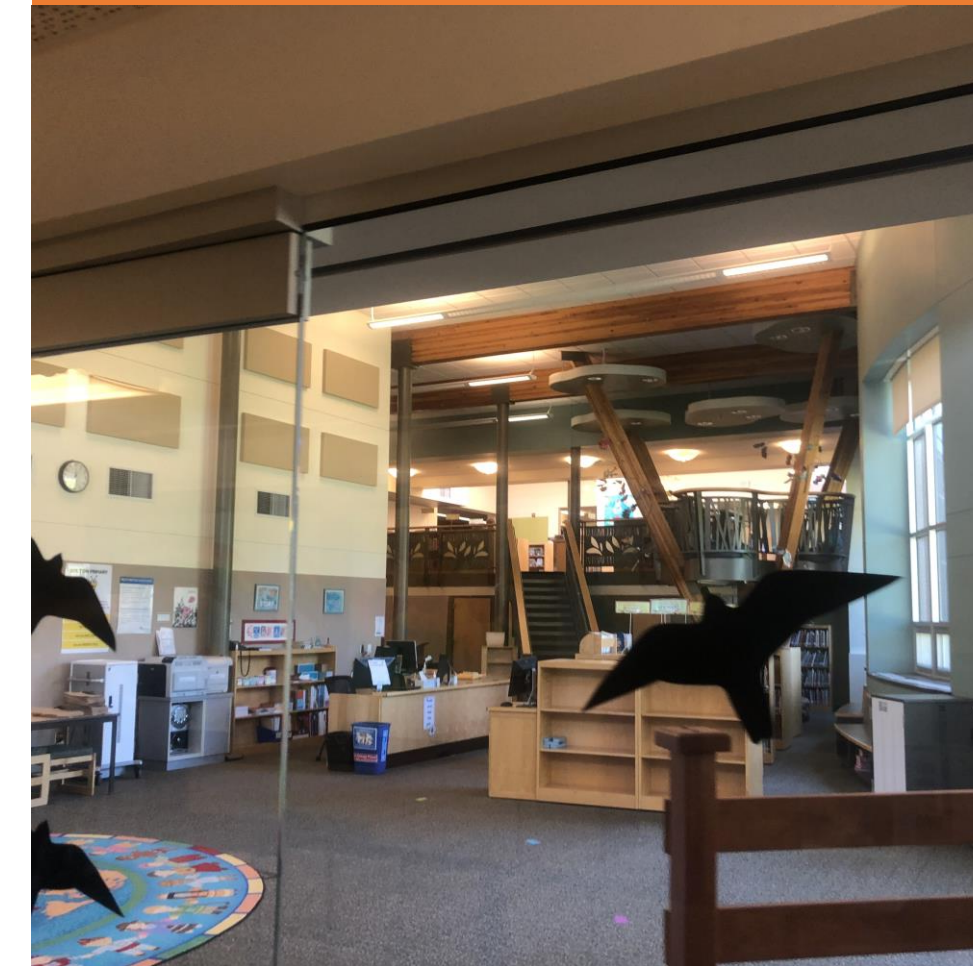
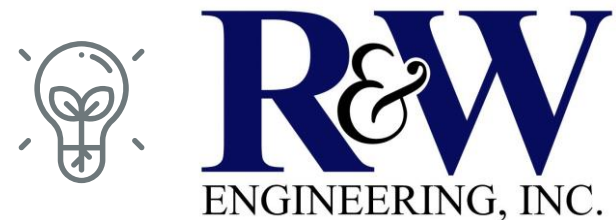


CHALLENGES AND OPPORTUNITIES IN ENERGY MODELING FOR SCHOOLS





Mark Jones, P.E, LEED AP, CCP

Associate, Mechanical Engineer

Mark Jones is a Mechanical Engineer who has been in the engineering field since 1996. Experienced at HVAC, piping and plumbing design, energy audits, life cycle cost analysis, and LEED energy modeling and commissioning. Up to date in the various mechanical, plumbing, and energy codes. In his well-rounded experience, he has designed commercial, industrial, municipal, educational, and residential mechanical and industrial process systems.



Patrick Steelman

Energy Analyst & Mechanical Designer

Mr. Steelman has been providing engineering services since 2019 for energy projects at R&W. His experience includes site visits to interview the owners on building operations, gathering required information, and documentation of HVAC equipment and the building. He also assembles energy models of the building's HVAC system; allowing him to understand the building's thermal envelope more completely.

