Developing an Energy Master Plan

Presentation at

58th Annual Water Workshop
Operator Training Committee of Ohio
Doubletree by Hilton, Columbus OH

Tuesday, March 10, 2020

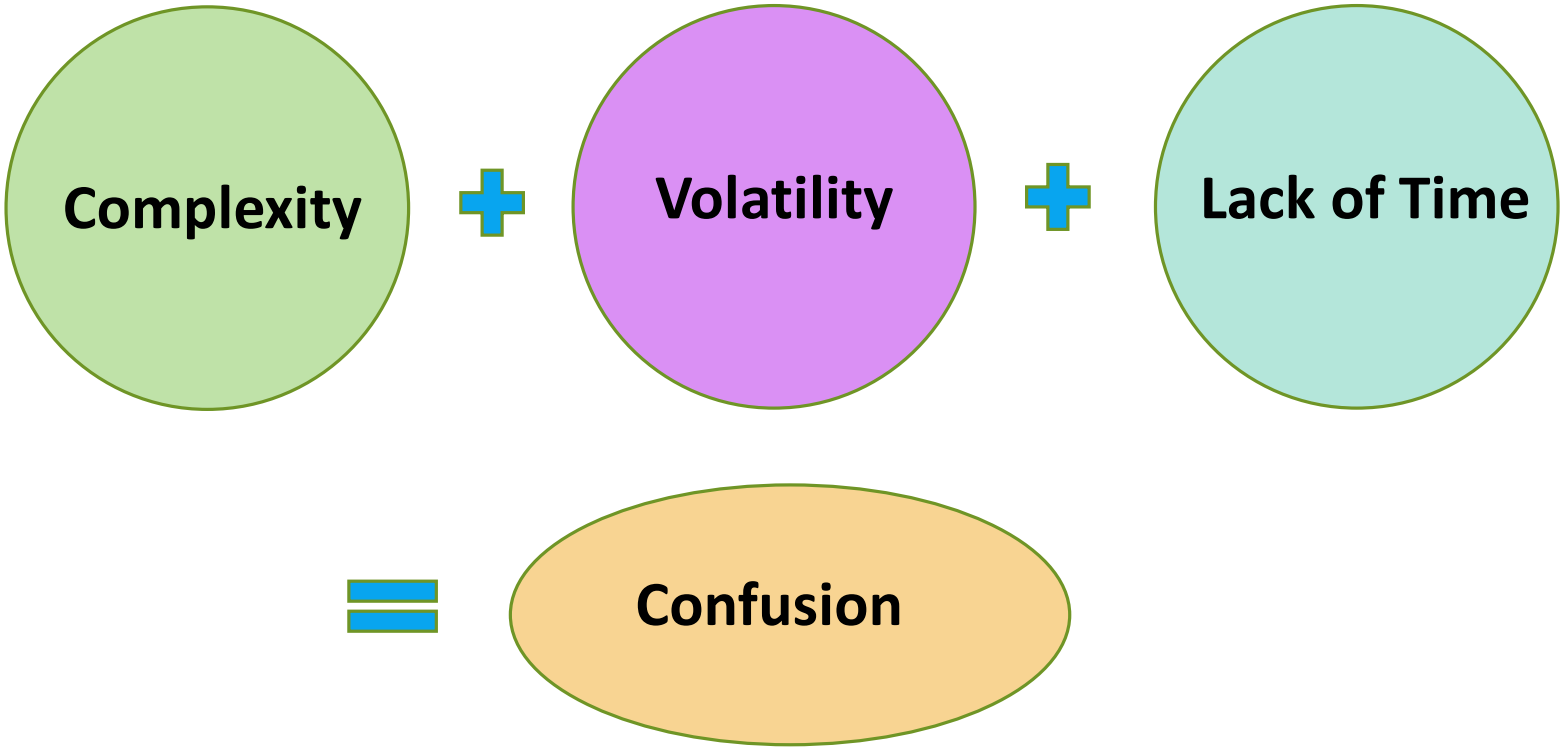
SES
SUSTAINABLE
Energy Services

Electric Certificate – Ohio PUCO 15-960E

Natural Gas Certificate – Ohio PUCO 15-427G

A Certified Woman-Owned Business

Energy Management –
Understanding the Challenges



Energy Master Plan

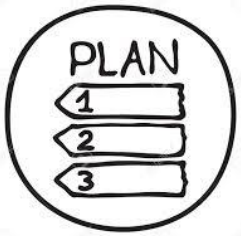
Why?

- Provides comprehensive, coordinated approach to reducing a major cost category
- Develops an actionable strategy to address critical infrastructure needs
- Prepares organization for growth

Objective – Provide a roadmap for an efficient, practical, cost effective and robust energy infrastructure

Energy Master Plan
Planning Considerations

- It's a "Living Document"
- Determine Goals and Expectations
- Level of Detail
- Time Window
- Biases/Political issues
- Ensure Energy Systems Meet Mission Needs and Addresses Growth and Deferred Maintenance
- Improve Energy Reliability & Redundancy
- Reduce GHG Emissions & Operating Costs



Energy Master Plan

Getting started

- Buy-in from the top is critical for success
- Develop internal team
  - Facility and maintenance depts
  - All levels
  - Who's the energy geek?
- Set realistic goals – aim for small wins in the beginning
- Create 2 to 3 year benchmark for measuring success
  - What is your carbon baseline?
- Investigate funding options for worthwhile projects
- An ASHRAE Level 2 Energy Audit will quantify opportunities
- Create an Energy Policy

Keep it Practical!

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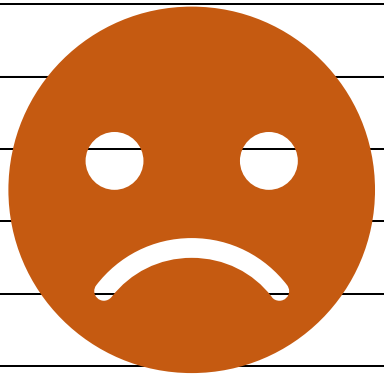
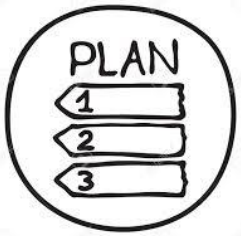
What have you done so far?

Look back at past projects

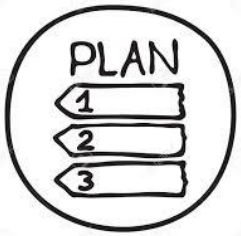
These Things Worked Well		Not So Good	
✓		✓	
✓			
✓		✓	
✓			

Lessons Learned from past projects



Energy Master Plan

What is Your Key Metric?



Energy Master Plan

What is Your Key Metric?

