Grid Impacts Subgroup

Report-out to Stakeholders
2/4/2021

Jenny Edwards, CEE

Introduction

- Group was focused on the potential future grid impacts of deep electrification, primarily from space and water heating and electric vehicles.
- Long term view and systems perspective
- Many of these issues have a “tipping point” and aren’t necessarily of concern before then
- Presentations from:
  - Gary Ambach, Slipstream
  - Jeff Haase, Great River Energy
  - Patrick Dalton, ICF
  - Nick Dreher, MEEA
  - John Heer, Centerpoint

Subgroup Members

Alexis Troschinetz

Ashly McFarlane

Gary Ambach

Jeff Haase

Jeremy Peterson

Kaesha Baloch

Kevin Lawless

Lisa Fischer

Luke Meech

Maddie Wazowicz

Nick Dreher

Patrick Dalton

Travis Hinck

Winona LaDuke

Jenny Edwards

Peter Scholtz (observer)

Kristin Berkland (observer)

Topic 1

We need to prepare for a shift for the electric grid to be winter peaking.

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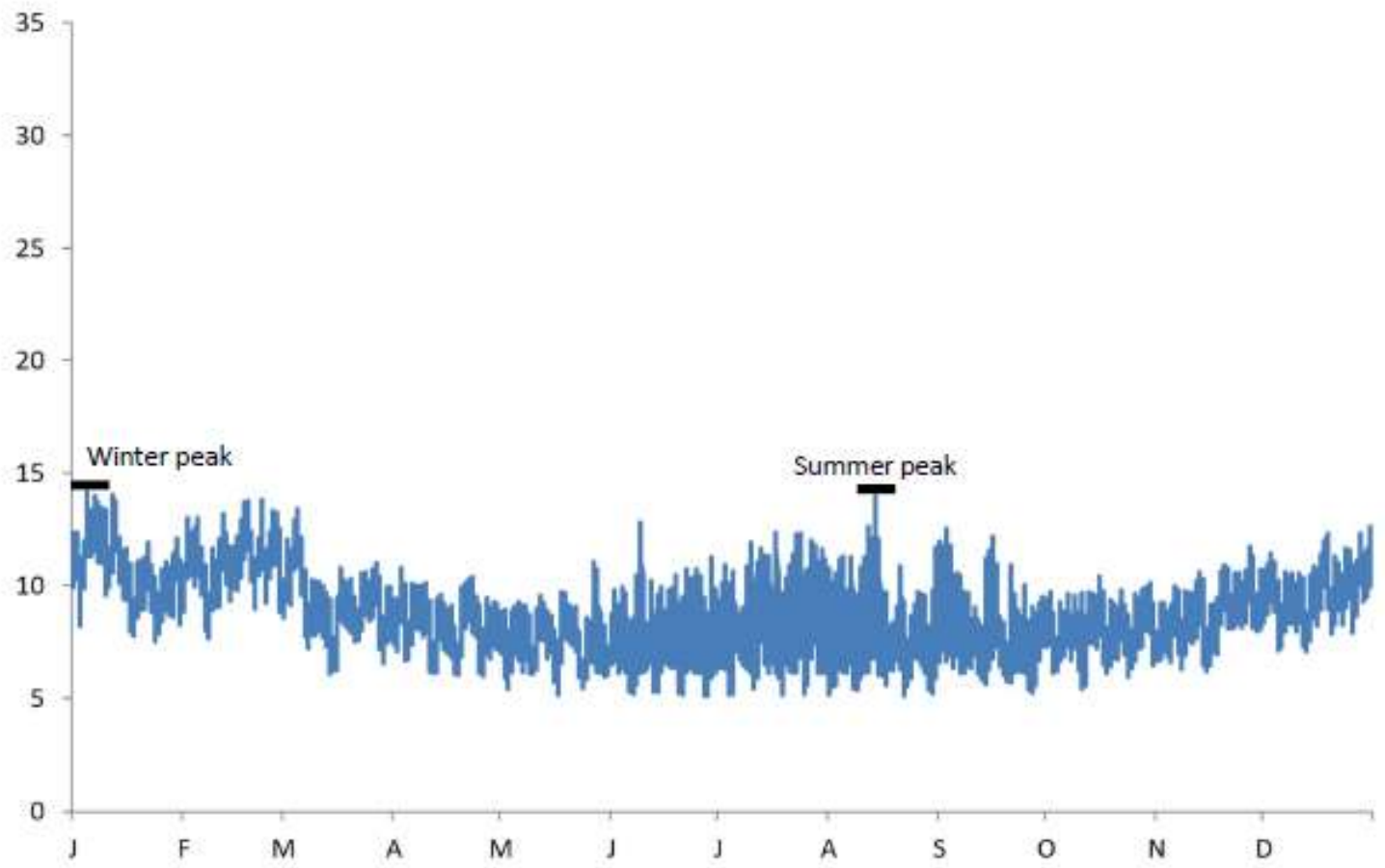
- The electric grid will shift to a winter peak, and some estimates show the winter peak will be about 2x larger than current summer peak.
- Some utilities already are winter peaking
- The future resiliency of energy services will continue to be supplied by both the gas and electric system.
- The single coldest day (design day) is the important day for planning both the gas and electric systems
- On these worst-case days, the heat is supplied by the back-up system (electric or fossil fuel).