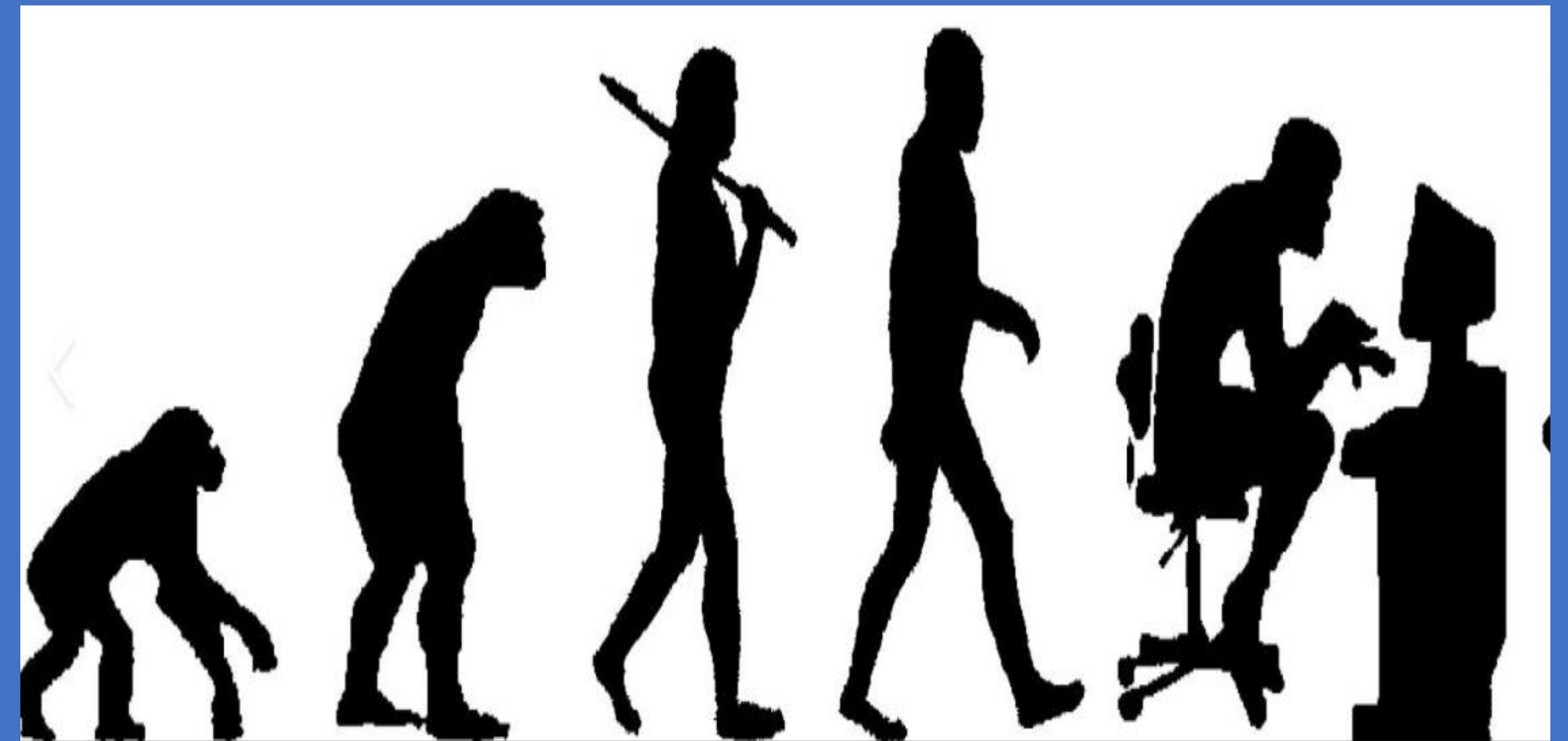


HISTORY OF SB1149, ENERGY TRUST, & SCHOOLS

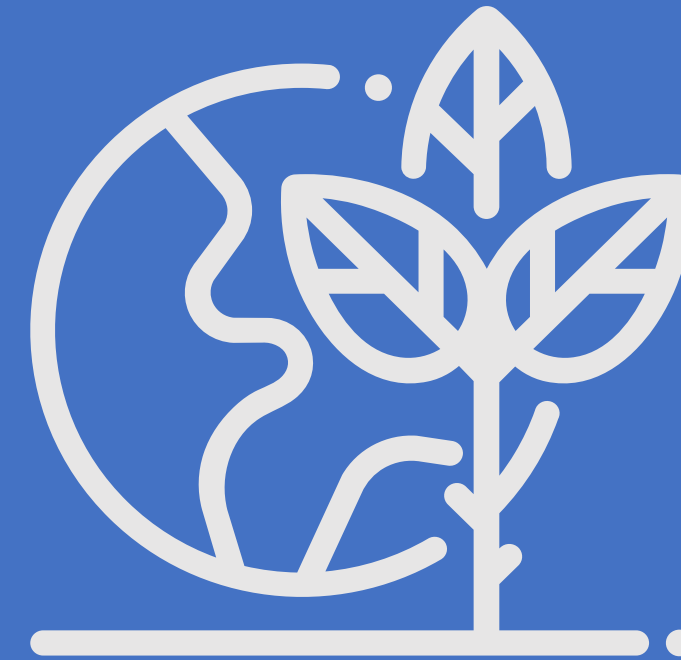


EVOLUTION OF SB1149 & ENERGY TRUST SCHOOLS

- Early Challenges of programs for districts and modelers
- Recent Streamlining of programs



CHALLENGES
SCHOOLS FACE
RELATED TO
ENERGY USE



“Complaining about a problem without posing a solution is called whining”
– Teddy Roosevelt

“I am ready to face any challenges that might be foolish enough to face me”
– Dwight from the show The Office



