



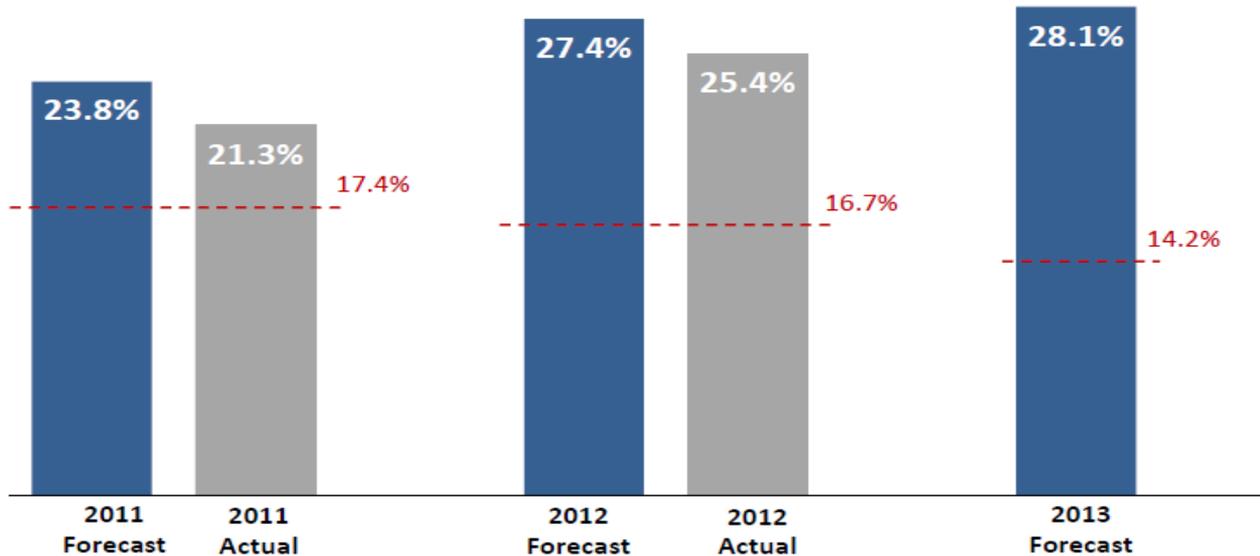
U.S. Environmental Protection Agency
Clean Power Plan - Proposed Rule
Initial Department Review

Resource Planning

- The question of how much EPA's new CO₂ regulation impacts Minnesota is a question of how well we've done resource planning.
- Resource plans are 15-year plans that balance four long-term goals:
 - reliability;
 - cost;
 - environmental impact; and
 - risk management.

Reliability Goal—Regional Reserve Margins (MISO Data from July '13)

Forecast v. Actual Reserve Margins (Installed Capacity)

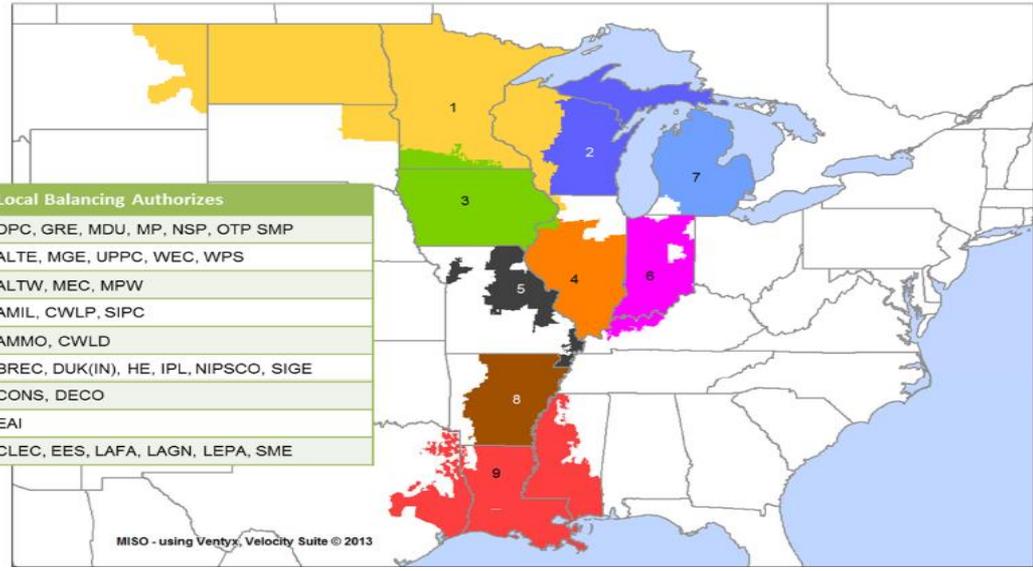


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- Red line shows required level of reserves.
- Resources are adequate now, but MATS has an impact...

