Why Districts Cannot Ignore Energy Efficiency

KSBA Annual Conference

Jon Nipple
Manager KSBA-SEMP

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Louisville, Kentucky

Ron Willhite
Director KSBA-SEMP

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Overview

- Kentucky's Changing Electricity Profile
- School's Response to Change
- What you Use – How you Pay
- Diversified Portfolio of Energy Options
- Enabling Energy Efficiency and DEMAND Response
- KRS157.455 Efficiency & Life-cycle Costing

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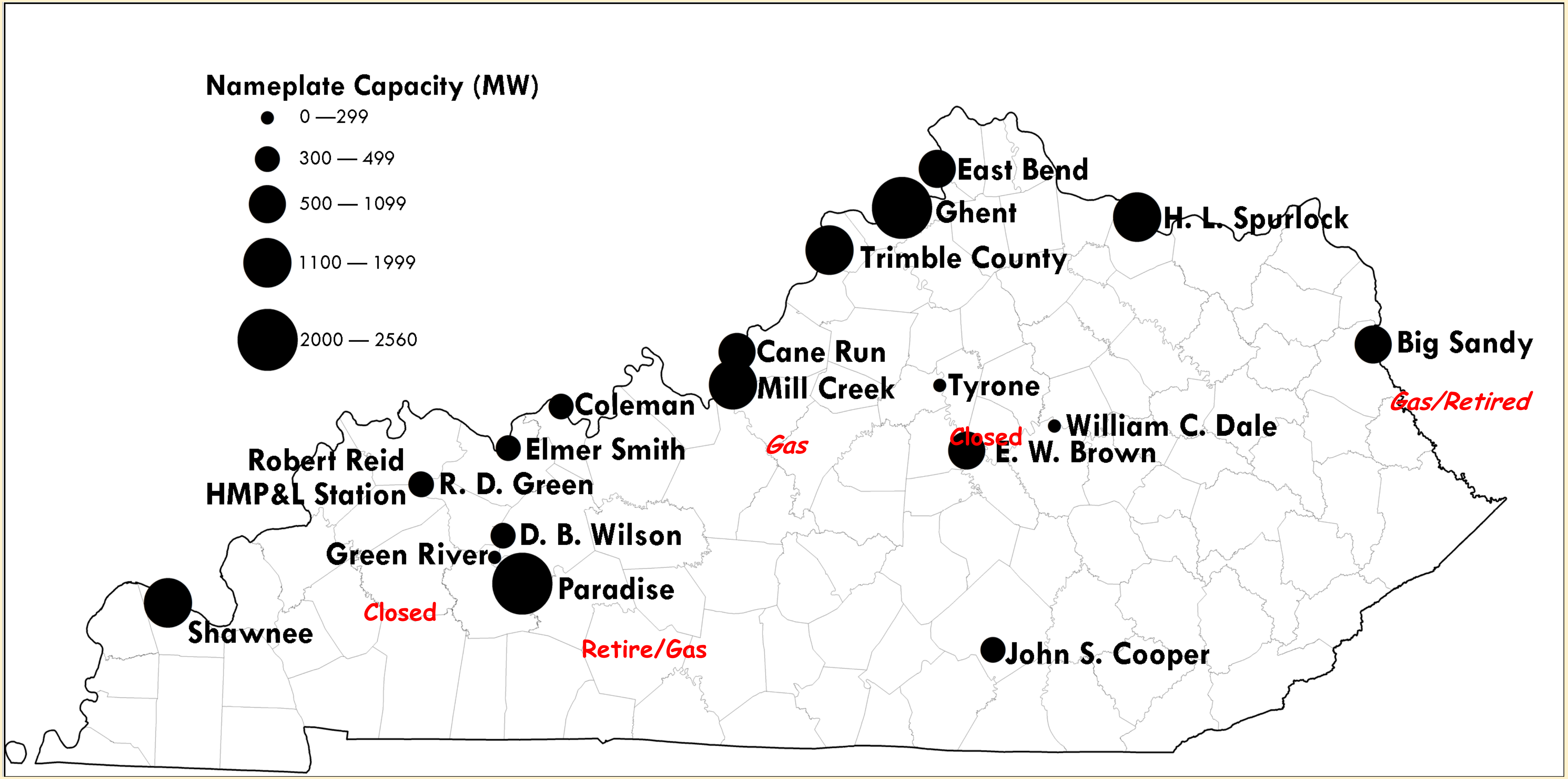
Kentucky's Changing Electricity Profile

- Forty percent of coal-fired generation units retired by 2016
- Greenhouse Gas regulations limiting replacement options
- Low gas prices driving switch to natural gas without Greenhouse Gas regulations
- Competitive advantage of low prices declining

