ANATOMY OF AN ECM

HOW TO FIND AND EVALUATE ENERGY CONSERVATION MEASURES

TWO-STEPS TO SUCCESS

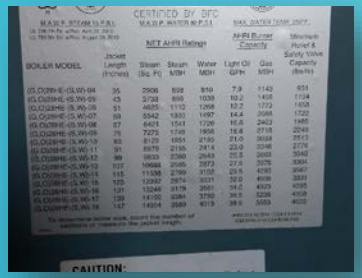
- Locate your opportunities
  - Quantify your consumption
  - Identify your problem areas
  - Determine technical requirements
- Evaluate the opportunities
  - Determine how much energy money is capturable
  - Create reasonable financial thresholds
  - Don’t forget the intangibles

LOCATING OPPORTUNITIES

- Energy Audits are your best tools.
- Do your own or buy one from reputable professionals.
- Objectivity is key. There are no 'feelings' in the science. Be prepared to slaughter your sacred cows.
- Rules of thumb are not your friend at this stage.
- Common sense is not particularly 'common' and is almost never 'sense.'
- Are you measuring it?
- Data without measurement is pronounced "guess."
  - *Helpful formula:*

  $guess + vendor\ markup = disappointment^2$
- Numerous commercially available measurement devices and systems are available.

MEASUREMENT TYPES AND TOOLS



AVAILABLE DATA

Manufacturer's data sheets.

Equipment lists.

Nameplate information.

Operational records.

Utility bills.

SPOT READINGS

Amp or Watt readings. (Multimeter)

CFM (anemometer)

Pressure (manometer)

Combustion efficiency (combustion tester)

Media temperature (thermistor, thermometer)

Footcandles (Light meter)

LONGITUDINAL

Data loggers

EMS trends

Flowmeter trends

NOAA data

COLLECT, INSPECT, SELECT

Once you have collected all the information, ORGANIZE IT!

Make a spreadsheet. Put it in a database. Write it down on the back of a napkin. Whatever. But put it in a place and format where you can look at it and manipulate it.

Now inspect it.

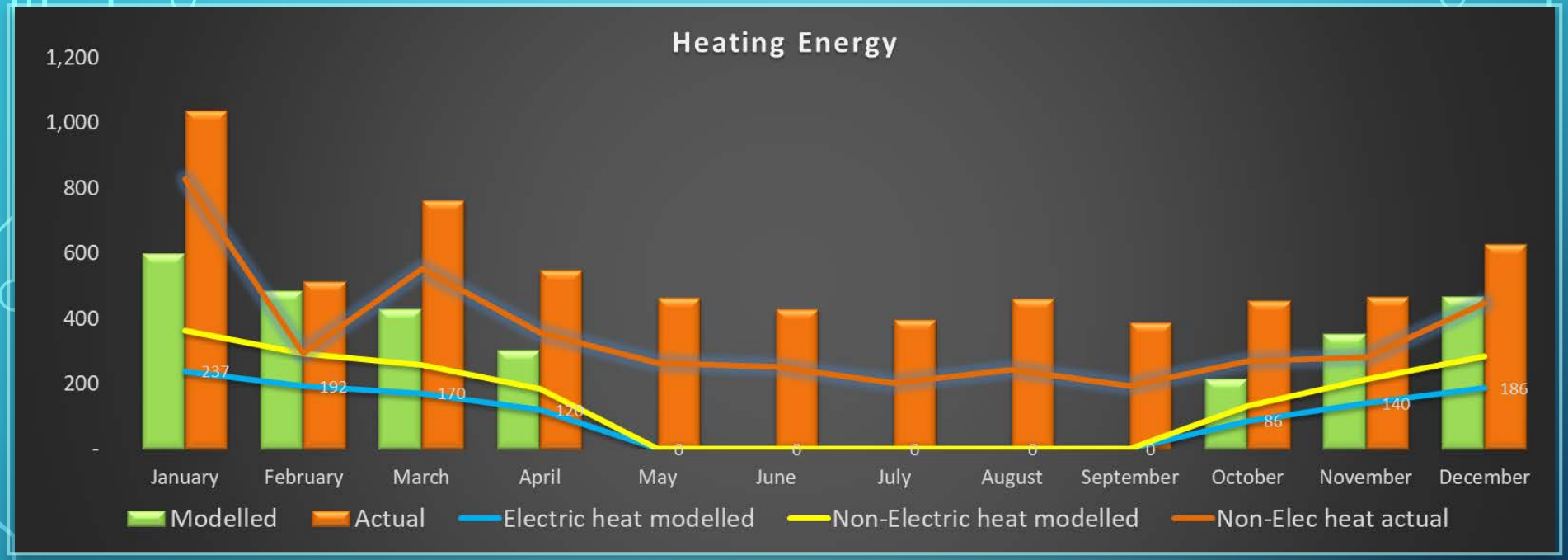
Look for outliers. What is using the most energy? Can that part of the operation be changed without sacrificing production? Are things running when they don't have to?

