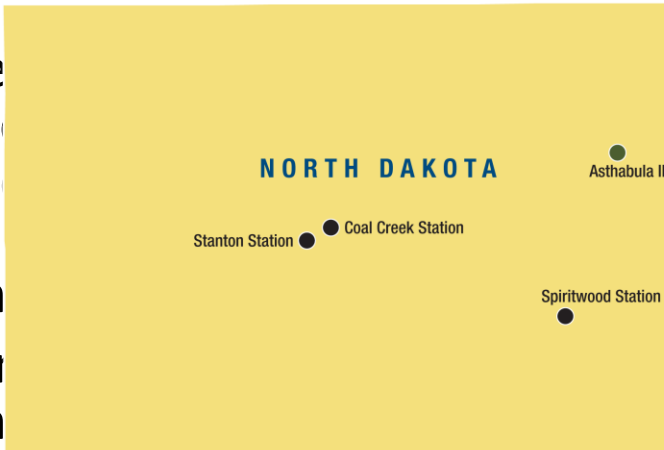


Great River Energy Demand Side Management Overview

June 14th, 2017

Great River Energy

- Generate electricity from coal, natural gas, wind, and fuel oil
- Operate a wholly owned distribution utility in Minnesota
- Second largest electric utility in Minnesota



cooperatives distribute electricity to families, farms and businesses serving almost 1.7 million people.



Utility Metrics

	Investor-Owned	Publicly Owned	Cooperatives
Miles of Distribution Line	50%	7%	43%
Customers per mile of line (density)	34	48	7.4
Revenue per mile of line	\$75,500	\$113,000	\$15,000
Distribution plant per Customer	\$2,798	\$2,740	\$3,290
	Investor-Owned	Publicly Owned	Cooperatives
Sales (billion kilowatt hours)	2708	570	413
Residential	36.6%	37.2%	57.9%
Commercial	39.0%	36.8%	20.3%
Industrial	24.3%	26.0%	21.8%

GRE's Energy Efficiency Perspective

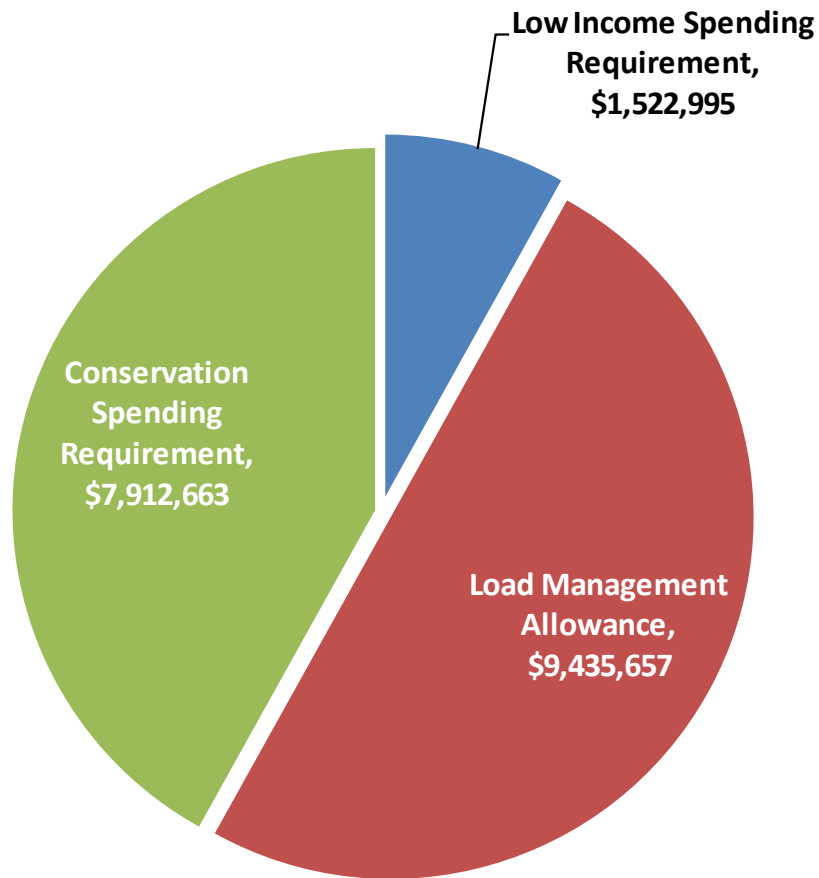
- ▶ Is less expensive than alternatives
- ▶ A goal established by the state
- ▶ Built into our future resource plants
- ▶ Encouraged and supported by GRE and its members
- ▶ Enhances relationship between member consumers and cooperatives

