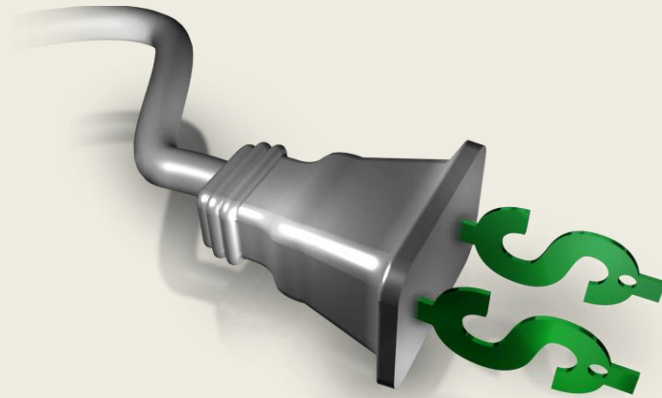


Energy Accounting & Education



Energy Manager

John Daily School District of Holmen

Mike Freybler School District of La Crosse

Topics (Electricity)

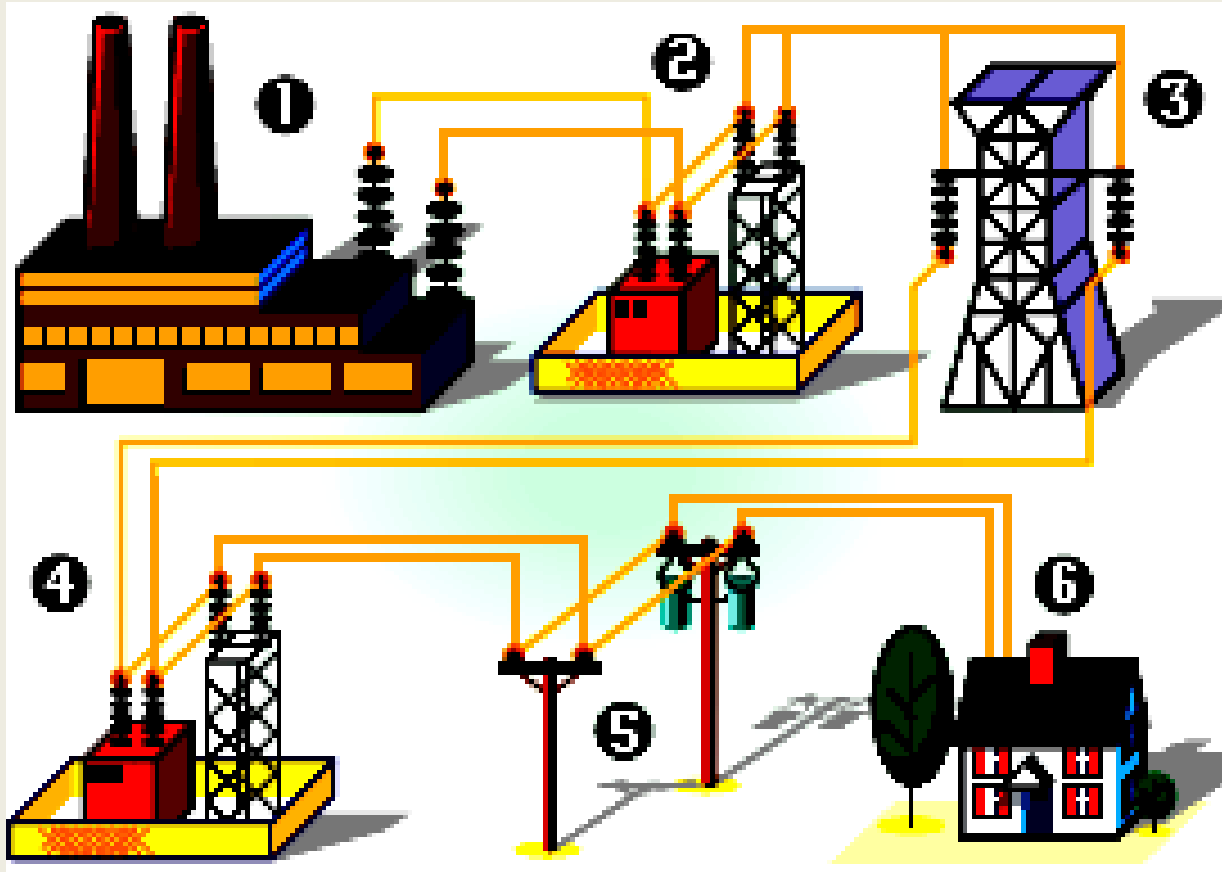
- **Creating electricity**
- **Defining degree days**
- **Customer charges**
- **Types of rates**
- **Energy usage**
- **Demand charges**
- **Taking control of your electric bill**

Creating Electricity

- Electric generators have large quantities of copper wire spinning around inside very large magnets at very high speeds to create electric current.
- [How Electricity is Created](#)



Generation, Transmission and Distribution



Provided by Edison Electric Institute

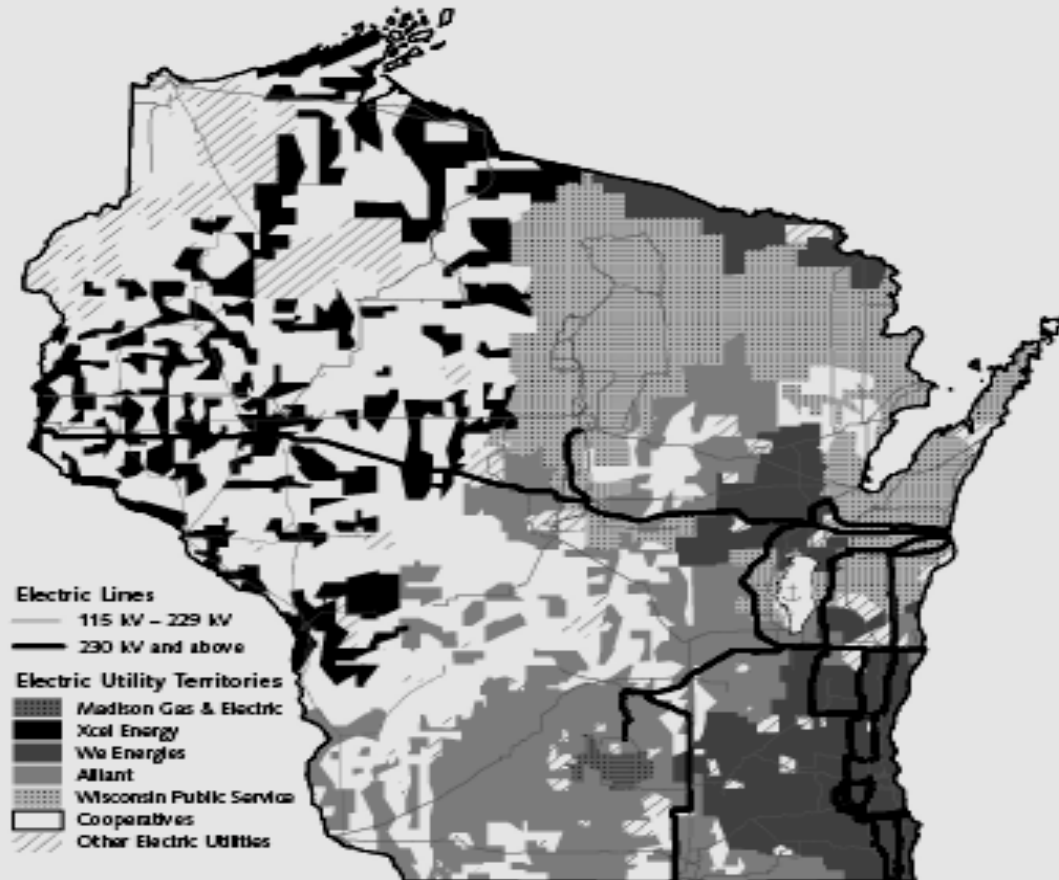
Renewable Energy

- **Electricity produced by sources that can be replaced naturally and do not involve burning fossil fuels or use of nuclear energy**
- **Considered less harmful to the environment because it results in less air pollution, emissions, and waste compared to electricity produced from traditional sources**
- **Includes solar, wind, geothermal, and biomass**



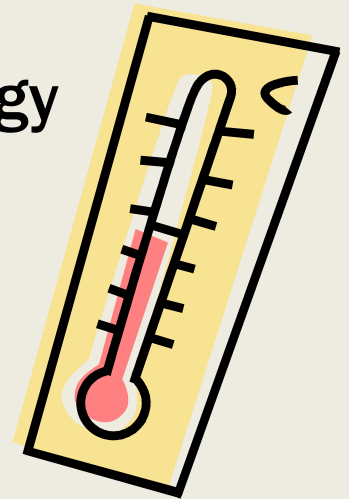
Major Electric Lines and Service Areas

Major Electric Lines and Service Territory Areas



Degree Days

- **Degree Day** - indicates how far a day's average temperature departed from 65° F
- **Heating Degree Day** – measures heating energy demand; indicates how far the average temperature fell below 65° F (cooler weather = more heating demand)
- **Cooling Degree Day** – measures cooling energy demand; indicates how far the temperature averaged above 65° F
- **Smaller values = less fuel demand**