Select a target

Pick a process, machine, schedule, or strategy and figure out how to alter it for energy savings.

Physical Dimensions	
Number of people in space	150
Roof Height (in Feet)	50
No. of Floors (Storeys)	5
Basement (Y/N?)	n
Building Perimeter in feet	936
Average Wind Speed (mph)	6
Roof Area (sq-ft)	25,700
Wall Area (sq-ft)	46,800
Total Heat Transfer Area (sq-ft)	72,500
Total Building Sq Footage	97,763
Building Usage/Type:	Hotel

Operational Characteristics		
Infiltration rate (ACH) & Ventillation rate (ACH)		Vent When Unocc (Y/N)?
0.1	Inf.	n
0.25	Vent.	0%
Envelope	U-value	
Wall	0.05	
Roof	0.033333333	
Window U-value	0.5	
% Window	65%	
Setpoints		
Heating set point	70	
Cooling setpoint	66	
Setback? (Y/N)	n	
Temp Setpoint	Heat	Cool
Deg F	70	66



WHAT'S WRONG WITH THIS PICTURE?

Using only data from site visits and utility bills, we were able to locate over $37,000 in natural gas savings at a cost of less than $1,000 to the customer. No one had ever looked at the data critically before, and this oversight cost the client more than $120,000 over four years.

EVALUATE THE TARGET

CAN IT BE DONE?

Does the targeted ECM violate the laws of man, physics, or probability?

Do your systems, equipment and personnel have the capability to execute this ECM safely and effectively?

Can you afford to do it?

SHOULD IT BE DONE?

What are the tangible benefits?

What are the intangible benefits?

What are the risks (best case, worst case, and probable).

WILL IT BE DONE?

What financial metrics does ownership/management employ to select capital projects for implementation?

What entrenched polices and procedures will the ECM modify?

Will this project make my boss look foolish?

CONGRATULATIONS! YOU'VE DECIDED ON AN ECM!

Welcome to…

THE TRINITY OF "NO." (WHERE GOOD ECMS GO TO DIE)

LUDICROUS PAYBACK CRITERIA

The finance department has a strict "2-year payback" rule for facility improvements. No ECM can realistically be expected to have a 2-year payback. This is equivalent to a 50% ROI. The same CFO who would be thrilled to get an 8% ROI on any other investment will become apoplectic at the thought of an ECM with an ROI of 15% (7-year payback).

OPERATIONAL INERTIA

If somehow you convince the CFO to go along with your idea, the floor supervisor will fall over and weep at the thought of you altering any part of the process. Everything is already perfect, and any alteration will absolutely result in an actual extinction-level catastrophe.

ANALYSIS PARALYSIS

So the CFO and the floor supervisor are on board. Now we talk to the CEO. Naturally he wants to evaluate this plan in comparison to six other ideas, and then he and the rest of the board will discuss it and get back to you. Ultimately they will table the idea until the next budget cycle while they look at adding another production line. Maybe next year.

BEATING THE ODDS

SET REALISTIC EXPECTATIONS

- ECMs are investments in the company. ROI and payback should be evaluated like any other investment. Frankly, if you've done your homework, ECMs are far more reliable than most financial instruments.

GET CREATIVE WITH FINANCING

- Equipment can be leased for positive cash flow.
- Leverage utility programs for incentive money.
- Transfer the risk to the vendor. Look into performance contracts and performance guarantees.

Example

Both bake oven and drying tunnel have their own burners. Both exhaust directly outside.

Data: 1200 CFM of 475-degree air is exhausted by the bake oven. Drying oven uses 1000 CFM of 150-175 degree air.

