2024-2040 Upper Midwest Integrated Resource Plan
Docket No. E002/RP-24-67

February 2024

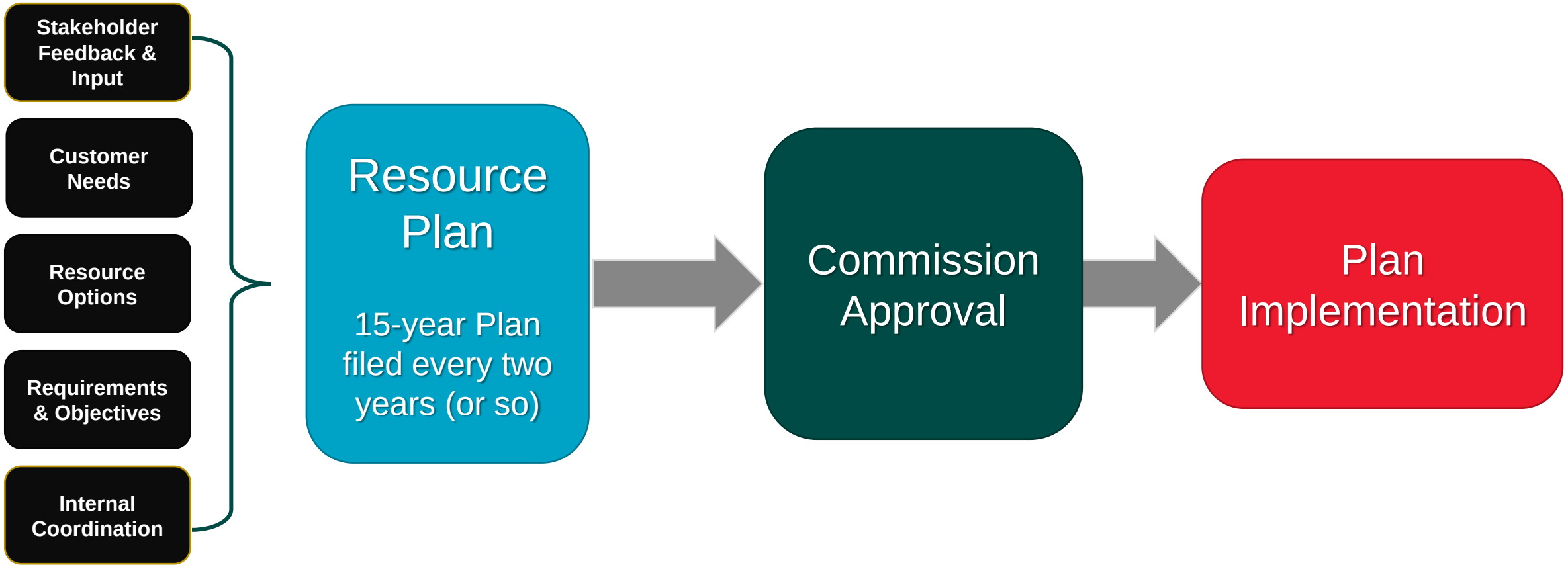
UPPER MIDWEST IRP OVERVIEW

- **15-year plan for Upper Midwest** service area

- Capacity expansion modeling to assess **size, type, timing** of **least-cost resource sets** that can serve future load

