



Solar Energy at the Northland Pines School District 2006 to 2024: Empowering Students while saving Money

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Why are we here?

- Describe on-site solar PV (photovoltaic) system options to enable schools to achieve cost savings and even achieve Zero Energy (net basis), or close to it.
- Describe how solar is educationally and financially beneficial
- Describe how solar has been successfully implemented at Northland Pines School District
- Answer your questions



Why it matters: Students at the St. Germain Elementary School



Northland Pines School District's Long-Term Commitment to Energy Efficiency and Renewable Energy is Reflected in:

- Ongoing, thoughtful management to reduce energy costs
 - Monitoring performance
- Requirements in construction and remodeling, including the design and construction of the new high school in 2006
 - LEED Gold certification
 - District's First solar PV system
- Continuing evaluation of energy efficiency and solar PV energy opportunities
 - Conversion to LED lighting
 - Large solar PV installations at all four schools in the District
 - Demand Management (peak kW)
- Teachers using energy efficiency and renewable energy curriculum that uses their schools as living laboratories



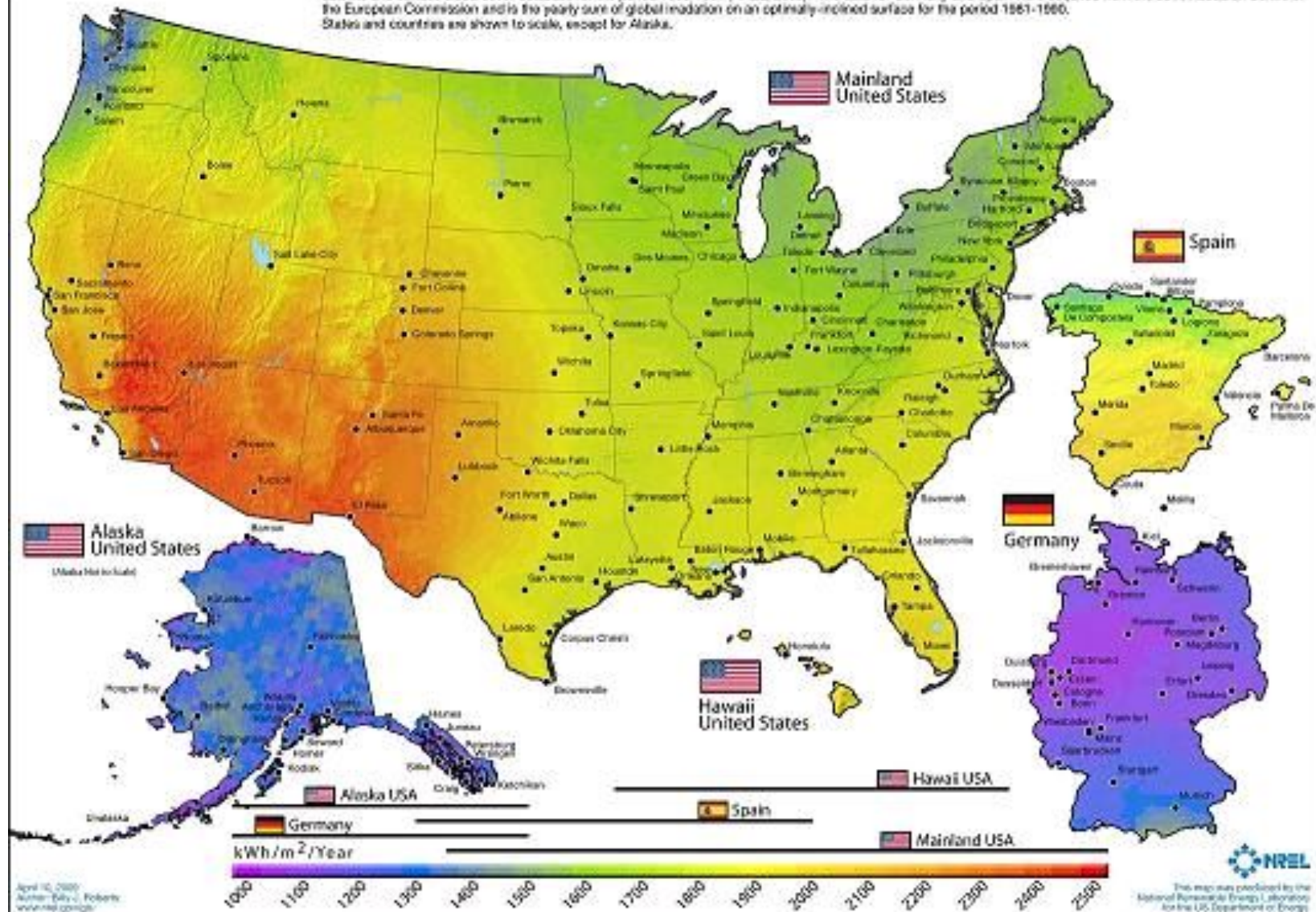
A Solar PV Play in Four Acts (489 kW-dc)