Electric Generating Plants



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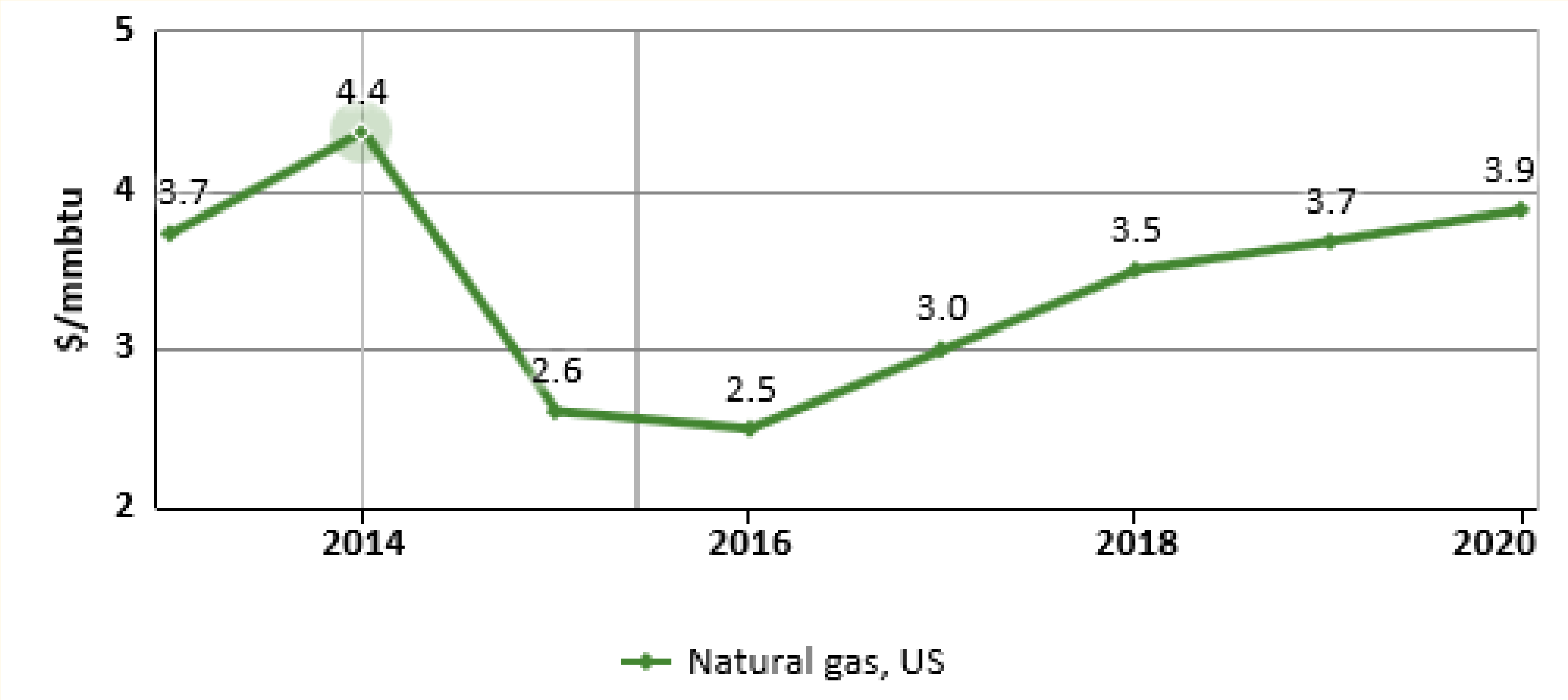
Impact of EPA's – Clean Power Plan

- By 2030 Reduce Nationwide CO_2 Emissions by 32 %
- Final Ruling Increased KY Reduction from 18% to 40%
- 2020 – KY Current Plans Fall Short by 17 %
- Per KY Energy and Environment Cabinet
  - $2 Billion GDP Decrease
  - 30,000 Less Jobs

Natural Gas Price Outlook



Source: [World Bank Commodity Forecast Price Data, January 2016]

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Levelized Production Cost of Energy

2020 Projections: US DOE and National Renewable Energy Laboratory				
	Source	Capacity Factor	Levelized Cost/KWh	Comments
Dispatchable				
	Conventional Coal	85	$0.092	
	Advanced Coal w/ CCS	85	$0.128	Technology not scaled
	Conventional NG Combined Cycle	87	$0.083	
	Advanced CC w/ CCS	87	$0.106	Technology not scaled
	Advanced Nuclear	90	$0.089	Safety Concerns
	Geothermal	94	$0.061	
	Biomass	83	$0.094	
NonDispatchable				
	Wind	35	$ 0.075	Transmission Investment
	Wind Offshore	38	$ 0.176	Transmission Investment
	Solar PV	25	$ 0.117	Transmission Investment
	Solar Thermal	20	$ 0.214	Transmission Investment
	Hydroelectric	52	$ 0.090	