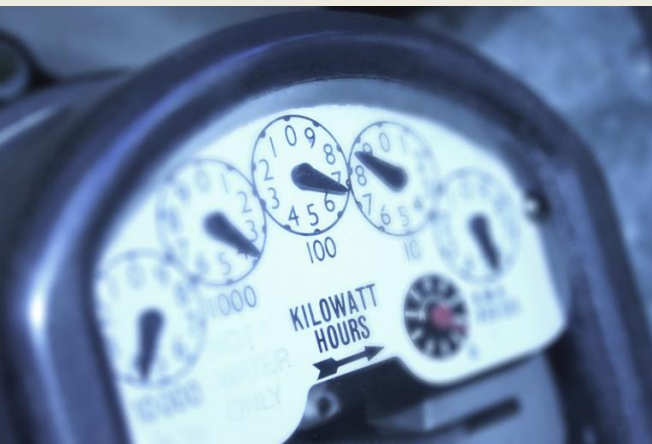
Customer Charges

- Recurring charges for administrative activities for maintaining a customer account (also referred to as *service charges*)
- Includes billing, metering, and meter reading



What's a Kilowatt?

- **Kilowatt (kW)** - One kilowatt equals 1,000 watts (10 bulbs @ 100 watts each)
- **Kilowatt-hour (kWh)** - Basic unit of electric energy = one kilowatt of power supplied to or taken from an electric circuit steadily for one hour
 - One kilowatt-hour equals 1,000 watt-hours



Time of Use Rate

- Rates that vary by the time of day that the electricity is used
- Higher rates are charged during hours of peak system usage
- Lower energy costs by shifting use to “off-peak” hours when electricity costs less
- Consult with your local utility representative
 - May require a special meter



On-Peak vs. Off-Peak Rates

- **On-Peak Rate:** Period between 9:00 a.m. and 9:00 p.m., Monday through Friday, when most energy is used
 - Excludes weekends and holidays
- **Off-Peak Rate:** Includes all hours not included in the on-peak period



Power Factor

- The ratio of real power (kW) to apparent power (kVA) at any given time in an electrical circuit
- Goal of electric utilities: power factor of **1** (unity power factor)
 - If less than one, utility has to supply more current to the user = more line losses
 - Must have larger capacity equipment in place
- Facilities are charged a penalty if their power factor is much different from **1**

Sample Bill

Current Charges	\$4,452.57
Electric Billing Period: 11/014/16 to 12/17/16	
1036 Heating Degree Days, 0 Cooling Degree Days	Meter# 11628123
Actual Reading on 12/17	24,179
Actual Reading on 11/14	23,731
Difference	448
Meter multiplier	X 80
Usage in 30 Days (kWh)	35,840
Total On-Peak Consumption 9 a.m. to 9 p.m., Monday-Friday	17,120KWh
Total Off-Peak Consumption	18720KWh
Facility Power Factor	97.58%

Sample Bill: Demand Charges

Current Charges	\$4,452.57
Electric Charges Period: 11/14/16 to 12/17/16	
Customer Demand Charge: 197.0 kW @ \$1.750	\$ 344.75
On-Peak Demand Charge: 170.0 kW @ \$10.250	\$ 1,742.50
Facilities Charge	\$ 180.00
Non-taxable Customer Charge (3%)	\$129.69
Off-Peak Energy Charge: 18,720 kWh @ \$0.048460	\$ 907.17
On-Peak Energy Charge: 17,120 kWh @ \$0.074180	\$ 1,269.96
Saver Switch Load Control (Credit)	\$121.50



MAILING ADDRESS	ACCOUNT NUMBER	DUE DATE	
SCHOOL DISTRICT OF HOLMEN 1019 MCHUGH RD HOLMEN WI 54636-9296	52-4594119-3	01/20/2017	
	STATEMENT NUMBER	STATEMENT DATE	AMOUNT DUE
	529372970	12/29/2016	\$53,765.17

SERVICE ADDRESS: HOLMEN MIDDLE SCHOOL NORTH
502 N MAIN ST HOLMEN, WI 54636-9313

NEXT READ DATE: 01/20/17

ELECTRICITY SERVICE DETAILS

PREMISES NUMBER: 302437232
INVOICE NUMBER: 0652867409

METER READING INFORMATION				
METER 11628123 - Multiplier x 80		Read Dates: 11/14/16 - 12/17/16 (33 Days)		
DESCRIPTION	CURRENT READING	PREVIOUS READING	MEASURED USAGE	BILLED USAGE
Total Energy	24179 Actual	23731 Actual	448	35840 kWh
On Pk Energy	12484 Actual	12270 Actual	214	17120 kWh
Off Pk Energy	11695 Actual	11461 Actual	234	18720 kWh
Reactive Energy	3819 Actual	3771 Actual	48	3840 kVArh
Demand	Actual			170.4 kW
Billable Demand				197 kW
On Pk Demand	Actual			170.4 kW
Billable On Pk Demand				170 kW
Off Pk Demand	Actual			165.6 kW
Billable Off Pk Demand				166 kW
Power Factor On Pk Demand	97.58%			

1146 Heating Degree Days

ELECTRICITY CHARGES

RATE: Large TOD Service

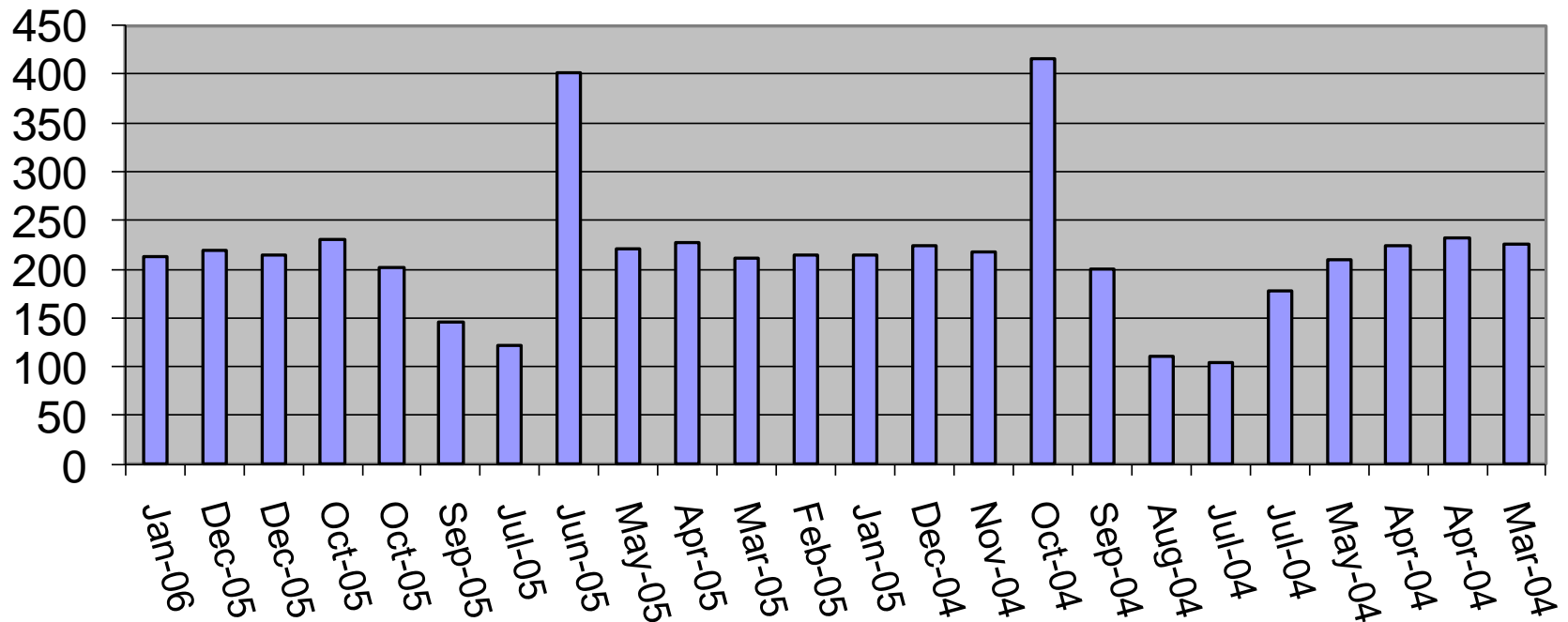
DESCRIPTION	USAGE UNITS	RATE	CHARGE
Customer Charge			\$180.00
On-Peak Energy ChWinter	17120 kWh	\$0.074180	\$1,269.96
Off-Peak Energy CWinter	18720 kWh	\$0.048460	\$907.17
Customer Demand	197 kW	\$1.750000	\$344.75
On-Peak Demand ChWinte	170 kW	\$10.250000	\$1,742.50
Com SS Load Control			- \$121.50 CR
Subtotal			\$4,322.88
WI Low Income Assist		3.00%	\$129.69
Total			\$4,452.57