 EnergyWiseMN.com

Agricultural EE Program Offerings

- ▶ LED Lighting
 - Our biggest program
- ▶ Hog Farrowing Controls
- ▶ Water Heating
- ▶ Agricultural Ventilation
 - High Volume, Low Speed Ventilation Fans
- ▶ Variable Frequency Drives
- ▶ Demand Response Programs for Irrigators

State Requirements

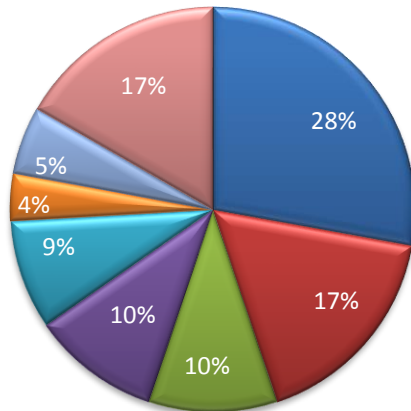


- ▶ Total spending is comprised of several components:
 - Conservation Spending
 - Load Management
 - Low Income Spending
- ▶ Minimum Spending **~\$18.9 Million**

Energy efficiency programs

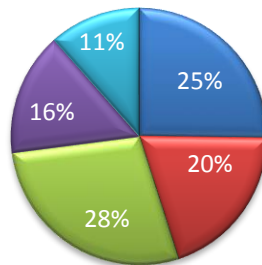
Residential energy savings – Top programs

- GSHP
- ASHP
- Residential Behavior
- Lighting
- ENERGY STAR Appliances
- Income Eligible : Custom
- ECM Motor
- Other



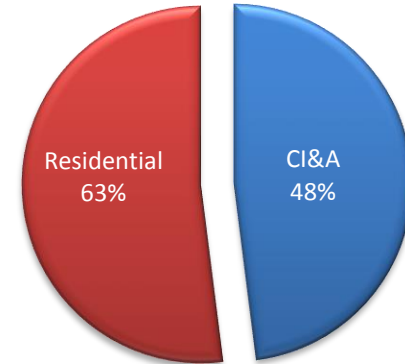
Commercial energy savings – Top programs

- Lighting New Construction
- Custom Rebate
- Retrofit Lighting
- Motors & Drives
- HVAC



Rebate spending

- ▶ 2010: \$10M
- ▶ 2011: \$8M
- ▶ 2012: \$6M
- ▶ 2013: \$6M
- ▶ 2014: \$6M
- ▶ 2015: \$6M



Energy efficiency facts

- ▶ Met all spending requirements between 2010 and 2015
- ▶ Exceeded the energy savings goal in 2010-2013
- ▶ Total savings in 2015 was approximately 1.1 percent

Strategic energy sales – The future

Focusing on energy sales that result in productive load growth while helping to meet the CIP goals.

