RESOURCES & DATA COLLECTION IDEAS

How To Do A Baseload Assessment

1. *Before the visit, review electrical billing information*. Is the history complete? How do the daily, monthly and annual averages compare? What is the pattern?

2. *When in the home, start with what the occupant knows* about their home, and energy use. Ask what they think are the major energy uses? Inquire about changes to occupancy or equipment?

3. The *biggest energy users offer the greatest savings opportunities*. *Identify 5 major electricity uses—quickly*. 50 to 60% of usage often occurs in only 5 end uses.

4. *Analyze electric use*. What size is the load? Is this a low, mid or high use home? Notice all appliances. Pay attention to the big users. How much do they run? Are there control or operations issues (like the refrigerator being too cold or the dryer timer faulty)? Determine occupancy and usage patterns. Construct a monthly baseload. Estimate seasonal uses. Compare annual estimates to actual. Check monthly use. Keep looking if necessary.

Interview Awareness & Issues

Age, health, occupancy patterns:
Concerns and issues -- plans and changes
Hopes, fears, expectations
Perceived biggest electric/energy users

Observations

Time of day: Weather (including outdoor temp)
Lights on:
AC on: T-stat set: Furnace on: Circ Fan on: Indoor Temp:
TV's on; # Stereos on; #Computers on; other unused equipment on
Approach to Laundry:
Washer Type/ Settings
Dryer Type/Settings
Drips/leaks in the water system (hot side if electric, full system if a well pump)

Overall Impressions

Lighting Assessment

Replace incandescent lamps used daily with compact fluorescent lamps (CFL's); Replace lighting fixture with an Energy Star fixture, if necessary, and if building codes allow.

Existing Incandescent (W)	Replacement CFL (W)	Location Installed
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Appliances & Equipment Note Example

*Method	Description	Options / Actions	Impact
	▪ Sump pump on a lot ▪ Dehumidifier on maximum setting ▪ Heater on in crawlspace ▪ Refrigerator plugged in all the time only used for holidays	Can it be fixed right now? Is it how it is draining, Is this an occupant operating issue? A structural issue? An appliance issue? Who is going to fix it?	

* Source used to assess electric use: Chart = C; Label= L; Meter = M; Occupant-reported = R

Electric Energy Terms

Ampere (amp) – the unit for measuring the strength of an electric current; describes the rate of flow of the charge

Btu – British thermal unit is the energy needed to raise a pound of water 1 degree F. There are 3,412 Btu in a kWh of electricity. 1 Btu is about equal to the energy given off as a wooden kitchen match burns to a crisp.

Million Btu's – MMBtu -- roughly the energy equivalent of a person year of labor; or one billionth of a quadrillion (Quad) A Quad is $10^6 * 10^9 = 10^{15}$ Btu, or a million billion Btu.

Volt – the unit of *electromotive force* or difference in potential between two points in an electric field. Electric utilities typically provide 120/240 volt service to residential circuits. Heavy duty equipment and appliances (baseboard heaters, central air conditioning, water heaters, clothes dryers, kitchen range and some shop equipment) need 240 volts. An average of 117 volts of alternating current (117Vac) is supplied to the "120" line serving outlets. Low voltage (around 105 Vac) can harm motors and compressors.

Watt (W) – a unit of *electrical power* developed in a circuit by a current of one ampere flowing through a potential difference of one volt; also used to express the rate of demand of a light or appliance, for example the heater in a refrigerator that operates during a defrost cycle typically *demands* between 200 and 400 Watts.

Watts = amps x volts

KiloWatt (kW) = 1000 watts; a unit *of instantaneous demand or power*. For example: An electric space heater rated at 1,500 watts (1.5 kW), operated for 1 hour (hr) has a demand of 1.5 kW and consumes 1.5 kilowatt-hour (kWh) of electrical energy (1.5 kW x 1 hour = 1.5 kWh)

MegaWatt (MW) – a million watts; power plants are sized by the number of megawatts they produce.

Wattage – the amount of watts required to operate a given electrical device and displayed on rating plates

Watt hour (Wh) – the unit of *electrical energy,* or work, equal to one watt acting for one hour

KiloWatt hour (kWh) – the unit of *electrical energy* displayed on bills and household electric meters, equal to one thousand watts acting for one hour, or 3,412 British thermal units (Btu). If the heater mentioned above were to be on for 120 hours a month (about 4 hrs per day) it would still have a demand of 1.5 kW, but the energy consumed would increase to 180 kWh (1.5 kW x 120 hrs = 180 kWh)
Meters such as the BrulTech™ , Line Logger™, Brand™ or Kill-a-Watt™ can display instantaneous watts and voltage, as well as recording kWh used in the metering period.