- Balances four core planning objectives

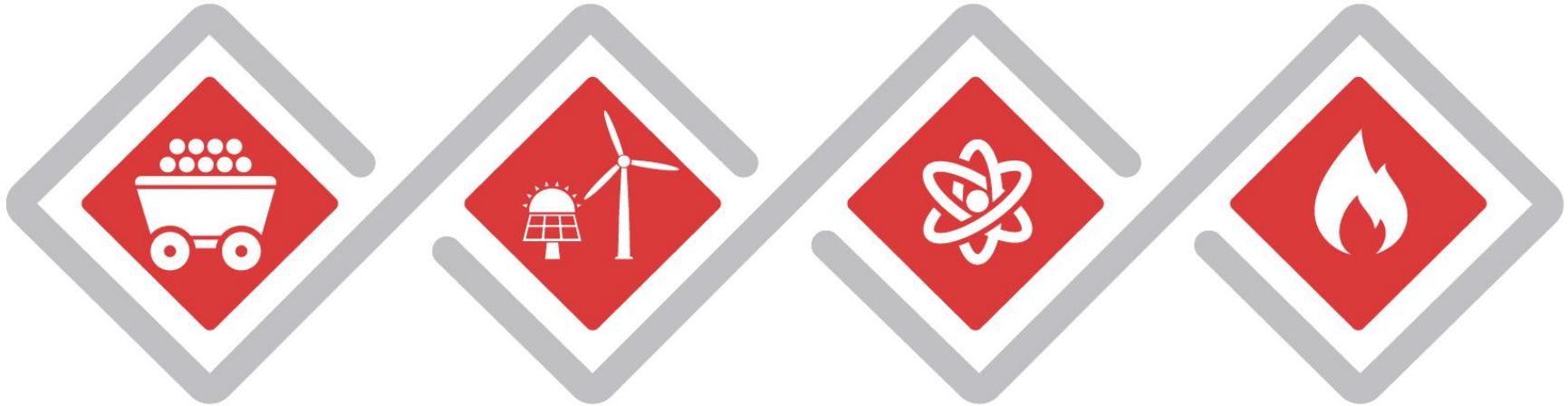
Integrated Resource Planning Process



Summary

- Continuation of last IRP
- Reliability increasingly important and accounted for in preferred plan
- Preferred plan charts a path toward achieving Minnesota’s new “100 by 2040” law.
- Complies with new DG solar mandates
- Load growth expected- data centers, EVs, and BE
- Coal retirements on track
- Advanced technology considered
- Maintains critical reliability and affordability for our customers at less than a one percent average annual increase in rates—less than half the national average.

Elements of Our Plan



Close coal plants

Retire the last of our coal plants in the Upper Midwest by 2030

Add renewables

Build about 3,600 megawatts of new wind and solar facilities, along with 600 megawatts of battery energy storage by 2030