Discussion Spotlight

Planning for Resiliency at Peaks

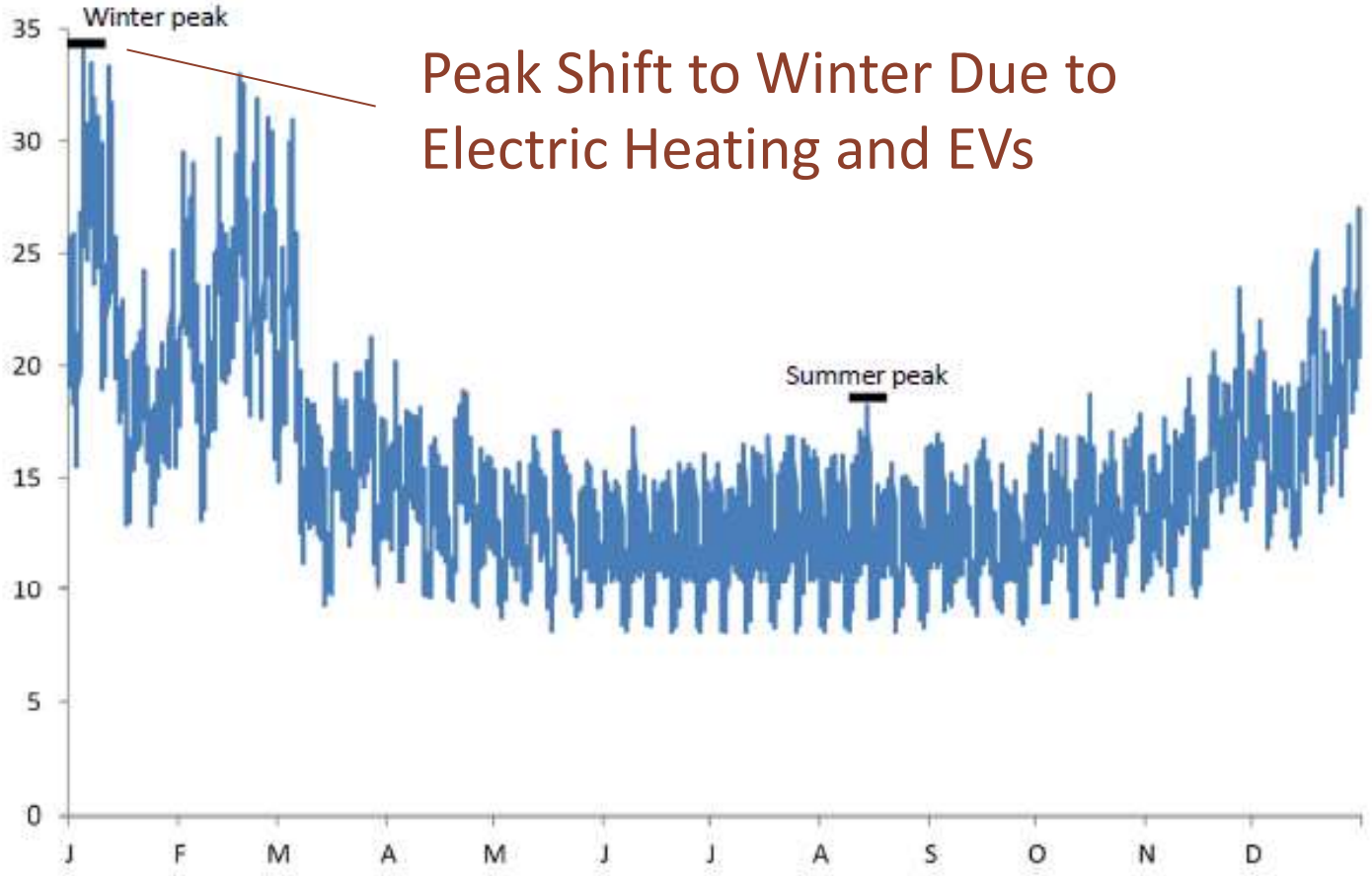
Minnesota's 2015 Electric Load



- Peak MN electricity load in 2015 was similar between summer and winter

Source: Opportunities for Decarbonizing Minnesota's Economy: Energy System Supply and Demand Assessment. EPRI, Palo Alto, CA: 2020. 3002019333