DIFFERENCES BETWEEN VARIOUS ENERGY PROGRAMS



FUNDING OF OPERATIONS



Staffing Shortage

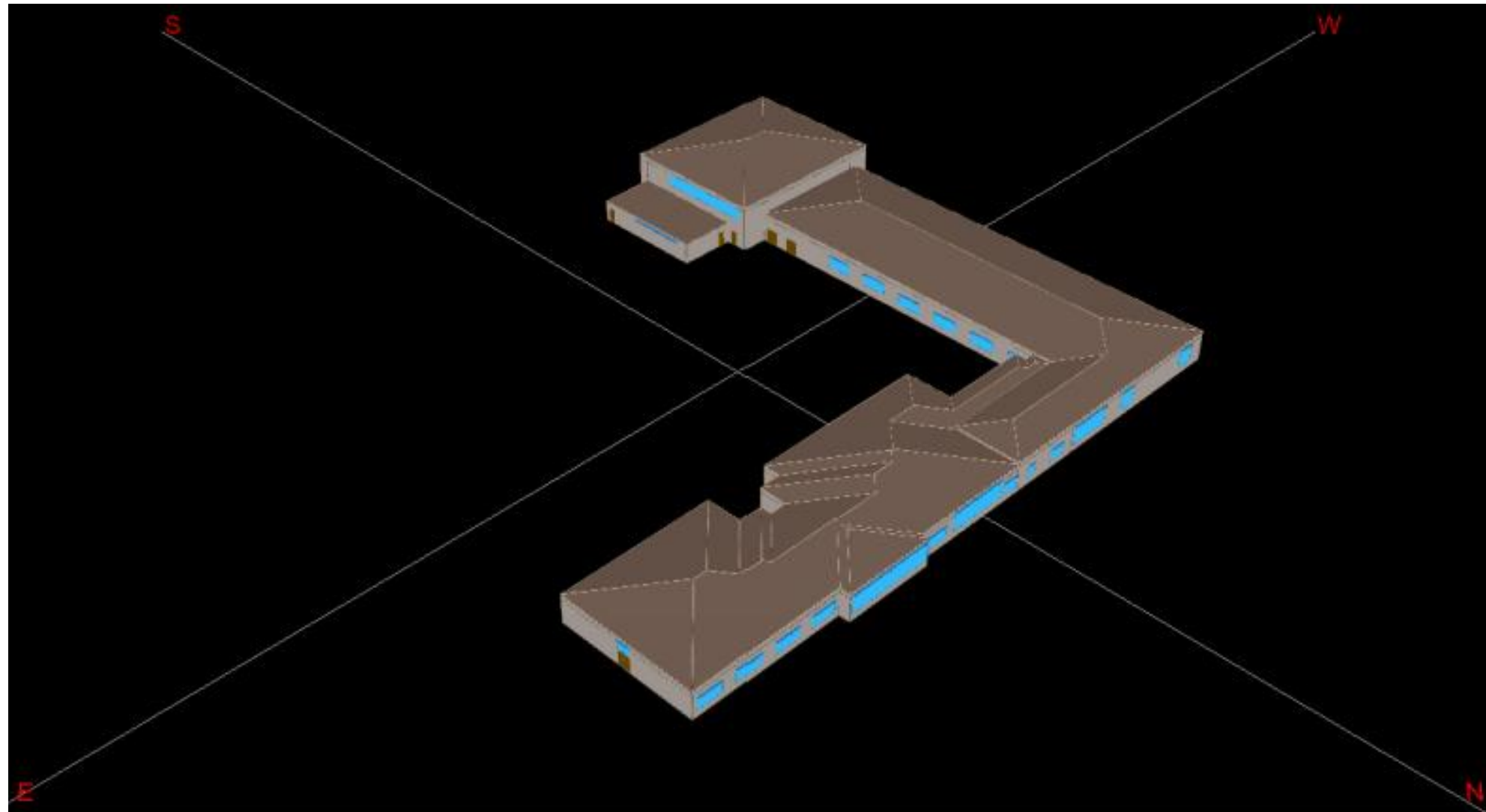


Lack of
Equipment
Maintenance



Shortage of
Expertise

AGE OF BUILDINGS & SYSTEMS



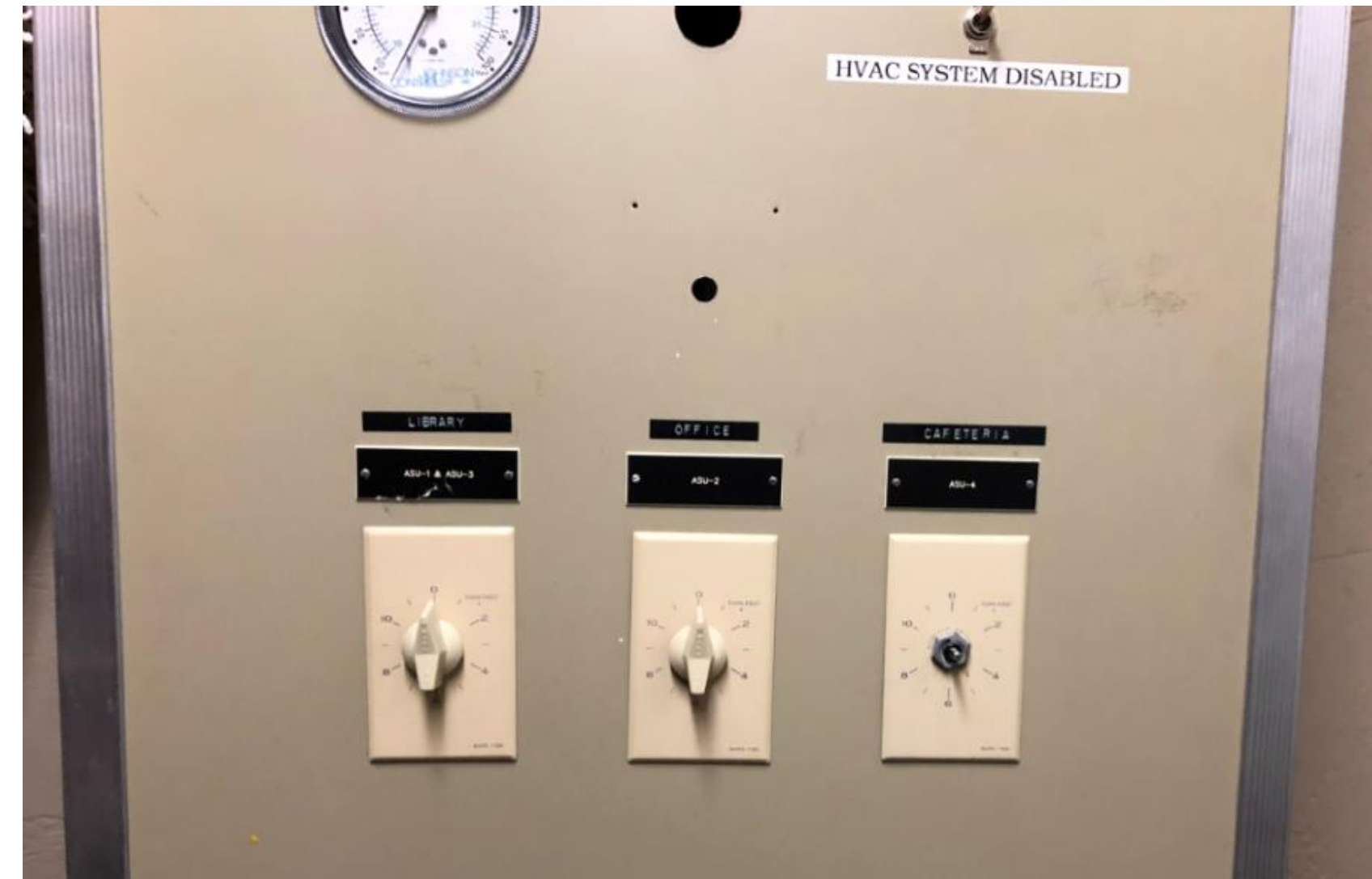
Building Envelope

Windows

Weatherstripping

Insulation

Infiltration



Old Control Systems

Pneumatics

Manual

Permanent Adjustments

AGE OF BUILDINGS & SYSTEMS



HVAC

Electric Strip Heating