- ▶ ETS space and water heating
- ▶ Air source and ground source heat pumps (2015 top residential programs)
- ▶ Electric vehicles

CAN GRE Member Coop Load - 7/14/2015 00:00

GRE load curve

Member Wholesale Billing

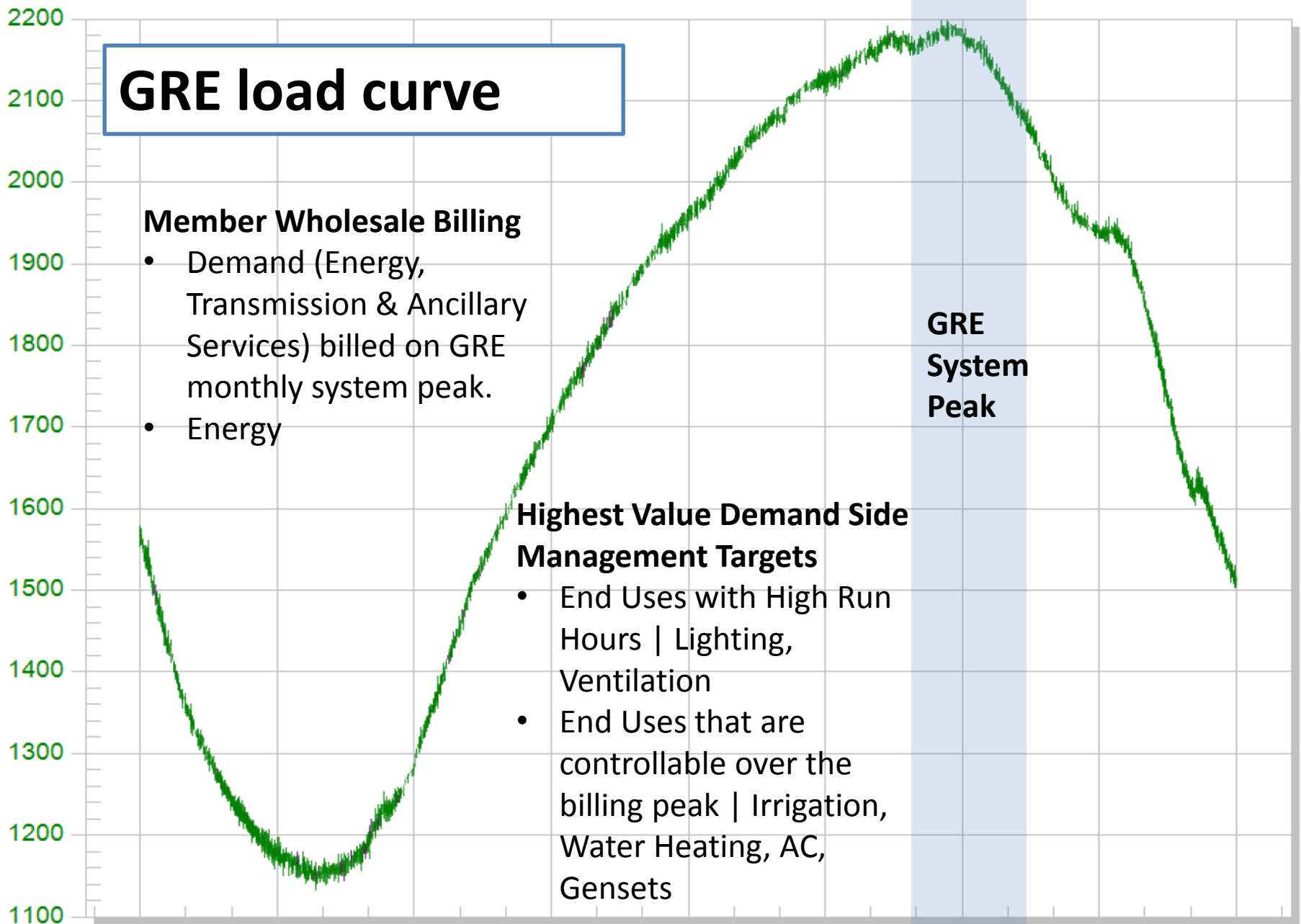
- Demand (Energy, Transmission & Ancillary Services) billed on GRE monthly system peak.
- Energy

Highest Value Demand Side Management Targets

- End Uses with High Run Hours | Lighting, Ventilation
- End Uses that are controllable over the billing peak | Irrigation, Water Heating, AC, Gensets

