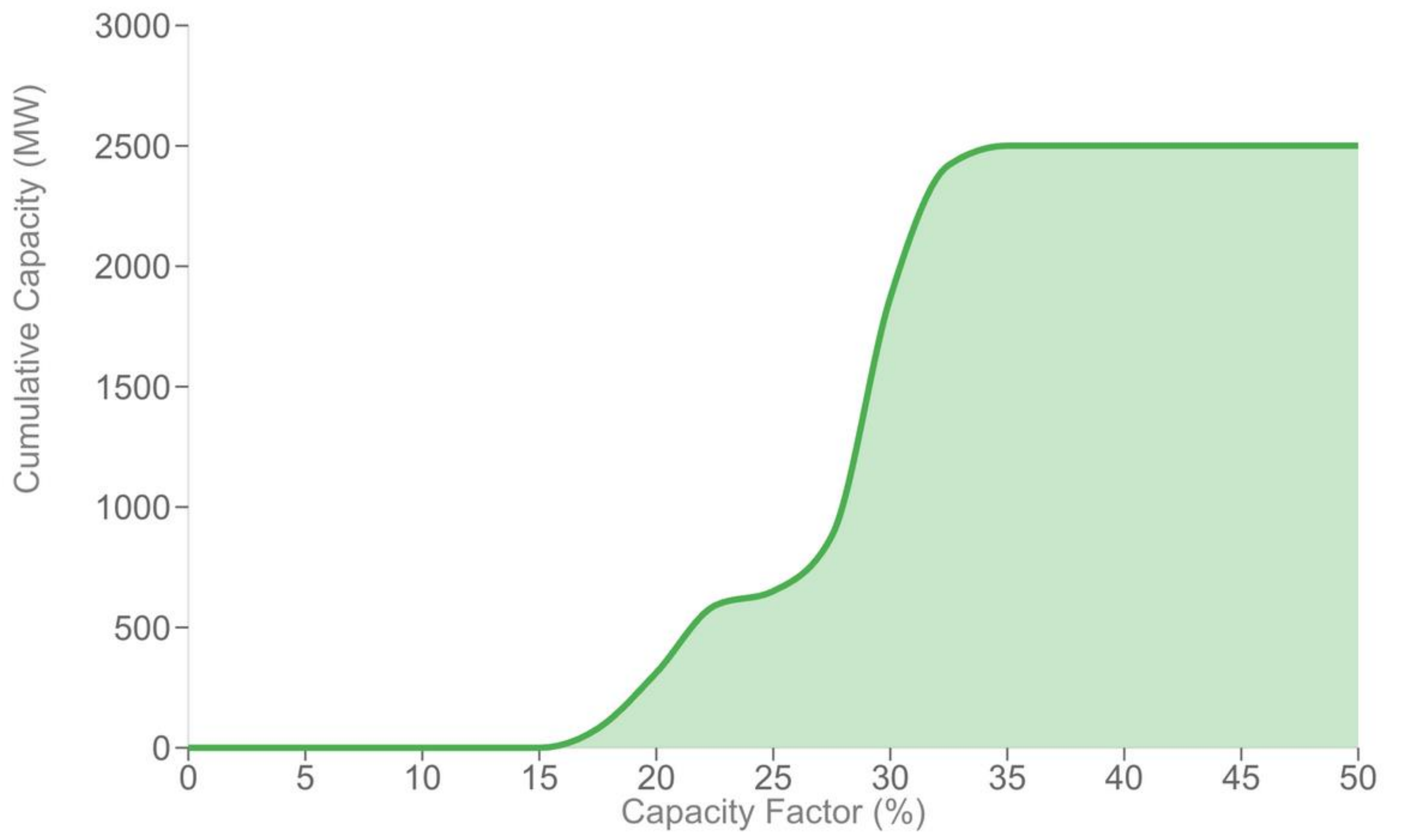
- Solar: 27.9% (2126.5 MW)
- Wind: 22% (386.5 MW)

Aggregate Renewable Performance

- Total Capacity: 2,513 MW
- Weighted Average CF: 27.0%

The 2.5 GW renewable capacity utilizes their interconnection only 27.0% of the time

Cumulative Renewable Capacity by Capacity Factor



Cost of Renewable Generation

Renewable Generation Economics

Indiana's 5.8 GW renewable capacity shows unsubsidized costs (without IRA tax credits) comparable to thermal generation seen in the previous slide. Solar (2.2 GW) averages $37.6/MWh unsubsidized. Wind (3.6 GW) averages $42.84/MWh unsubsidized. These costs are competitive with the $30-40/MWh variable costs of coal and gas CCGT plants shown previously.

Capacity-Weighted Average LCOE (2025)

Without IRA tax credits (unsubsidized LCOE)

- Solar: $37.6/MWh (2.2 GW installed)
- Wind: $42.84/MWh (3.6 GW installed)

- Total Renewable Capacity: 5.8 GW
- Solar below $50/MWh: 100% of capacity
- Wind below $50/MWh: 69.1% of capacity

Cumulative Renewable Capacity by Unsubsidized LCOE