Constant Volume Fans/Pumps
Inefficient Boilers



Lighting

Incandescent
Fluorescent
Lighting Controls

COMPETING PRIORITIES: HEIGHTENED BY COVID

Ventilation/Air
Quality



Filtration

MERV 13



Security



Lead Piping



RURAL SCHOOLS

ENERGY SOURCES OTHER THAN NATURAL GAS OR ELECTRICITY

Propane, heating oil, biomass
Not covered by Energy Trust of Oregon or SB1149

LOCATION

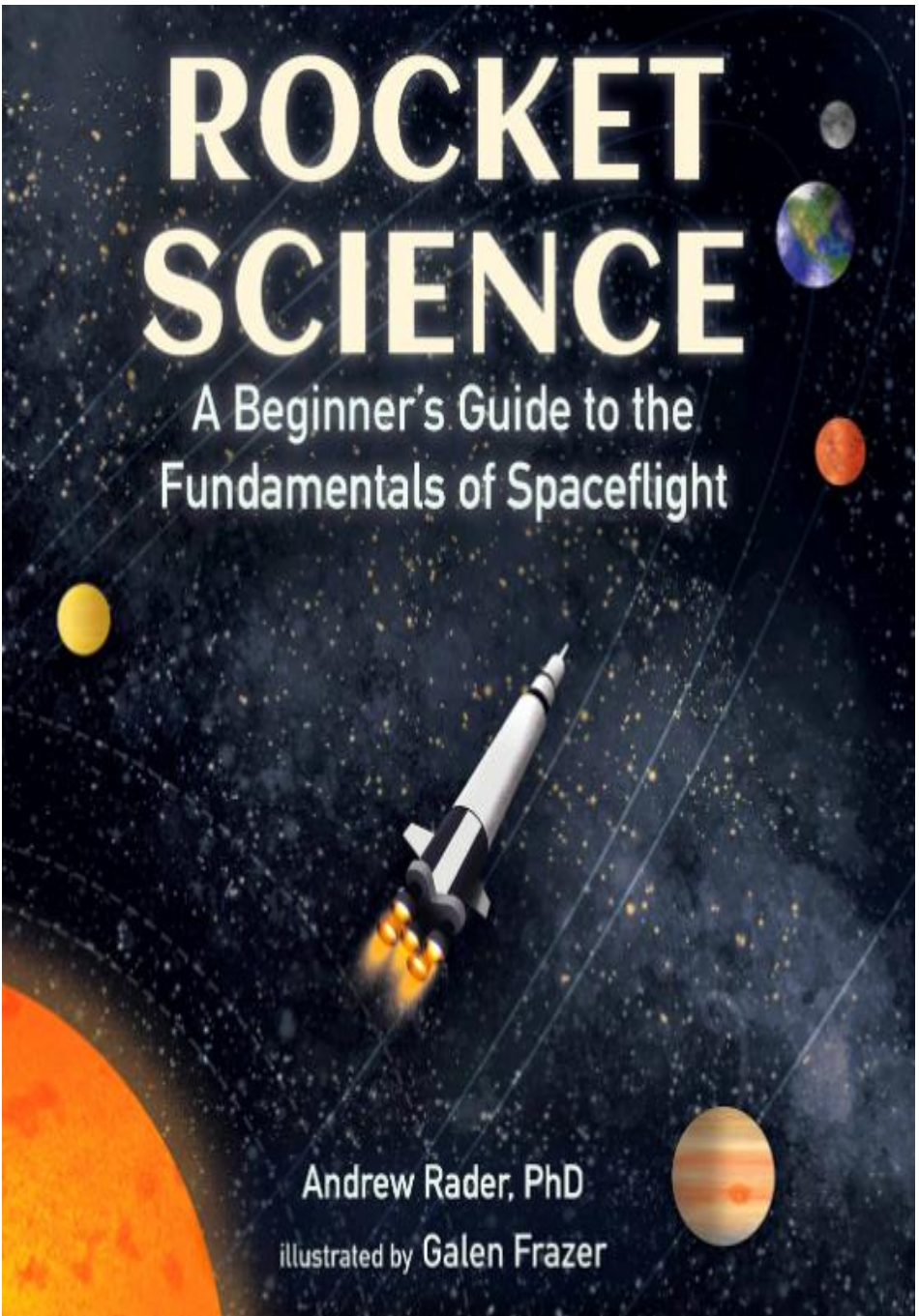
Far from equipment, service vendors and
consulting engineers