- Act 1: Northland Pines High School (now includes Middle School)
 - Planning for the new high school begins in 2004 with renewable energy
 - 1.5 kW-dc demonstration solar PV system installed in 2006
 - Waiting for solar PV costs to drop to provide cost savings
 - 231 kW-dc roof and ground mount system installed in 2017
- Act 2: Eagle River Elementary School
 - 101 kW-dc ground mount PV system installed in 2017
 - Installation coordinated with the HS project for better bidding and use of third-party, green investors (no up-front cost to the District)
- Act 3: Land O' Lakes Elementary School
 - 86.4 kW-dc ground mount PV system installed in 2019
 - We Energies Solar Now Pilot Program
- Act 4: St. Germain Elementary School
 - 69.4 kW-dc ground mount PV and 60 kW/120 kWh battery installed 2023

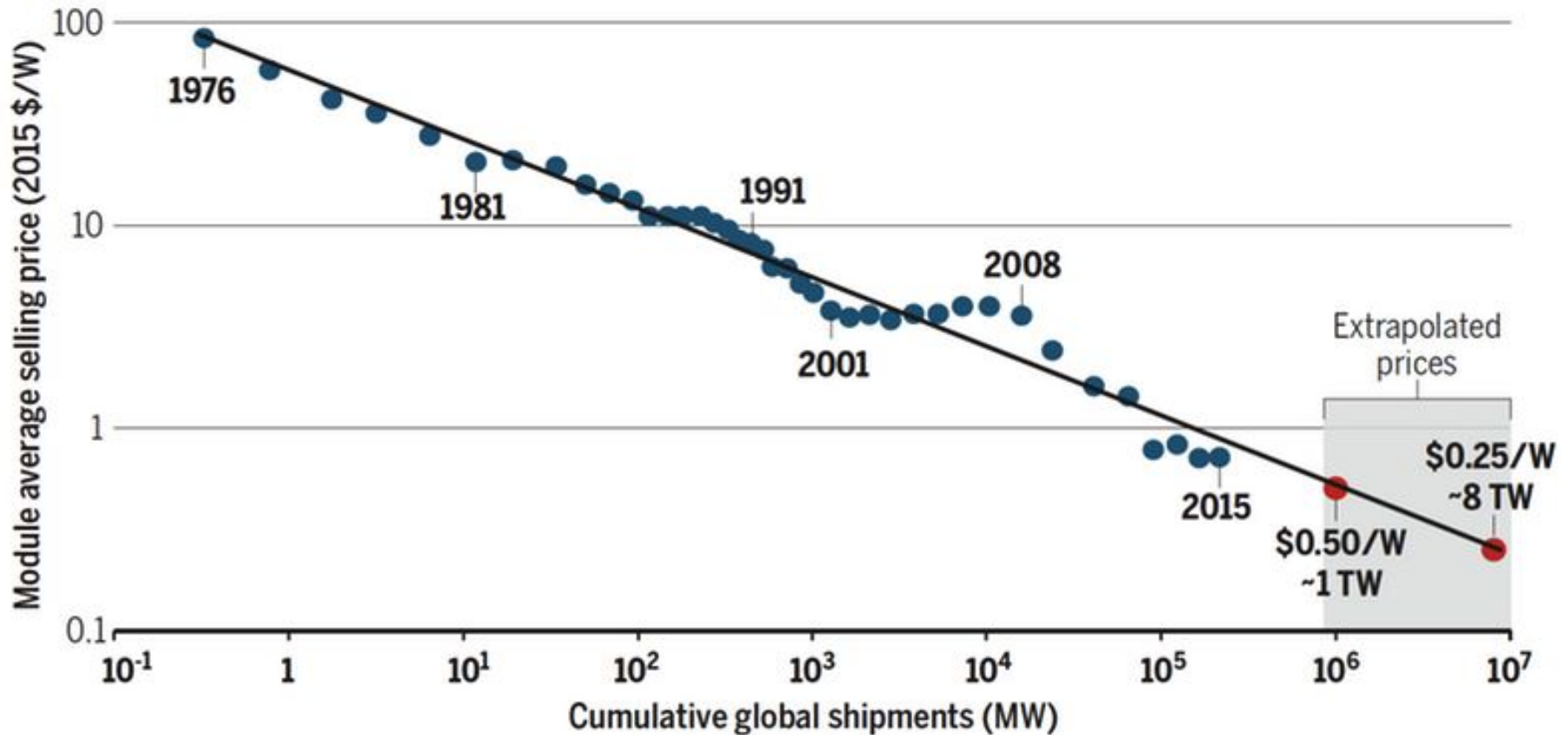


Photovoltaic Solar Resource: United States - Spain - Germany

Annual average solar resource data are for a solar collector oriented toward the south at a tilt = local latitude. The data for Hawaii and the 49 contiguous states are derived from a model developed at SUNY/Waters using geostationary weather satellite data for the period 1998-2005. The data for Alaska are derived from a 40-yr satellite and surface cloud cover database for the period 1965-1991 (NREL, 2003). The data for Germany and Spain were acquired from the Joint Research Centre of the European Commission and is the yearly sum of global irradiation on an optimally-inclined surface for the period 1961-1990. States and countries are shown to scale, except for Alaska.