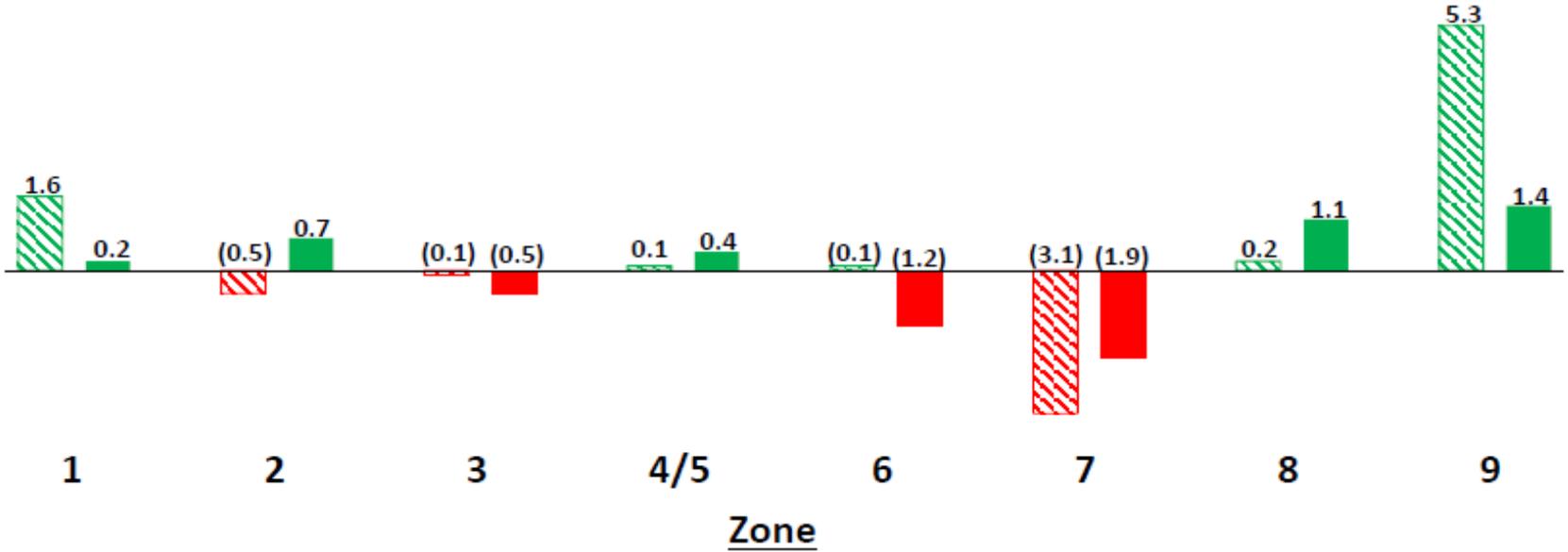
Reliability Goal—Regional Reserve Margins (MISO Data from June '14)