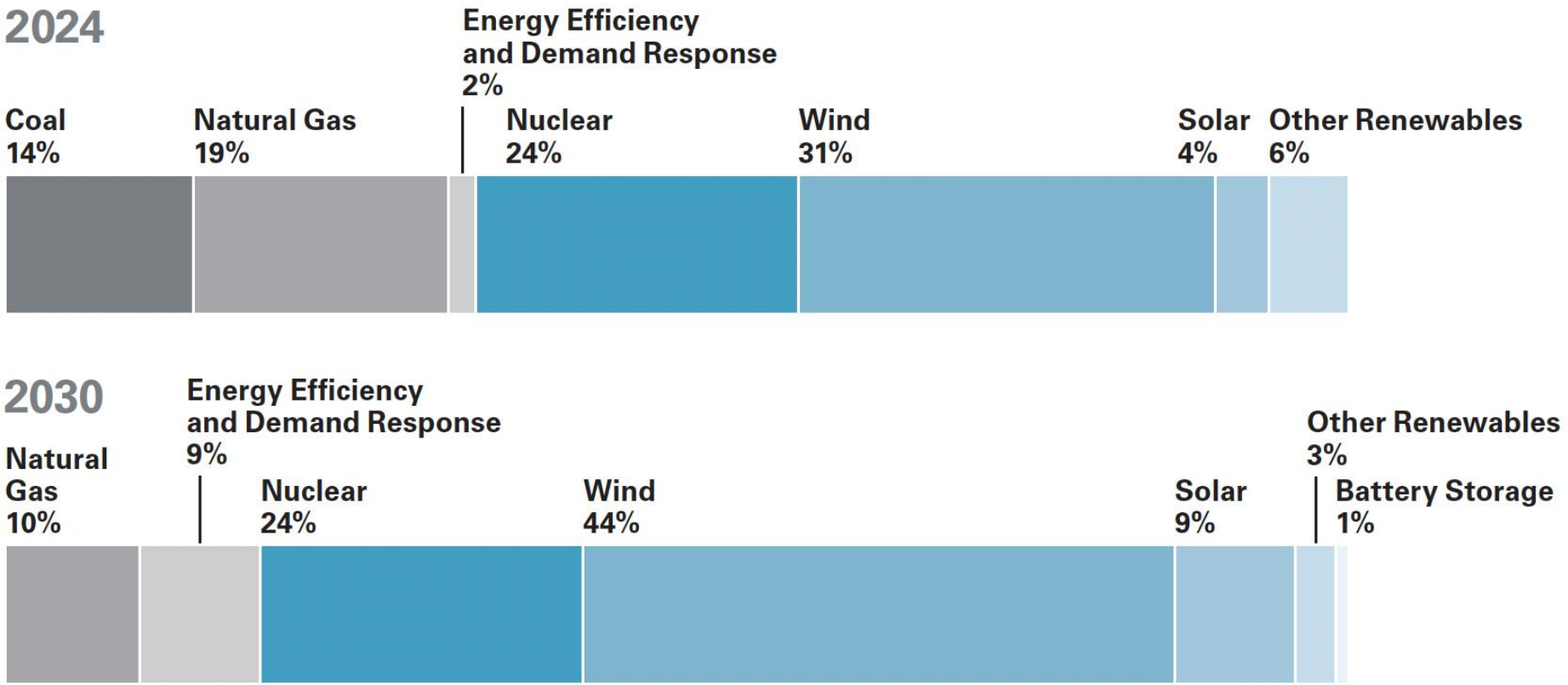
Continue carbon-free nuclear

Extend the use of our carbon-free nuclear plants until the early 2050s

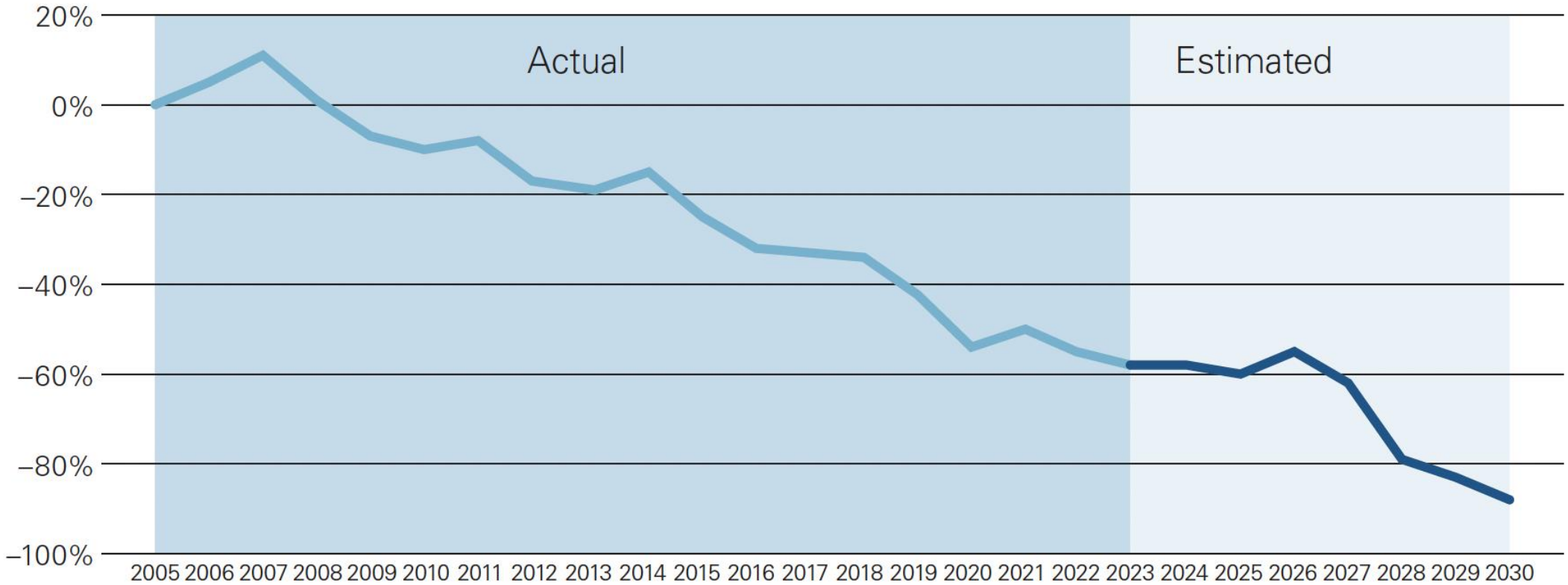
Enable a carbon-free future

Continue to use natural gas facilities to ensure the reliability and stability of the electric system while exploring new "always available" energy sources to advance the clean energy transition

Our Customers' Energy Mix



Projected Carbon Emissions



Advanced Tech

- Conducted special study of advanced tech on preferred plan- Hydrogen, SMRs, and Long duration storage
- Each Technology analyzed separately and combined with constraint of 100% carbon-free generation by 2050.
  - Case 1: Long-Duration Storage – first selected in 2036. 7600 MW selected by 2050.
  - Case 2: SMR - first selected in 2047. 4200 MW selected by 2050.
  - Case 3: H2 - Blending starts in 2034.
- Combination Scenario – Long-Duration first selected in 2036. 6,200 MW by 2050. Hydrogen blending begin in 2034.
- Conclusion: Depending on technological advances, each resource presents the potential to contribute to meeting carbon emission goals.

Sensitivities

Key takeaway: Preferred plan is robust and accounts for a variety of future scenarios

Sensitivity Category	Sensitivity
Standard	PVSC - Base
	PVRR - Base
Fuel prices	High Fuel/Market Price