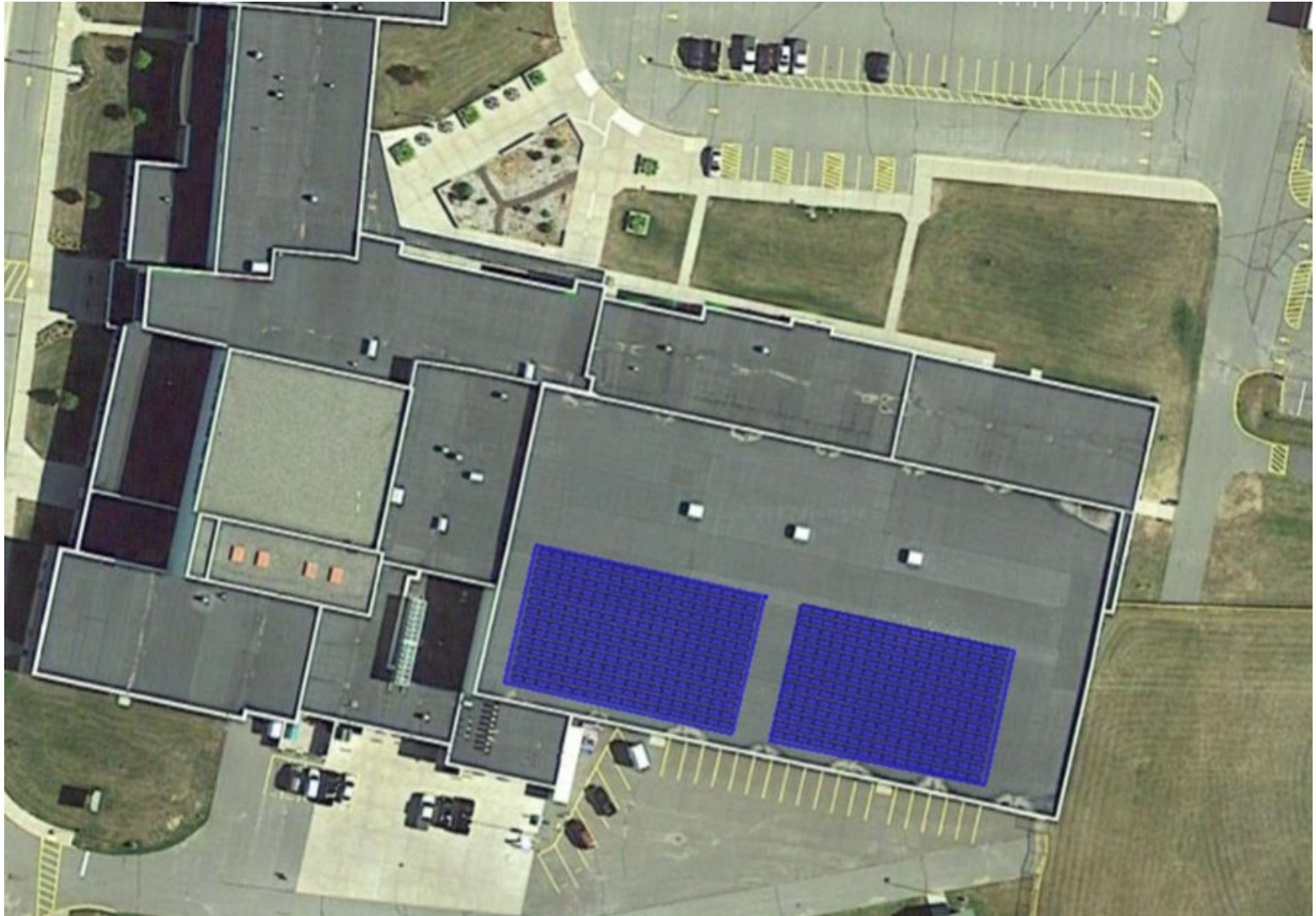
Declining Module (panel) Price



Source Haegel et al, Science April 2017



High School PV Roof Top System Schematic

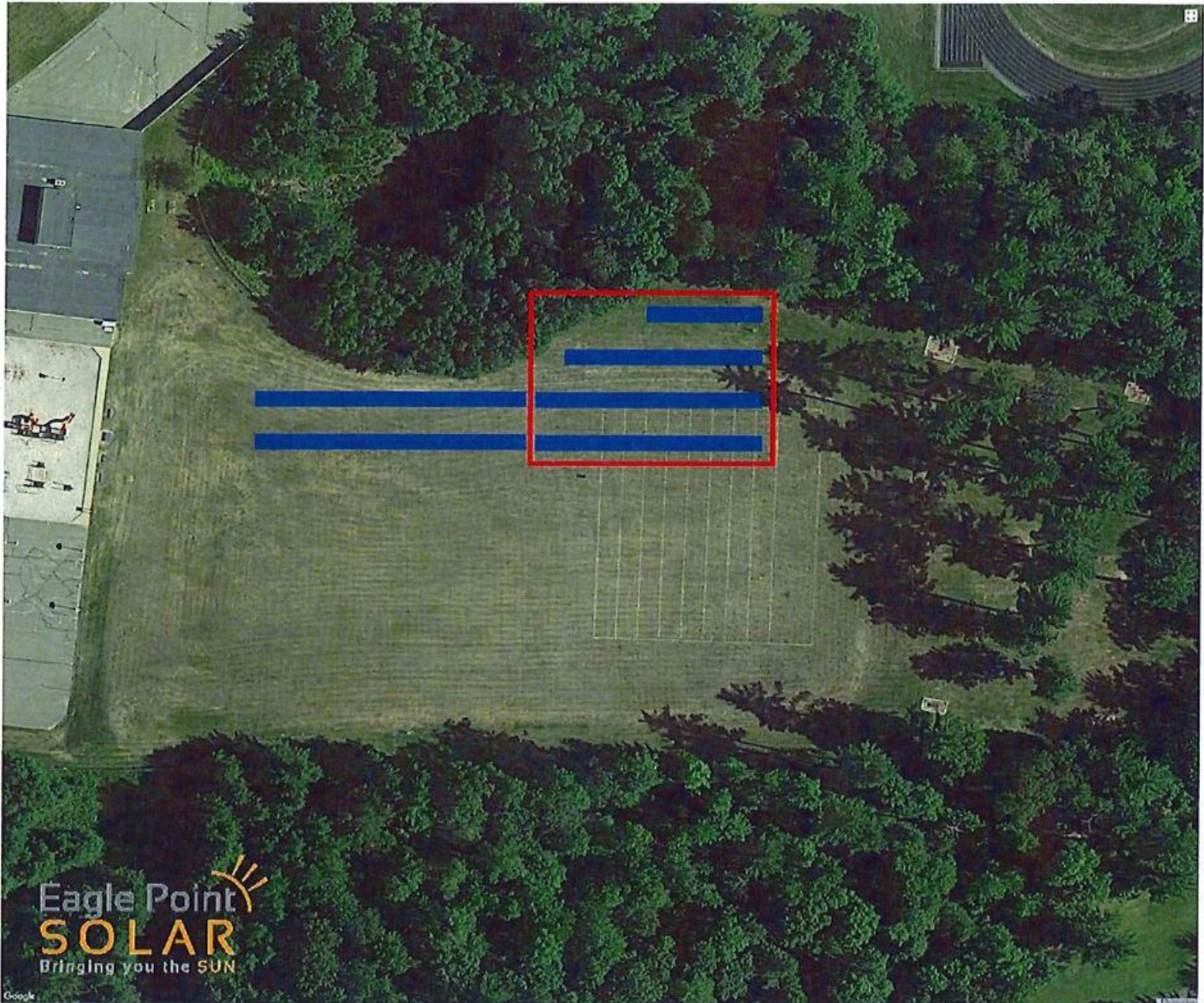