MISO Local Resource Zones

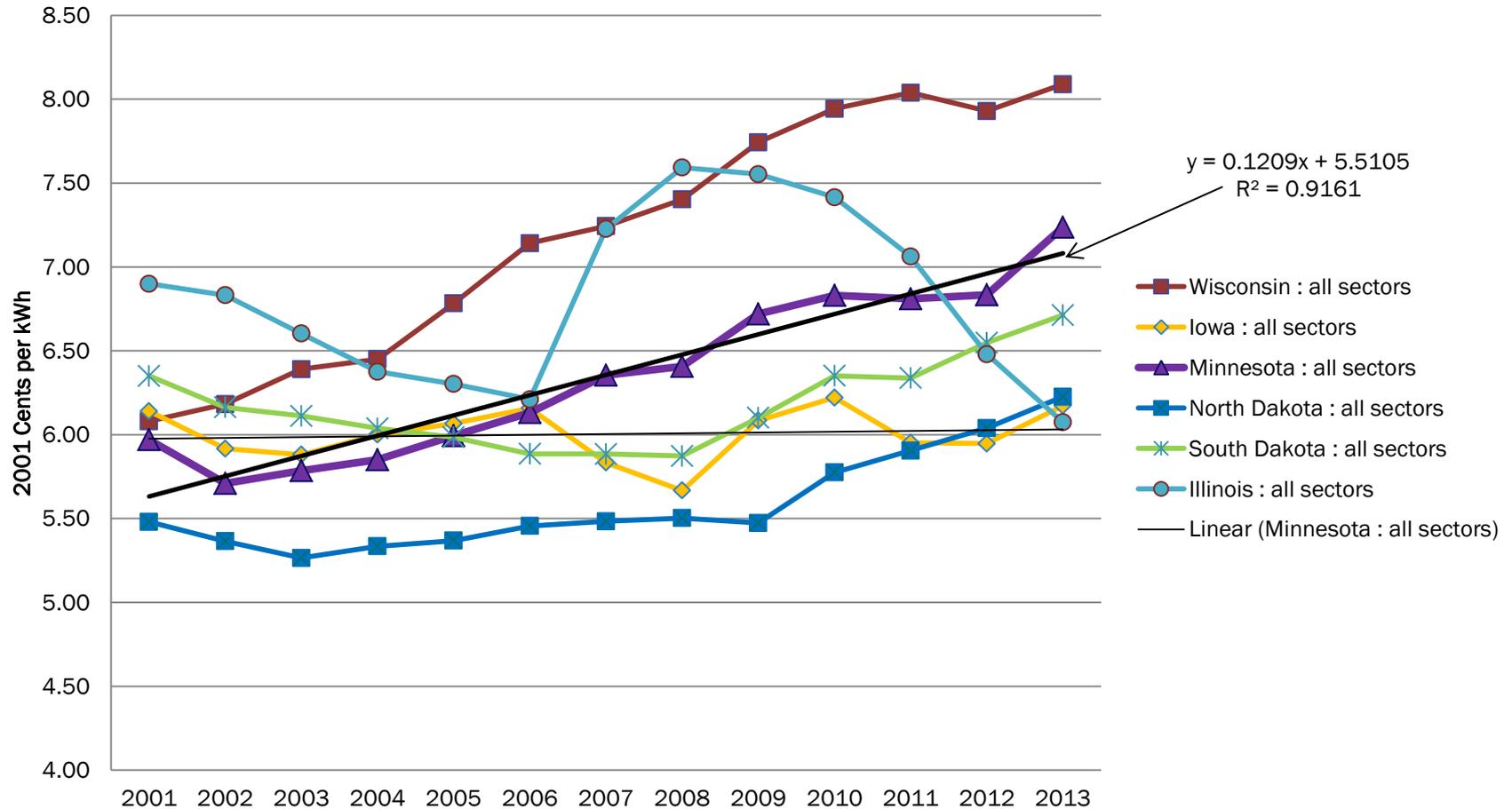


2016 Resource Adequacy Zone Summary

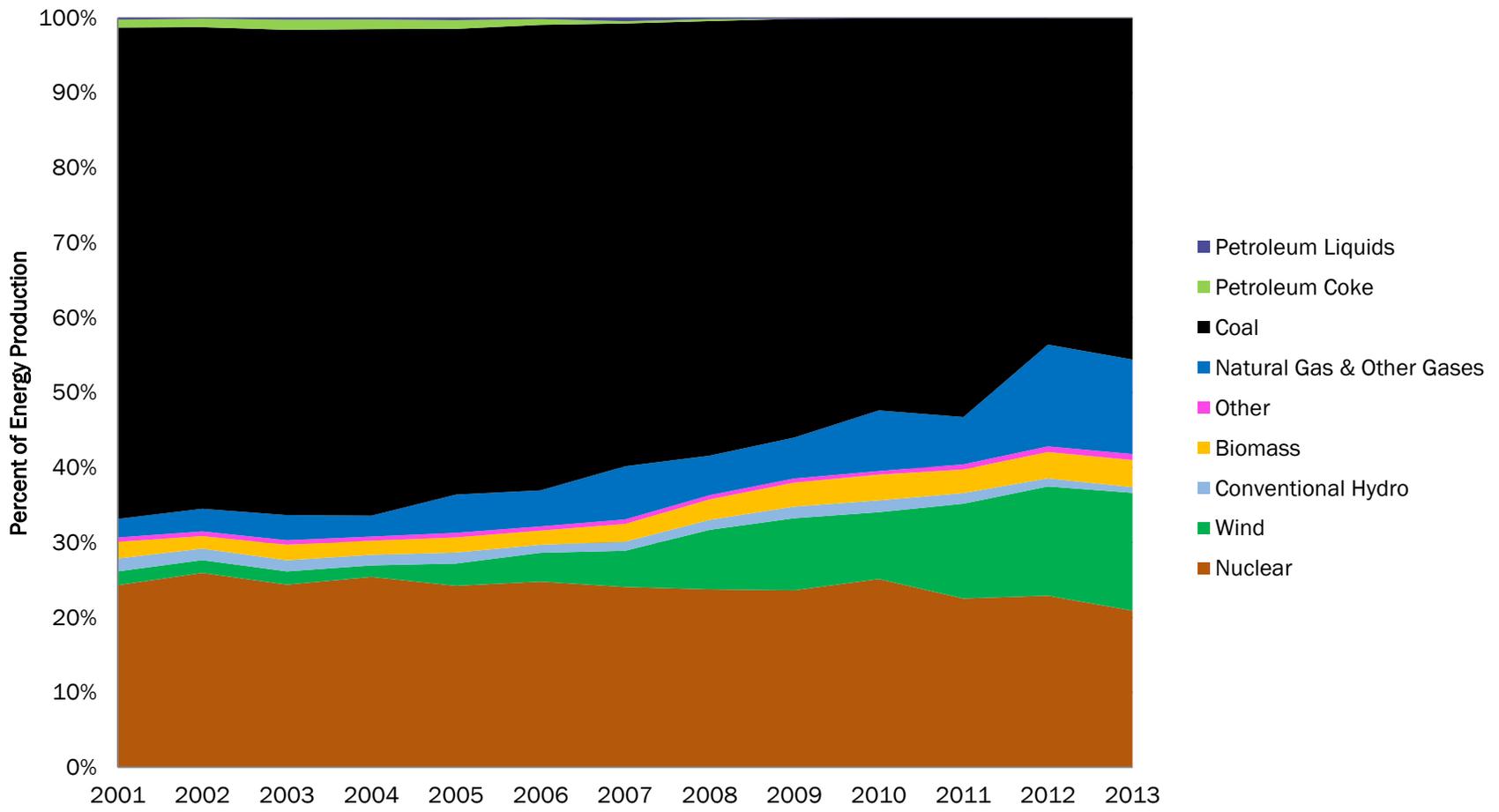
-  January 2014 Survey (3.6 GW Surplus)
-  June 2014 Survey (0.2 GW Surplus)