Calculating Electric Operating Costs

Monthly operating costs of lights and some appliances can be estimated if you know the "on time", the wattage, and the cost per kWh. Multiply the wattage (either measured or from a chart or nameplate) times the hours of operation, convert from watt-hours (Wh) to kilowatt hours (kWh and multiply resulting kWh use by the cost per kWh.

Wattage of the appliance x hours per month used x .001 kilowatts per watt
= **kWh per month**
kWh per month x the cost per kWh = cost per month to use that appliance

Example: Three one hundred watt light bulbs on for an average of five hours per day will cost $3.83 for the month if electricity costs 8.5 cents per kilowatt hour.

3 bulbs @ 100 W x 5 hrs/day x 30 days /month x .001 kW/W = **45 kWh per month**

45 kWh/mo x $.085/ kWh = **$3.83 per month**

Estimating Wattage

If the appliance label is missing the wattage information but lists the amps the watts can be calculated this way:

Watts = Amps x Volts

Example: 6.5 amps x 115 Vac (Volts alternating current) = 747.5 Watts *at full load*

Basic Tools For Assessing Residential Electric Energy Use

In addition to information gleaned from the household, worksheets and handouts, some tools and materials are needed to do Baseload/ Electric Audits. Here is a beginning list:

1. Clipboard for customer to use during house tour.
2. Flashlight (for looking at refrigerator coils, into furnaces, AC units, water heater/equipment labels and other murky places)
3. Extra batteries for flashlights
4. Ladder (for reaching overhead light fixtures and attic installed central AC units)
5. Vacuum cleaner with a long hose and a brush (for coil cleaning and cleaning up any mess made while looking around. Small wet/dry is good)
6. Refrigerator coil cleaning brush (available at appliance stores)
7. Measuring tape (to size appliances and doorways for refrigerator or water heater replacement)
8. Room Thermometer (for checking refrigerator and kitchen room temperatures)
9. High temperature thermometer (for testing water temperature)
10. Microweir® or container and watch with a second hand or timer (for measuring water flow of showerheads and faucets)
11. Drip gauge for measuring water leaks
12. KiloWatt hour (kWh) monitors for checking refrigerator and other appliance usage
13. SureTest® Circuit Analyzer (Like a stress test EKG; Puts a 15 amp load on a circuit to see how it performs. If voltage drops more than 5%, there's a problem between the circuit breaker box and the plug)
14. 3 prong adapters (for appliances or receptacles with only 2 prongs)
15. Kitchen timer (for timing exactly one hour for the kWh meter and for timing unplug time depending on local protocol)
16. Inspection mirror (to see under refrigerators, up walls, inside ducts and air handlers)
17. Razor knife or scissors (to cut the filter material)
18. Hand wipes or Purell antibacterial hand cleaner
19. Screw drivers (for removing filter, water heater covers), pliers, or a multipurpose tool like a Leatherman®
20. Cardboard, carpet sample or towel to kneel on when checking appliances
21. Small slippery rug to aid in sliding refrigerator out
22. Appliance electrical cord (in case the refrigerator cord is hard to get to more than once)
23. Extension cord(s) for vacuum cleaner &/or easy access with kWh meter
24. Gloves (filter material is very hard on the hands & bulbs can be hot)
25. Ear plugs (while vacuuming)
26. Face masks (some old filters hold harmful deposits that should not be breathed)
27. Tool box (to carry some of the above)

Electrical Appliance Metering Equipment

This is a list of Watt meters that can be used to meter refrigerators and other appliances and electrical equipment.

