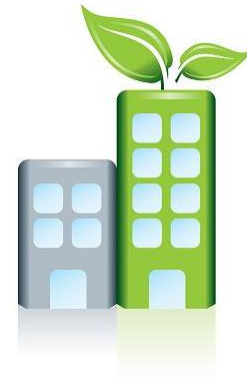


Promoting Energy Efficient Behaviors in the Home through Feedback: The Role of HCI



The **United States consumes one quarter of the world's energy resources**, despite accounting for **less than five percent** of the world's population (US Department of Energy, 2002).

The **residential sector accounts for 21%** of the nation's energy use and the average American household spends nearly \$2,000 on energy bills per year (US Department of Energy, 2006).

Home energy and personal transport are the **top two contributors** of the average American's CO₂ emissions into the environment (Weber and Matthews, 2007), accounting for **over 50%** of their total carbon footprint.

What are the **most effective strategies** in motivating energy efficient behavior through feedback technology?

How can we successfully **incorporate theories of human behavior** from environmental psychology, behavioral economics, decision-theory, goal-setting theory, etc. into our designs?

What **presentation medium** should the feedback use? How is it accessed? How often should it update?

How can **intelligent user interfaces** be used to open up new opportunities for feedback? Can we automatically link higher level human activities to energy usage, thereby presenting information not just in terms of energy consumption but also in terms of the activities that occurred to cause the consumption?

Can **machine learning help** determine the best time and format to feed information back to the user ?

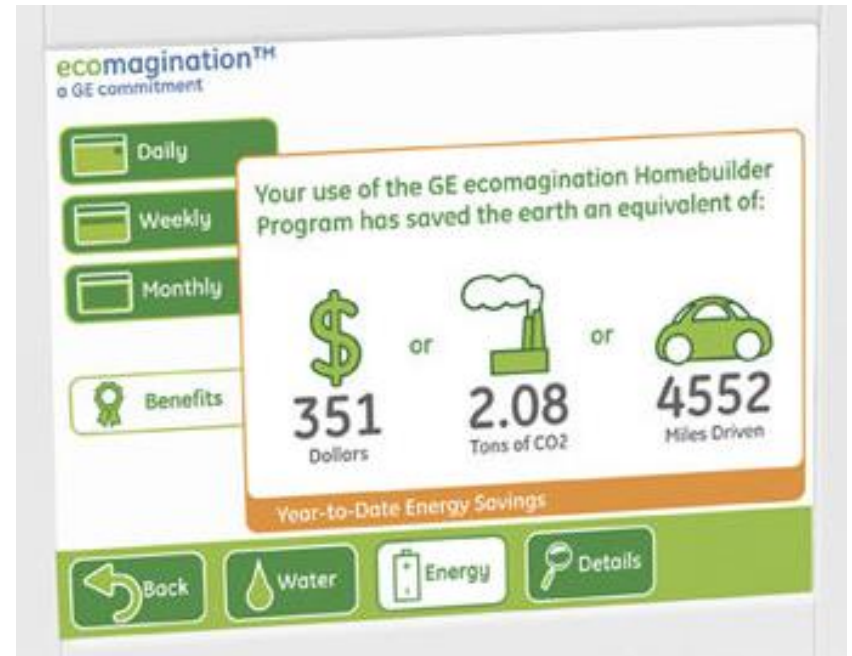
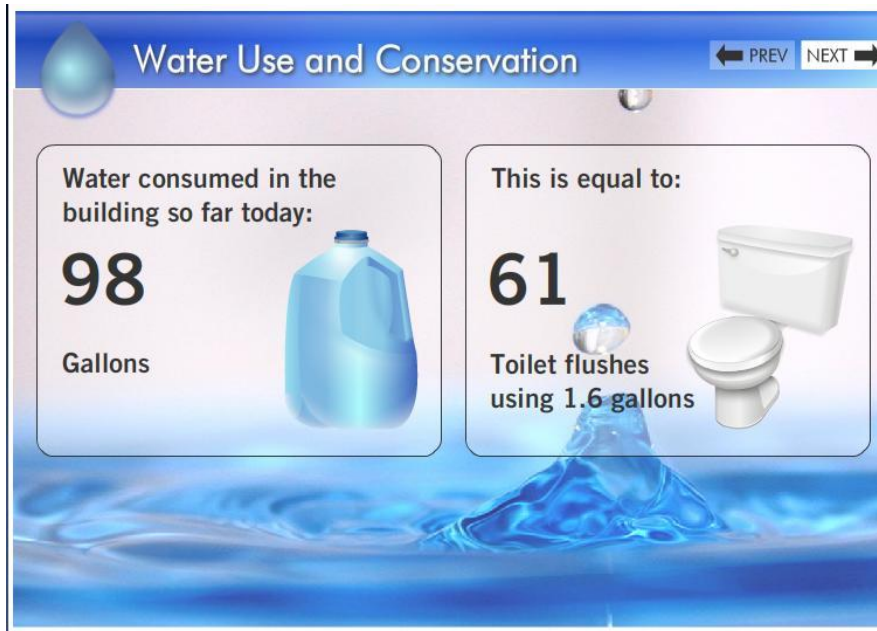
ten design dimensions