Billing Demand

System Demand (KW)

■ System Demand (KW)

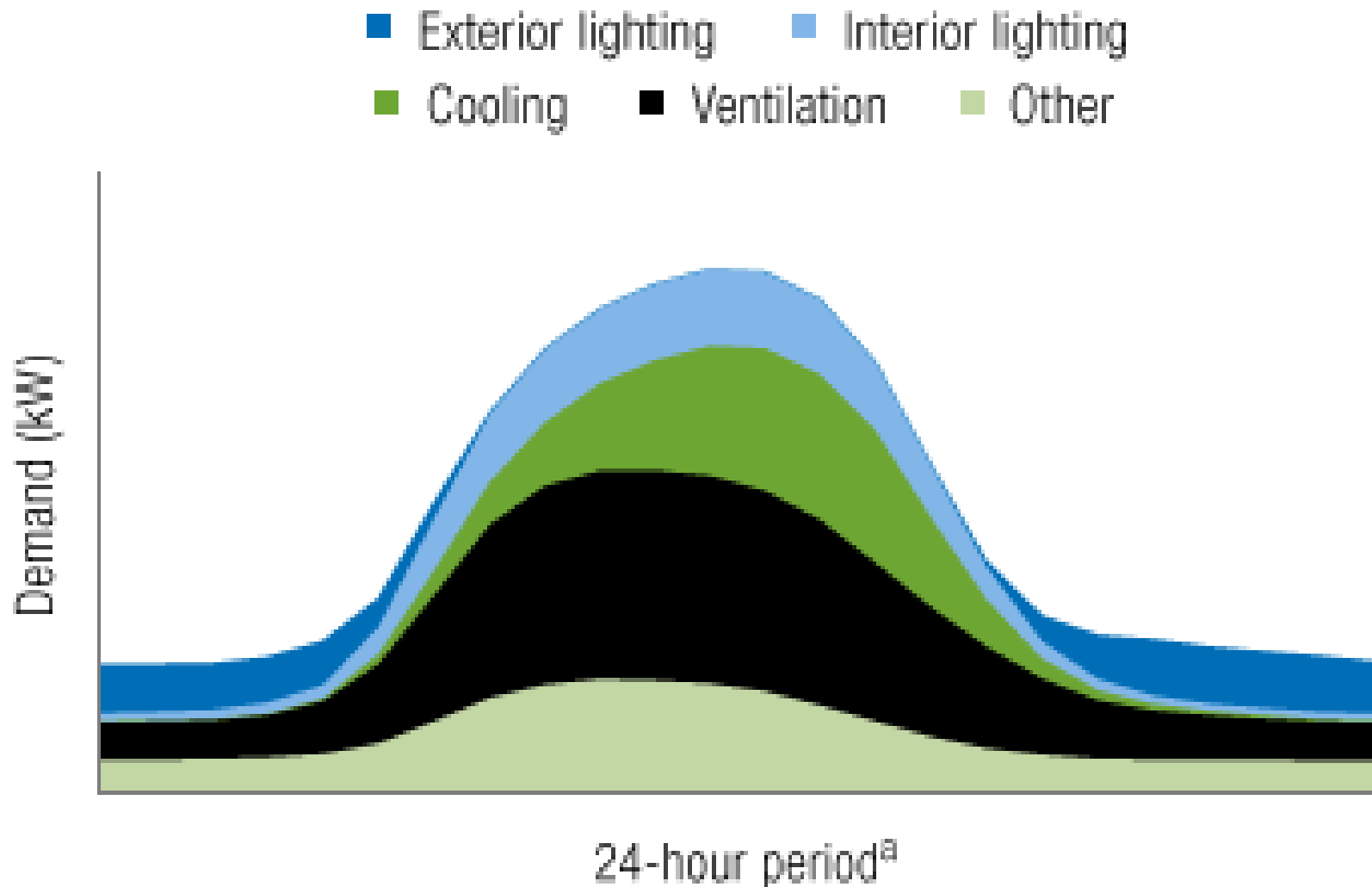


Taking Control of Your Electric Bills

Follow best practices with these systems:

- **Lighting**
- **HVAC**
 - **Air conditioning/chillers**
 - **Air handling equipment/ventilation**
 - **Controls**
 - **VFD**
- **Domestic hot water/booster heaters**
- **Demand limiting controls**

Energy Use in Schools



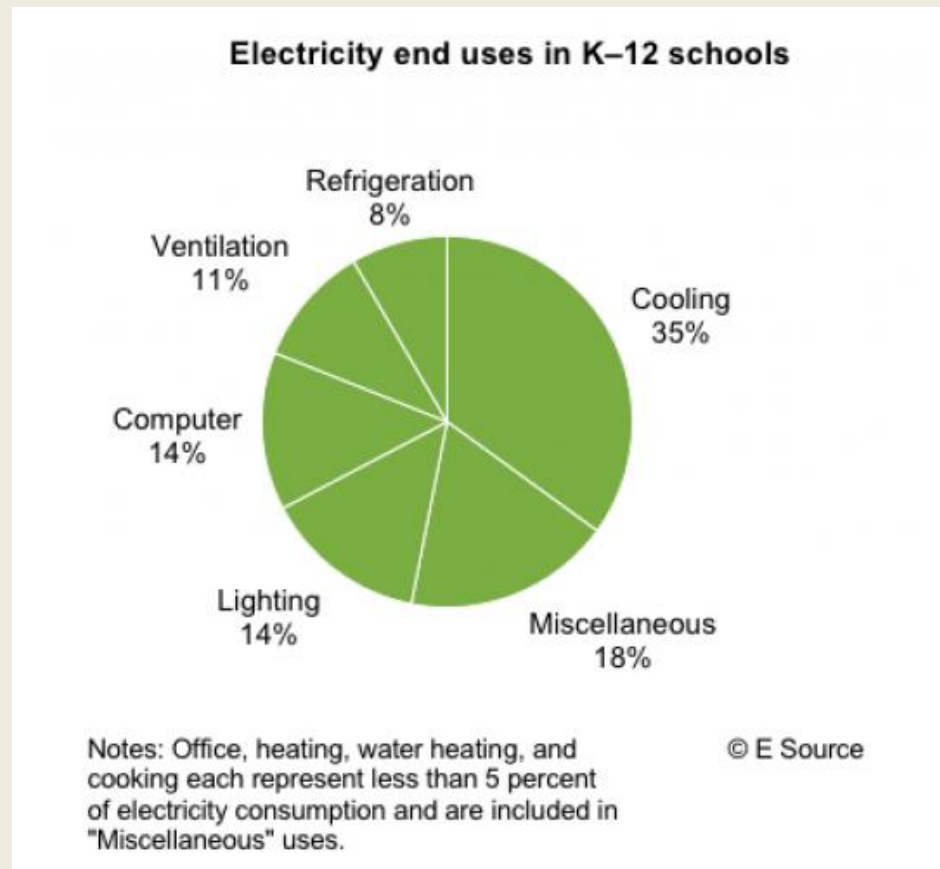
Notes: kW = kilowatt.

© E Source; data from ITRON

^a 24-hour period = midnight to midnight

Energy Use in Schools

- In school facilities, space heating, cooling and lighting accounts for about 70% of school energy use.



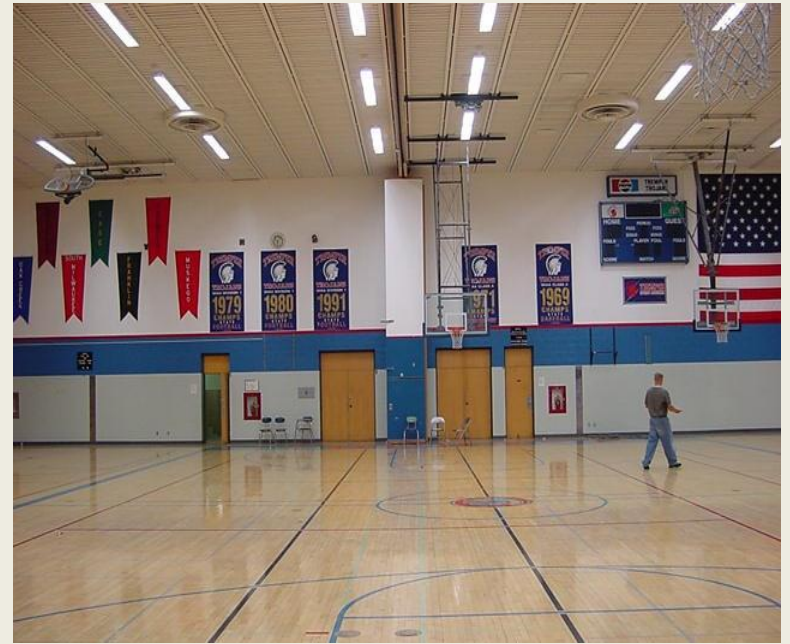
Lighting

- **Lighting is the easiest place to save energy and expect a quick payback**
 - De-lamp where possible
 - Use reduced-wattage lamps: **25-watt** and **28-watt T8** technology
 - **L.E.D. Technology**
 - **Complete lighting retrofits**

LED Lighting



Results of Lighting Upgrade



HVAC

High efficiency upgrades/replacements

- Air conditioning
 - DX units, Rooftop, Chillers
- Air handling equipment
 - VFD Drives on fan motors
 - Demand Controlled Ventilation
- Controls
 - DDC conversion, occupancy driven
 - Scheduling
 - Scheduling
 - Scheduling



Chiller Options



Air-Handling Units



Saving Energy with Domestic Hot Water



- Install a high-efficiency hot water heater
- Schedule pumping with occupancy
- Booster Heaters- consider natural gas or chemical wash to reduce electrical demand.