- ✓ mmBtu/million gals pumped
- ✓ kWh/kgals pumped

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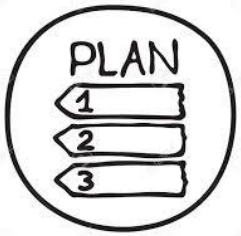
Energy Master Plan

Typical Plan Components

- Current State Assessment, Energy Audit
- Review of Operating and Maintenance Records
- Load Growth Projections
- Energy Conservation Improvements Already Made
- Self-Generation/Fuel Diversity
- Power and Gas Distribution Analysis
- Environmental Compliance Strategies
- New Plant/Infrastructure Siting
- Reliability Improvements
- Cost Estimating
- Economic Evaluation
- Funding/Phasing/Scheduling Plans



Energy Master Plan

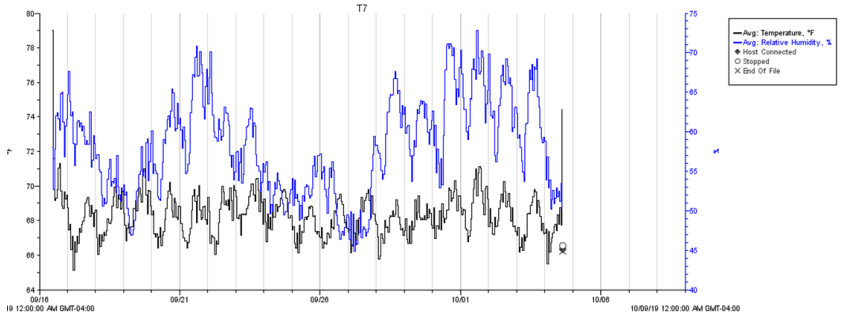
Develop a support team

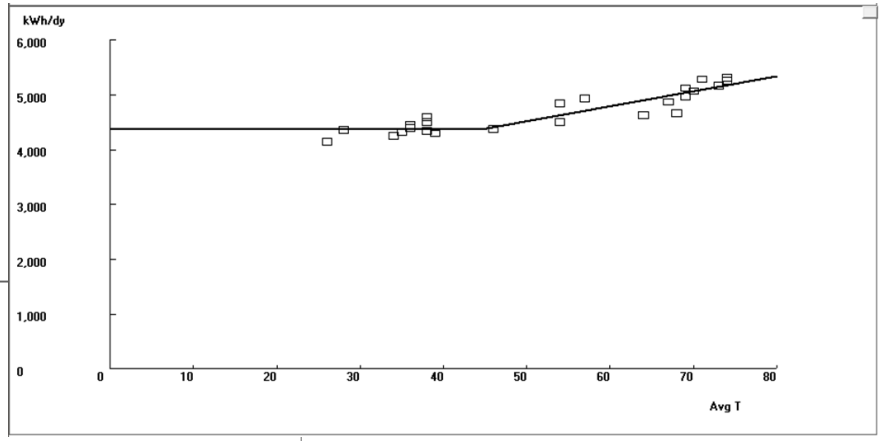
- Use independent consultant that is unbiased
- Make sure their expertise is in both the supply and demand sides
- They should be able to evaluate multiple mechanical firms, proposals & products
- And recommend best products/solutions for your project
- This type of holistic approach is crucial for successful projects

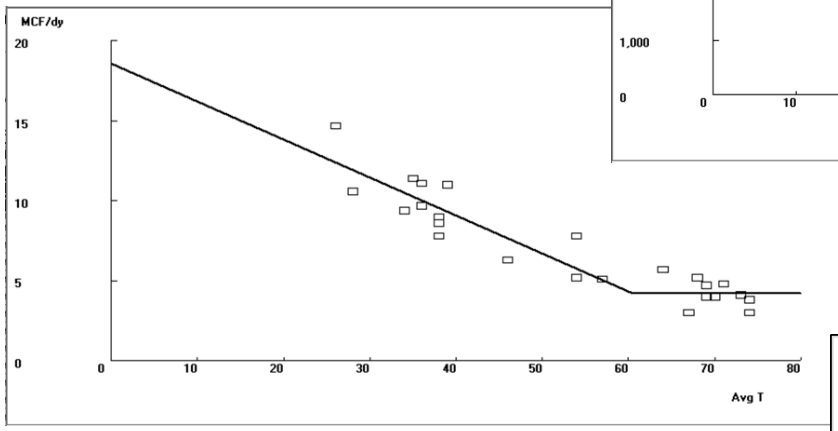
Energy Master Plan
Developing a Baseline

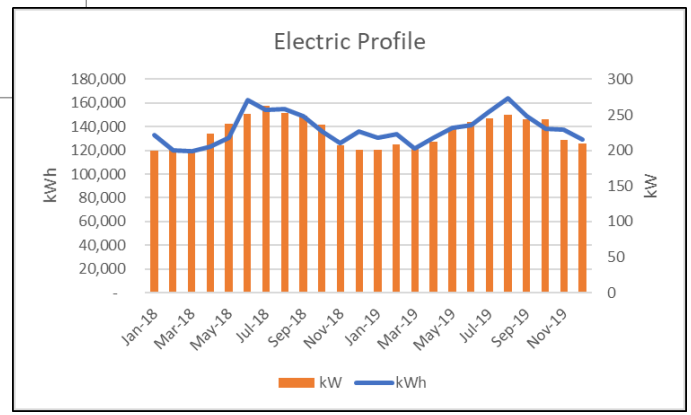
- Baseline your energy (2-3 years)
  - Monthly kWh
  - Monthly kW
  - Monthly kVar
  - Monthly MCF
  - Monthly kBtu
  - Annual PLC
  - Annual Capacity
  - All price components
- Weather normalize