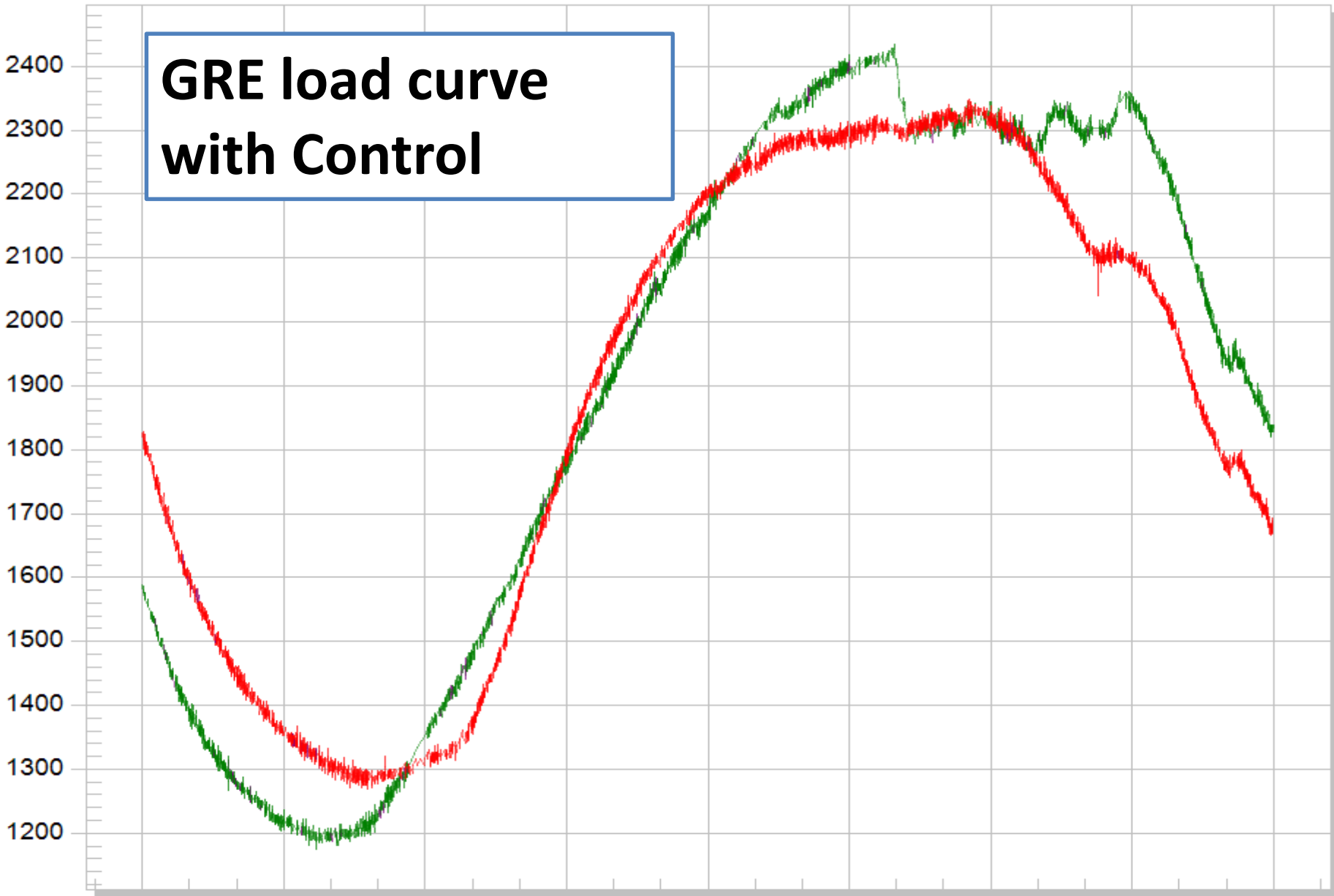
GRE System Peak

14 Tue 3AM 6AM 9AM 12PM 3PM 6PM 9PM 15 Wed Jul 2015



CAN GRE Member Coop Load - 8/14/2015 00:00
CAN GRE Member Coop Load - 8/14/2015 00:00 - 8/15/2015 00:00

**GRE load curve
with Control**



Program Marketing

ENERGY WISE for your Business



Your farm is your business. We treat it that way as well. The commercial programs at [\[your electric coop\]](#) can be applied at your farm just like any other business. The least expensive, quickest, and easiest way to save money on your farm (including the home residence) is by using energy efficiently.