Demand Limiting Controls

- **Use a more sophisticated approach to lock out stages of cooling equipment to control peak demand.**
- **Use a peak demand strategy to monitor and control facility (smart building).**

Financial Incentives

- **Energy Rebates**
- **Utility Provider**
- **Focus on Energy**
- **Grants**



focus on energy

Partnering with Wisconsin utilities

Energy Accounting & Education

Natural Gas



Energy Manager

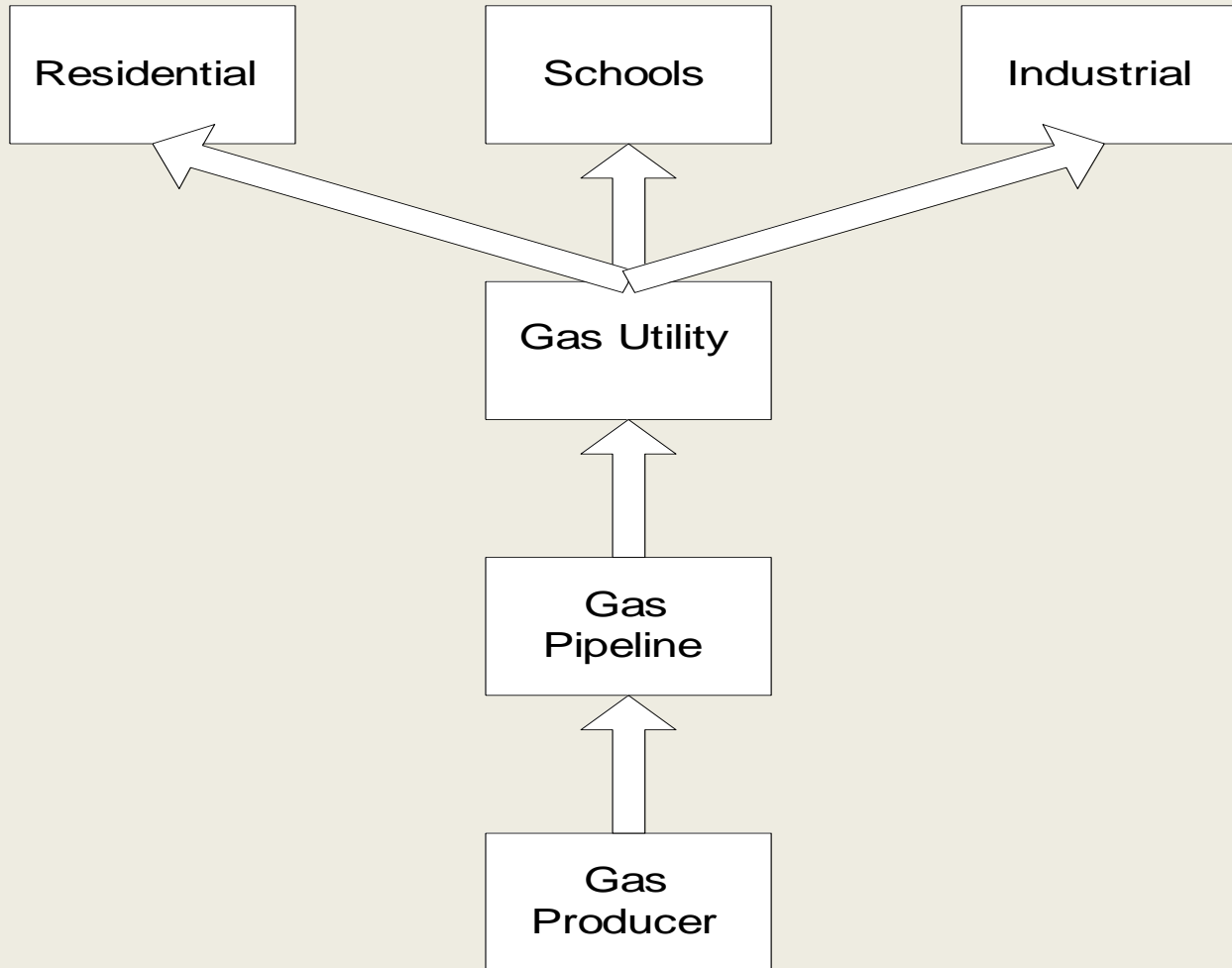
John Daily School District of Holmen

Mike Freybler School District of La Crosse

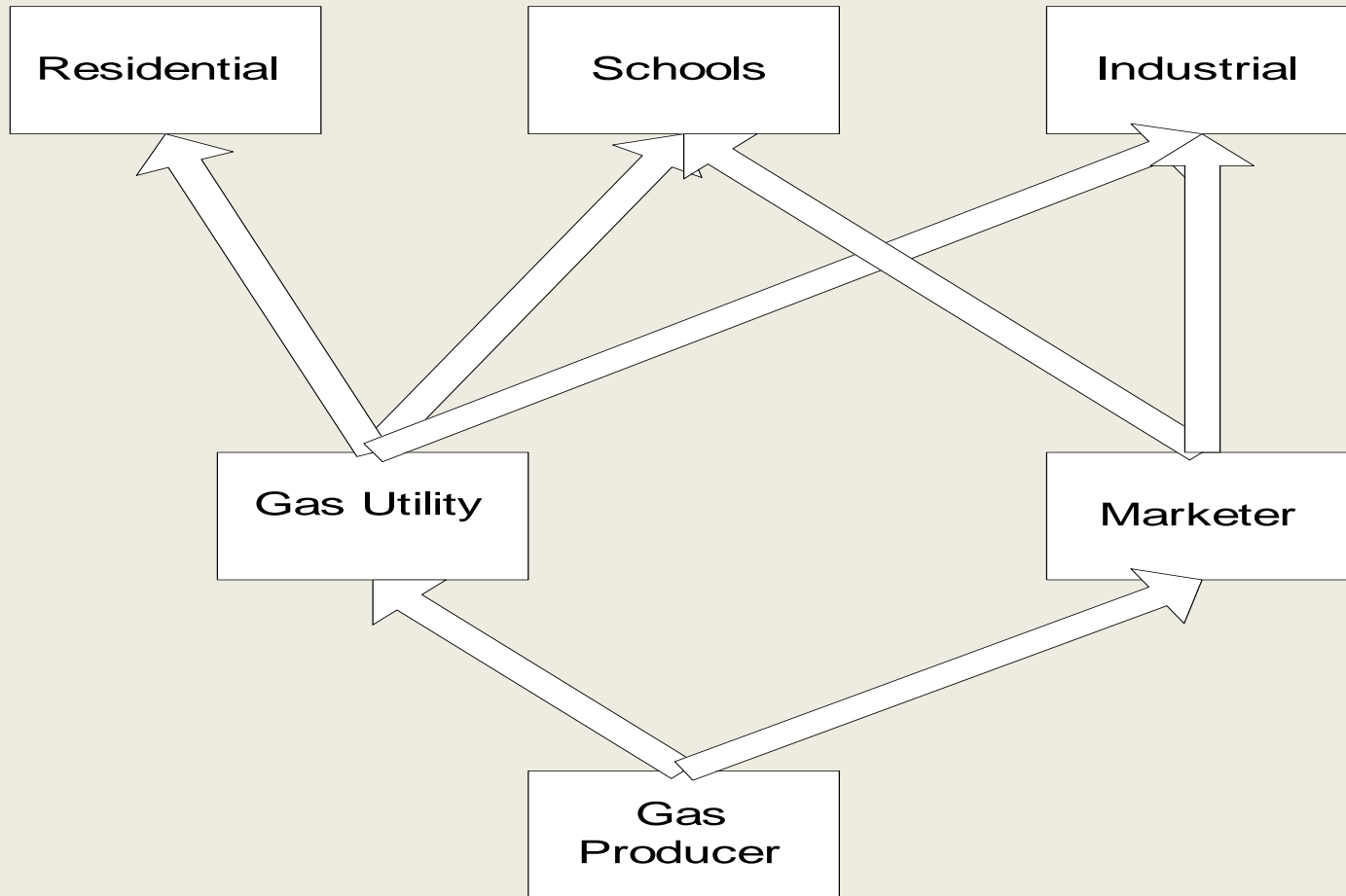
Topics (Natural Gas)