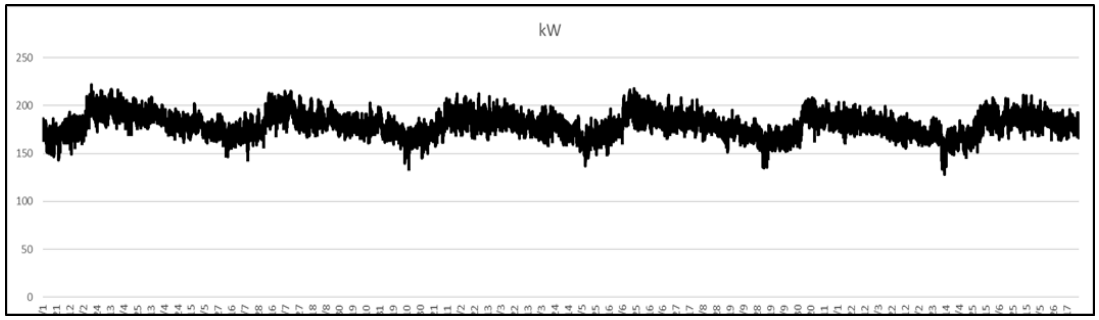
Good Data is Critical









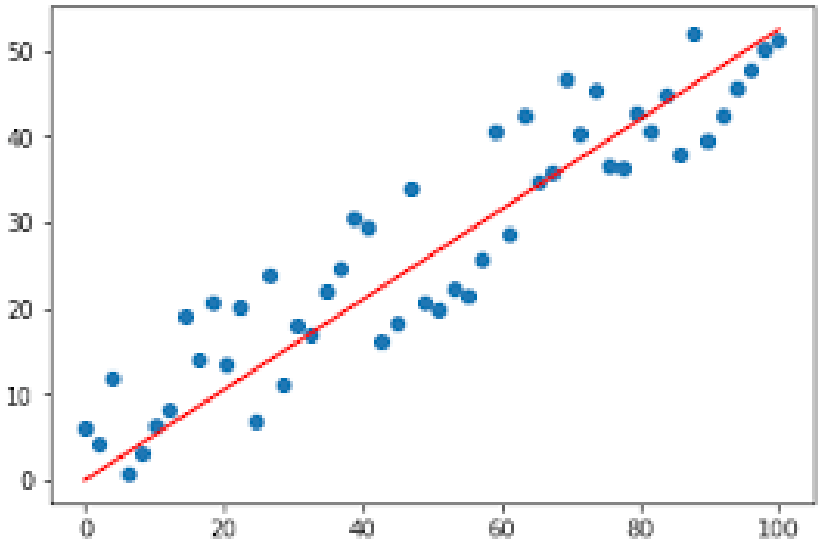


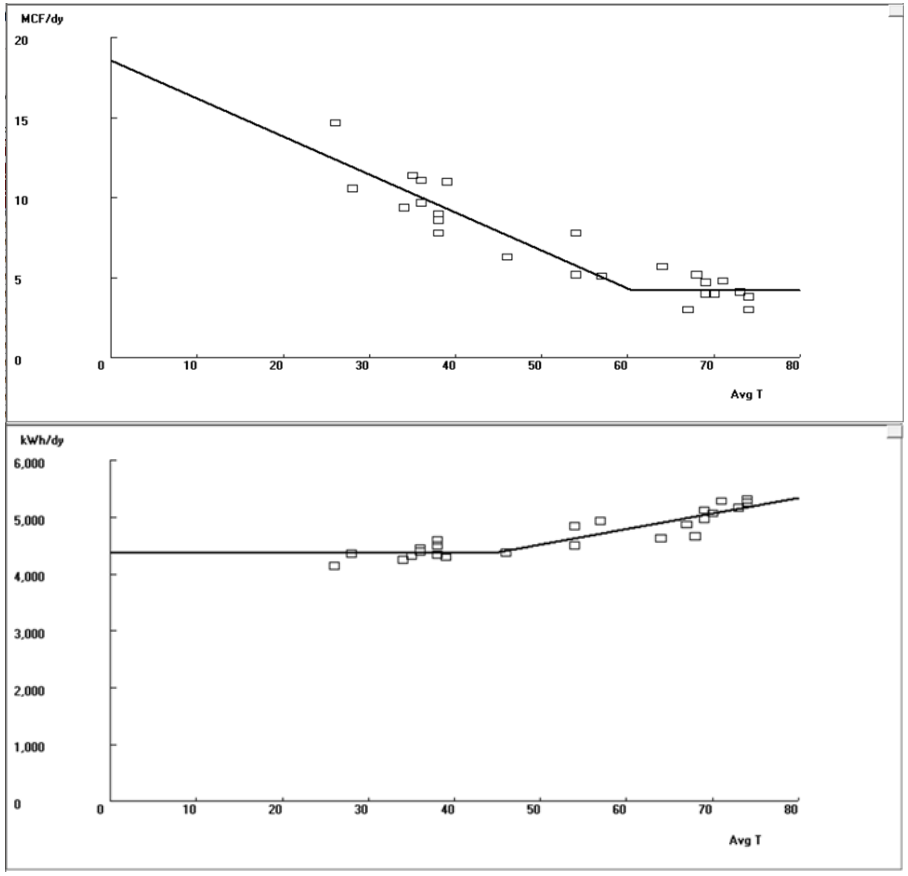
Data

- ✓ Understand data interdependencies
- ✓ Review collection methods
- ✓ Understand service life of equipment, processes being measured
- ✓ Watch for gaps and assumptions

Data Analysis

- Proper Data Analysis is Crucial
- Understand the models you use





The Use of "All-In" Utility Cost

The Most Common Mistake Made

Project: Replace 200 high bay light fixtures with LED fixtures

HID = 458 watts	*Annual Hours = 6250*	*All-in cost/kWh = $0.12*	*Demand cost/kW = $11*
LED = 150 watts	*Investment = $60,000*		*Actual cost/kWh = $0.07*

"All-in" annual savings = (458 – 150) / 1000 x 200 x 6250 x $0.12 = $46,200

Actual savings from kWh reduction = (458 – 150) / 1000 x 200 x 6250 x $0.07 = $26,950

Saving from kW demand reduction = (458 – 150) / 1000 x 200 x $11 x 12 = $8,131

Total annual savings based on actual costs = $26,950 + $8,131 = $35,081

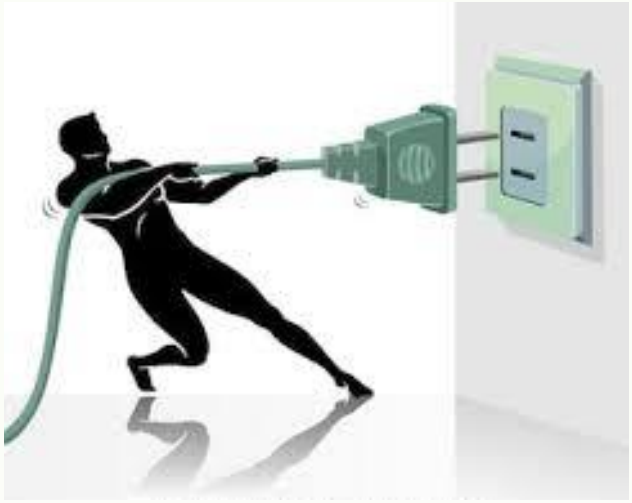
Under the All-in scenario, the annual projected savings of $46,200 provides a payback in 1.3 years.