AGRICULTURAL ENERGY:

Rebates and incentives for agricultural customers are available for the installation of various types of equipment including, but not limited to:

- Milking vacuum pump variable frequency drive (VFD)
- Milk transfer pump VFD
- Scroll compressors for bulk tank
- Waste heat exchangers and frame type milk pre-coolers (well water pre-cooler)
- Energy efficient lighting
- Hog farrowing control systems

Value for Your Business

WATER HEATING SYSTEMS

One step a farmer can take to create the most energy efficient building is an evaluation of their water heating systems. This should be done both for the home and farm buildings. Data in the residential and commercial sectors indicate a potential savings of approximately 20 percent in the agriculture sector.

ENERGY EFFICIENT FANS

High volume, low speed fans are an efficient way to move large amounts of air and make less noise than standard agricultural ventilation fans.



Dairy farms are a great candidate for motor energy efficiency programs due to their large use of pumps. Upgrading motors can have a significant impact on the energy efficiency of the farm and provide significant savings.



The least expensive, quickest, and easiest way to save money on your farm is by using energy efficiently

DAIRY FARMING

Dairy farms are a great candidate for energy efficiency programs due to their large use of pumps. Upgrading motors can have a significant impact on the energy efficiency of the farm and provide significant savings.

Another great way to improve energy efficiency is through the refrigeration system. As a farmer, you should address refrigeration system efficiency measures in a logical, step-by-step manner. These measures, in order of priority, include:

1. Refrigeration Heat Recovery (RHR) units
2. Scroll compressors
3. Plate-coolers
4. Variable speed milk pumps

These measures can reduce refrigeration related energy costs substantially and maintain, or even improve, milk quality.

How does it work?

Meet with [\[your cooperative's\]](#) energy expert to set up a plan and they will recommend the best actions to make your farm more energy efficient.

Who can participate?

Any agricultural cooperative member can participate.

What you'll receive

Besides a lifetime of savings on energy efficiency, you could qualify for a rebate depending on what changes you are making.

CONTACT US AND START SAVING TODAY

If you have any questions or need assistance in making these savings a reality for your business, please contact your local energy expert at your electric cooperative.

SUCCESS STORY:

Variable Frequency Drives For Dairy Farms

From the Center for Ecological Technology

Vacuum pumps on dairy farms are typically sized to have sufficient capacity for the largest possible anticipated demand. Even though this demand occurs less than one percent of the time, the pump always operates at full speed. This condition wastes energy and is noisy. Now a new vacuum control system, using state-of-the-art electro-technology sensors with feedback control to variable frequency drives, changes the pump capacity to match the need. The energy savings are 50-80%.

The amount of energy savings a dairy farm will realize using the new vacuum pump control system varies, but in every test case, energy savings were more than 50 percent. One farm with 800+ cows reduced its kWh/cow-year-milking from approximately 40 to 20, resulting in an energy savings of approximately 55,000 kWh/yr.

Savings range from 50 to 80 percent depending upon the degree to which the pump is oversized and the hours the pump operates per day. Payback periods can be less than one year or as long as four years. Cost for a control system ranges from \$1,800 for a 5 hp (3.7 kW) up to \$7,400 for a 30 hp (22.4 kW) unit.

Keep in Mind: Variable Frequency Drives that are designed for dairy milking are as reliable as regular vacuum drives. Research has shown that they do not increase milking time, nor do they have any adverse impacts on cow health.