Minnesota's 2050 Electric Load

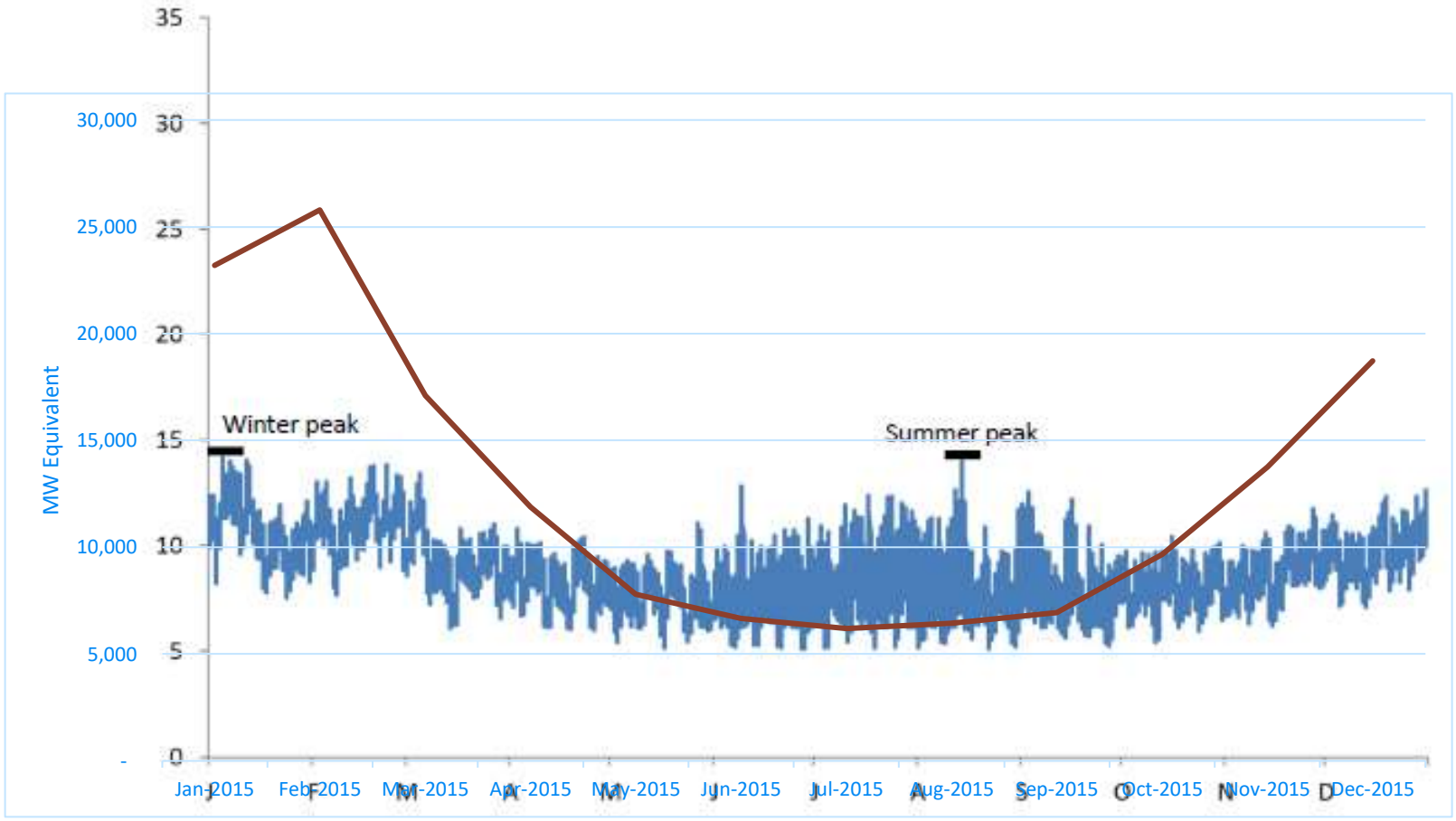


Peak Shift to Winter Due to Electric Heating and EVs

- With 80% Economy-wide policy, 2050 load throughout the year significantly higher than with the other policies
- System heavily dominated by winter peak

Source: Opportunities for Decarbonizing Minnesota's Economy: Energy System Supply and Demand Assessment. EPRI, Palo Alto, CA: 2020. 3002019333

Minnesota's 2015 Electric Load



- Peak MN electricity load in 2015 was similar between summer and winter

2015 Average Monthly Natural Gas Demand (if converted to MW)

Source: Opportunities for Decarbonizing Minnesota's Economy: Energy System Supply and Demand Assessment. EPRI, Palo Alto, CA: 2020. 3002019333

Topic 2

Electrification that improves the system load factor will require controlling electric use into low-demand periods. Tools include grid-connected devices, rates, and storage.

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- Electrification that improves system load factor will lower rates (because we won't increase peak, just fill in valleys).
- Current volumetric rates can be a disincentive, and are often higher than the actual cost to serve load that fills in valleys.
- Control of electric technologies can reduce costs to consumers under certain rates (i.e. nighttime charging of EVs).
- Many tools already exist. Some controls to make this happen are fairly nascent but equipment installed has long lifetimes
- This issue is of particular importance in the context of electrification incentives.