LACK OF POPULATION DENSITY

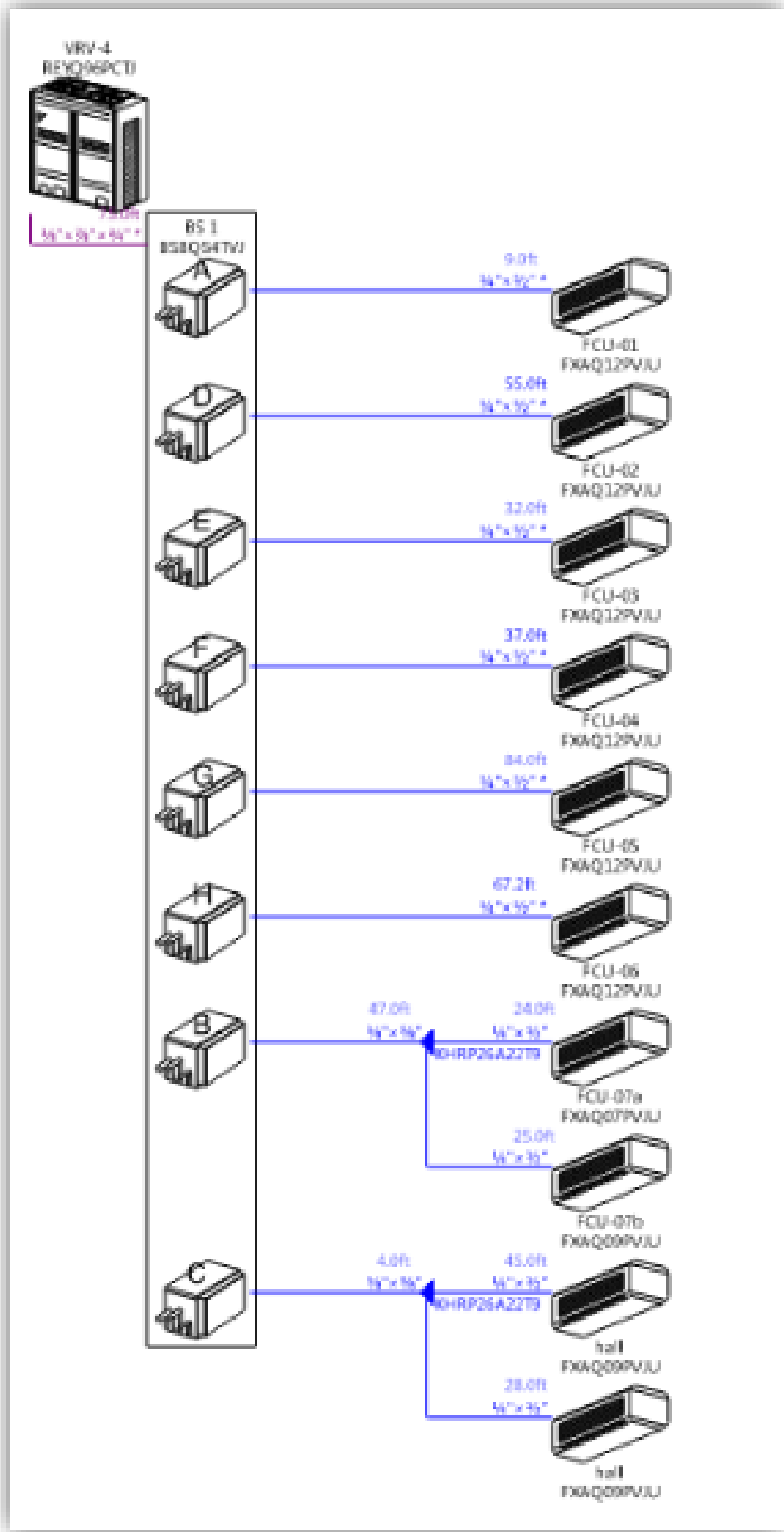
Often facility personnel wear many different hats