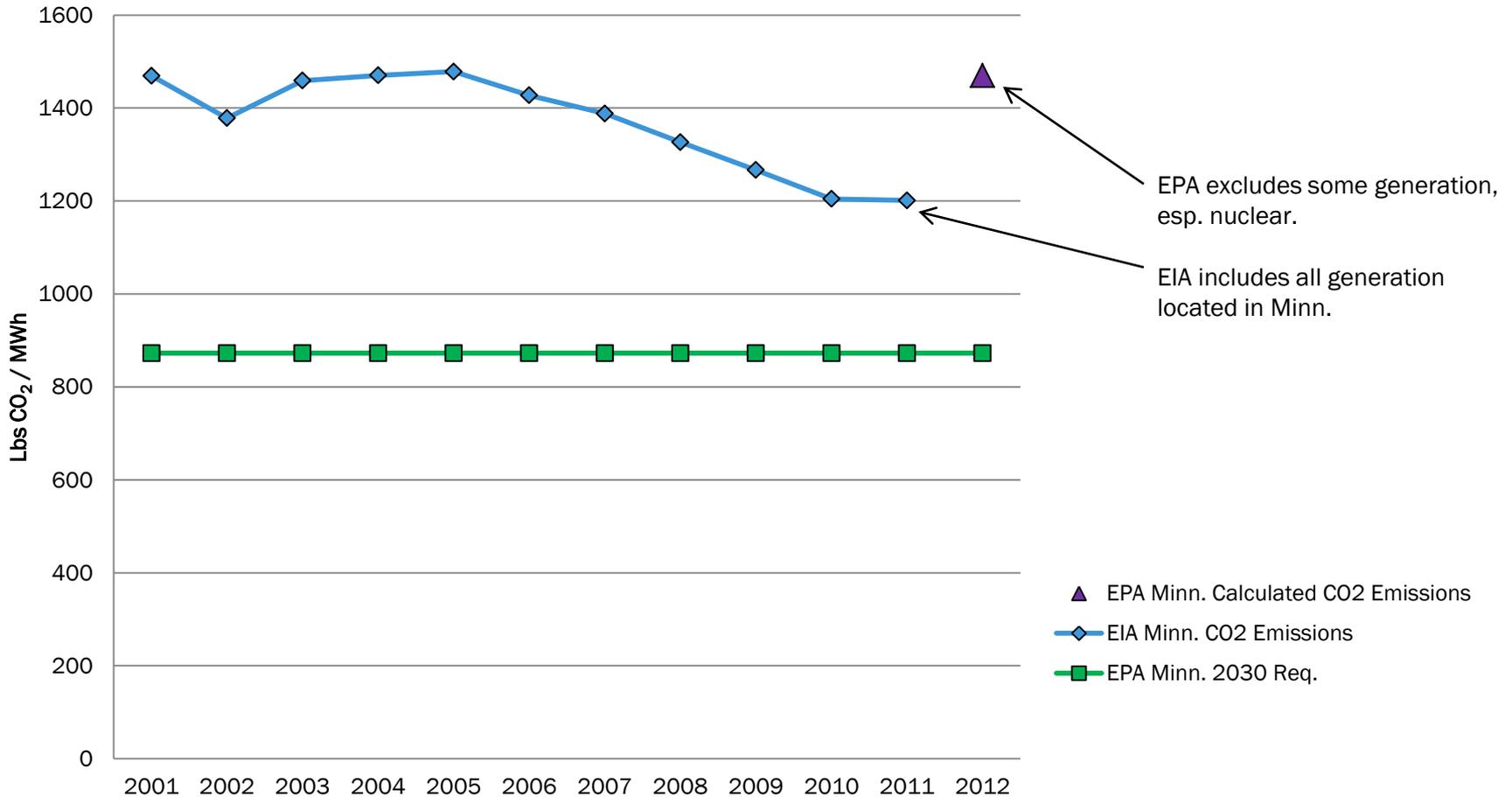
Cost Goal—Real Price of Electricity (U.S. EIA Data, All Customers)



Impact Goal—Historical Minnesota Generation Mix (U.S. EIA data)



Impact Goal—CO₂ Intensity, Minnesota Generation (U.S. EIA/EPA Data)



NOTE: EIA Calculation is not consistent with EPA goal formula.

Where Are We Going? (Recent Resource Plan Results)

- Near Term (2014 to 2020) actions:
 - Minnesota Power
 - Add Bison 4 wind farm;
 - Add Manitoba Hydro Purchase;
 - Retire Taconite Harbor 3 coal unit;
 - Convert Laskin coal plant to natural gas.
 - Otter Tail Power
 - Retire Hoot Lake coal plant;
 - Add natural gas-fired (and potentially wind) capacity.
 - Xcel Energy
 - Retire Black Dog 3 and 4 coal units;
 - Add natural gas-fired capacity;
 - Add 750 MW of Wind.
 - All Three Utilities:
 - 1.5% Solar Energy Goal;
 - 1.5% Conservation Goal.

Build a Model—Step 1, Define Affected Units (from draft PCA unit list, EIA capacity data)

Coal Plants	Owner	MW
Sherburne County	Xcel, SMMPA	2,430.6
Clay Boswell	MP	1,072.5
Allen S King	Xcel	598.4
Taconite Harbor 1, 2	MP	168.0
Austin Northeast	Austin	31.9
Total		4,301.4

Natural Gas Combined Cycle Plants	Owner/PPA	MW
High Bridge	Xcel	644.0
Riverside	Xcel	585.9
Calpine-Mankato	Xcel	530.0
Faribault Energy Park	MMPA	334.5
Black Dog 2, 5	Xcel	324.8
LSP-Cottage Grove	Xcel	283.5
Total		2,702.7

Coal Power Plants Not Included in Analysis

Coal Plants Scheduled to Shut Down	Owner	MW
Black Dog 3, 4	Xcel	293.1
Hoot Lake	Otter Tail	129.4
Taconite Harbor 3	MP	84.0
Silver Lake	Rochester	79.0
Total		585.5

Build a Model—Step 2, Obtain Data on Affected Units

- Faribault Energy Park (MMPA) not included in analysis—No model data
- Austin Northeast (SMMPA) not included in analysis—No model data & might be retired
- Hibbard (MP) not included in analysis—Biomass
- Fox Lake (Alliant) not included in analysis—No longer burns coal

Build a Model—Step 2, Obtain Data on Affected Units Cont'd

- Existing nuclear units—fixed at the ‘at risk’ amount (840 GWh per EPA)
- Existing wind and solar units—fixed at 2012 amount (8,121 GWh per MRETS)
- Existing coal and gas—fixed at Dept. model output in last resource plan