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EAGLE RIVER • RHINELANDER



Eagle River Elementary School – Ground Mounted 100.2 kW DC:





Inverter at the Eagle River Elementary School



Land O' Lakes Elementary School Ground Mount PV



St. Germain Solar and Battery Installation



St Germain Installation Nearing Completion



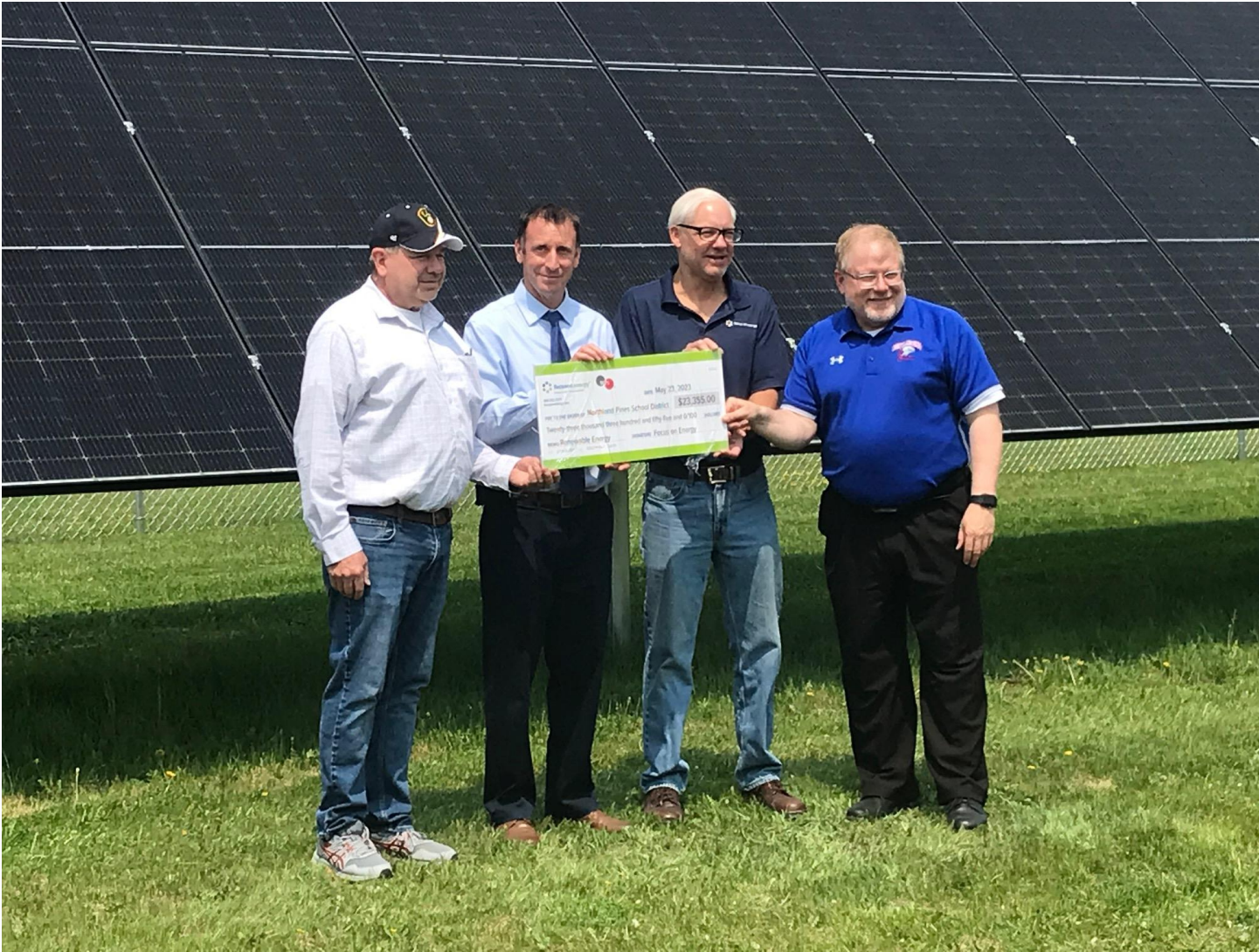
St. Germain Elementary Solar PV Design Details