Discussion Spotlight

System Load Factor

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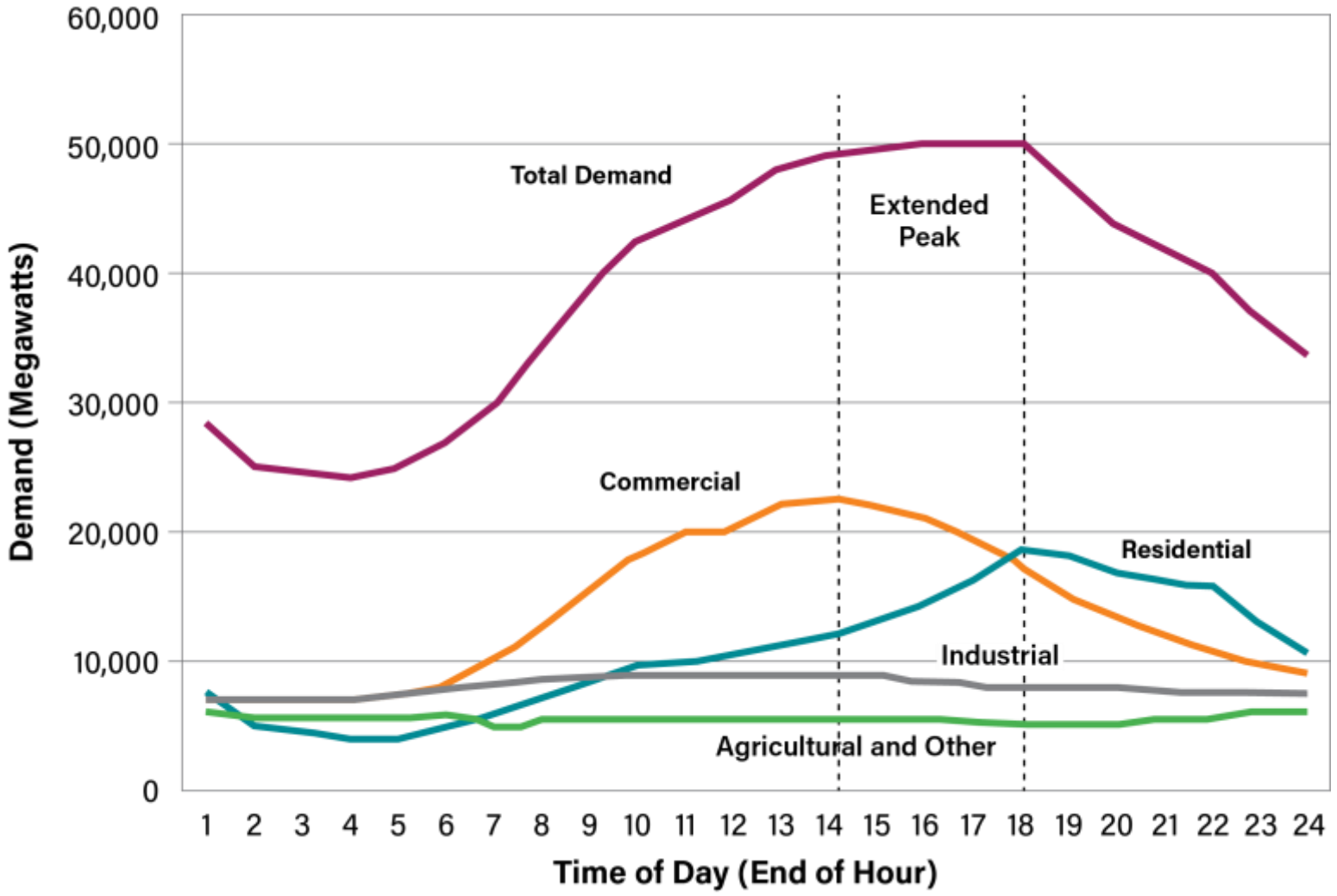
ECO Legislation (HF 164) indicates that an efficient fuel switching measure is “installed or operated in a way that improves the utility’s system load factor”



Source: Gary Ambach for a presentation to the TAC

Topic 3

Electrification will impact distribution systems (both T&D infrastructure and natural gas distribution) which will have associated costs.

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- Distribution costs are determined by peak day, not year-round volume. About $35/month is the flat cost to give access to gas a back-up fuel.
- The smallest level of the distribution system will present the most challenges.
- Likely no one-size-fits all solution
- Avoid creating under-investment in areas of the grid where consumers aren't first to electrify.
- There might be cost implications for gas grid, including how much and when do costs increase for remaining customers.