Developing a Model—Step 3, Compliance Formula (U.S. EPA Rule)

- EPA 2030 Minn. Goal Calculation:
 - Starting Point CO₂/MWh (2012): 1,470
 - After Block 1: heat rate improvements: 1,389
 - After Block 2: redispatch existing NGCC: 999
 - After Block 3: “at risk” nuclear & renewables: 1,042
 - After Block 4: Energy Efficiency: 873
- EPA: These block-by-block values are purely illustrative and meant to assist in the understanding of the state goals.
- EPA State Goal =

$$\frac{\{(coal\ gen.\ x\ coal\ emission\ rate) + (OG\ gen.\ x\ OG\ emission\ rate) + (NGCC\ gen.\ x\ NGCC\ emission\ rate) + Other\ emissions\}}{Coal\ gen.\ +\ OG\ gen.\ +\ NGCC\ gen.\ +\ "Other"\ gen.\ +\ Nuclear\ gen._{uc + ar} + RE\ gen.\ + EE\ gen.}$$

Where:

OG = Oil and Natural Gas Turbines

RE = Renewable Energy

UC = Under Construction

NGCC = Natural Gas Combined Cycle

EE = Energy Efficiency

AR = At Risk

NOTE: “Other” includes fossil sources that are likely subject to 111(d) rulemaking, but not subject to building block abatement measures (e.g., IGCC, high utilization CTs, useful thermal output at cogeneration units).

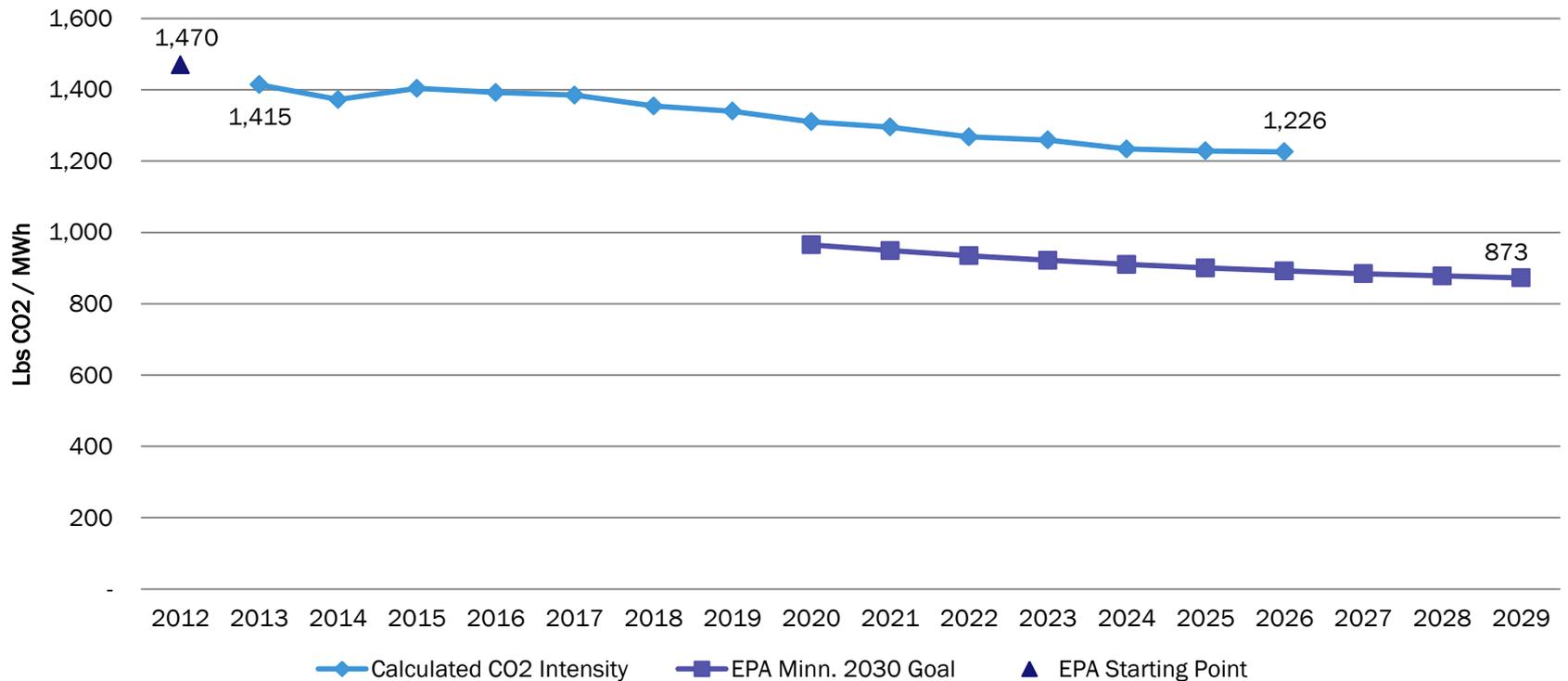
Disclaimer

- We are not advocating any particular alternative at this time.
- This information is based upon preliminary, spreadsheet analysis.
- Detailed analysis is the next step, incorporating stakeholder input.