Watts Up?	www.professionalequipment.com
Pro Kill A Watt	www.p3international.com
ECM-1200	www.brultech.com
EML 2000	www.electricitymetering.com
Plug Logger	www.dentinstruments.com
Watt Stopper	www.wattstopper.com

Typical Cost per Use Based on Different Costs per kWh

		Cost per kWh (cents)				
Use	**Time, Quantity or Cycle**	**10**	**12**	**15**	**18**	**20**
Shower	Per minute, 6 gallons per min.	9	11	14	16	18
Shower	Per minute, 2.5 gpm head	4	5	6	7	8
Bath	Per inch (equals 5 gals)	6	7	9	11	12
Hair dryer, 1500 watts	Per hour	15	18	23	27	30
Curling iron	Per hour	1	1.2	1.5	1.8	2.0
Laundry, hot wash and rinse	Per load	85	102	128	153	170
Laundry, warm wash and rinse	Per load	64	77	96	115	128
Laundry, cold wash and rinse	Per load	5	6	8	9	10
Laundry, hot wash, cold rinse	Per load	47	56	71	85	94
Laundry, warm wash, cold rinse	Per load	37	44	56	67	74
Front loading washer, 1/3 water, all cold	Per load	2	2.4	3.0	3.6	4.0
Dryer, 1 load	45 minutes	27	32	41	49	54
Dishes	By hand, water running	42	50	63	76	84
Dishwasher	Each load	32	38	48	58	64
Dripping hot water faucet	1 drop per second	94	113	141	169	188
Waterbed heater	per day, average	51	61	77	92	102
Drip coffee maker	one pot, brew cycle	2	2.4	3.0	3.6	4.0
Drip coffee maker	one pot, warmer, each hour	1	1.2	1.5	1.8	2.0
Crock pot	3 hours	7	8	11	13	14
Toaster oven	40 minutes	11	13	17	20	22
Microwave	10 minutes	2	2.4	3.0	3.6	4.0
Range, stove top	30 minutes	5	6	8	9	10
Range, oven	1 hour, 350 degrees	21	25	32	38	42
Window air conditioner	8,000 BTU, 4 hours	20	24	30	36	40
Window air conditioner	24,000 BTU, 4 hours	80	96	120	144	160
Box window fan	7 hours	17	20	26	31	34
Ceiling fan, no lights	7 hours	5	6	8	9	10
Attic fan	7 hours	40	48	60	72	80
60 watt incandescent bulb	10 hours	6	7	9	11	12
100 watt incandescent bulb	10 hours	10	12	15	18	20
100 watt incandescent bulb	100 hours	100	120	150	180	200
15 watt fluorescent bulb (equals 60)	10 hours	1.5	1.8	2.3	2.7	3
27 watt fluorescent bulb (equals 100)	10 hours	2	2.4	3.0	3.6	4.0
27 watt fluorescent bulb (equals 100)	100 hours	27	32	41	49	54
Space heater, 1500 watt	1 hour	17	20	26	31	34
Space heater, 1500 watt	8 hours	120	144	180	216	240
Dehumidifier	24 hours	53	64	80	95	106
Furnace blower motor/fan, 1/2 H.P.	8 hours	39	47	59	70	78
Furnace blower motor/fan, 1/3 H.P.	8 hours	34	41	51	61	68
Furnace blower motor/fan, 1/4 H.P.	8 hours	31	37	47	56	62
Furnace burner motor	per day	22	26	33	40	44
Hot water circulating pump	per day	12	14	18	22	24
Water pump, shallow well	per day	9	11	14	16	18
Water pump, deep well	per day	18	22	27	32	36
Computer	1 hour	4	5	6	7	8
Printer (wattage varies from 3 - 300 watts)		Varies	Varies	Varies	Varies	Varies
Fax machine (wattage varies form 15 to		Varies	Varies	Varies	Varies	Varies
TV, color	6 hours	15	18	23	27	30
Fish tank, 50 gals, with light filter and heater	per day	19	23	29	34	38

* Each degree the heater thermostat is setback saves 1% of the heating cost. If it is turned down due to a more comfortable home, each degree the thermostat is turned down saves 3% of the heat costs.