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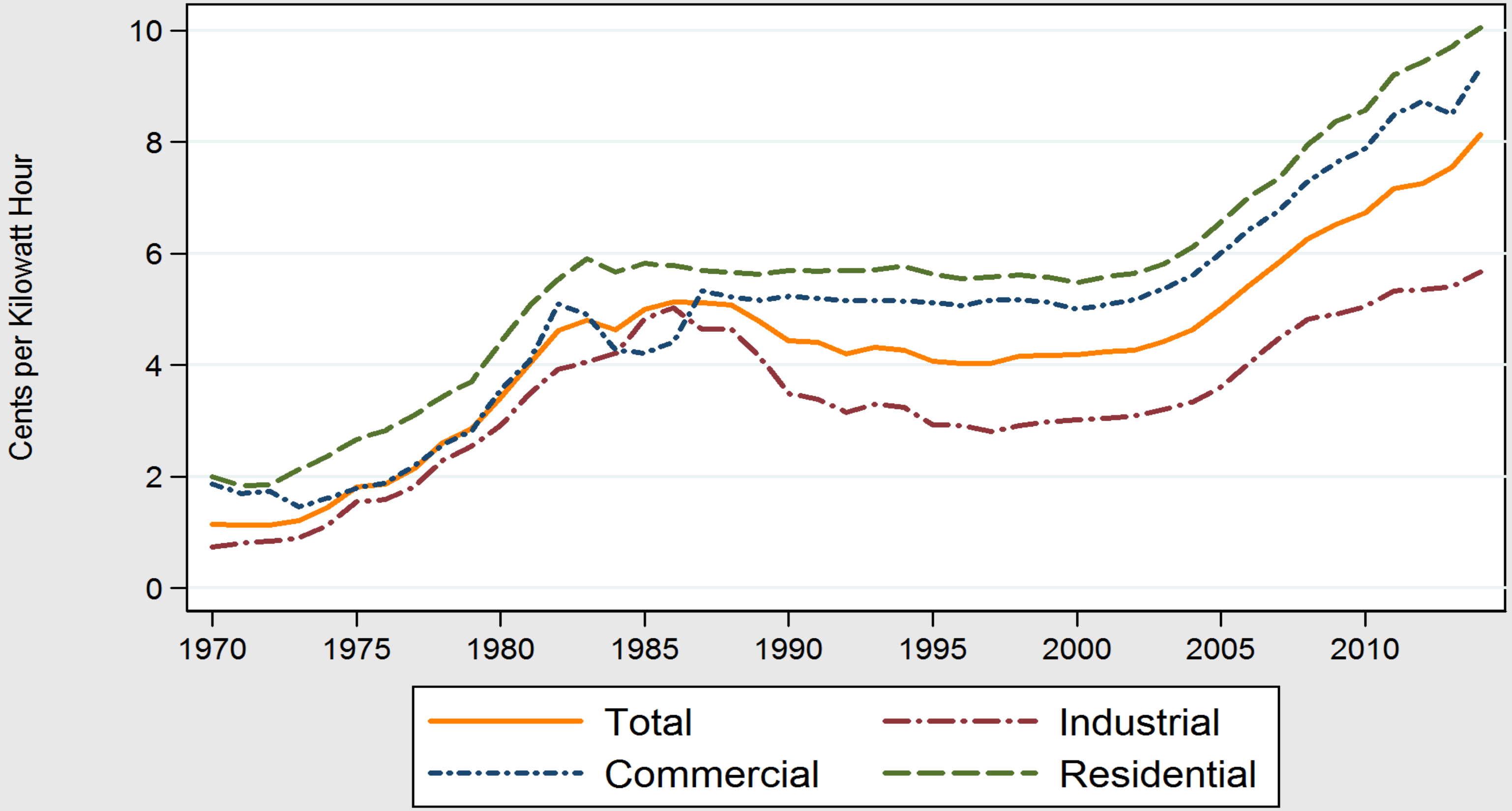
Kentucky Average Electricity Price, 1970-2014

Nominal Prices by Sector



Kentucky Energy Database, EEC-DEDI, 2015

Data Source: EIA Form 861 & 826

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Best Fuel Source – Energy Efficiency

- Doesn't require new technology
- Can do it today
- Reduces Greenhouse Gas
- Lowers Cost

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School's Response to Change

Statutory & Policy Drivers

- HB2 (2008) to KRS160.325 to Board Policy 05.23
  - Develop/ Implement/Monitor Energy Management Plan
  - Track & Monitor Progress Managing & Reducing Costs
  - District/Superintendent Annual Reporting
  - KSBA collects, verifies and reports to DEDI & LRC

What have schools done to date

- Employed Energy Managers
- Facility & Operation Audits
- Staff/Student Involvement
- Implemented Efficiency Measures
  - Adjusted HVAC temperature set points
  - Incorporated HVAC temperature set backs
  - Lighting Retrofits
  - Performance Contracts
  - ENERNOC Programs

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Energy Efficiency

	2010	2015
National	73	73
Kentucky	**65**	**57**
ENERGY STAR	50	50
KY's Best District	**43**	**32**
Net-Zero Ready	20	20