Developing a Model—Step 4, Initial Model Base Case Results

Carbon Intensity of Affected Units, Current IRPs of GRE, MP, SMMPA and Xcel

(Affected Unit CO₂ / [Affected Unit GWh + 'at risk' Nuclear + Renewables + New DSM])

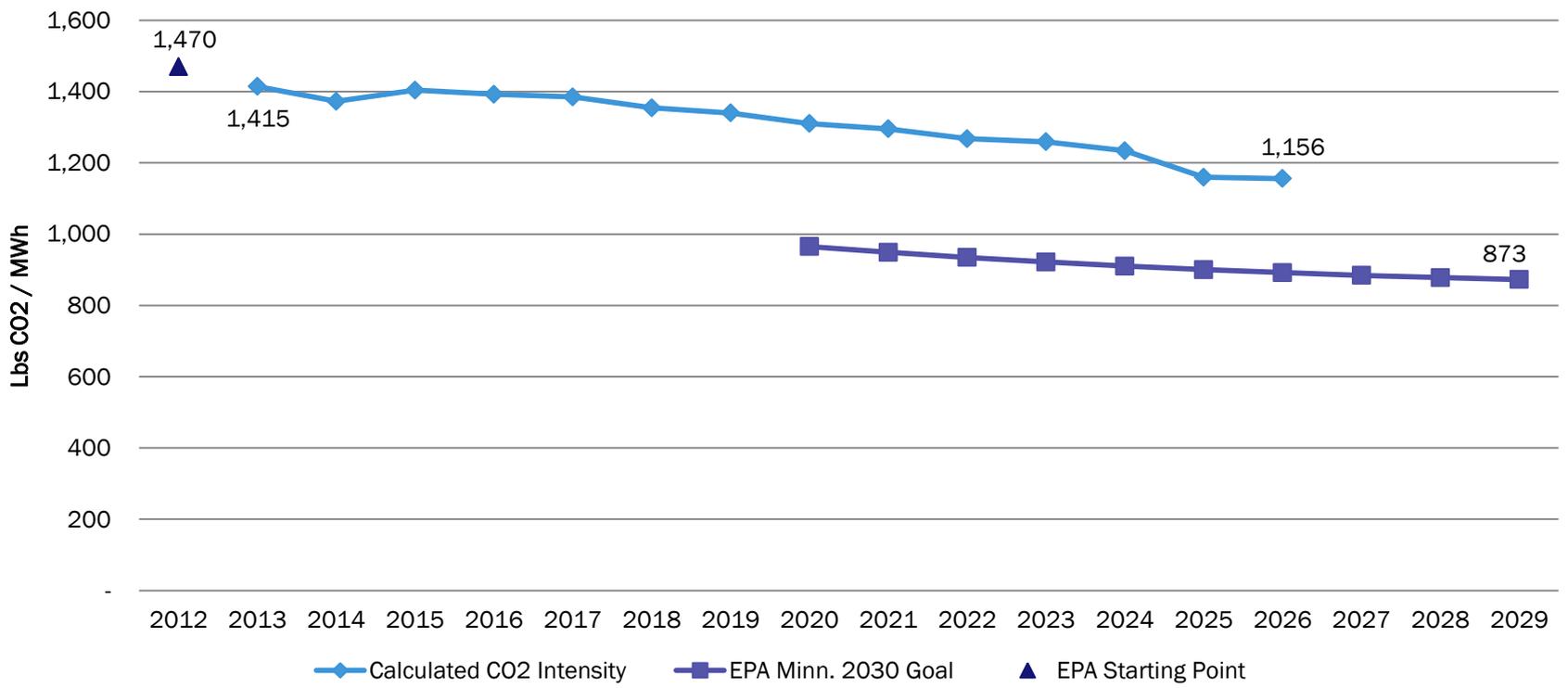


Concept 1a: MP Small Units

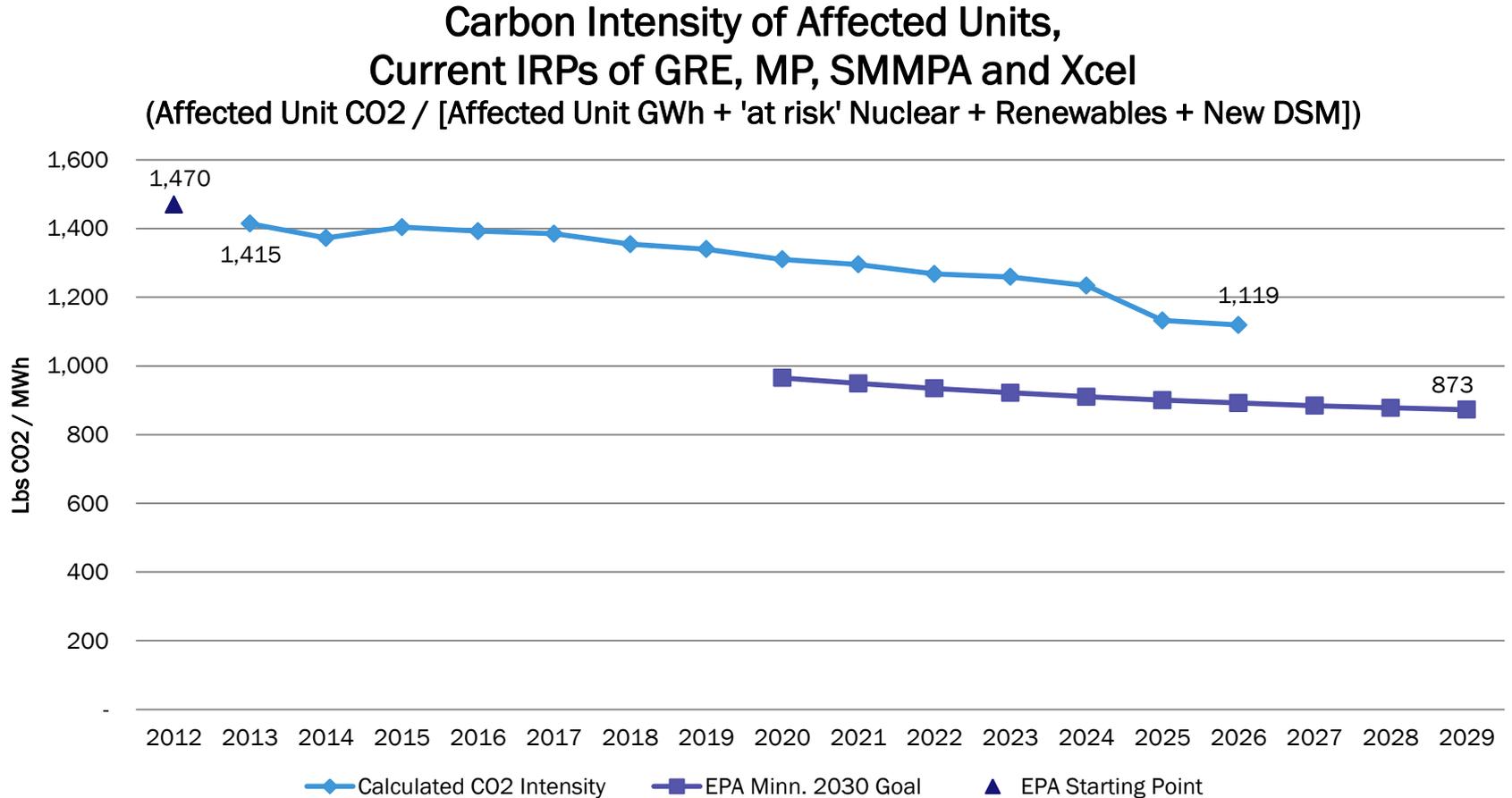
Retire: Boswell 1, 2; Laskin 1, 2; & Tac. Harb. 1, 2 Replace Energy with Renewables