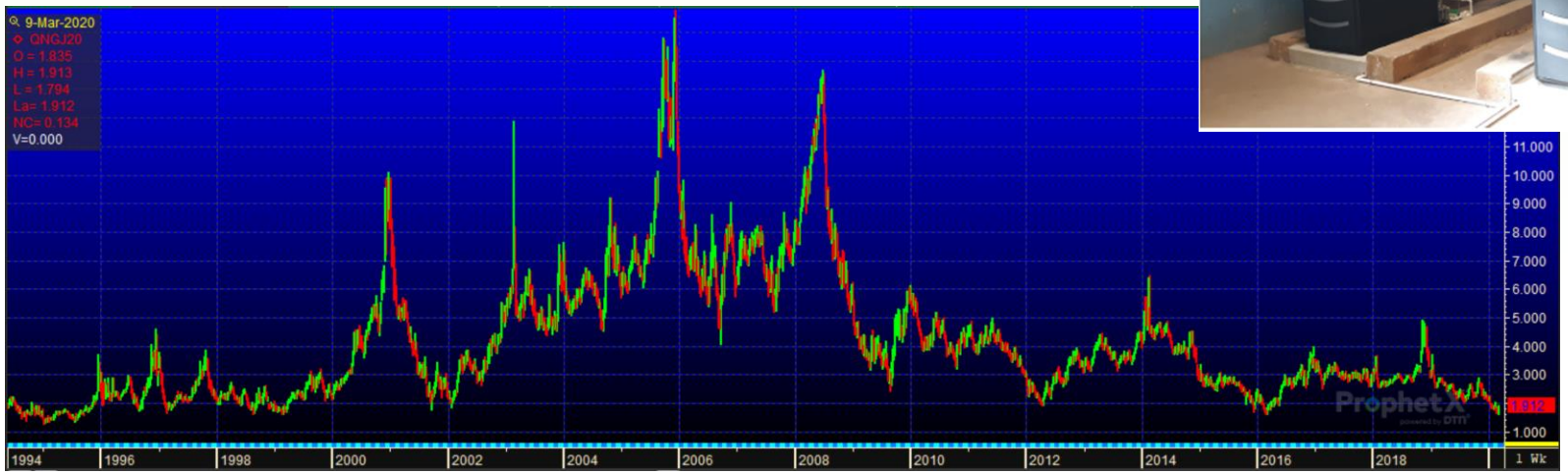
However, using the more accurate savings of $35,081, the payback is actually 1.7 years. Therefore, using the All-in cost per kWh results in a 32% error!

Energy is a Major Cost in Water Operations

- Water pumping dominates energy consumption
- Pumps are great candidates for VFDs
- Clear well and other storage allow make water operations good Demand Response participants
- Leaving a computer on overnight for a year creates enough CO_2 to fill a double-decker bus
- How many trees can we plant if we reduce our energy footprint?