- **Effects of deregulation**
- **Sources of natural gas**
- **Transportation of natural gas**
- **Major gas supply lines**
- **Comparing fuel prices**
- **Understanding your gas bill**
- **How to reduce your gas bill**
- **Measure Yourself**

Before Deregulation



After Deregulation



Natural Gas Transportation

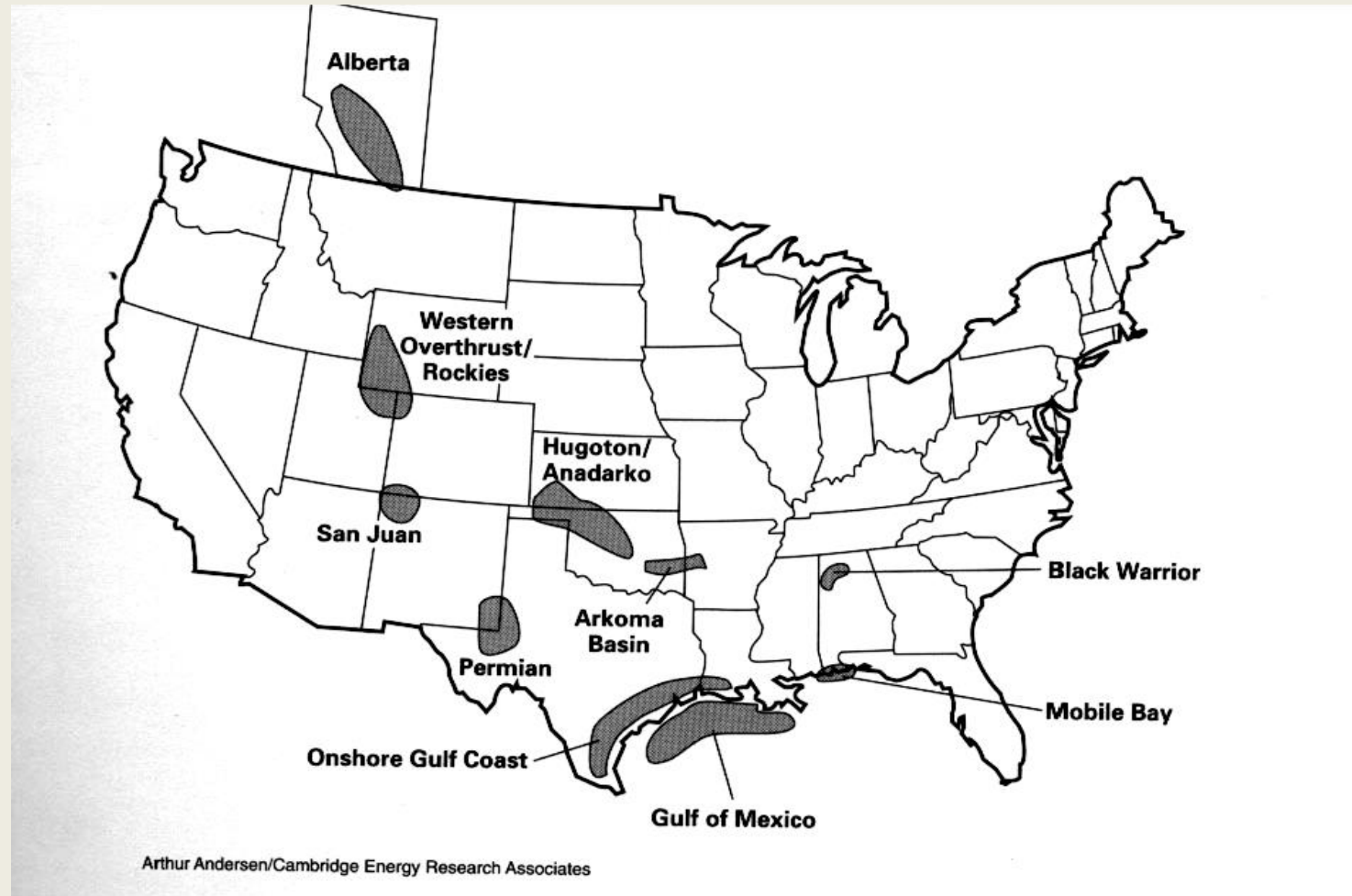
System Supply Customer

- Purchased by utility
- Transported by utility
- Distributed by utility
- Maintained by utility
- Billed by utility

Transportation Customer

- Purchased by marketer
- Transported by marketer
- Distributed by utility
- Maintained by utility
- Billed by both

Sources of Natural Gas

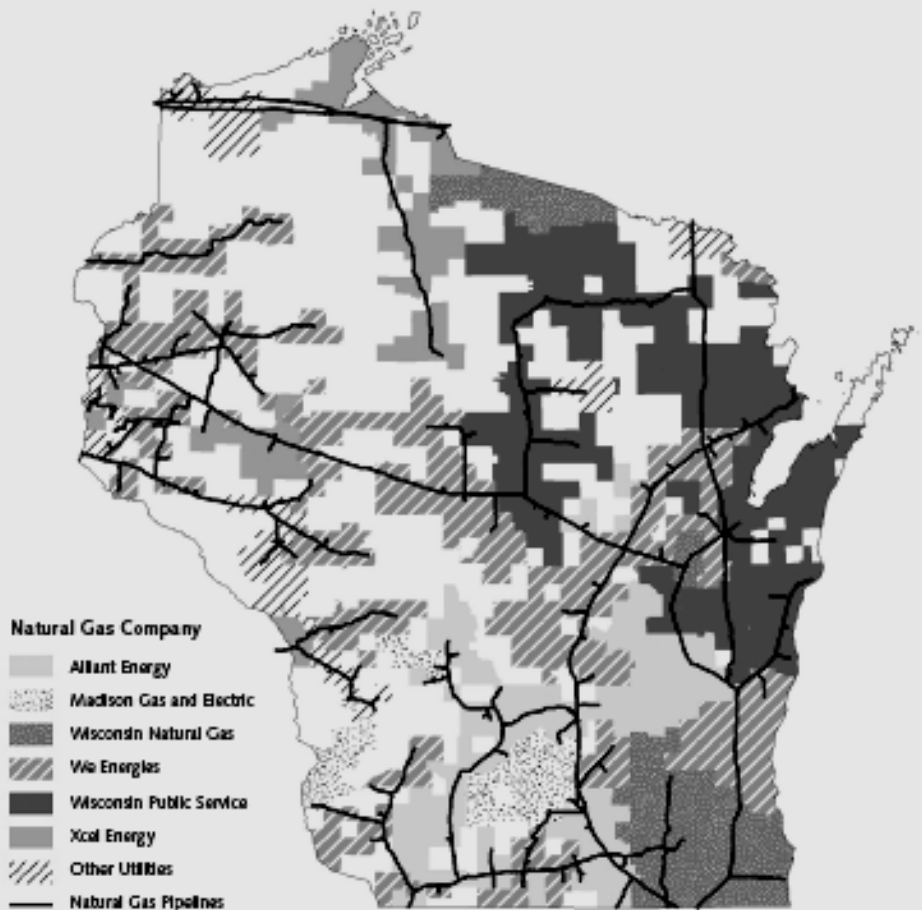


Natural Gas Pipelines



Major Gas Lines and Service Territories

Wisconsin Natural Gas Company Territories & Major Pipelines



Gas Pipeline Network



Factors Contributing to Gas Cost

- Actual purchase price of gas
- Gas transportation costs
- PSC regulates utilities, not marketer
- Market fluctuations
- Price-locking
- Combination of weather and market determine the savings/costs in any given year
- Commodity price/transportation price



Comparing Fuel Costs

Btu's per unit

#2 Fuel Oil	=	139,000 btu's/gallon
Propane	=	91,600 btu's/gallon
Kilowatt Hour	=	3,412 btu's
Therm	=	100,000 btu's

Fuel Conversion Example

- If the price of natural gas is \$.8364 per therm, should you consider burning propane?
- Formula: Multiplier x cost of natural gas = equivalent cost
- Use multiplier from table = .92
 $.92 \times \$.8364 = \$.77$ per gallon
- Burn propane if it costs less than \$.77 per gallon.