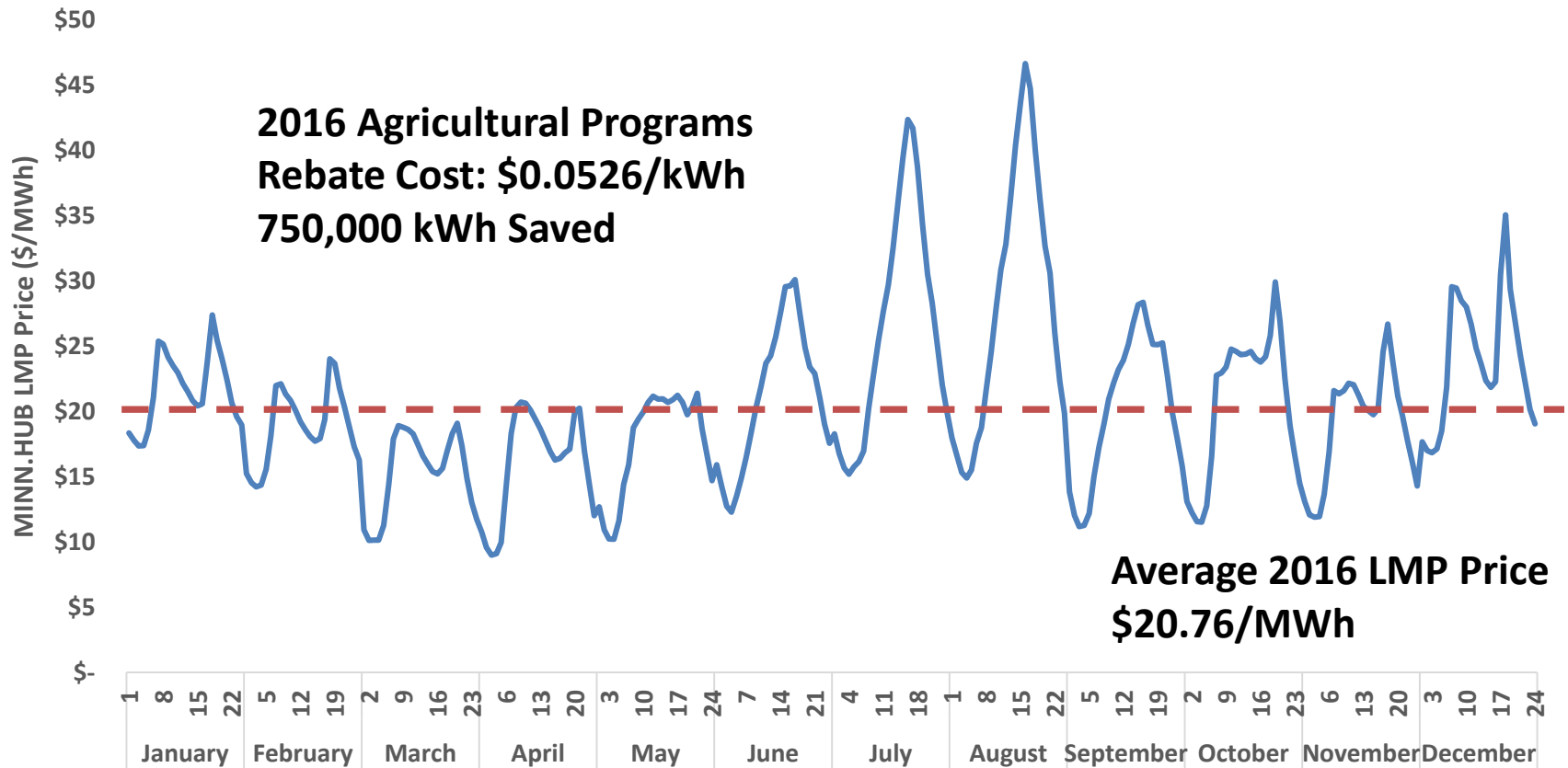
[\[Your electric cooperative\]](#) provides incentives for the installation of variable frequency drives on vacuum pump motors and ventilation systems.