Typical Cost per Use Based on $.085 per kWh

Use	Time, Quantity or Cycle	Cost
Shower	Per minute, 6 gallons per min. head	8 cents
Shower	Per minute, 2.5 gpm head	3 cents
Bath	Per inch (equals 5 gals)	5 cents
Hair dryer, 1500 watts	Per hour	13 cents
Curling iron	Per hour	Less than 1 cent
Laundry, hot wash and rinse	Per load	72 cents
Laundry, warm wash and rinse	Per load	54 cents
Laundry, cold wash and rinse	Per load	4 cents
Laundry, hot wash, cold rinse	Per load	40 cents
Laundry, warm wash, cold rinse	Per load	31 cents
Dryer, 1 load	45 minutes	23 cents
Dishes	By hand, water running	36 cents
Dishwasher	Each load	27 cents
Dripping hot water faucet	1 drop per second	80 cents a day
Waterbed heater	per day, average	43 cents
Drip coffee maker	one pot, brew cycle	2 cents
Drip coffee maker	one pot, warmer, each hour	1 cents
Crock pot	3 hours	6 cents
Toaster oven	40 minutes	9 cents
Microwave	10 minutes	2 cents
Range, stove top	30 minutes	4 cents
Range, oven	1 hour, 350 degrees	18 cents
Window air conditioner	8,000 BTU, 4 hours	17 cents
Window air conditioner	24,000 BTU, 4 hours	68 cents
Box window fan	7 hours	14 cents
Ceiling fan, no lights	7 hours	4 cents
Attic fan	7 hours	34 cents
100 watt incandescent bulb	10 hours	9 cents
100 watt incandescent bulb	100 hours	85 cents
27 watt fluorescent bulb (equals 100)	10 hours	2 cents
27 watt fluorescent bulb (equals 100)	100 hours	21 cents
Space heater, 1500 watt	1 hour	14 cents*
Space heater, 1500 watt	8 hours	$1.02*
Dehumidifier	24 hours	45 cents
Furnace blower motor/fan, 1/2 H.P.	8 hours	33 cents
Furnace blower motor/fan, 1/3 H.P.	8 hours	29 cents
Furnace blower motor/fan, 1/4 H.P.	8 hours	26 cents
Furnace burner motor	per day	19 cents
Hot water circulating pump	per day	10 cents
Water pump, shallow well	per day	8 cents
Water pump, deep well	per day	15 cents
Computer	1 hour	3 cents
Printer (wattage varies from 3 - 300 watts)		Varies
Fax machine (wattage varies form 15 to 500.)		Cost is low
TV, color	6 hours	13 cents
Fish tank, 50 gals, with light filter and heater	per day	16 cents

* Each degree the heater thermostat is setback saves 1% of the heating cost. If it is a turndown due to a more comfortable home, each degree the thermostat is turned down saves 3% of the heat costs.

Typical Wattages for End Uses

End Use	Typical Wattage	End Use	Typical Wattage
Air conditioner, central	3,000 to 4,500	Garage door opener	230
Air conditioner, room	850 - 2,000	Garbage disposal	420
Air filter	60	Halogen torchiere	300
Appliance timer	2	Hot tub, heater and pump	5,560
Aquarium heater	100	Humidifier, no heater	120
Bathroom fan, high efficiency	15	Iron	1,000 – 1,600
Bathroom fan, standard	75	Juicer	90
Battery charger	100	Microwave oven	1450
Blender	380	Mixer	120
Block heater	600 - 1,500	Oil burner	450
Box fan	75	Oxygen concentrator	420 – 575
Bread maker	600	Pressure cooker	1,300
Can opener	100	Printer, desk jet	48
CD player	12	Printer, laser jet	300
Ceiling fan	150	Radon fan	15 to 150
Circular saw	1,150	Range stove top	1,600 – 2,100
Circulator pump	105	Range, oven	3,500
Clock radio	4	Refrigerator	450 – 625
Clothes dryer	4,500 – 5,500	Refrigerator ice maker heater	700
Clothes washer, cold water	360	Roof and gutter cable	7 watts / foot
Coffee maker	1,500 brew, 50 warm	Sander	290
Computer and monitor	200 – 250 each	Scanner	100
Computer, laptop	54	Security light, HPS	70
CPAP	12	Security light, mercury	175
Crock pot	100	Sump pump	200
Curling iron	40	Table saw	1,380
Dehumidifier	250 – 400	Toaster	1,150
Digital satellite system	14	Toaster oven	1,200
Dishwasher	450 – 1,200	TV, big screen, 48”	250
DVD player	14	TV, solid state	100
Electric blanket	175	TV, tube type	210
Electric space heater	1,500	Vacuum cleaner	350
Fax machine	500	Video games	80
Food dehydrator	875	Water heater	4,500
Food processor	690	Waterbed heater	150 - 300
Freezer	330 - 600	Well pump	1,000
Furnace fan	190 – 375	Whole house fan	500