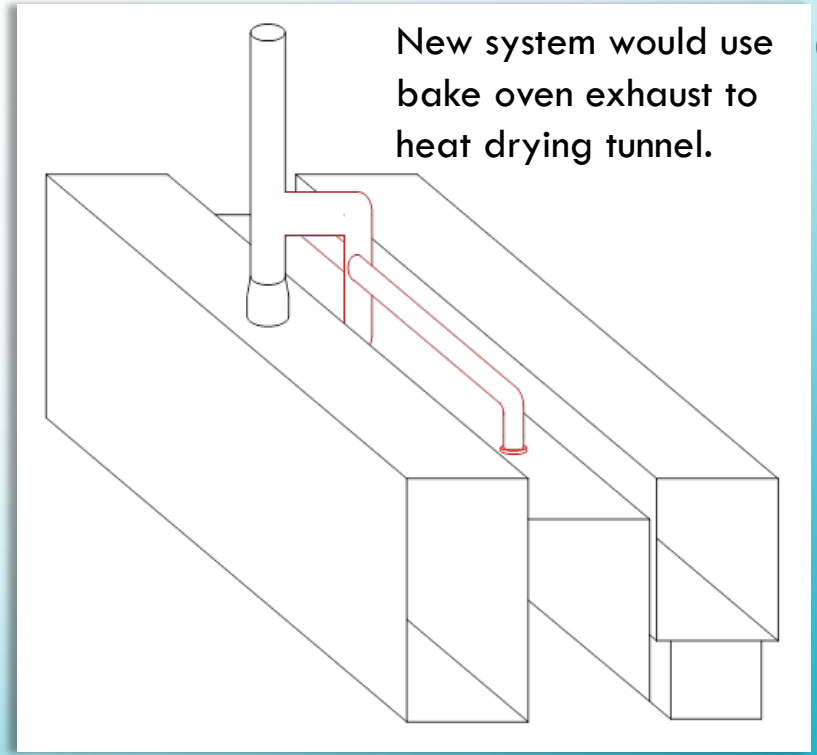
Target: Bake oven exhaust energy recovery.

THE ECM: HEAT RECOVERY

Furnish and install ~60-80 feet of 12” round duct rated for 475 degrees. (Areas in red below).

Considerations:

- Temperature-rated dampers (2) to direct exhaust outside or into drying tunnel as needed on thermostatic control. Drying Tunnel temperature to dictate heat recovery.
- Dampers must fail to “exhaust” configuration.
- Controls must interlock with existing tunnel heater control panel to ensure safe and reliable operation.



THE NUMBERS

WITH $14,557 IN APPROVED UTILITY INCENTIVES, THE PROJECT HAS A PAYBACK OF FOUR YEARS (ROI OF 25%).

Oven Temp	475	deg
Exhaust Temp	475	deg
Drying tunnel setpoint	175	
ΔT	300	deg
Recovery CFM	1200	
Recoverable heat (btu)	388800	/hr
Therms	3.888	/hr
% recoverable heat achieved	90%	
Hours	2080	/yr
Annual therms saved	7278	/yr
$/therm	1.1	
$ saved	**8006**	/yr
Implementation cost	$46,500	

LET'S EVALUATE THE TARGET

CAN IT BE DONE?

Does the targeted ECM violate the laws of man, physics, or probability?
No.

Do your systems, equipment and personnel have the capability to execute this ECM safely and effectively?
I hope so.

Can you afford to do it?
Probably

SHOULD IT BE DONE?

What are the tangible benefits?
$8,000/yr in savings.

What are the intangible benefits?
Lower emissions, smaller carbon footprint, less equipment wear.

What are the risks (best case, worst case, and probable).
Worst case: fire.
Best case: big savings and environmental responsibility.
Probable: Savings.

WILL IT BE DONE?

What financial metrics does ownership/management employ to select capital projects for implementation?

3 year payback proffered
5 allowable

What entrenched polices and procedures will the ECM modify?
None

Will this project make my boss look foolish?
Probably not.

TAKEAWAYS

COLLECT, INSPECT, SELECT

- Your analysis is only as good as your data.
- Your project is only as good as your analysis.
- Your results are only as good as your project.

OVERCOME THE OBJECTIONS

- Treat projects like any other investment.
- Explore alternative financial instruments and arrangements.
- Never forget the intangibles.