DAILY AVERAGES	Last Year	This Year
Temperature	39° F	36° F
Gas Therms	41.5	187.1
Gas Cost	\$21.69	\$90.88

MAILING ADDRESS	ACCOUNT NUMBER	DUE DATE	
SCHOOL DISTRICT OF HOLMEN 1019 MCHUGH RD HOLMEN WI 54636-9296	52-4594119-3	01/20/2017	
	STATEMENT NUMBER	STATEMENT DATE	AMOUNT DUE
	529372970	12/29/2016	\$53,765.17

SERVICE ADDRESS: HOLMEN HIGH SCHOOL
1000 MCHUGH RD HOLMEN, WI 54636-9524

NEXT READ DATE: 01/16/17

NATURAL GAS SERVICE DETAILS

PREMISES NUMBER: 302283981
INVOICE NUMBER: 0329587998

METER READING INFORMATION

METER 924206	Read Dates: 11/09/16 - 12/13/16 (34 Days)		
DESCRIPTION	CURRENT READING	PREVIOUS READING	USAGE
Total Energy	69576 Actual	68972 Actual	604 mcf

997 Heating Degree Days

NATURAL GAS ADJUSTMENTS

DESCRIPTION	VALUE UNITS	CONVERSION	VALUE UNITS
Meter Multiplier	604 mcf	x 10	6040 ccf
Heat Content Adjustment	6040 ccf	x 1.053300	6362 therms

NATURAL GAS CHARGES

RATE: Int Svc Mnthly Sys Sup

DESCRIPTION	USAGE UNITS	RATE	CHARGE
Customer Charge			\$100.00
Distribution Charge	6362 therms	\$0.110000	\$699.82
Gas Supply Charge	6362 therms	\$0.359984	\$2,290.22
Total			\$3,090.04

Premises Total

\$3,090.04

001034 3/12



Taking Control of Your Gas Bills

Best Practices Using Gas

- **HVAC:**
 - Boilers and furnaces
 - Controls, scheduling and outside air
 - Hot water delivery and pumping
- Domestic hot water
- Cooking equipment



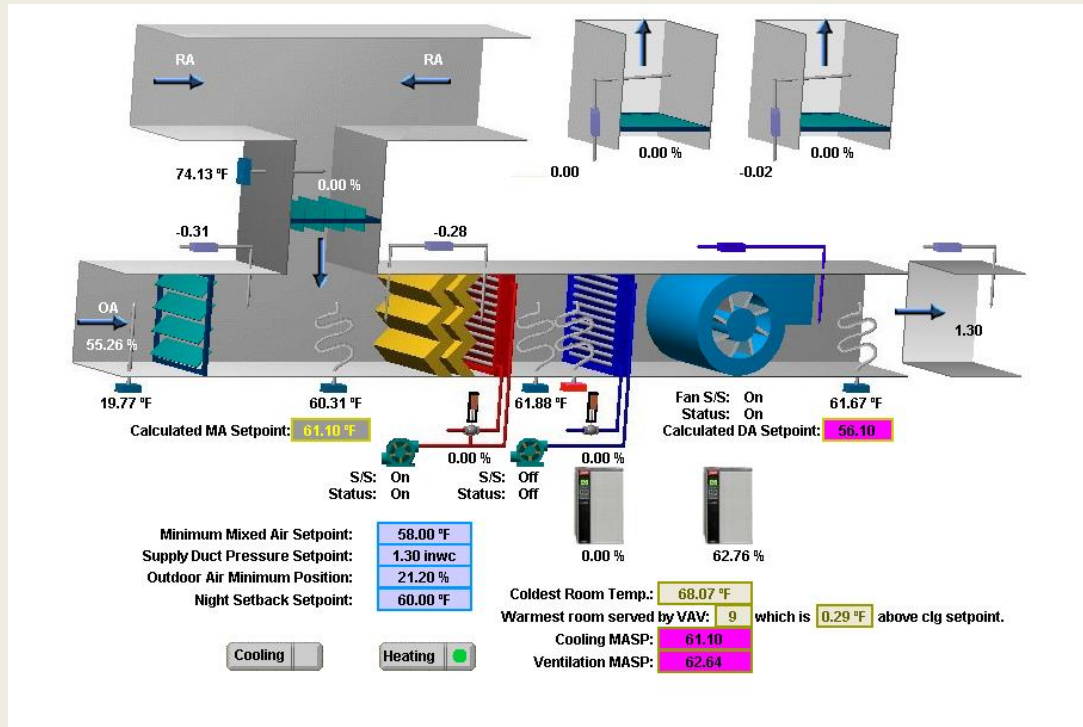
HVAC

- **High-efficiency heating system upgrades:**
 - Condensing technology
 - Steam to hot water conversion
 - Energy management system
 - Outdoor air reset



Saving Energy with Control Systems

- Pneumatic to DDC conversion
- Schedule occupancy correctly (tighten up)
- Reduce outside air in large air spaces



Energy Efficient Kitchen Equipment

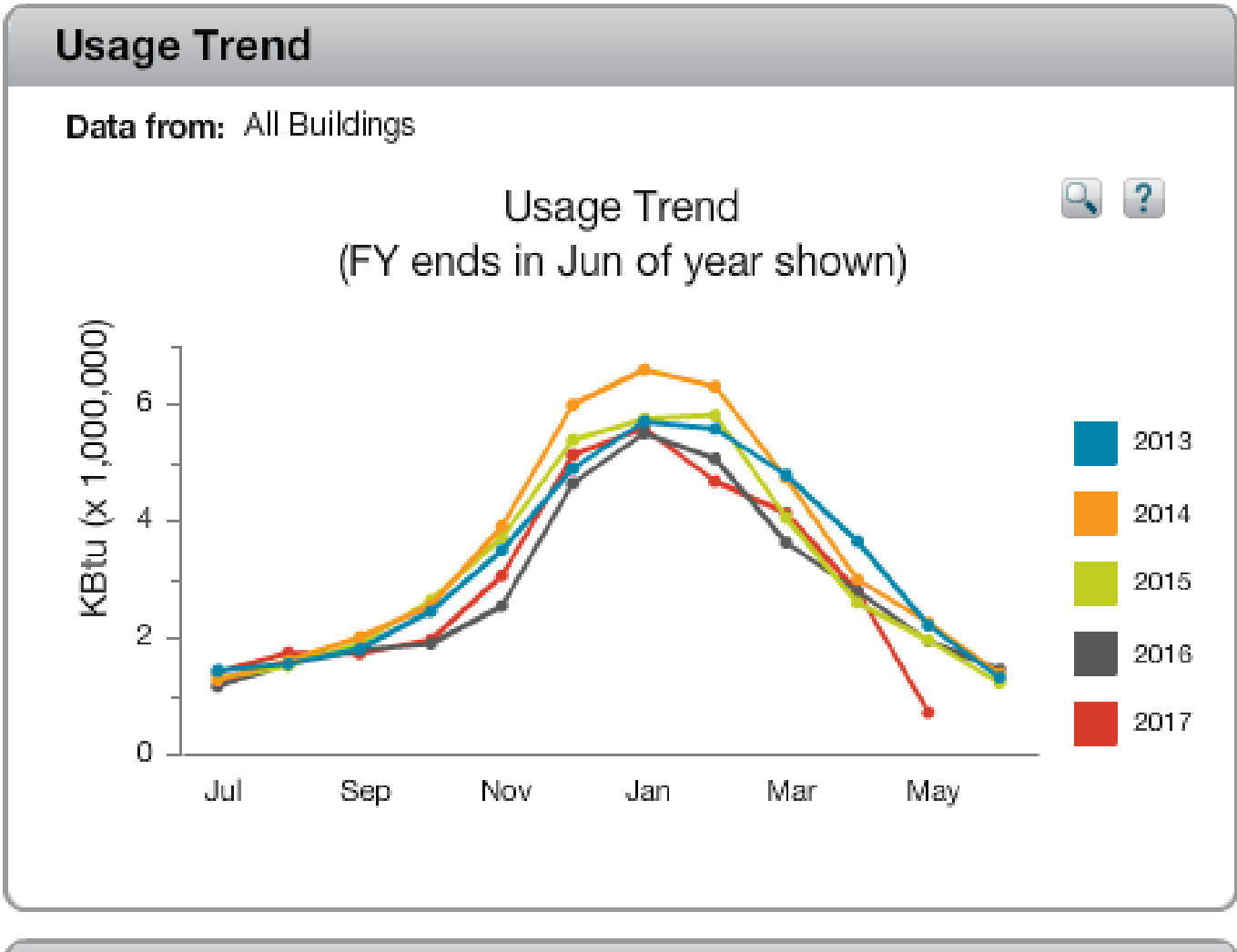
- Consider high-efficiency appliances when upgrading
- Information and incentives available at www.focusonenergy.com



Measure Yourself

- **Track Energy use**
- **Look For and Implement Savings**
- **Compare Your Buildings**
- **Measure Against Others**
- **Share Results**