Source: U.S. Department of Energy

ENERGY WISE  MN

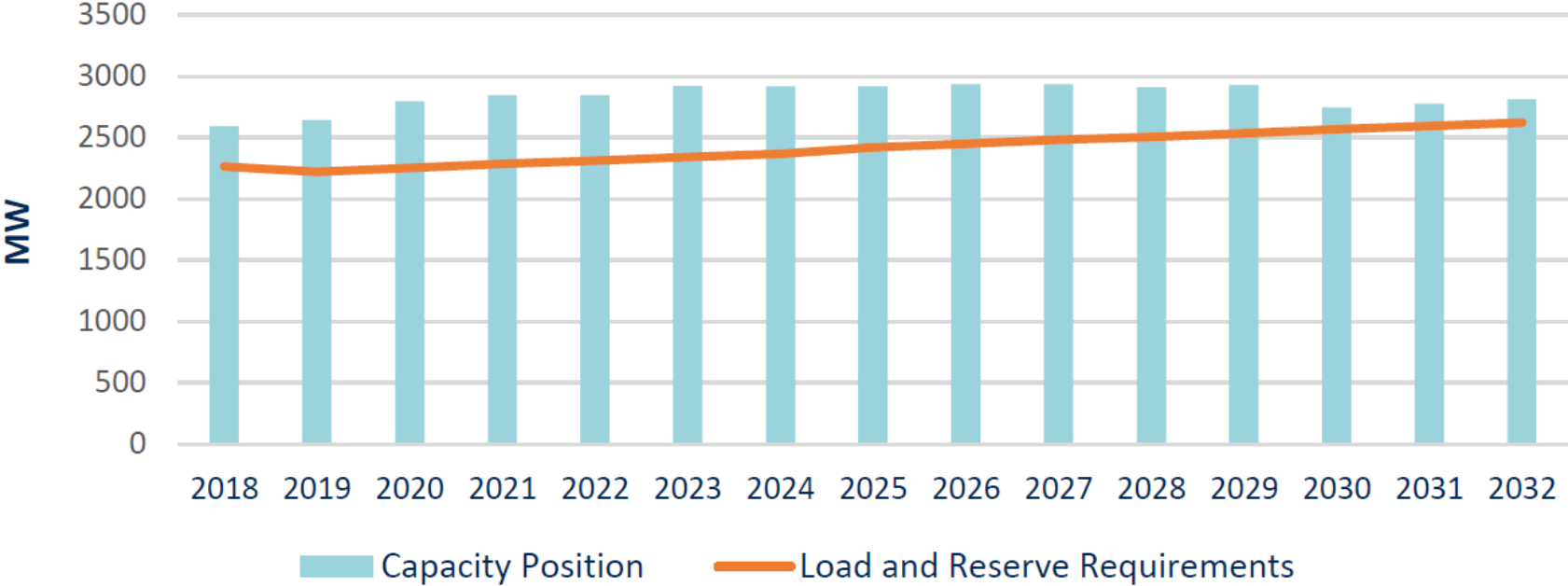
Market Value of Efficiency

2016 Hourly LMPs by Hour & Month | MINN.HUB



GRE's Current Capacity Position

15-Year Outlook: GRE Preferred Plan Capacity Position and Requirements



Capacity Additions | Next 15 Years

Resource Plan (MW) Based on Nameplate Rating		
Year	Capacity	Type
2017	-189	Stanton Station Retirement
2018		
2019		
2020	300	Wind Power Purchase Agreement
2021	100	Wind Power Purchase Agreement
2022		
2023		
2024		
2025		
2026		
2027		
2028		
2029	100	Wind Power Purchase Agreement
2030	100	Wind Power Purchase Agreement
2031	200	Wind Power Purchase Agreement
2032	200	Wind Power Purchase Agreement

Planning Period

Thank you!

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