St. Germain Battery Energy Storage System



Leveraging Incentives to Maximize Financial Benefits



Financial Impact of Solar, Efficiency, and Demand Management

Northland Pines High and Middle School	2016	2019
Total Electricity Use in MWh (thousands of KWh)	1509	1208
Solar Electricity Use included in Total in MWh	none	193
Percentage of Total from Solar (not including 8% of solar production sold to the grid)	none	16%
Solar Electricity Cost (until a buy-out of the PV system owned from investors at market value)	none	\$27,200
Total Electricity Cost including Solar Cost	\$160,718	\$111,936
Annual Cost Savings from Solar with Demand Management and Efficiency	-	\$48,782

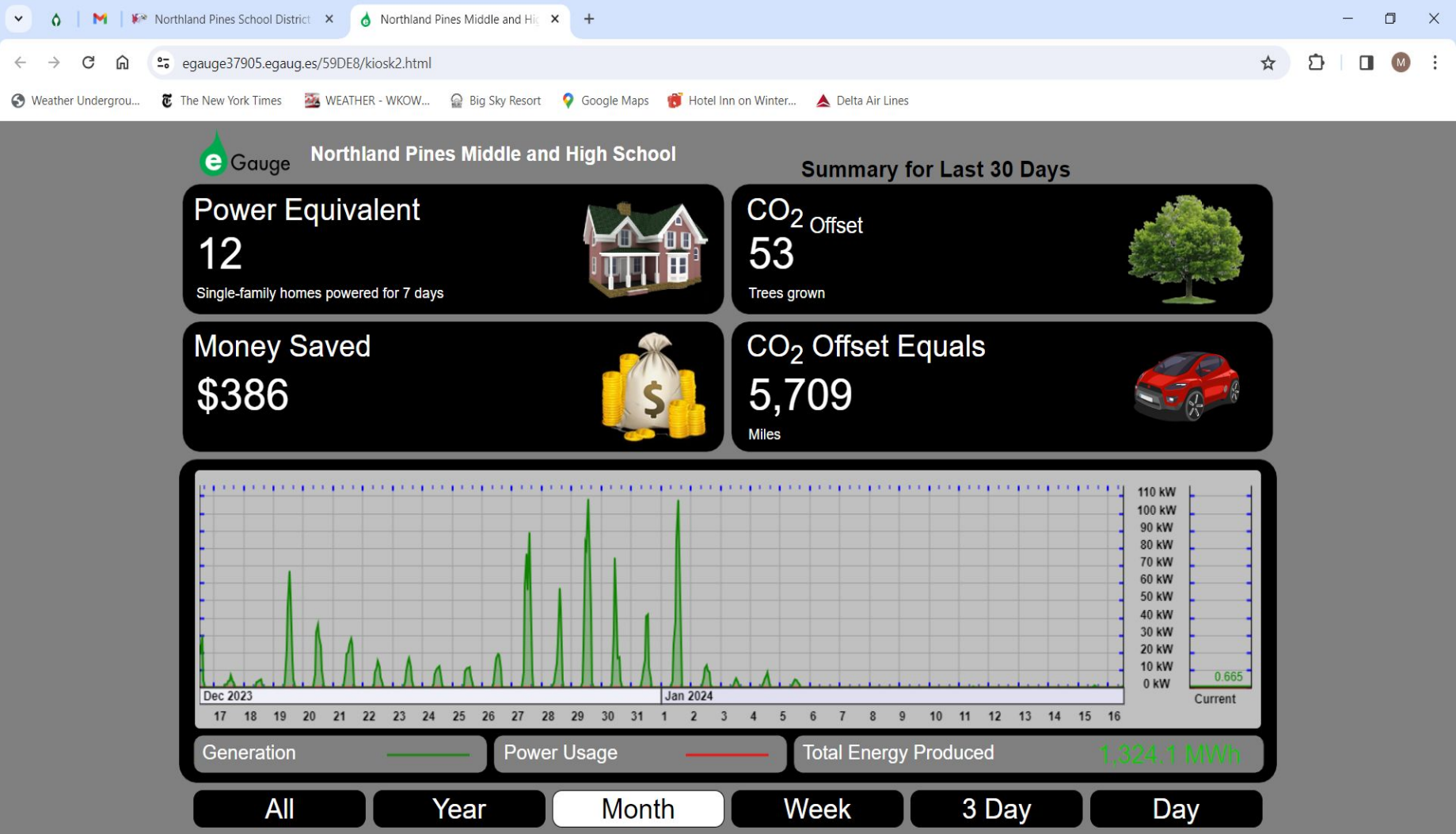


Northland Pines School District Financial Summary

- High/Middle School
 - Cash flow positive with no District funds invested at beginning
- Eagle River Elementary School
 - Cash flow positive with no District funds invested at beginning
- Land O' Lakes Elementary School
 - Annual solar land rental payment of \$2,632 from We Energies
- St. Germain Elementary
 - Simple payback (equipment and planning costs) estimated at 10 years
- District education benefit?
 - Priceless



Information for the Education of Students and the Community



Recognizing the Collaborating Organizations

- Carlson Electric, Hayward
- Couillard Foundation
- Eagle Point Solar, Dubuque
- Eagle River Light & Water Utility
- Focus on Energy
- Hoffman Planning, Design & Construction, Inc.
- IRA Renewable Energy and Battery Incentives
- KEEP (K-12 Energy Education Program-UW Stevens Point)
- Madison Solar Consulting
- Midwest Renewable Energy Association/Solar on Schools Program