Energy Procurement, Demand Response, Energy Efficiency, & Tariff

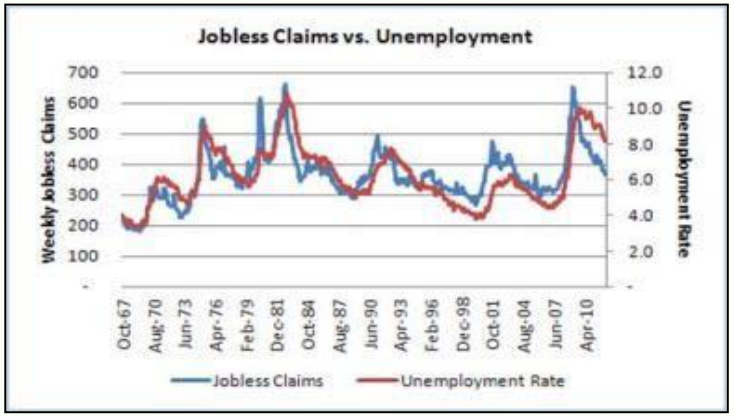




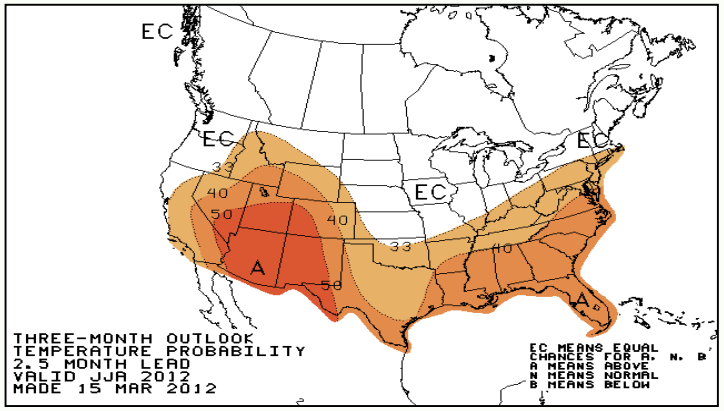
Energy Prices

Depends on Energy Market Forces

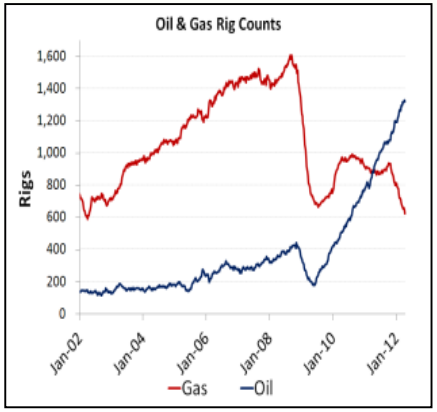
Macroeconomic

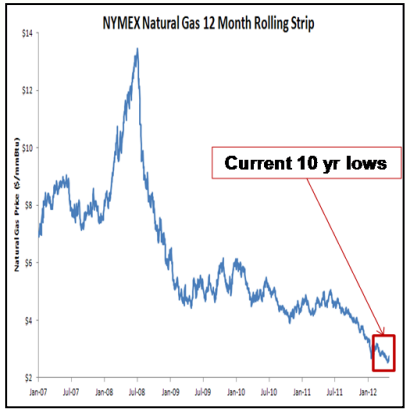


Weather

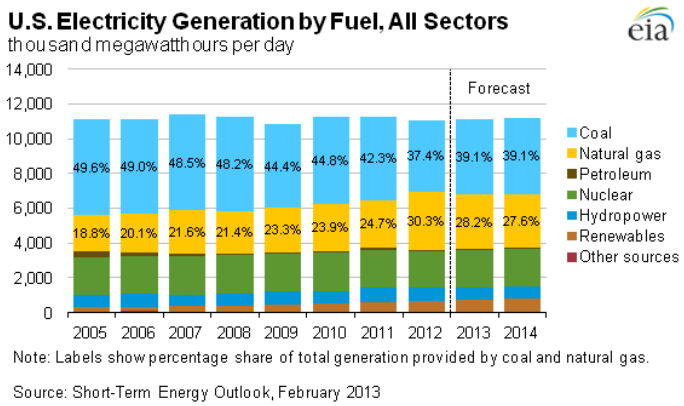


Energy Fundamentals

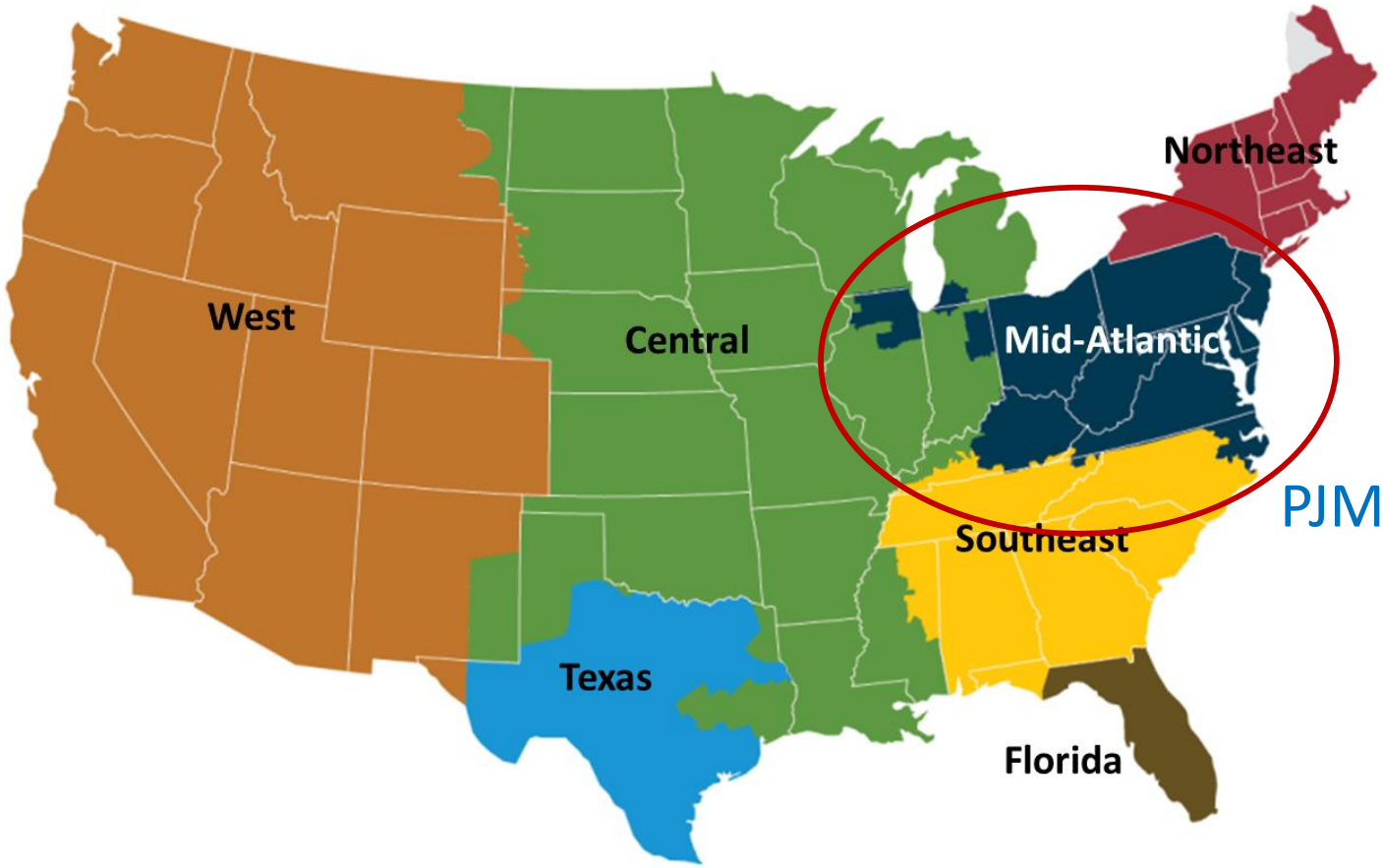




Regulatory Policy

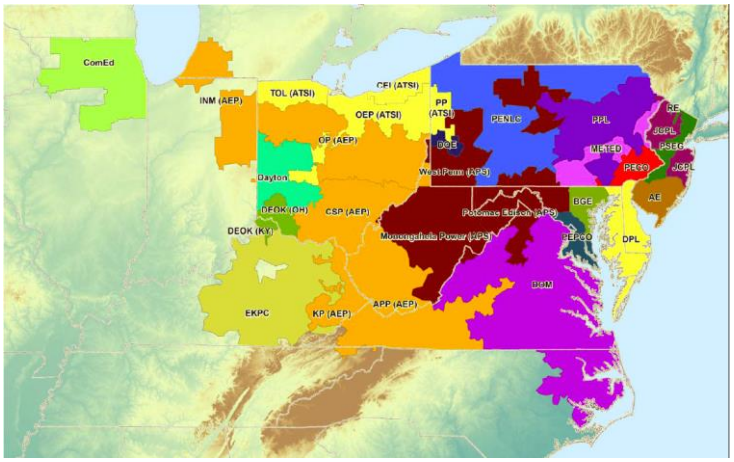


Demand Response
Multiple grids manage electricity & transmission



PJM in Ohio

SUSTAINABLE Energy Services



PJM Interconnection – our grid operator

Founded in 1927, non-profit

Serves 61 million people

Ensures the reliability of the high-voltage electric power system in all or parts of Ohio, DE, IL, IA, KY, MD, MI, NJ, NC, PA, TN, VA, West VA and the District of Columbia.

PJM coordinates and directs the operation of the region's transmission grid, which includes 62,556 miles of transmission lines -

- administers a competitive wholesale electricity market
- plans regional transmission expansion improvements to maintain grid reliability and relieve congestion

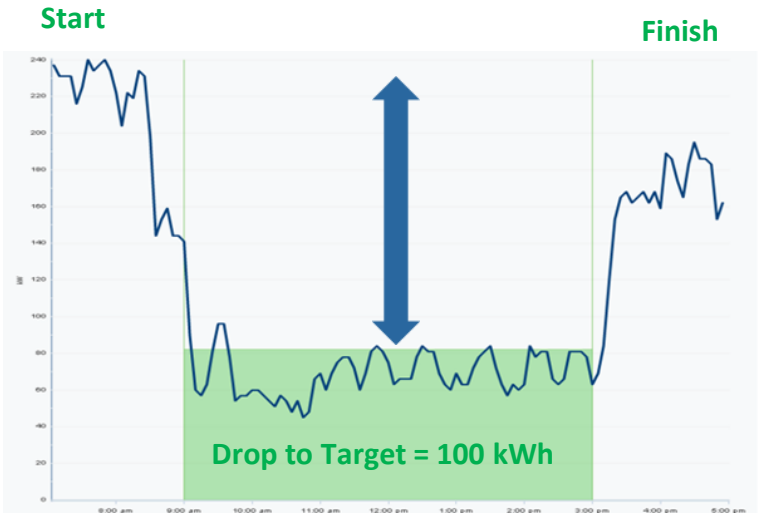
SUSTAINABLE Energy Services

Demand Response

Earn Revenue While Protecting the Grid

In return for your commitment to be on stand-by (as a last line of defense), users are rewarded with capacity payments

- 100% voluntary
- No cost to participate
- Smart meter provided
- Other benefits
  - Early notification of black/brownouts
  - Help stabilize grid
  - Social/community responsibility



Demand Response

Earn Revenue While Protecting the Grid

Capacity price you pay is based on PJM 3-Year forward auction.