COMPLICATED MODERN SYSTEMS



MODERN
ENERGY
CODE



VRF

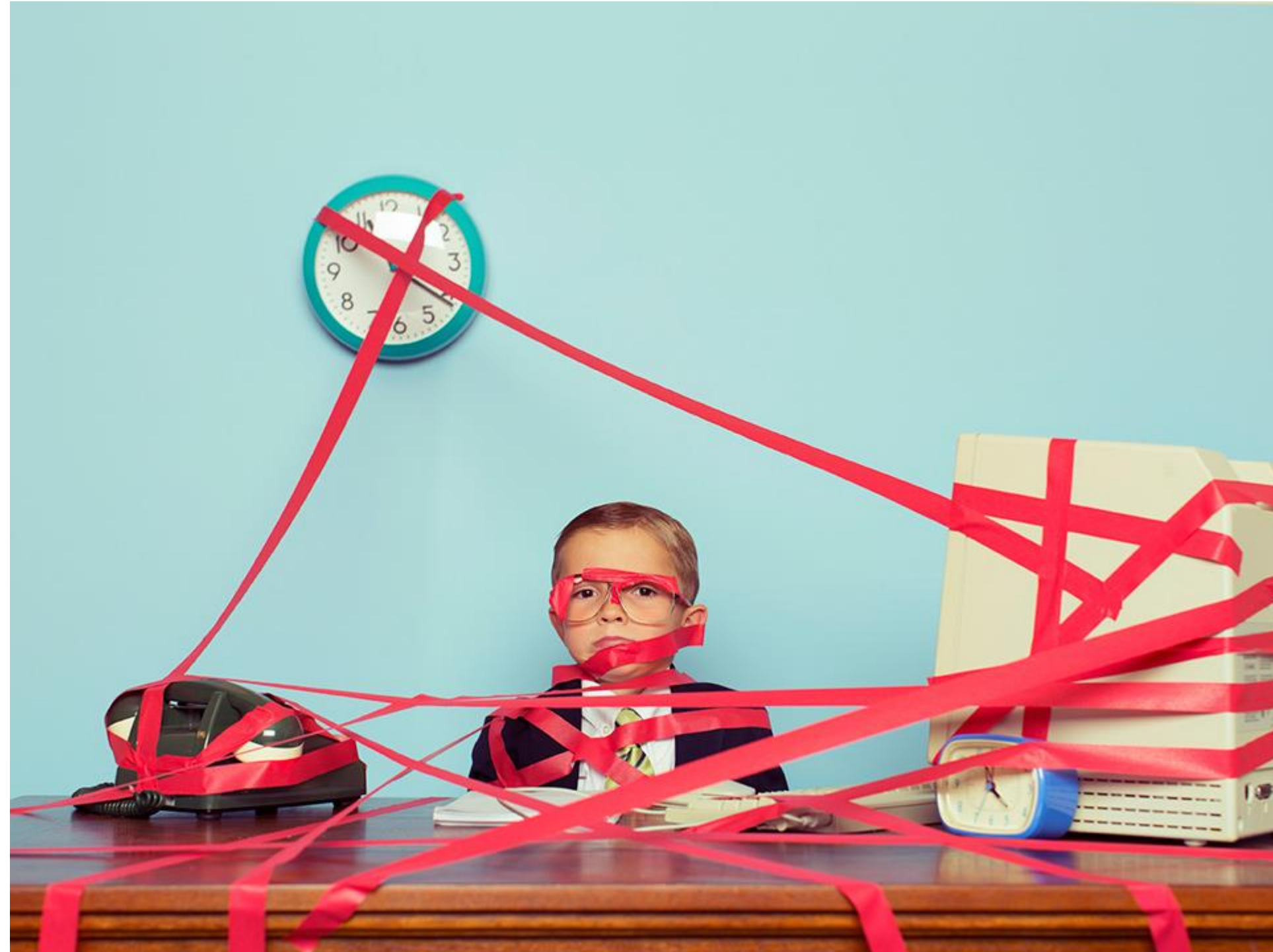


HEAT RECOVERY

- Occupied Mode:**
- Supply and return fans run continuously.
 - Mixed air set point is reset by zones calling for the most cooling
 - On a full call for cool Mixed air set point is reset to: (60.0 F)
 - On a No call for cool Mixed air set point is reset to: (68.0 F)
 - Mixed air dampers are modulated to maintain Mixed air set point, currently: (60.0 F)
 - When outside air temperatures rises above return air temperature mixed air dampers are return to: (15 %)
 - Heating circulation pump is controlled from highest of the zone heating demand.
 - Heating circulation pump starts when Heating is => 11% for 3 minutes.
 - Heating circulation pump starts when Heating is =< 9% for 3 minutes.
 - Reheat coil circulation pump Starts if outside air temp is below (20.0 F)
 - Zone Valves are modulated to maintain zone set point.