1. frequency
2. measurement unit
3. data granularity
4. push pull
5. presentation medium
6. location
7. visual design
8. recommending action
9. comparisons
10. social sharing

frequency



measurement unit



data granularity



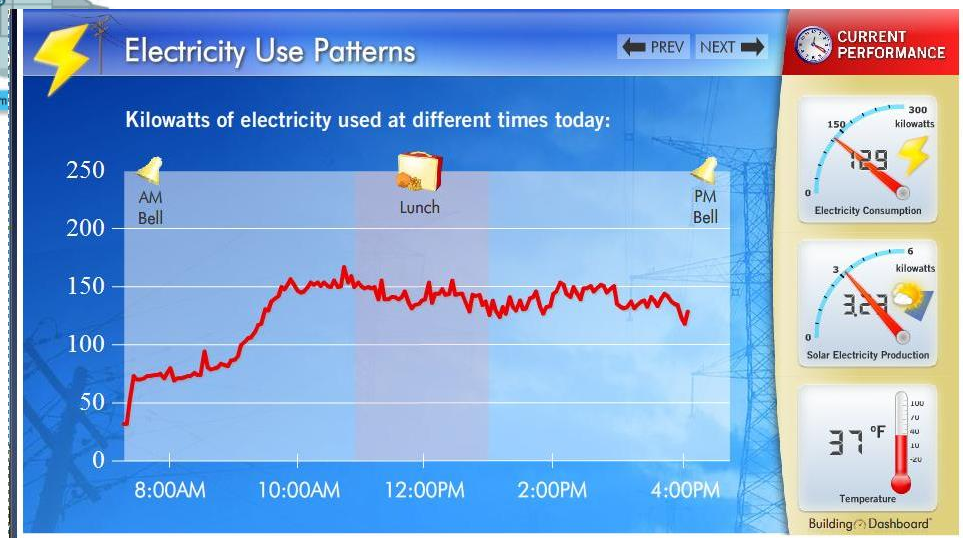
Living Room

The living room is a gathering spot for family and friends to spend quality time. It's also a place where you can take simple steps to be more energy-efficient.

Click the ★ to find tips.

