ELECTRIC HEAT FOR COMMERCIAL & INDUSTRIAL CUSTOMERS ARTICLE

Electricity is very useful but costly when used as a source of heating fuel. Once the choice is made to install electric heating in a facility, it is likely to stay that way for the life of the building. But there are still things you can do.

Options include installing equipment that does not rely on electric resistance for heat (fuel switching), conservation to use less heat to begin with, or shifting/managing the electric loads.

Background

Conventional electric generation uses heat from burned fuel and converts it into electricity. Electricity is a very useful and refined form of energy that can do many things. But when electricity is used for basic 'heating', it yields only a fraction of the heat it was originally created from. The additional fuel plus equipment used to make electricity explain why electric resistance heating costs more.

Quiz for Electric Heating:

You need to buy box of nails to hold boards together. Choose which brand to buy.

Brand A: Raw metal is used to make nails. $4.00 per box.

Brand B: Same raw metal is machined into small parts that are then used to make fine watches. The watches are then crushed and melted down and formed into nails. $10.00 per box.

Quiz Answer:

If the nails are the same, there is no benefit to all the additional work on the metal before it ends up as a plain nail. Pick the cheaper nails.

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Electricity as a Fuel

See **Table 1**. Heating economics comes down to the cost of fuel. Leveling the numbers to "delivered Btu of heat" makes the comparison direct. But note that heating units that burn fuel have combustion efficiency losses. For example, a gas furnace with 80% efficiency will burn 1.25 units of fuel to deliver 1.0 units of heat from the fuel. Electric heating has no combustion losses. A few fuel costs are shown based on fuel costs today; of course, fuel costs change.

Choices

Compared to natural gas, electric heat costs more to operate for basic uses like space heating and water heating. But it can still be an appropriate choice, such as when:

- Precise control is needed, as in some manufacturing processes
- Heating requirements are very minor (consider a heater in Miami)

- Heater location has no source of combustion air
- Electricity costs per Btu are less than other options
- No other options are available

Often electric heating is chosen when first cost concerns dominate ongoing operational costs:

- Construction budget is gone – must accept what is cheapest and live with it
- Leased and rented property - utility bills are someone else's to pay

Once the choice is made to install electric heating in a facility, it is likely to stay that way for the life of the building. This essentially decides the heating utility bills for the life of the building which can easily be the next 50 years. Conditions that discourage 'backing up' to undo electric heat can include:

- Installing a natural gas service where there isn't one
- Provisions for flue and combustion air, especially in multi-story buildings
- Fire-rating for adding a boiler, to meet current code
- Disruption to existing facility operations (business down time)
- Negative business case of discarding equipment that is working fine

Table 1. Representative Heating Fuel Costs

Heating Fuel Cost Comparison

Values are in units of delivered heat (useful heat)

Prices of fuel vary over time. Heating equipment efficiencies vary.

Fuel	Unit cost	Measure	Btu/unit	Eff	$/million Btu Delivered Heat	
Natural gas	$0.81	therm	100,000	80%	**$ 10.1**	note 2
Firewood	$150	cord	17,000,000	60%	**$ 14.7**	note 6, 7,8
Wood Pellets	$249	ton	16,500,000	80%	**$ 18.9**	note 5,7
Fuel Oil	$2.38	gallon	145,000	80%	**$ 20.5**	note 4,7
Propane	$1.84	gallon	84250	80%	**$ 27.3**	note 3
Electricity	$0.10	kWh	3,413	100%	**$ 29.6**	note 1

Notes

1 US EIA, Electric Power Monthly, Table 5.6.A, Colorado, September 2016
2 US EIA, Natural Gas Prices. Commercial, July 2016
3 US EIA, Weekly Heating Oil and Propane Prices, October-March, 2016
4 NYSERDA, western region, October 2016
5 Home Depot, October 2016
6 Local data, split and delivered, 2016
7 Oregon State University, Home Heating Fuels, June 2009
8 Ponderosa Pine

What Can You Do if You Have Electric Heat?