Annual DR payments based on each year's Capacity price.

- FERC forced PJM to change the way renewables are priced
- PJM is still working on it
- Result is 2019 auction (for setting '22-'23 prices) didn't happen
- Each supplier pricing '22-'23 and future capacity their own way – requires detailed analysis to understand price offers

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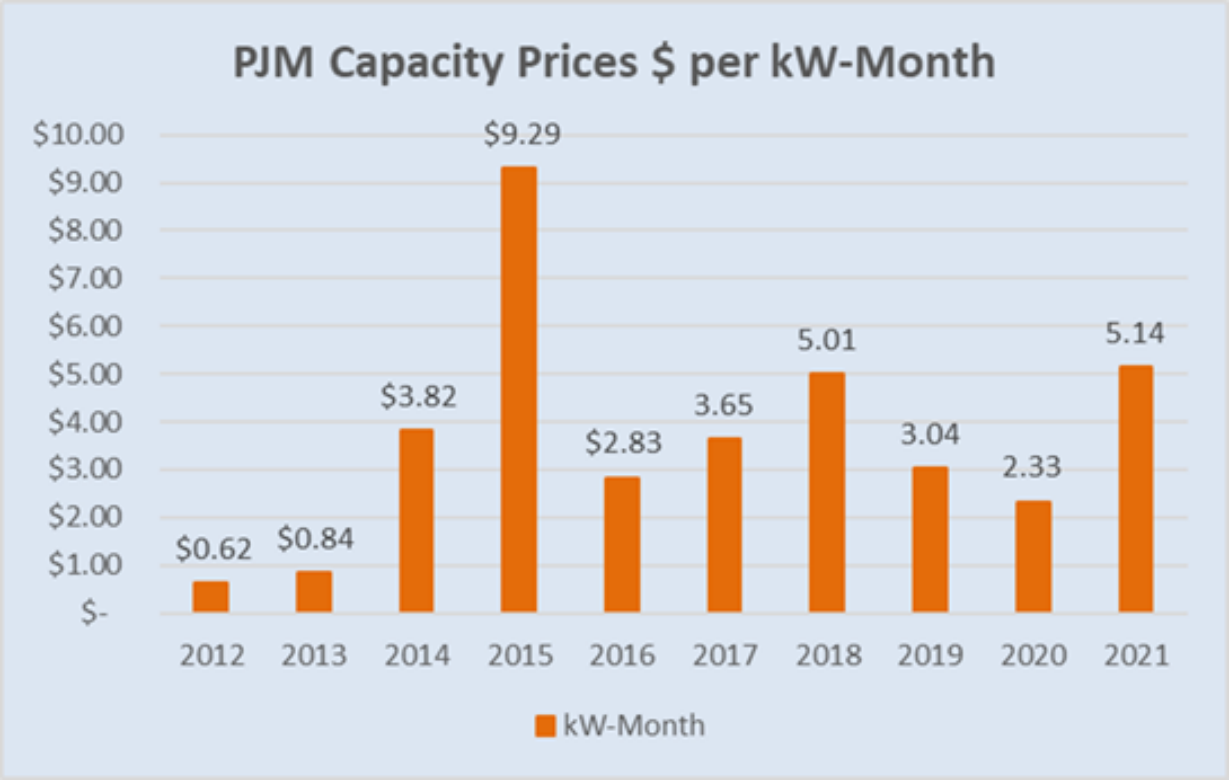
PJM Capacity Prices
ATSI



PLC X Capacity cost X PJM factor 1 X PJM Factor 2 = Your Capacity obligation ($)
PLC = XXX kW

Implement Energy Efficiency

Typical Payback Period for Projects

Energy Efficiency Measure	Simple Payback (Years)	Energy Efficiency Measure	Simple Payback (Years)
Phantom Load Reduction	0	Power Quality	3
Programming Changes	0	De-Stratification	3
HVAC Retro-commissioning	1	HVAC Replacement	5
Demand Controlled Ventilation	1	Window Films	5
Infiltration	1	Wind Turbine	8+
Motors and Pumps	1	Geo-Thermal	8+
Lighting	2	Solar PV	8+
Change Rate Code (GS to GP)	2	Power Factor Correction	8+
Insulation	2	Building Automation	8+

What to Look For When Reviewing an Energy Efficiency Project or Product

1. Proposals using “All-in” cost per kWh
2. Using energy cost escalators
3. Adding in soft costs
4. Utility rebate not mentioned
5. Only one funding option mentioned

New Technologies

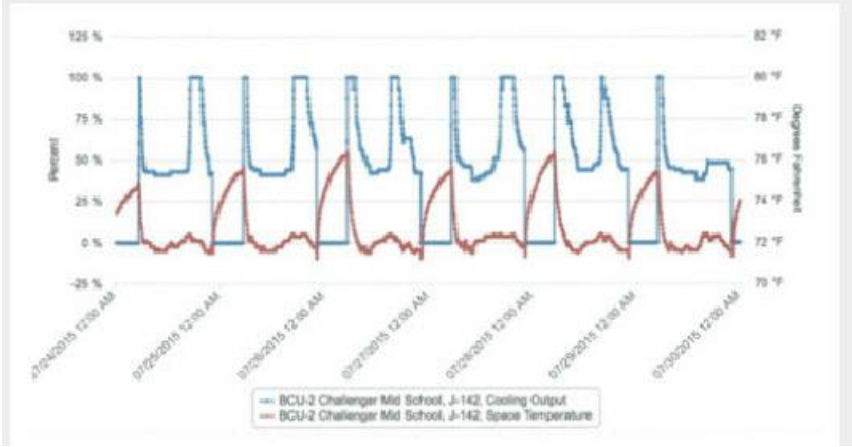
- Kits are available to retrofit older HVAC units
- Networked controls are now common with LED upgrades
- VFDs are more reliable and better address harmful harmonics
- Motors manufactures now adding shaft current mitigation
- Wireless building automation is much better today with 900 Mhz frequency band
- Broad array of metering, controls and data management tools

Phase Change Materials

Save 25% to 35% of HVAC energy costs

Classroom without ENRG Blanket Installed:

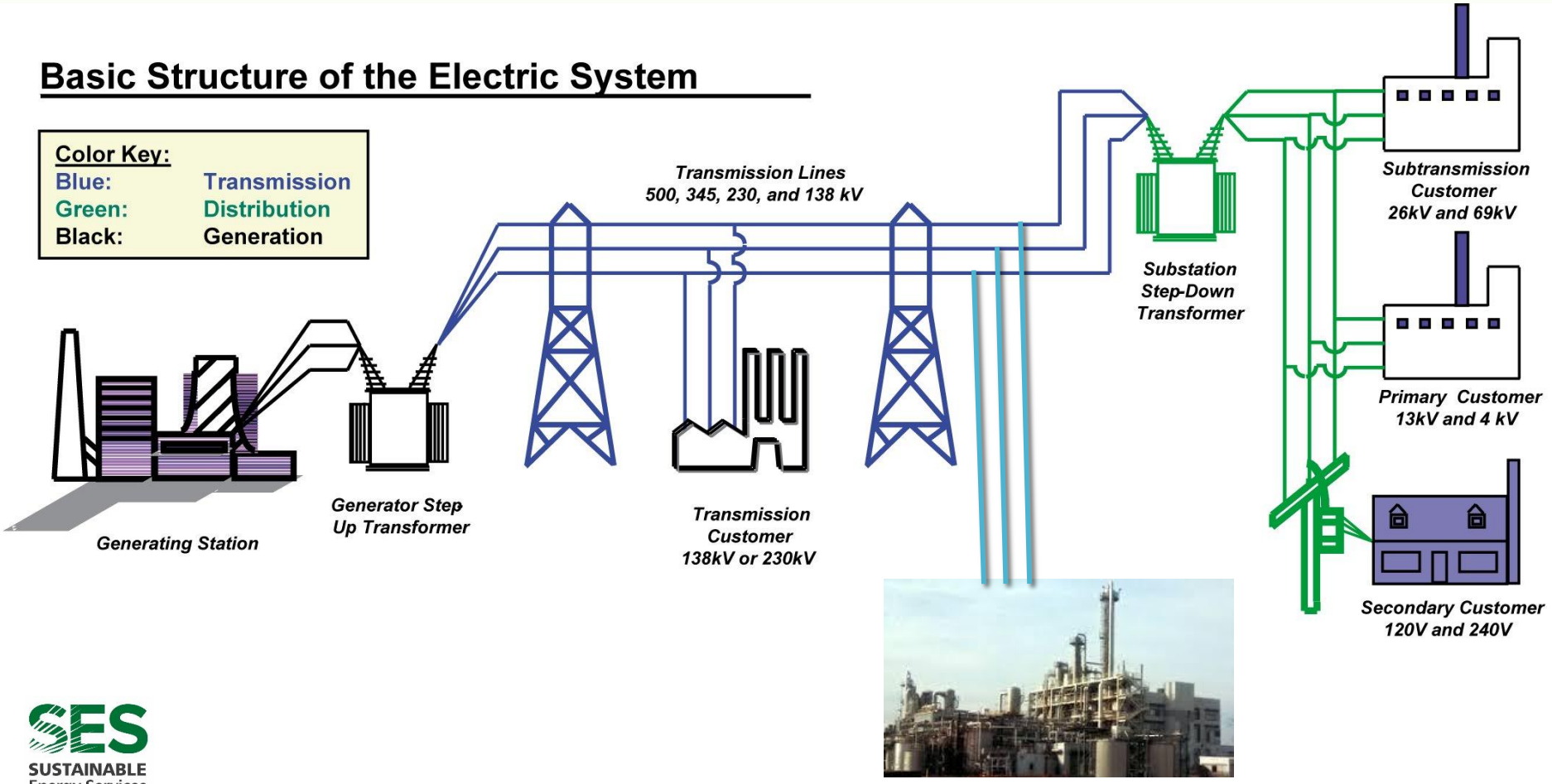
Classroom with ENRG Blanket Installed:



Electric System from Generators to your Facility

PJM Manages the Flow

Your Rate Depends on Where You Take Your Power



SES SUSTAINABLE Energy Services

Funding Energy Efficiency Projects

When There's No Money!

- On-Bill Funding
- PACE Financing
- Equipment Supplier Financing
- Port Authority Financing
- ODSA Grant and Loan Funding
- Power Purchase Agreements
- Capital Lease
- Operating Lease
- Commercial Loan

Funding Energy Efficiency Projects

We have premier energy partners who provide on-bill funding for energy efficiency projects including turnkey capability

- Any sized project
- Typically 3 to 7 year terms
- Energy audit normally required

Legislative Update – HB6

This was never about the Chinese taking control of our energy industry!

- It is now a law signed by Gov. DeWine on July 23, 2019
- FirstEnergy got stuck with uncompetitive nuclear plants after gas prices dropped caused buy the big shale play.
- So they needed $1 Billion from all their customers as a subsidy.
- This bill also provides subsidies for two coal plants, one in Ohio and one in Indiana.
- This bill also eliminates the energy efficiency mandates, passed into law in 2008.
- Ohioans Against Corporate Bailouts failed to submit the required signatures in time to get a referendum on the ballot to repeal HB6.
- A request for an extension has been filed with the court.

Sustainable Energy Services

Company Overview

Sustainable Energy Services was founded as one of the first energy consulting firms to combine energy purchasing and energy efficiency services. A certified woman-owned company, SES acts as an owner's advocate in all energy matters for customers in diverse industries, from manufacturing and retail to healthcare and education, as well as cities and public entities.

The energy specialists at SES are experts in executing customizable solutions to complex energy problems, drawing on 50+ years of energy consulting and engineering experience. The managing partners have shared their expertise as the exclusive energy advisors to the Ohio Association of Independent Schools, on the Energy Policy Board at Advanced Energy Economy Ohio, and as frequent speakers at national and regional conferences including OTCO. SES is a registered Trade Ally to all major utilities in Ohio.

The SES managing partners are certified by the PUCO for Electric and Natural Gas and by the Association of Energy Engineers in 4 key areas:

- C.E.M. (Certified Energy Manager)
- C.E.A. (Certified Energy Auditor)
- C.E.P. (Certified Energy Procurement Professional)
- C.D.S.M. (Certified Demand Side Manager)
- C.C.A.S.S. (Certified Compressed Air System Specialist)

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Utility Rebate: Being Kept or Not Mentioned?

Utilities that offer rebates have a specific approach they want followed, including how the kWh and kW savings are calculated.

- If rebate value is included proposal, make sure calculated value is verified by independent expert since ROI is affected.
- If rebate is not included, ask why. Make sure rebate is not being assigned to the contractor without your knowledge.
- Are both the utility rebate and PJM rebate included?