SOO

BUREAUCRACY



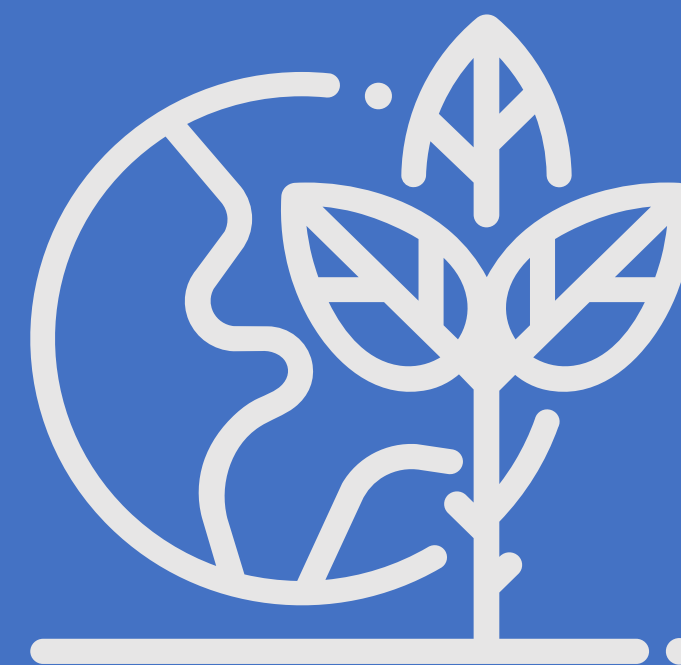
DIFFERENCES IN AGENCIES

HOW TO INTERFACE WITH AGENCIES

SEED & LEED

RECORD KEEPING

CHALLENGES
ENERGY
MODELERS FACE
(AND HOW WE
OVERCAME THEM)

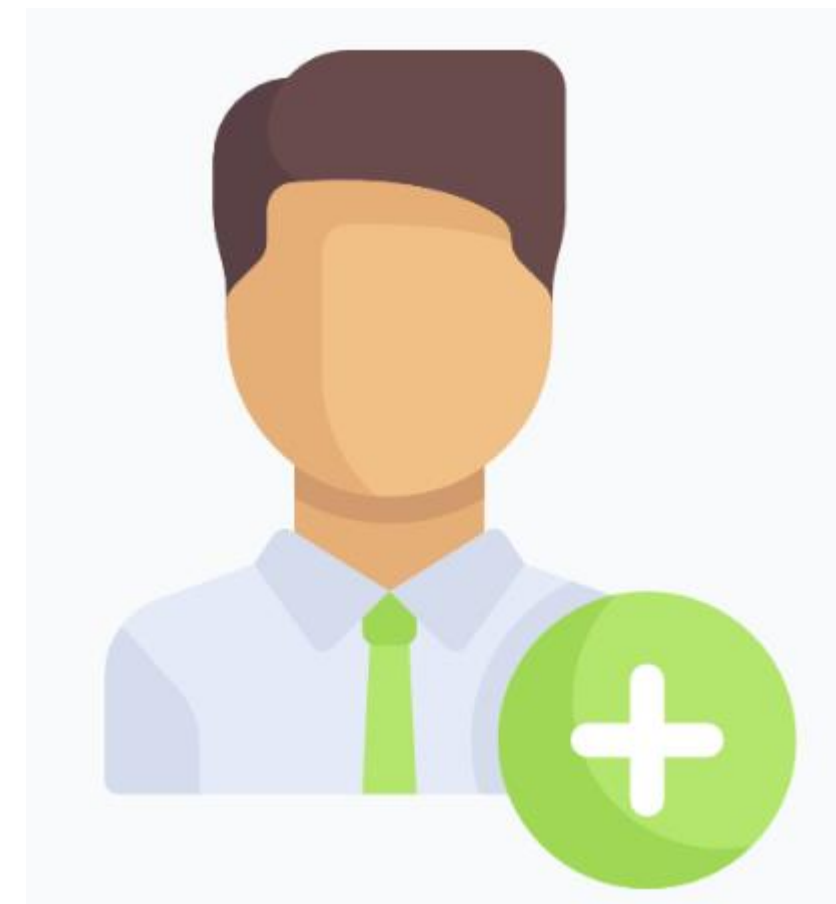


GETTING ACCURATE INFORMATION

UTILITY DATA



BUILDING INFO



DOCUMENTATION



PRICING

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P.
Crew C-14H						
1 Carpenter Foreman (outside)	\$52.70	\$421.60	\$80.25	\$642.00	\$49.36	\$74.88
2 Carpenters	50.70	811.20	77.20	1235.20		
1 Rodman (retil.)	54.65	437.20	83.45	667.60		
1 Laborer	39.85	318.80	60.70	485.60		
1 Cement Finisher	47.55	380.40	70.45	563.60		
1 Gas Engine Vibrator		25.60		28.16	.53	.59
48 L.H., Daily Totals		\$2394.80		\$3622.16	\$49.89	\$75.46