- Northland Pines School District
- Office of Energy Innovation Grant Program
- Sun & Daughters Solar LLC, Rhinelander
- We Energies
- WPS (Wisconsin Public Service)



Financial Considerations in Procuring Solar and Batteries

- Costs of Solar PV and Batteries are stable to falling
- Incentives have increased for schools
 - IRA Direct Payment Tax Credits at 30% for solar and 40% for U.S. made batteries
 - Wisconsin Focus on Energy Incentives
 - OEIGP (Office of Energy Innovation Grant Program)
- The third-party finance debate is not yet settled in Wisconsin
- Community fund raising is an option
- Fund 38 or cash reserves if available
- Roof and ground mount options have similar cost if land is available. Current simple paybacks are in the 6 to 12-year range depending on site conditions and utility service.
- Carport solar will cost more but may financially perform
- Costs (competitive bidding) and incentives continue to evolve

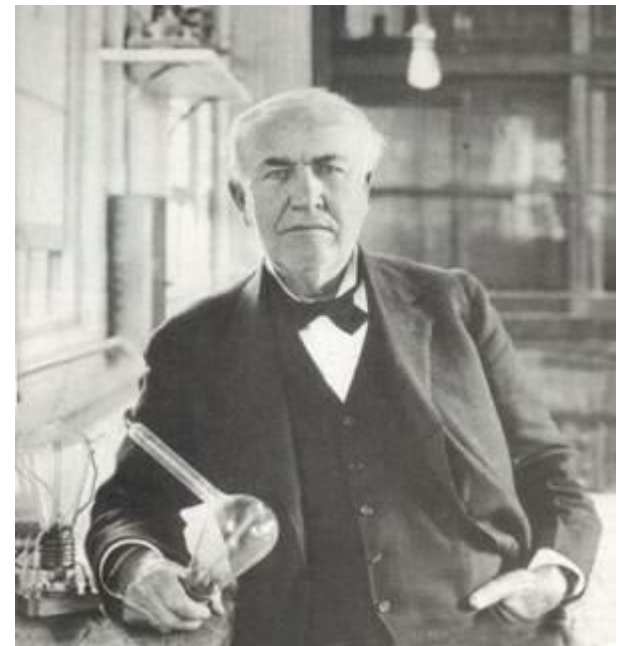


“I’d put my money on the sun and solar energy. What a source of power! I hope we don’t have to wait till oil and coal run out before we tackle that.”

- *Thomas Edison*

We are like tenant farmers chopping down the fence around our house for fuel when we should be using Nature’s inexhaustible sources of energy — sun, wind and tide. ... I’d put my money on the sun and solar energy...

In conversation with Henry Ford and Harvey Firestone (1931); as quoted in *Uncommon Friends : Life with Thomas Edison, Henry Ford, Harvey Firestone, Alexis Carrel & Charles Lindbergh* (1987) by James Newton, p. 31



What questions do you have?