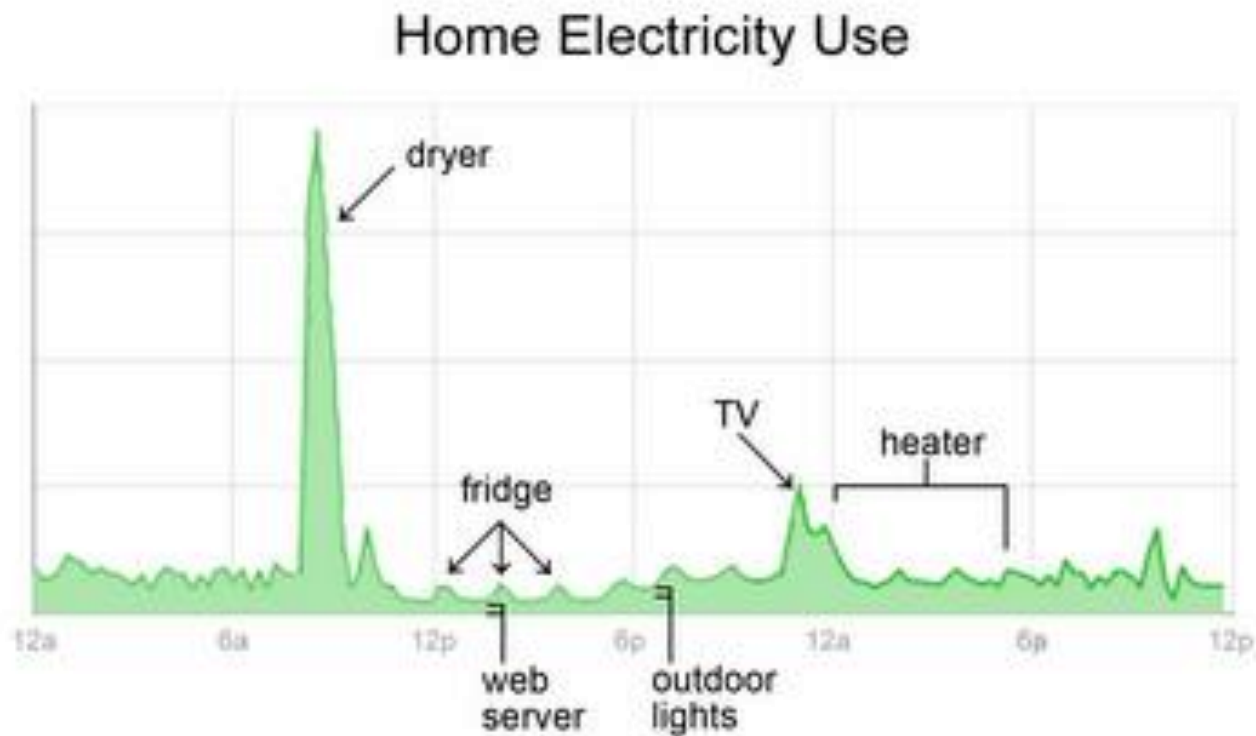


home choose a room

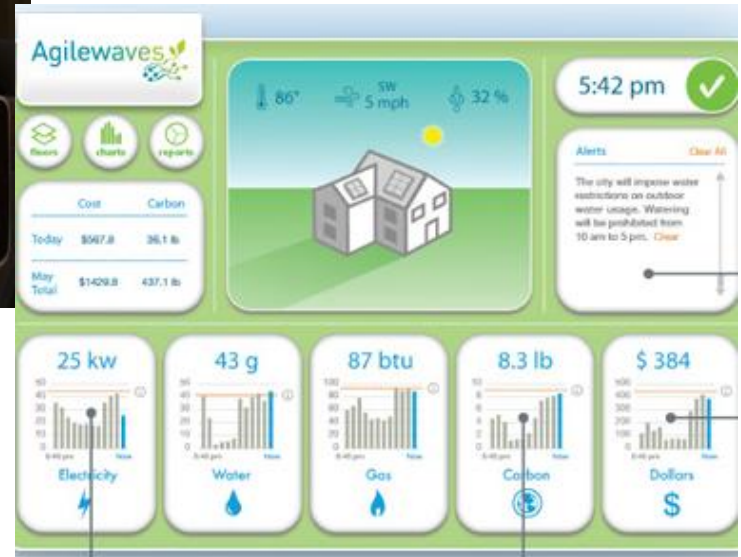
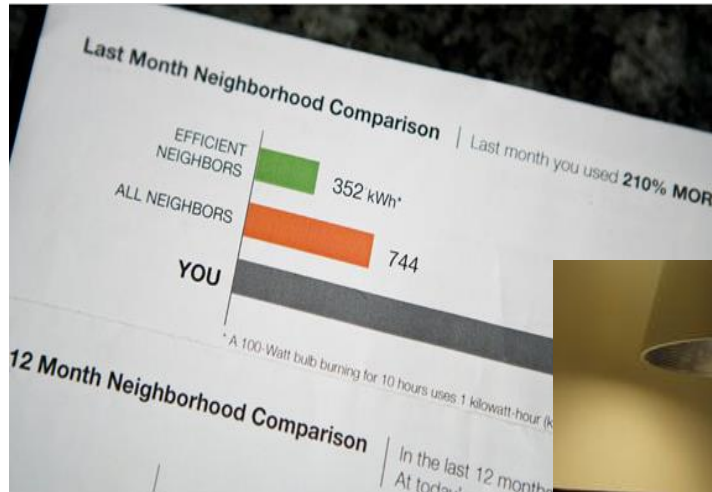