	Low Fuel/Market Price
Load	High Load
	Low Load
	Data Center Load (Low Expansion - Limited Growth
Technology cost	High Tech Cost
	Low Tech Cost
	Edison MISO Market Prices (Wind and Solar)
Cost of carbon	High Reg Cost ($75) >2028+ High Draft EPA <2028 + (Draft EPA - Reg Cost) starting in 2028
	Mid Reg Cost ($40) >2028+ Mid Draft EPA <2028 + (Draft EPA - Reg Cost) starting in 2028
	Low Reg Cost ($5) >2028 + Low Draft EPA <2028 + (Draft EPA - Reg Cost) starting in 2028
	Draft EPA - High ($0 Reg Cost)
	Draft EPA - Mid ($0 Reg Cost)
	Draft EPA - Low ($0 Reg Cost)
Resource Adequacy	Higher PRM (RBDC opt-out proxy)
	25% Battery ELCC
	All Markets Off (Redispatch)
	Market Access 2300 MW (Reoptimize)
	Variation of wind profile (reoptimize, with different assignment of wind profiles from different regions)
Policy	Good neighbor applied in both MN and WI + EPA 111
Combination	High tech cost + high load
	Low tech cost + low load
Reliability Analysis	Scenario 3 with Mkt Off
	Scenario 1 with Mkt Off
	Market access 2300 MW reoptimization for Scenario 3
	Low load scenario for Scenario 3 with Mkt Off
DG Special Study	Selectable DG bundles
Battery Special Study	Add 10hr Battery option and hybrid option in Scenario 3
Emerging Technologies	Hydrogen
	SMRs
	Long-Duration Storage
	DG Bundles

QUESTIONS?

Xcel Energy®