Carbon Intensity of Affected Units,
Current IRPs of GRE, MP, SMMPA and Xcel

(Affected Unit CO2 / [Affected Unit GWh + 'at risk' Nuclear + Renewables + New DSM])

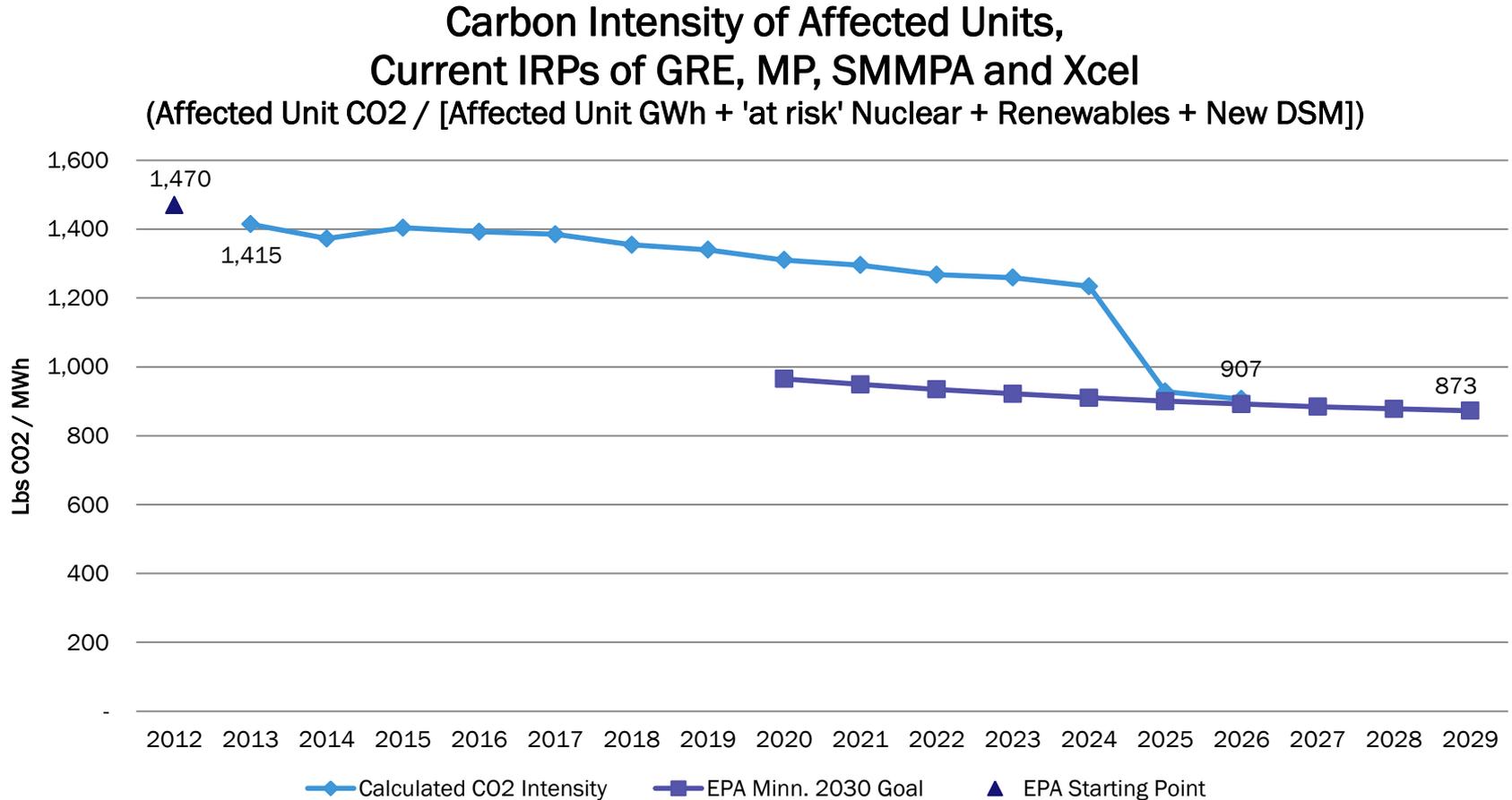


Concept 1b: MP Small Units + Xcel/Manitoba Hydro PPA* Rollover Treated as New Renewables