push / pull

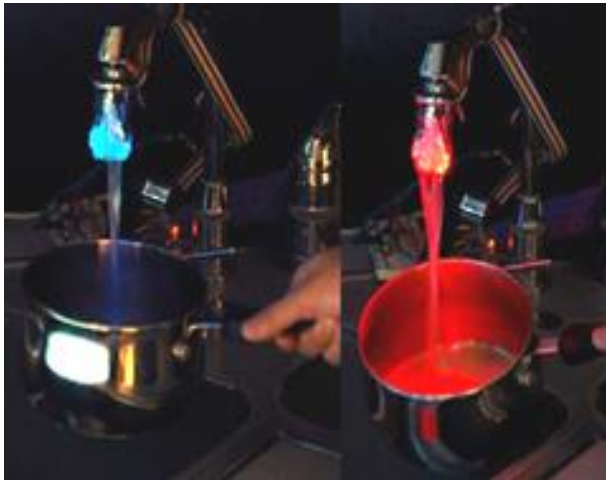
- On your iGoogle page



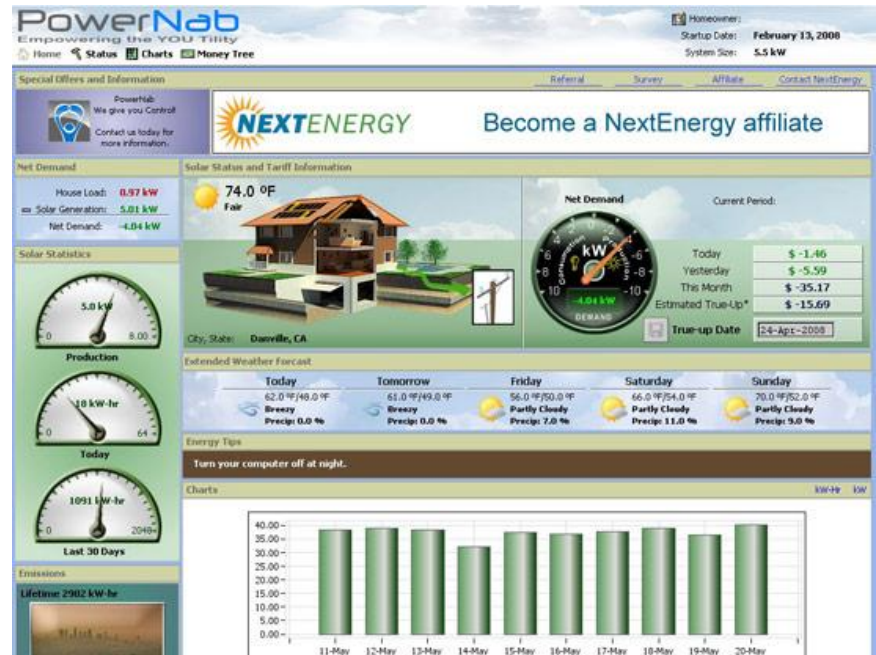
presentation medium



location



visual design



recommending action



[Google.org home](#)