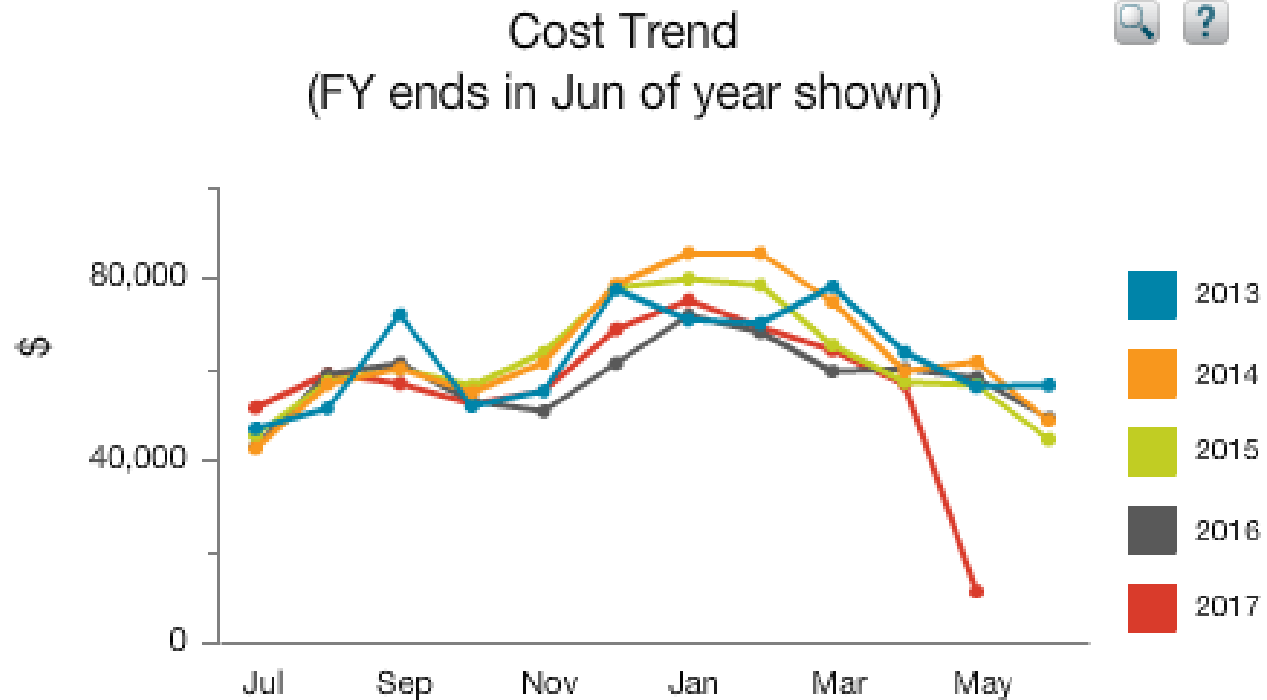
Tracking Energy Use



Tracking Energy Cost

Cost Trend

Data from: All Buildings



Building Savings



School District of Holmen

Sorted by BATCC Cost

Cost Avoidance Summary By Building CAP - 01B1

Place	BATCC Cost	Actual Cost	Cost Avoidance	Cost Avoidance %
[HHS_1] Holmen High School	\$299,534	\$217,881	\$81,653	27.3
[HMS_1] Holmen Middle School	\$216,135	\$142,831	\$73,304	33.9
[VES_1] Viking Elementary	\$179,091	\$93,659	\$85,432	47.7
[SLS_1] Sand Lake School	\$104,586	\$75,015	\$29,571	28.3
[EES_1] Evergreen Elementary	\$90,442	\$58,970	\$31,472	34.8
[PVE_1] Prarie View Elementary	\$69,765	\$63,428	\$6,338	9.1
[OGFLC_1] Oak Grove Family Learning Ctr	\$21,582	\$10,409	\$11,172	51.8
[DO] District Office	\$20,510	\$11,142	\$9,368	45.7
[EMPFLD] Empire Stadium	\$13,938	\$4,911	\$9,027	64.8
[TRANS] Transportation	\$12,282	\$11,798	\$483	3.9
[MAINT] Maintenance	\$3,862	\$2,056	\$1,807	46.8
[TMT0] TMT Office	\$2,937	\$2,919	\$18	0.6
[TSHR] Transport Shared	\$2,902	\$2,454	\$448	15.4
Totals:	\$1,037,567	\$697,473	\$340,094	32.8

Energy Star Portfolio

ABOUT ENERGY STAR

PARTNER RESOURCES



The simple choice for energy efficiency.

ENERGY EFFICIENT
products

ENERGY SAVINGS
at home

ENERGY EFFICIENT
new homes

ENERGY STRATEGIES FOR
buildings & plants

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Buildings & Plants

about us | press room | help desk | portfolio manager login

Owners and managers

Service providers

Program administrators

Tenants

Tools and Resources

Training

Existing buildings



Learn the benefits



Get started



Use Portfolio Manager



How Portfolio Manager helps you save

The benchmarking starter kit



Identify your property type



Enter data into Portfolio Manager

The data quality checker

How Portfolio Manager calculates metrics



Interpret your results



Verify and document your savings



Share and request data

Updates to ENERGY STAR scores with CBECS data



ENERGY STAR®
PortfolioManager®

The most-used energy measurement and tracking tool for commercial buildings.

Use Portfolio Manager

You've heard it before: you can't manage what you don't measure. That's why EPA created ENERGY STAR Portfolio Manager®, an online tool you can use to measure and track energy and water consumption, as well as greenhouse gas emissions. Use it to benchmark the performance of one building or a whole portfolio of buildings, all in a secure online environment.

Not sure if Portfolio Manager is for you? It is!

You can use Portfolio Manager to manage the energy and water use of any building. Seriously. Any building. K-12 school? Check. Office building? Check. Stadium? Check. We could keep going. All you need are your energy bills and some basic information about your building to get started.

Are you designing a new commercial building? You can also use Portfolio Manager to set your energy use target and see how your estimated design energy stacks up against similar existing buildings nationwide.



ENERGY STAR®

PortfolioManager®

"Ask The Expert" webinar

Wednesdays
at 12pm noon ET



New! Licensed Professional Finder

Enter your zip code to find Licensed Professionals that have verified properties near you for ENERGY STAR certification.



Energy Star Portfolio

MyPortfolio

Sharing

Reporting

Recognition

Holmen High School

1001 Mc Hugh Road, Holmen, WI 54636 | [Map It](#)

Portfolio Manager Property ID: 1488109

Year Built: 1994

[Edit](#)



[Apply for ENERGY STAR Certification](#)

ENERGY STAR Score (1-100)

Current Score: 82

Baseline Score: 11

Summary

Details

Energy

Water

Waste & Materials

Goals

Design

Property Profile [\(Future enhancements\)](#)

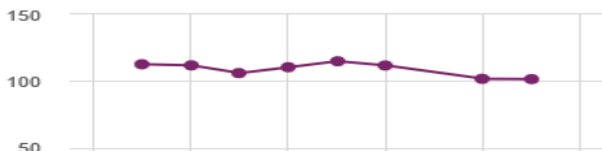
Your property is listed on the [REGISTRY of ENERGY STAR qualified buildings](#) with a basic profile. If you wish, you can provide a custom profile to highlight information about your property to the public, including a photo and narrative. The custom profile will need to be approved by EPA before it is published to the registry.

[View Published Profile](#) (approved on 12/09/2008)

[Create Custom Profile](#)

[Change Metrics](#)
[Change Time Periods](#)

Source EUI Trend (kBtu/ft²)



Metrics Summary

Metric	Aug 2006 (Energy Baseline)	Nov 2017 (Energy Current)	Change
ENERGY STAR Score (1-100)	11	82	71.00 (645.50%)
Source EUI (kBtu/ft ²)	207.8	101.9	-105.90 (-51.00%)
Site EUI (kBtu/ft ²)	83.6	47.0	-36.60 (-43.80%)
Energy Cost (\$)	Not Available	225,898.10	N/A
Total GHG Emissions Intensity (kgCO ₂ e/ft ²)	11.9	5.8	-6.10 (-51.30%)
Water Use (All Water Sources) (kgal)	Not Available	Not Available	N/A
Total Waste (Disposed and Diverted) (Tons)	Not Available	Not Available	N/A

Energy Star Portfolio

MyPortfolio | [Sharing](#) | [Reporting](#) | [Recognition](#)

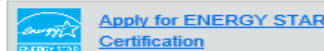
Holmen Middle School

502 N. Main St., Holmen, WI 54636 | [Map It](#)

Portfolio Manager Property ID: 1488120

Year Built: 1955

[Edit](#)



ENERGY STAR Score (1-100)

Current Score: 95

Baseline Score: 86

Summary | [Details](#) | [Energy](#) | [Water](#) | [Waste & Materials](#) | [Goals](#) | [Design](#)

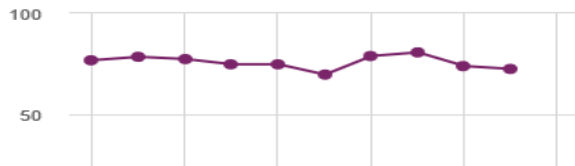
Property Profile [\(Future enhancements\)](#)

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[View Published Profile](#) (approved on 12/09/2008)

[+ Create Custom Profile](#)

Source EUI Trend (kBtu/ft²)



[Change Metrics](#)
[Change Time Periods](#)