Topic 4

The methodology for assigning carbon intensity to electrification loads needs to be determined. That methodology will change the assumed carbon benefit of electrification, especially in the short term.

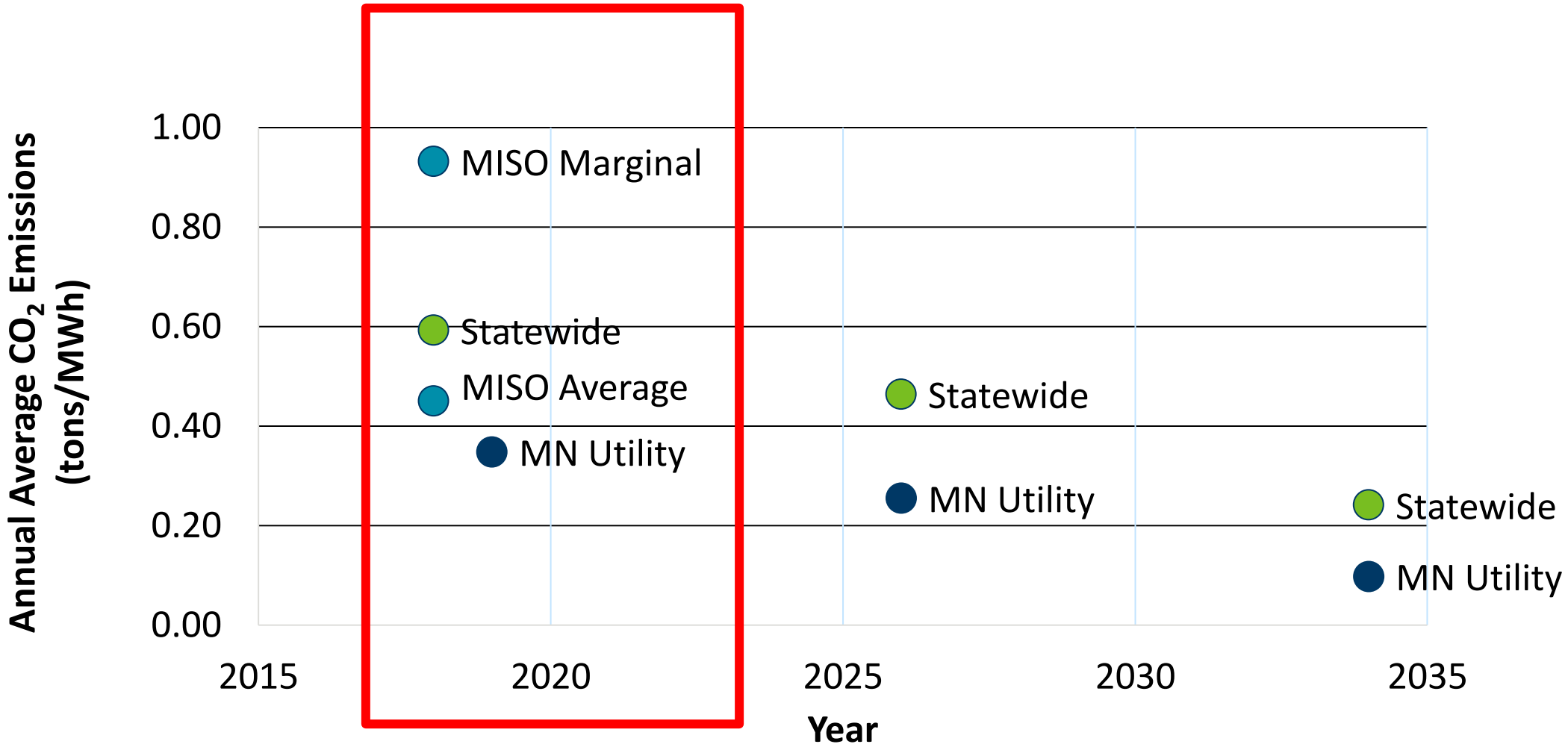
The methodology for assigning carbon intensity to electrification loads needs to be determined.