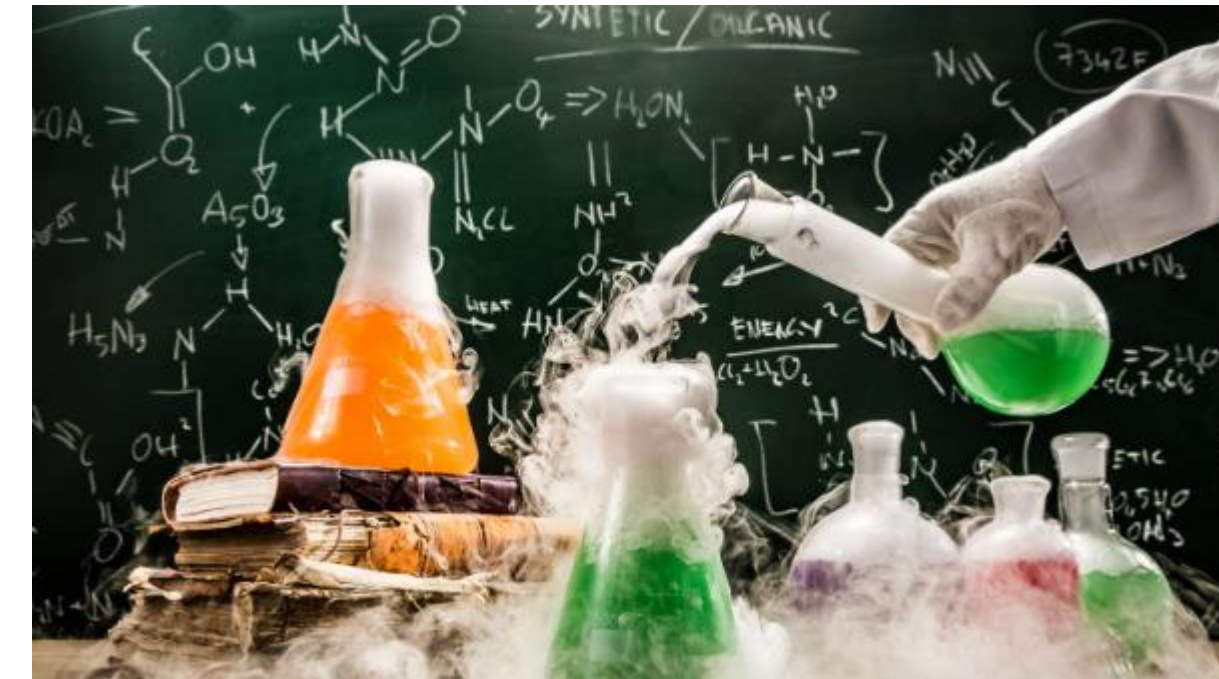
MODEL CALIBRATION

ART



- BE CONSISTENT
- MAKE REASONABLE ASSUMPTIONS
- LOOK AT BIG PICTURE + KEEP IT SIMPLE

SCIENCE



- BE CONSISTENT
- UTILIZE INFORMATION GATHERED
- COMPARE ENERGY USAGE RESULTS WITH DATA GATHERED

IMPLEMENTATION OF MEASURE INCREASES ENERGY USE

SYSTEMS NOT OPERATING UP TO CODE OR NOT
WORKING AT ALL

VENTILATION



ADDITION OF COOLING



BROKEN EQUIPMENT



CUSTOM MEASURES APPLICABLE TO SCHOOLS



- HVAC
 - Controls upgrades
 - VS Fans/pumps
 - VAV Upgrades
 - Heat Recovery
 - Retro-Commissioning



- Building Envelope
 - Window Upgrades
 - Weatherstripping
 - Insulation



- Lighting
 - LED Upgrades
 - Lighting Controls

NEW BUILDING CHALLENGES

Remodels, Major Demolition and Additions



EXISTING BUILDINGS PROGRAM VS NEW BUILDINGS PROGRAM

Going Higher Than Current Code



DIFFICULT TO COME UP WITH ENERGY SAVINGS WHEN
COMPARING AGAINST EFFICIENT CODE REQUIREMENTS

OPPORTUNITIES



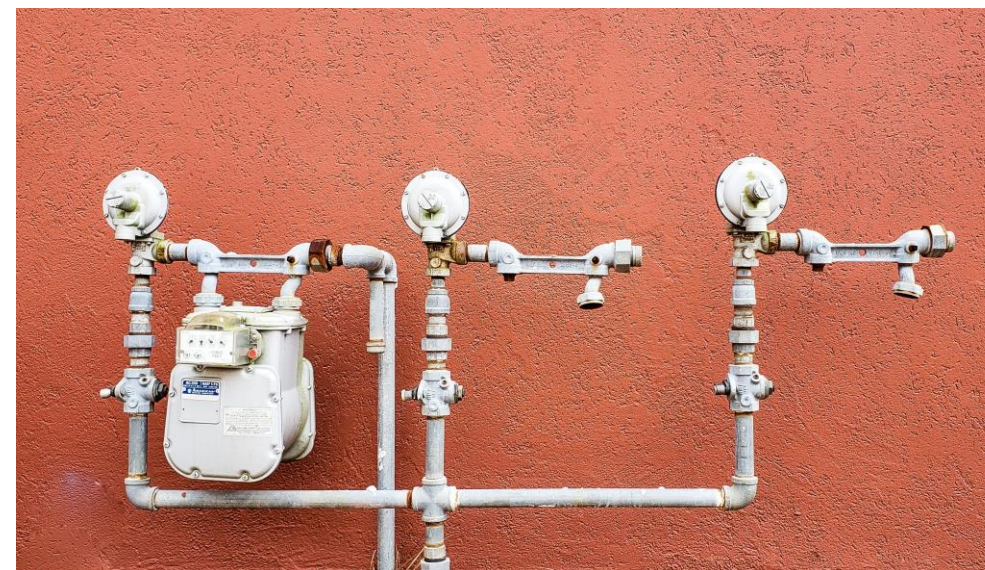
ODOE PROGRAMS



SOLAR PROGRAMS



ETO PROGRAMS



LOCAL UTILITIES



BPA PROGRAMS



COVID MONEY

CONCLUSION



QUESTIONS



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