Metrics Summary

Metric	May 2007 (Energy Baseline)	Oct 2017 (Energy Current)	Change
ENERGY STAR Score (1-100)	86	95	9.00 (10.50%)
Source EUI (kBtu/ft ²)	88.5	72.3	-16.20 (-18.30%)
Site EUI (kBtu/ft ²)	45.6	38.0	-7.60 (-16.70%)
Energy Cost (\$)	Not Available	154,612.09	N/A
Total GHG Emissions Intensity (kgCO ₂ e/ft ²)	4.9	4.0	-0.90 (-18.40%)
Water Use (All Water Sources) (kgal)	Not Available	Not Available	N/A
Total Waste (Disposed and Diverted) (Tons)	Not Available	Not Available	N/A

Energy Star Portfolio

MyPortfolio | [Sharing](#) | [Reporting](#) | [Recognition](#)

Evergreen Elementary School

510 Long Coulee Road, Holmen, WI 54636 | [Map It](#)

Portfolio Manager Property ID: 1436611

Year Built: 1980

[Edit](#)

[Apply for ENERGY STAR Certification](#)

ENERGY STAR Score (1-100)

Current Score: 92

Baseline Score: 76

Summary | [Details](#) | [Energy](#) | [Water](#) | [Waste & Materials](#) | [Goals](#) | [Design](#)

Property Profile [\(Future enhancements\)](#)

Your property is listed on the [REGISTRY of ENERGY STAR qualified buildings](#) with a basic profile. If you wish, you can provide a custom profile to highlight information about your property to the public, including a photo and narrative. The custom profile will need to be approved by EPA before it is published to the registry.

[View Published Profile](#) (approved on 12/09/2008)

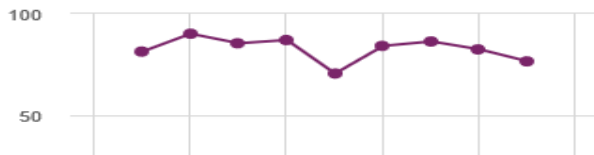
[+ Create Custom Profile](#)

[Change Metrics](#)
[Change Time Periods](#)

Metrics Summary

Metric ↗	Aug 2006 (Energy Baseline) ↗	Oct 2017 (Energy Current) ↗	Change ?
ENERGY STAR Score (1-100)	76	92	16.00 (21.10%)
Source EUI (kBtu/ft ²)	96.0	73.9	-22.10 (-23.00%)
Site EUI (kBtu/ft ²)	45.6	36.7	-8.90 (-19.50%)
Energy Cost (\$)	Not Available	57,582.56	N/A
Total GHG Emissions Intensity (kgCO ₂ e/ft ²)	5.4	4.1	-1.30 (-24.10%)
Water Use (All Water Sources) (kgal)	Not Available	Not Available	N/A
Total Waste (Disposed and Diverted) (Tons)	Not Available	Not Available	N/A

Source EUI Trend (kBtu/ft²)



Energy Star Portfolio

MyPortfolio | [Sharing](#) | [Reporting](#) | [Recognition](#)

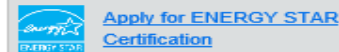
Viking Elementary School

500 E. Wall St., Holmen, WI 54636 | [Map It](#)

Portfolio Manager Property ID: 1488138

Year Built: 1972

[Edit](#)



ENERGY STAR Score (1-100)

Current Score: 94

Baseline Score: 46

Summary | [Details](#) | [Energy](#) | [Water](#) | [Waste & Materials](#) | [Goals](#) | [Design](#)

Property Profile [\(Future enhancements\)](#)

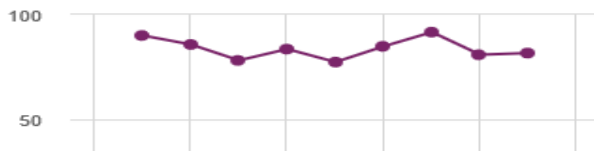
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[View Published Profile](#) (approved on 12/09/2008)

[+ Create Custom Profile](#)

[Change Metrics](#)
[Change Time Periods](#)

Source EUI Trend (kBtu/ft²)



Metrics Summary

Metric	Sep 2006 (Energy Baseline)	Nov 2017 (Energy Current)	Change
ENERGY STAR Score (1-100)	46	94	48.00 (104.30%)
Source EUI (kBtu/ft ²)	137.2	75.3	-61.90 (-45.10%)
Site EUI (kBtu/ft ²)	66.4	38.3	-28.10 (-42.30%)
Energy Cost (\$)	Not Available	97,009.83	N/A
Total GHG Emissions Intensity (kgCO ₂ e/ft ²)	7.7	4.2	-3.50 (-45.50%)
Water Use (All Water Sources) (kgal)	Not Available	Not Available	N/A
Total Waste (Disposed and Diverted) (Tons)	Not Available	Not Available	N/A

[Search energystar.gov](https://www.energystar.gov) , portfolio manager

<https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager>

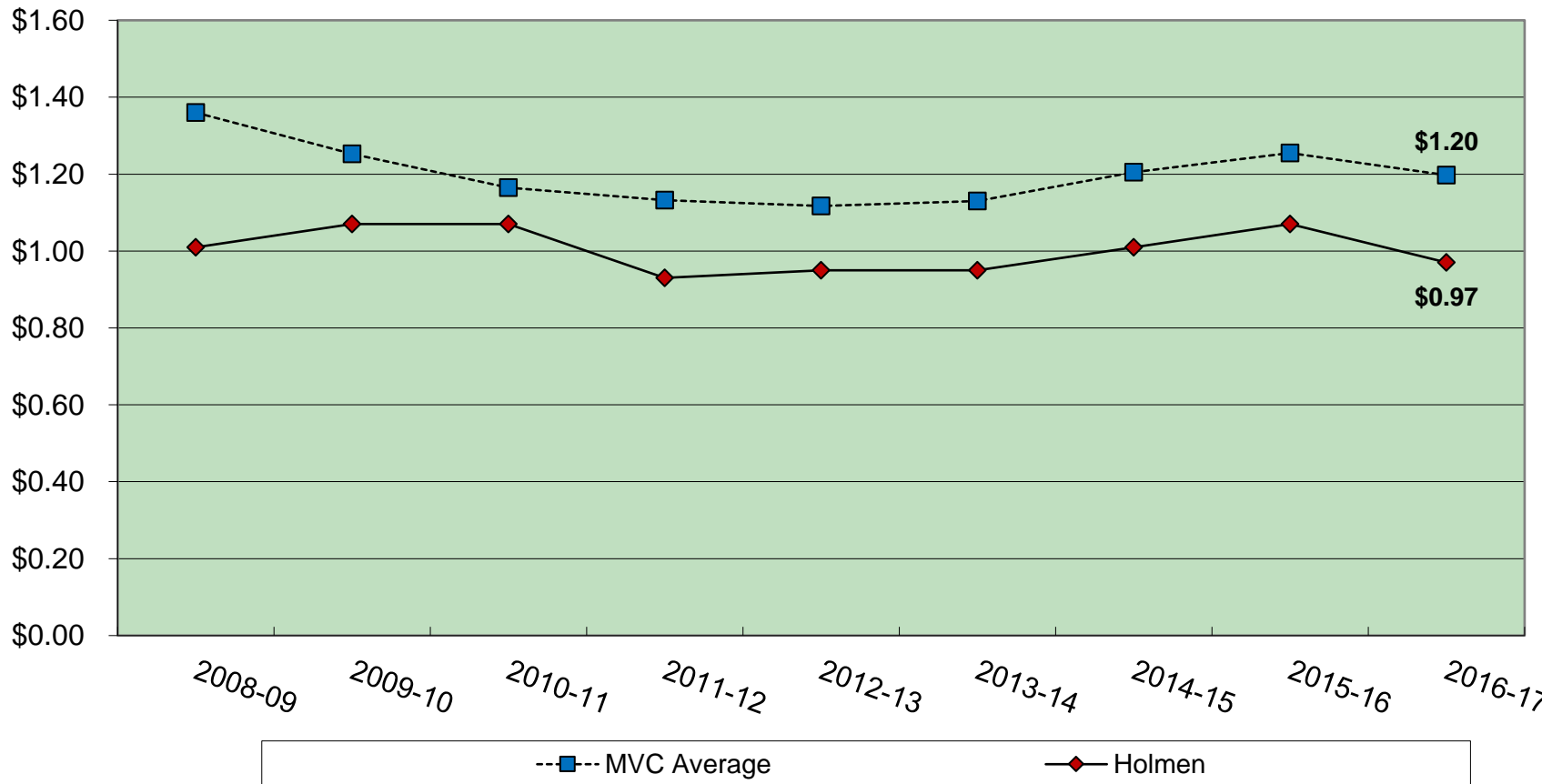


Measure the Physical Classroom Environment

- **Temperature**
- **Humidity**
- **Lighting**
- **CO₂**

Compare Costs to Neighbors

Utilities Expenditures per Square Foot



Any Questions?