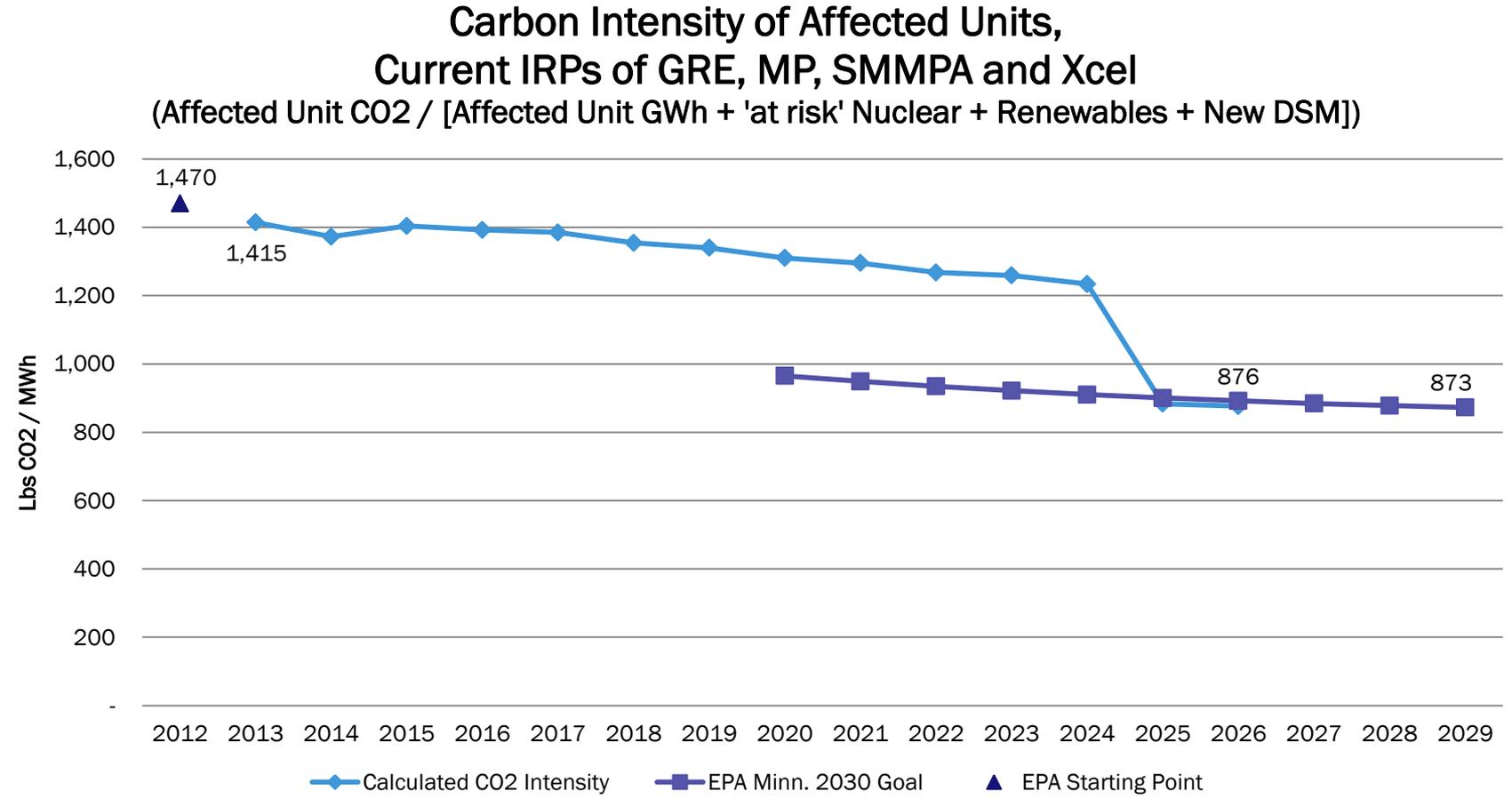


* There are more utility contracts with Manitoba Hydro, but they are ignored for now.

Concept 1c: MP Small Units + Xcel/MH + Sherco 1 Replaced With Renewables



Concept 2: Xcel's Sherco 1, 2 Replaced with 1/2 Renewables, 1/2 New Natural Gas



Summary of Initial Results

- A plan could be put together from several smaller pieces, but inclusion of retiring at least one major coal unit is likely
- A plan could be put together from retiring two or three major coal units:
 - Sherco 1, 2, 3;
 - Boswell 3, 4.
- Significant expansion of renewables & DSM will have to be part of the plan.

Summary of Initial Results Cont'd

- Have not explored system effects:
 - How will MISO dispatch be impacted or restricted?
 - How much energy from retired units would be picked up by existing natural gas and coal units?
 - How much renewables & DSM is least cost with several coal units retired?
 - How will the transmission system be impacted by compliance plans?

Next Steps For Department

- Acquire updated Strategist databases from utilities.
- Acquire related data (shut down costs, cost to build gas generation on coal plant sites, etc)
- Review databases and make needed changes.
- Determine scenarios and contingencies to explore.