1. **Fuel Switching (means replace it with something other than electric heat)**
   - If possible, use an alternate source of heating, such as natural gas.
   - Heat recovery using available waste heat can reduce or eliminate conventional energy use
   - If renting or leasing, you can move. If you do, consider shopping for your next space based on the combined cost of rent and utilities to avoid surprises
   - For commercial HVAC systems with a gas-fired 'warm up' mode and electric heat in zone terminal units, there can be good savings from re-programing controls to lock out electric heat in unoccupied time and use only the natural gas heat in the main unit. Big fan to run? Think of it as an electric heater. Be sure the outside air and exhaust dampers are tightly closed during this mode of operation
   - Evaluate electric heat end uses by the combination of size and hours used. Best energy savings will be larger capacity units with the most hours. Appliances that are seldom used will offer less energy savings potential, although demand charges will be impacted if an appliance is only used for 15 minutes if that usage is during the 'peak' times and you are on a demand-rate. Examples of prioritizing to make an impact on heating cost are in **Table 2:**

Table 2. Fuel Switching Example Possibilities

Important Note: If you are on a demand-rate, even an intermittent load usage moved off the electric system can represent savings from avoided demand charges if the usage occurs at a time when it pushes up the maximum on peak demand

	Good Bet	Long Shot	Remarks
Building heating systems including boilers, duct heaters, unit heaters, cabinet heaters, fan coils			Typical retrofit would be a hot water boiler and distribution piping
Hotel PTAC wall units			Gas-fired units are available, but gas piping added to the outside of the building is a barrier
Pool Heater			
Water heater used for large array of showers, commercial kitchens, laundry, car washing, etc.			
Water heater used only for handwashing in an office building			Usage is minor, however if natural gas is close by may be cost effective at normal replacement
Cooking equipment: ovens, kettles, broilers, grills, fryers			
Process heating equipment			
Process heating equipment used only in off-peak times, or rarely used			
Humidifiers			Easier to just turn them off if possible
Steam Generators, Including Saunas			

2. Use Less Heat - Conservation

Whatever type of heating system is used, using less of it will lower your utility bill:

- Envelope insulation, weather stripping, window coverings, vestibules
- Piping and equipment insulation
- Reduced flow shower heads
- Lower water temperature setting
- Scheduled operation of equipment compressed to nearly match actual occupancy, with 2-hour overrides for anomaly usage
- Set back thermostats, with aggressive set back settings and warm attire
- Turn down/off the heating in unoccupied rooms or areas (be careful not to create a pipe freezing condition from being too cold. Consider 50F as a low value)
- Turn down or turn off humidifiers
- Replace space heaters with heated foot mats controlled with occupancy sensors
- Ride through a couple of chilly hours in spring/fall weather when it is certain to be hot most of the day
- Root out any sources of false-loading that add burden to the heaters, such as simultaneous heating and cooling. If possible, make heating and cooling action mutually exclusive
- Reduce excess exhaust or ventilation that is beyond that needed for good indoor air quality and building pressure
- Cover pools

3. Load Shifting (try to use the heat when rates are lowest)

Electricity costs less to produce in off-peak times, and so it is priced lower

- Shift manufacturing/process unit operations to off-peak times
  There is a mix of influences for cost and savings including facility operation and staffing at different times, and dependencies of the shifted process step with other steps.

CSU on/off peak times are currently different for summer and winter periods:

> On-peak periods Oct. - March: 4 p.m. to 10 p.m. Monday through Friday
> On-peak periods April - Sept.: 11a.m. to 6 p.m. Monday through Friday
> Off-peak periods: all other hours plus legally-observed holidays
> Source: Rate Sheet, www.csu.org, 'Business' tab, 'Customer Service' tab, Oct. 2016

4. Load Management (try to prevent large short-term demands from heaters)

Very large demands, even for short term and even in off-peak time - can result in a 'minimum demand' charge, sometimes also called a 'ratchet' charge. Higher demand charges increase the overall cost of electricity that you use to get work done. Managing demand can save money.

- Example: Bringing on large heaters in increments instead of all-at-once.

  Consider a cold-start of an electric heater; it comes on fully to warm up the process, building, etc. Once at the desired temperature, the heater capacity then cycles to maintain the temperature. The warm-up period can use more than twice the electricity required to maintain the temperature. Thus, there can be merit in waiting to start a second group of heaters until the first group of heaters has made it through warm-up and is no longer at continuous full power. This is known as ‘staging’ banks of heaters.

A key concept for managing start-up loads like this is: same energy, just spread out over time to reduce demand.