- There is not a comprehensive understanding of what supply dispatch looks like in a high renewables future.
- Carbon results are very different if one considers marginal emissions versus average emissions.
- Agreement on this topic is important. If lowering carbon is the end goal, this is a critical issue.
- Focus on short term is a challenge if it disrupts getting to longer term goals.

Discussion Spotlight

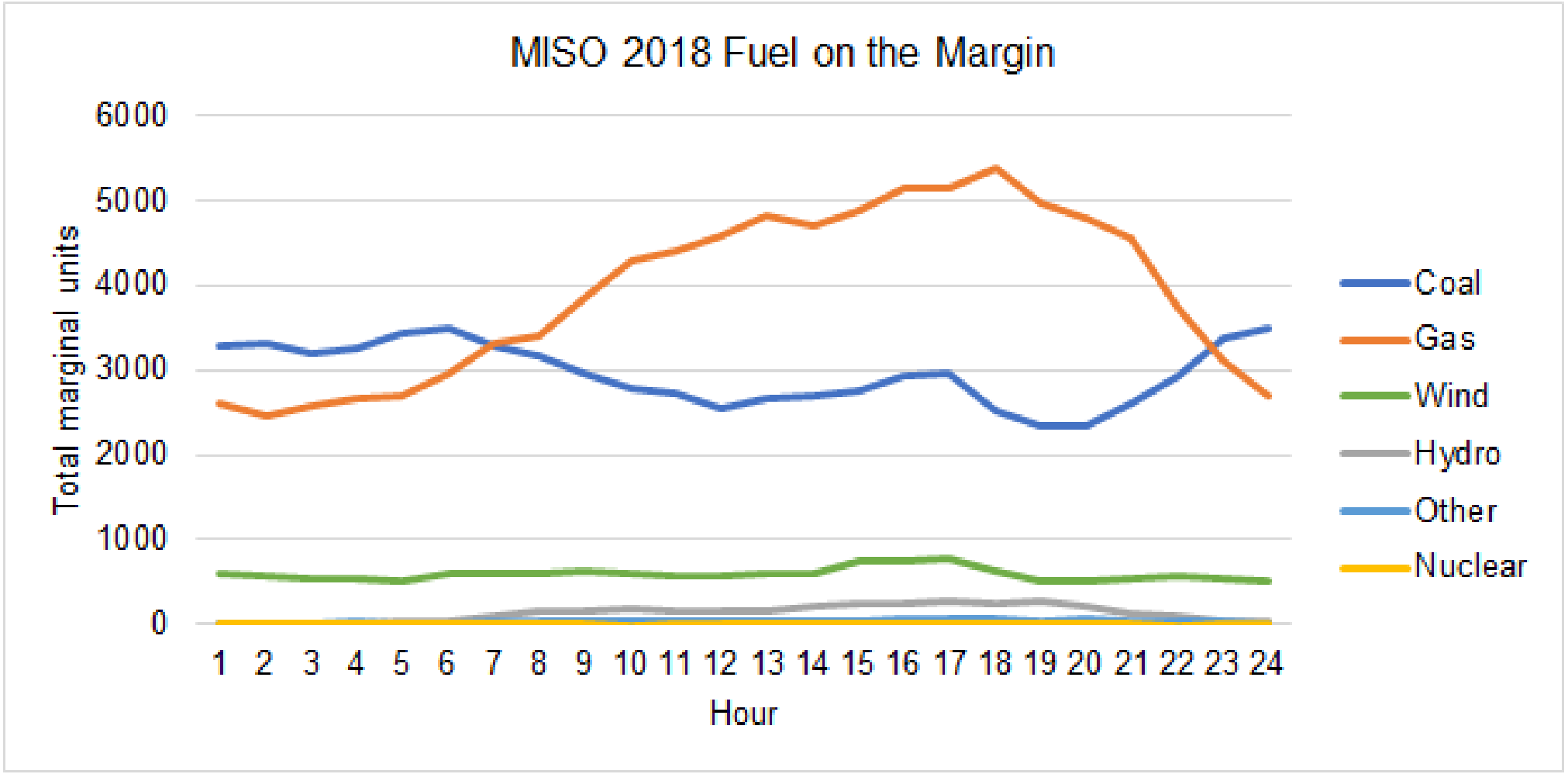
Carbon Accounting Methods

Average vs Marginal Emissions Factors



Source: Slipstream, CEE, and Rakon Energy. Market Potential for Saving Energy and Carbon Emissions with Load Shifting Measures. MN DOC Contract 157427

Average versus Marginal Emissions Factors



Source: L Shaver, https://sustainability.stackexchange.com/questions/7112/what-is-marginal-energy

Key Recommendations

Key Recommendations

1. Incorporate gas and electric information into planning.
2. Investigate cost-to-serve for the electric grid and gas system for electric technologies – this would help set appropriate rates.
3. Work to achieve consensus on methodology for accounting for carbon.
4. Conduct an electrification potential study

Additional Documentation

Research Needs, Policy Implications, and Recommendations as identified by the Technical Advisory Committee

Topic 1: We need to prepare for a shift for the electric grid to be winter peaking.

2) What research is needed?	• Understand the magnitude of winter peak under different scenarios, and when we are likely to see it • Understand the options for mitigating the peak • Explore how other states incorporate feedback from gas planning into their electric IRP process.
3) What policy issues are there?	• Traditional CIP measures like envelope retrofits help reduce the future peak. Currently these are largely funded through natural gas efficiency programs. • Does the shift from summer to winter really matter?
4) Do we have any recommendations?	• Develop projections for technology adoption and load shapes • Understand adoption scenarios via an electrification potential study • Consider how electric IRP processes can include inputs of natural gas planning for fuel switching measures.

Topics 2: Electrification that improves the system load factor will require controlling electric use into low-demand periods.