Adding in Soft Costs

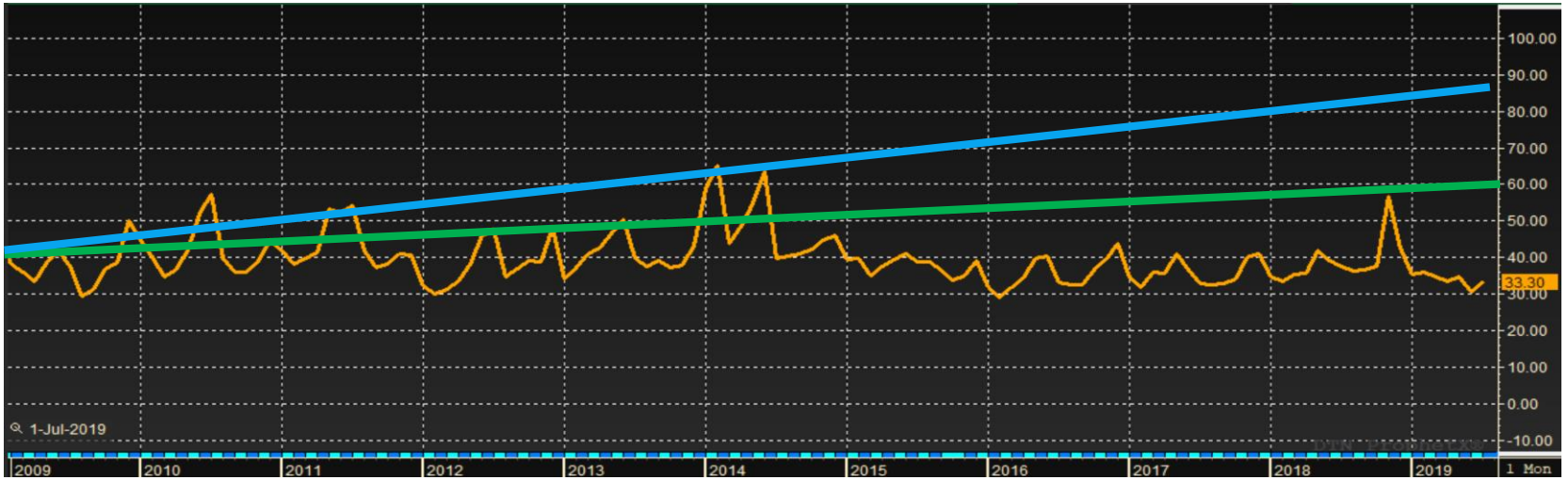
Operating & Maintenance Costs

You know the cost should not be included in the ROI calculation if ….

- ✓A maintenance employee(s) remains on the payroll after a project is implemented.
- ✓An outside service contract for the upgraded system remains unchanged.
- ✓Insurance rates remain unchanged after a project is implemented.
- ✓Security, banking, legal, admin or other fees remain unchanged

Adding Cost Escalation

Ohio Electric Prices: 10-Year Price Trend



8%

4%

Adding cost escalators will improve the apparent ROI and Payback, but are they real?

We advise leaving off any energy related cost escalators.

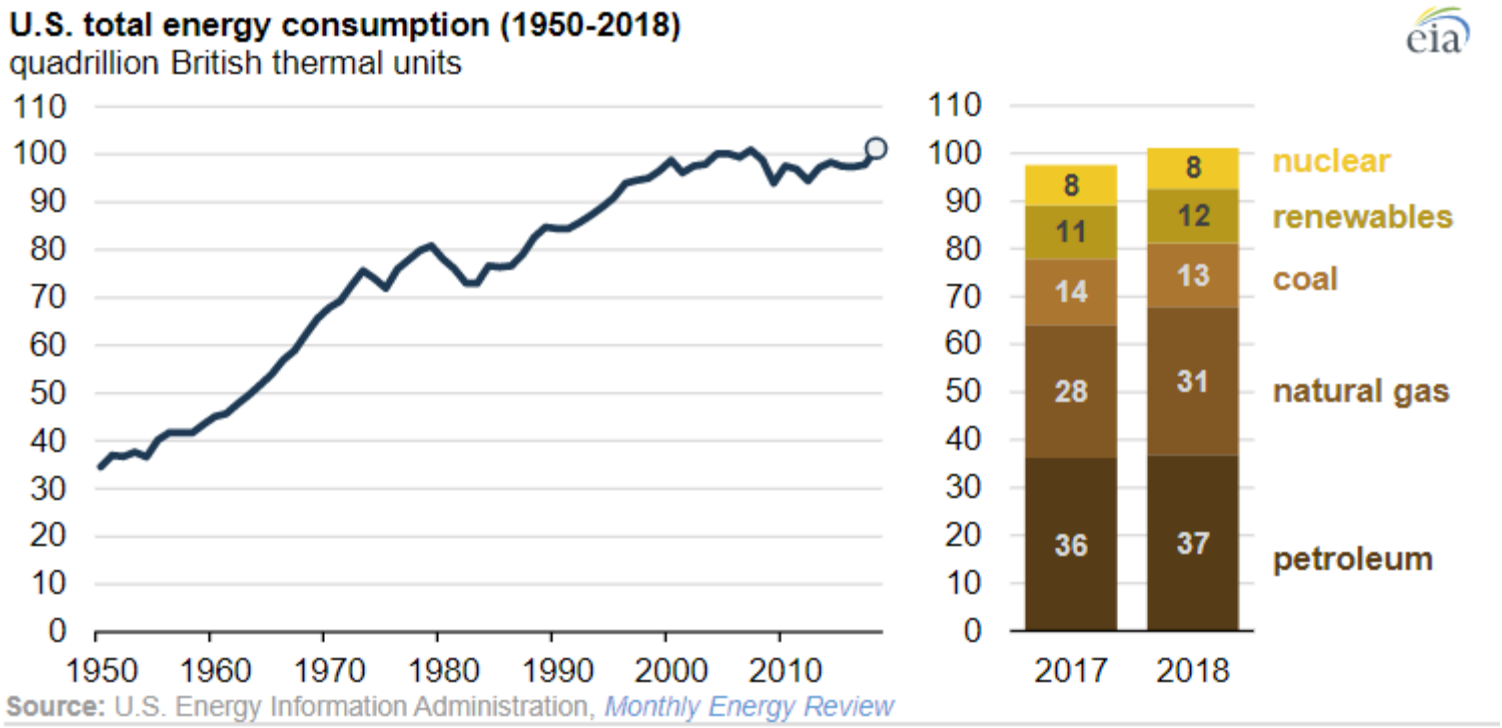
Despite the continued additions of renewable capacity out West, the combined output of nuclear, hydropower, and renewable generation has not budged year-over-year.
Total renewable generation since July 1st has increased by a total of 926 GWh (4.1%) over the last 3.5 months—but this gain has been entirely offset by a slight decline in nuclear output due to a maintenance outage at Diablo Canyon 2.

Still, even with weaker renewable output, natural gas-fired generation is down nearly 5,000 GWh (-16.4%) year-over-year—primarily due to weaker weather-driven demand.

In total, year-over-year power sector demand is down only 0.2 Bcf/d, accounting for 19 Bcf of lower power burn since July 1st.

Energy costs are an enormous expense for U.S. schools--approximately $6 billion each year according to Energy Star-- second only to personnel costs, exceeding the costs of textbooks and supplies. PowerSave Schools students are educated about energy and the importance of energy efficiency, as well as trained to use a diagnostic toolkit that assesses the energy usage in their school. The school building becomes a learning lab for students to apply STEM principles (science, technology, engineering, math), as well as language arts, to solve a global problem.
6-step scientific method

U.S. Energy Usage



Increasing Renewables