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Your Future is Now…

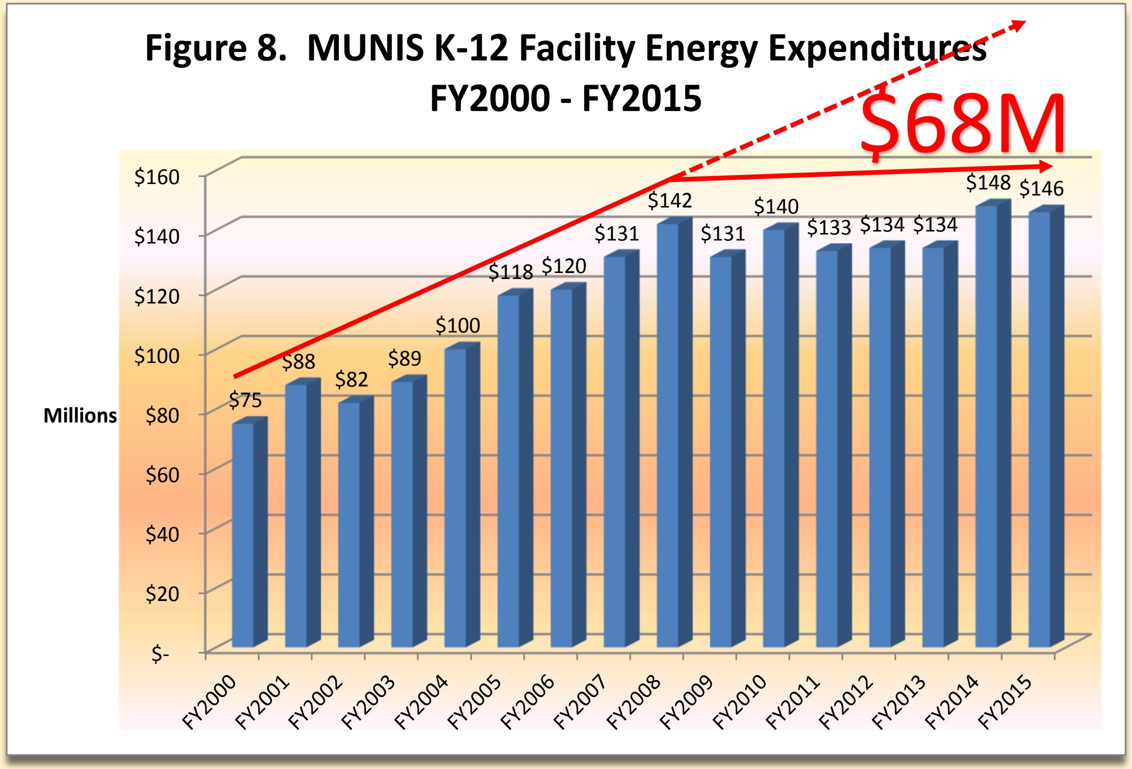

Table 3. Annual Energy Savings Potential			
Level	EUI	Incremental Savings	Annual Savings
Current	57.5		$16.4M
ENERGY STAR	50	$21.1M	$37.5M
Best Performer	40	$21.5M	$59.0M

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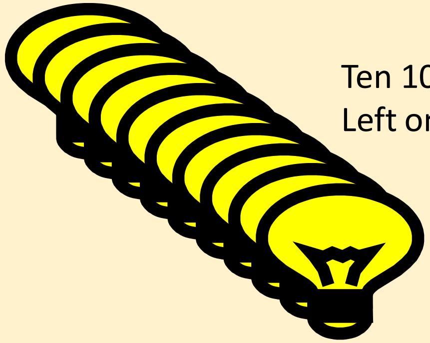
What you Use – How you Pay

Demand vs. Energy



Ten 100 watt bulbs = 1000 watts = 1KW (Power or Demand)
Left on for 1 hour = 1KWh (Energy)

Schools don't have incandescent lights,
yet one 3-lamp, 2 X 4 foot fluorescent fixture ≈ 100 watts
(slightly less)

An Elementary School may have 500 , 2 X 4 foot fixtures.

DEMAND: 100 watts/fixture X 500 fixtures = 50,000 watts (50KW)
ENERGY : = 50 KWh (on for one hour)
= 10000 KWh (on for 200 hours, 1 mo.)

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What If

a. Turn lights off for all but 15 minutes…

b. Turn lights off for half the time…

a. Demand still equals 50KW,	**= $750**
Energy (.25h x 50 KW x $0.10/KWh)	= $1.25
Total Cost	= $751.25
b. Demand still equals 50KW,	**= $750**
Energy (100h x 50 KW x $0.10/KWh)	= $500
Total Cost	= $1250

DEMAND is measured at the highest 15 minute interval during the entire month. One 15 minute interval sets the demand for the entire month.

Why is that?

DEMAND is the Power the Utility Company has to reserve for each and every customer on their grid in case all customers “called for power” at the same time.

Generation Plants are limited in the amount of electrical power they can generate and transmit.

Does everyone really call for power at the same time? The answer is yes. See the next slide.