2) What research is needed?	• Investigate cost-to-serve for the electric grid and gas system for electric technologies – this would help set appropriate rates. • What is potential for behavior-based changes
3) What policy issues are there?	• Current limitations within CIP require energy savings, which means load shifting is note possible. • Legislation, such as Energy Conservation and Optimization (ECO), would address this barrier.
4) Do we have any recommendations?	• Develop a list of tools to assist in load shifting: rates, incentives, controls, software, etc… • Understand this issue from a carbon perspective as well as a cost perspective

Topic 3: Electrification will have impacts on distributions systems which will have associated costs.

2) What research is needed?	• Understand the adoption rate, and location of electric technologies to better understand when and where peaks will occur. This will also help ID customers leaving gas system. Focus on coincident peaks (with and without fossil back-up) • Research on control of end uses to avoid localized peaks • Explore the rate impact of electrification - will it result in the need for further investments in the grid that will tend to increase rates, by how much, and how much will those impacts be offset by incremental revenue from new load?
3) What policy issues are there?	• How can we be preparing for needed future investments, even if we haven't reached the tipping point yet • Other jurisdictions are passing legislation limiting natural gas in new construction.
4) Do we have any recommendations?	• Electrification potential study to help understand adoption • We need some granular analysis of adoption scenarios in specific high value location in order to mitigate investment costs.

Topic 4: The methodology for assigning carbon intensity to electrification loads needs to be determined.

2) What research is needed?	• Better knowledge of load shapes and expected adoption • Better understanding of when a new load in "on the margin" versus when it becomes part of baseload (understand the short versus long run)
3) What policy issues are there?	• Any tracking of carbon performance will require consistent methods.
4) Do we have any recommendations?	• Both research and stakeholder input are needed dedicated to this topic. In particular we need to better understand what the difference is between methodologies. • Increase the understanding / transparency of the MISO system versus individual utility operations