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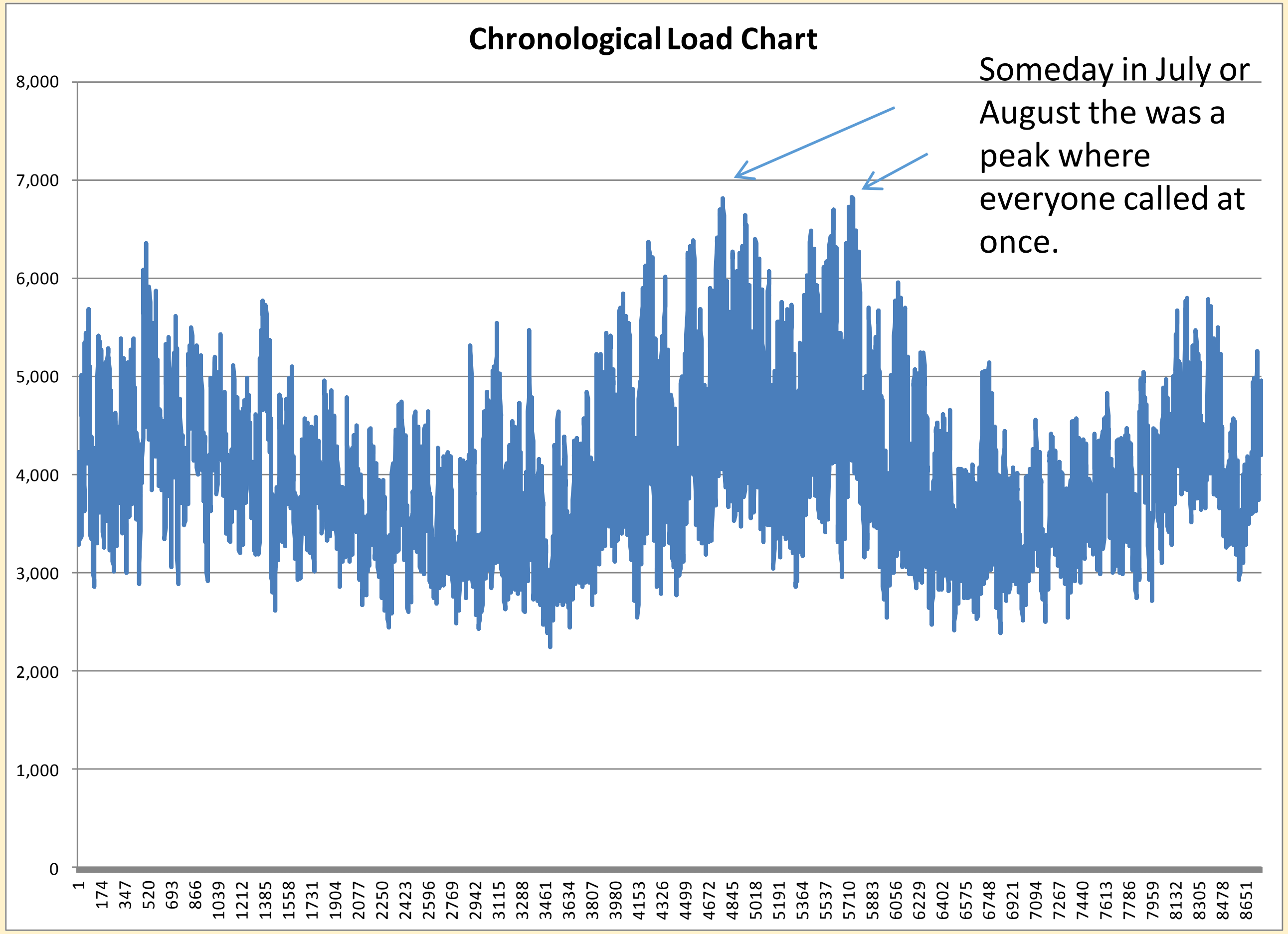
Annual Generation of a Power Plant



Megawatts

Chronological Hour

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Understanding Rates and Why DEMAND is so Important

Rate	Customer Charge	Energy Charge, $/kwh	Demand Charge, $/KW
Residential Service	YES	YES	
General Service	YES	YES	
Commercial Power	YES	YES	YES
Commerical Time of Day	YES	YES	YES

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Everyone Doesn't Pay the Same Way

Rate	Customer Charge	Energy Charge, $/kwh	Season	Demand Charge, $/KW	Time of Day
Residential Service	$ 10.75	$ 0.08870	All		
General Service	$ 40.00	$ 0.10426	All		
Commerical Power	$ 90.00	$ 0.03572	Summer	$ 19.05	
			Winter	$ 16.95	
Commerical Time of Day	$ 200.00	$ 0.03527	Summer	$ 6.13	All Hours
				$ 4.53	10AM - 10PM
				$ 5.20	1PM-7PM
			Winter	$ 6.13	All Hours
				$ 4.53	6AM-10PM
				$ 5.20	6AM - Noon

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It's just math…

but you have to know your history to get the right answer

Rate	Customer Charge	Energy Charge, $/kwh	Season	Demand Charge, $/KW	Time of Day	Annual cost
Residential Service	$ 10.75	$ 0.08870	All			-
General Service	$ 40.00	$ 0.10426	All			$ 156,870
Commercial Power	$ 90.00	$ 0.03572	Summer	$ 19.05		$ 144,675
			Winter	$ 16.95		
Commercial Time of Day	$ 200.00	$ 0.03527	Summer	$ 6.13	All Hours	$ 136,191
				$ 4.53	10AM - 10PM	
				$ 5.20	1PM-7PM	
			Winter	$ 6.13	All Hours	
				$ 4.53	6AM-10PM	
				$ 5.20	6AM - Noon	
Demand, KW	425					
Usage, KWH	1,500,000					

$90,000 in Demand

$81,000 in Demand

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Trend Toward Diversified Portfolio of Energy Options

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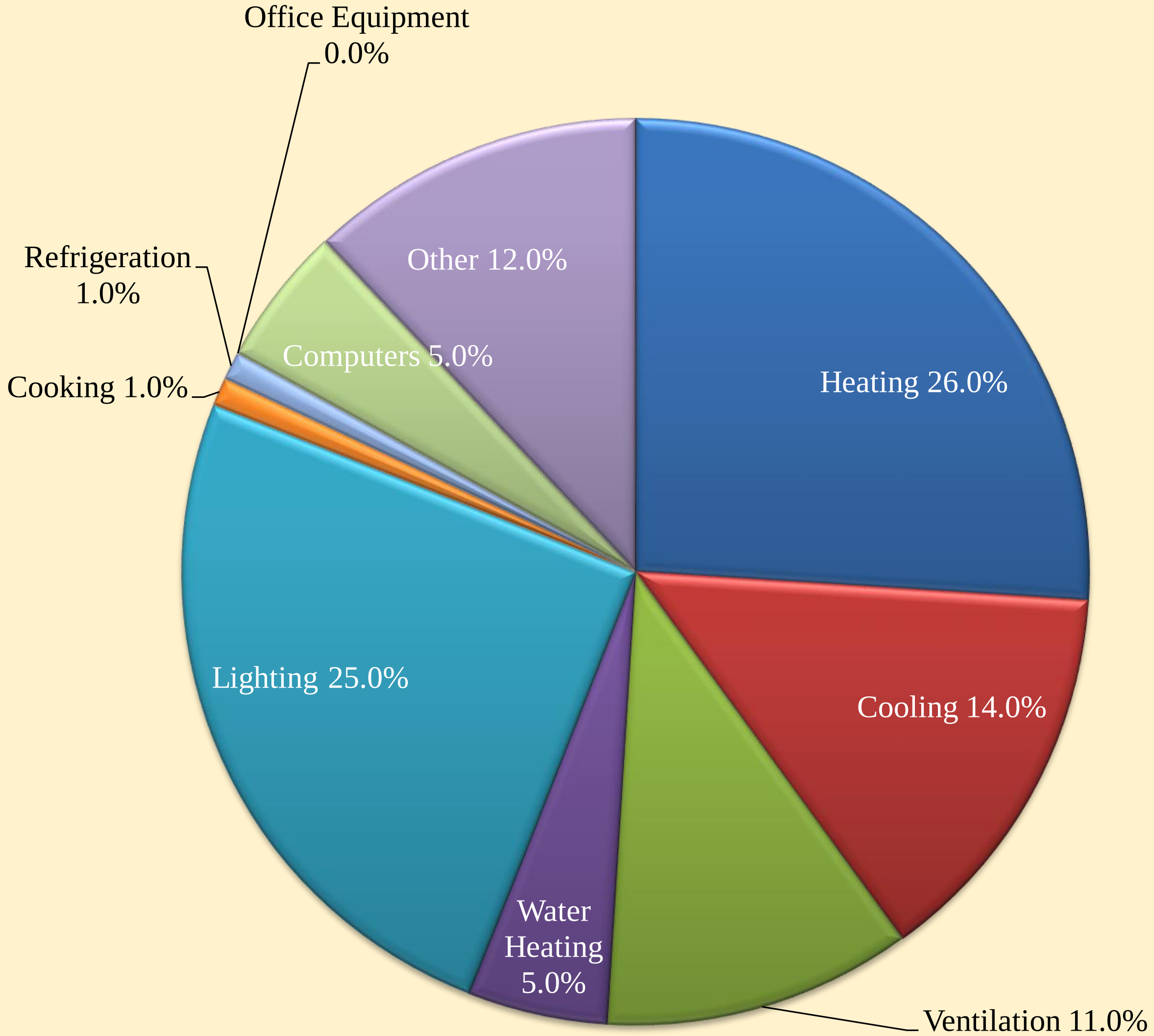
Where do those BTUs Go?

- Note HVAC
- Note Lighting
- Other = Things Plugged In
  - ✓ Space heaters
  - ✓ Coffee Makers
  - ✓ Microwaves
  - ✓ Mini Fridge



CBECS High School Energy Use Profile (2003)

- Commercial Building Energy Consumption Survey

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Managing Demand

End User

- Manage Startups
- Technology upgrades
  - Lights
  - Equipment
- Demand Limiting
- Demand Shedding
- Energy Management
- Reduce Baseline Load

Utility Company

- Demand Side Management Programs (DSM)
  - Rebates
    - Lights
    - Refrigerators
    - Equipment
  - Demand Limiting /Shedding Incentives
    - ENERNOC
  - Energy Manager Funding
  - Rates

Enabling Energy Efficiency and DEMAND Response

- Real Time Metering (Smart)
- Equipment
  - Technical Upgrades -- Lighting
  - Technical Upgrades – Apps
  - Equipment Upgrades
    - Demand Response Chillers, etc.
    - Energy Storage
- Off Hours Energy Usage (take advantage of TOD)
  - Heating and Cooling
  - Cafeteria Cleanup

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What If?...

- From Previous Example...

- If I had the ability to control those 500 light fixtures and could turn off 20 prior to the demand peak. I could save 2KW ($30/month or $360/year).

- That would be equivalent energy dollar savings of turning off all 500 fixtures for 6 hours/month.

- This is an example of Demand Shedding.

LED Outdoor Lighting

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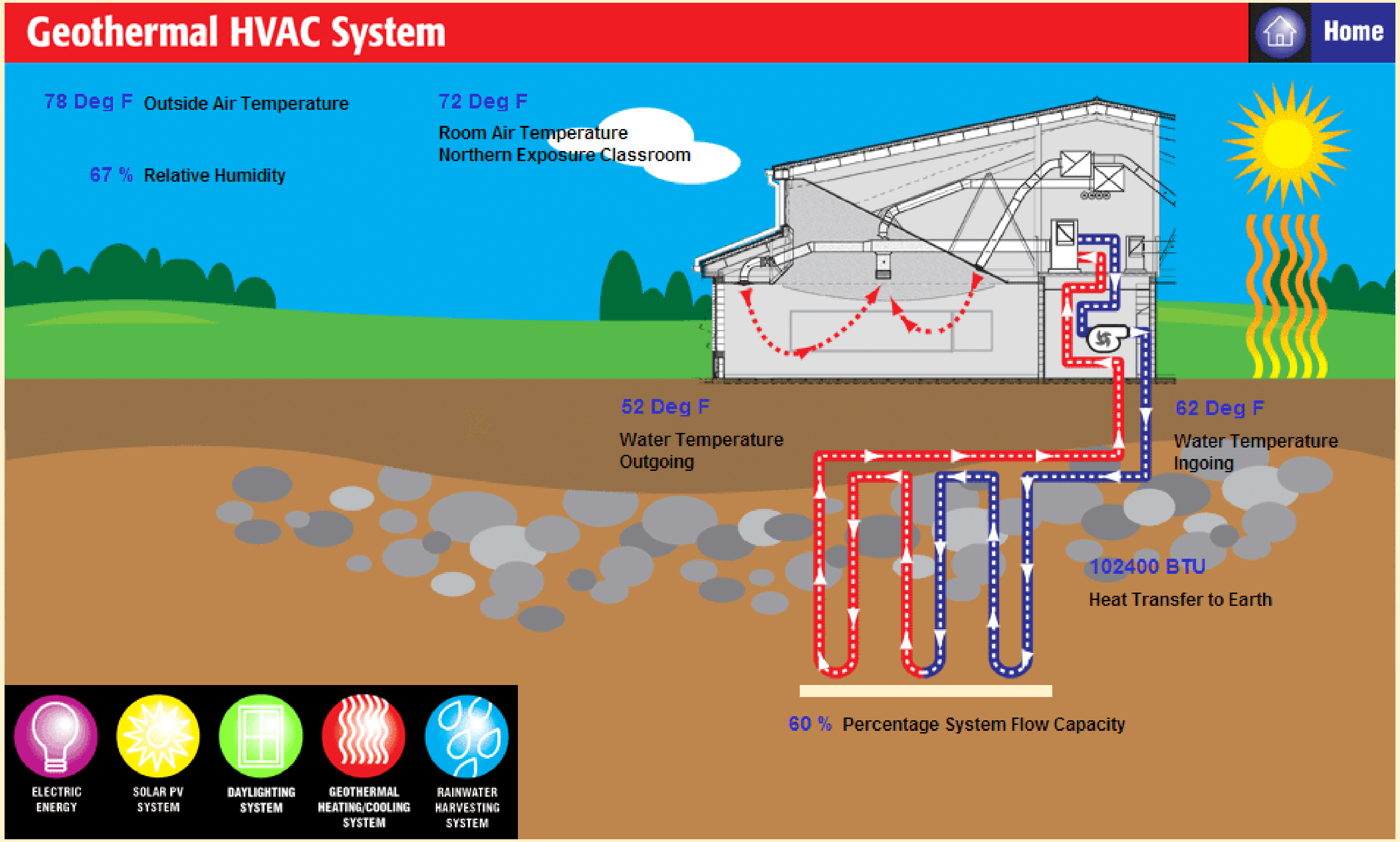
Envelope Improvement

Geothermal Picture



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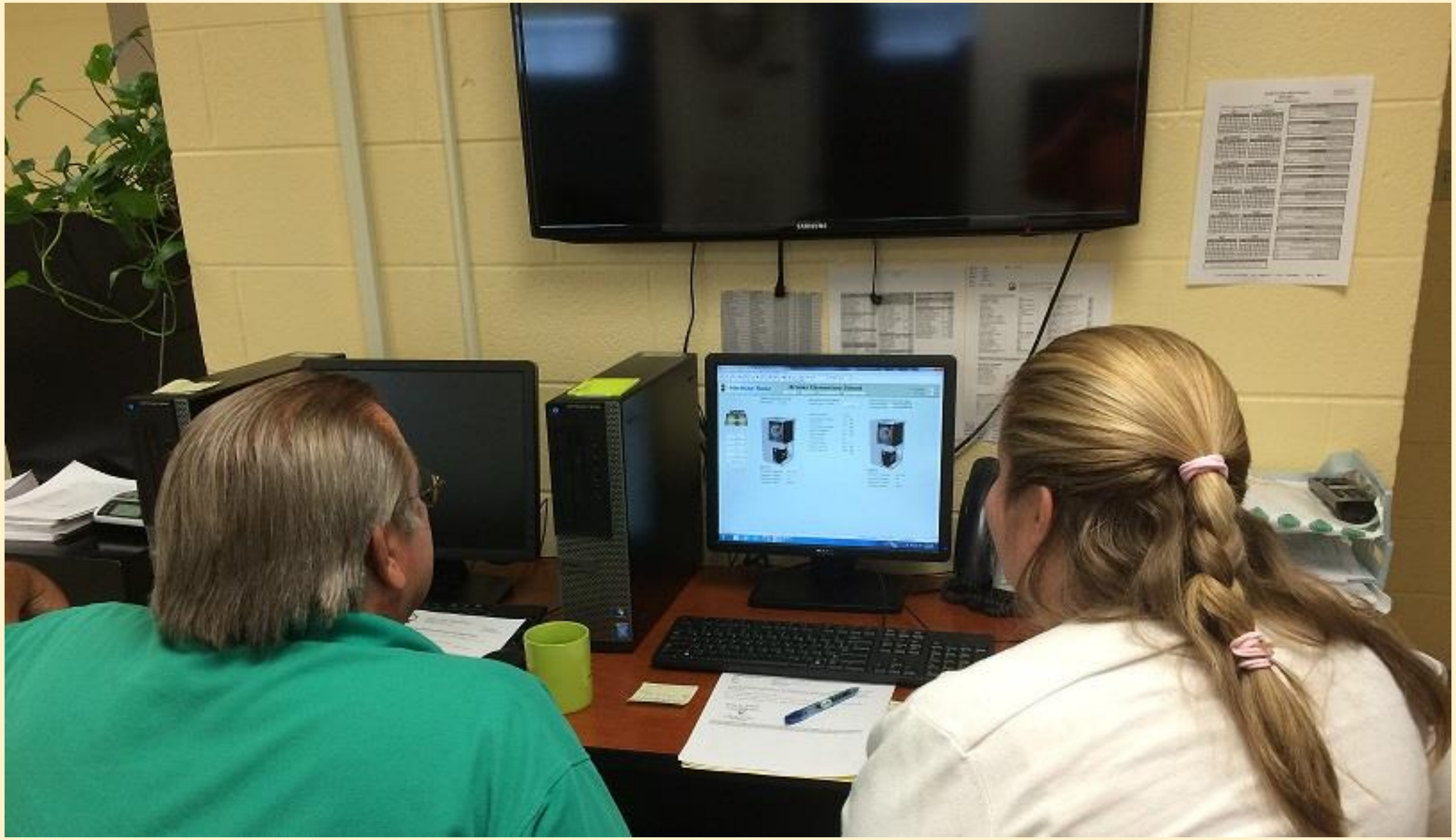
Control Systems



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Construction and Renovation

Net Zero Buildings

- New Construction "Ready"
  - Building EUI below 20KBtu/sf
  - Affordable w/o Solar Panels

- Major Renovations
  - Building EUI below 30KBtu/sf

- Energy Standards or Goals as Part of the Building Contract

Second Important Energy Statute for Schools

KRS157.455 – Highly Efficient Buildings

- Create Healthy Environment while Saving Energy
- Use Life-Cycle Analysis in Proposal Evaluation
- Consider Net-Zero Construction

Operational Savings for Equipment Retrofits

- KRS157.455
  - Life-Cycle Costing

- Financing of Capital Improvements using Energy Savings
  - Example

Real Question is Not "What does it Cost?" but "What does it save and how soon?"

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Operational Savings for Equipment Retrofits

Example:

Operational Savings for Equipment Retrofits

Example:

- Your energy manager has identified an air infiltration problem in one of your buildings and estimates the savings will be $15,000 per year but will cost $45,000 to repair.

- You say, “No way, I’ve got to find $130,000 to repair a roof in another building.”

- ?????

Operational Savings for Equipment Retrofits

Example:

- Assume the repaired building will last 20 years
- Assume 5% discount rate
- By understanding the Life Cycle Cost and the Time Value of Money, you can determine the Present Value of the $15,000 per year annuity over the next 20 years

Operational Savings for Equipment Retrofits

Example:

- $15,000 X 12.4622* = $186,933 (Present Value)

- $186,933 - $45,000 = $141,933 (Net Present Value)

❖ The Net Present Value of the Energy Savings will fund the Roof Repair!!

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COMING SOON

SPECIAL ENERGY PROJECT FUNDING

- Settlement part of last summer's rate interventions for KU and LGE
- $1M for Energy & Demand Reduction Projects
  - Help initiate projects
  - Limited to LGE-KU Accounts and Districts who participated in Rate Case
- KSBA to Administer by issuing RFPs
- Funding Potential allocated thru minimum participation amount and number of KU/LGE schools within a district
- Maximum Funding obtained thru district's willingness to match dollar for dollar

Funding the Future with Today's Savings

Savings Calculation				
	Old	New	Savings	
Light Type	400 w MH	LED		
# fixtures	50	50		
Annual kwh	56,500	25,000	31,500	$1,125
Summer KW	22.6	10.0	12.6	$1,200
Winter KW	22.6	10.0	12.6	$1,495
	Total Annual Savings			$3,820

	Additional Investment Supported by Grant			Additional Fixtures Supported by Grant		
	Term			Term		
Rate	5	10	15	5	10	15
3.50%	$17,551	$32,289	$44,663	43.9	80.7	111.7

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Average K-12 Price by Supplier

Provider	Rate
Kentucky Utilities	$0.093
Duke	$0.095
Eastern Kentucky COOP	$0.099
Louisville Gas & Electric	$0.108
Kentucky Power	$0.112
TVA COOP	$0.114
Princeton Municipal	$0.161

Savings Potential

	Energy Intensity, Kbtu/sf/yr	Cost/sf	Annual Operating Cost, $	Annual Savings, $
National Average School	73	$1.83	$183,000	
Average Kentucky School	57	$1.43	$143,000	$40,000
ENERGY STAR School	50	$1.25	$125,000	$58,000
Net Zero Ready School	20	$0.50	$50,000	$133,000

For a 100,000 Square Foot Middle School

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The End