Energy Information

[Home](#)

[Smarter Power](#)

[What We're Doing](#)

[Demo Project](#)

[FAQs](#)

[Work with Us](#)

[Energy Saving Tips](#)

Energy Saving Tips

Here are some more resources to help you find ways to reduce your energy

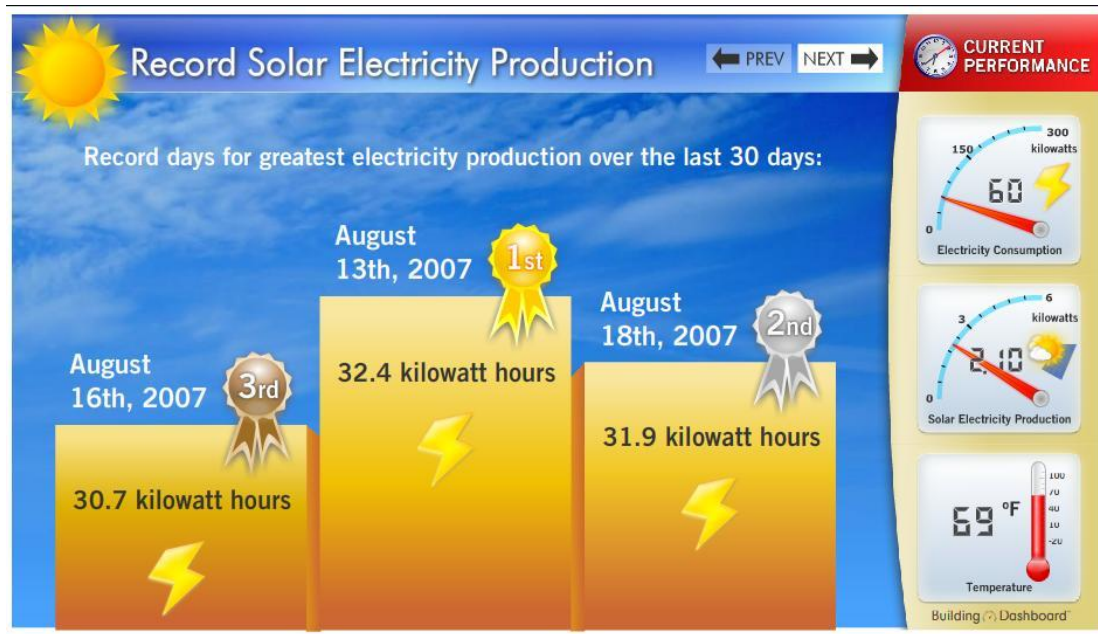
Heating and Cooling:

- [Weatherstrip](#) and caulk your windows and doors
- [Seal and insulate](#) your home
- Consider installing a [Geothermal Heat Pump](#) to heat and cool your home
- [Clean](#) your furnace's [filter](#) monthly
- Consider buying an ENERGY STAR [furnace](#) or [air conditioner](#), insulated
- [Cover](#) your hot water heater with an insulation blanket
- Consider installing energy efficient [windows](#) or [storm windows](#)

Saving Water:

- Reduce the temperature of your [hot water heater](#) to 120F or less (or lower)
- Install a low flow shower head (there are some [nice ones](#) out now)
- [Solar hot water heaters](#) can reduce your hot water heating bill
- Wash clothes in [cold water](#)
- Run full loads in the [washing machine](#) and [dishwasher](#)
- If available, use the energy savings settings on your [dishwasher](#) and
- Consider air drying your clothes. saves energy, money and keeps your clothes softer
- Take a [shorter shower](#)

comparisons

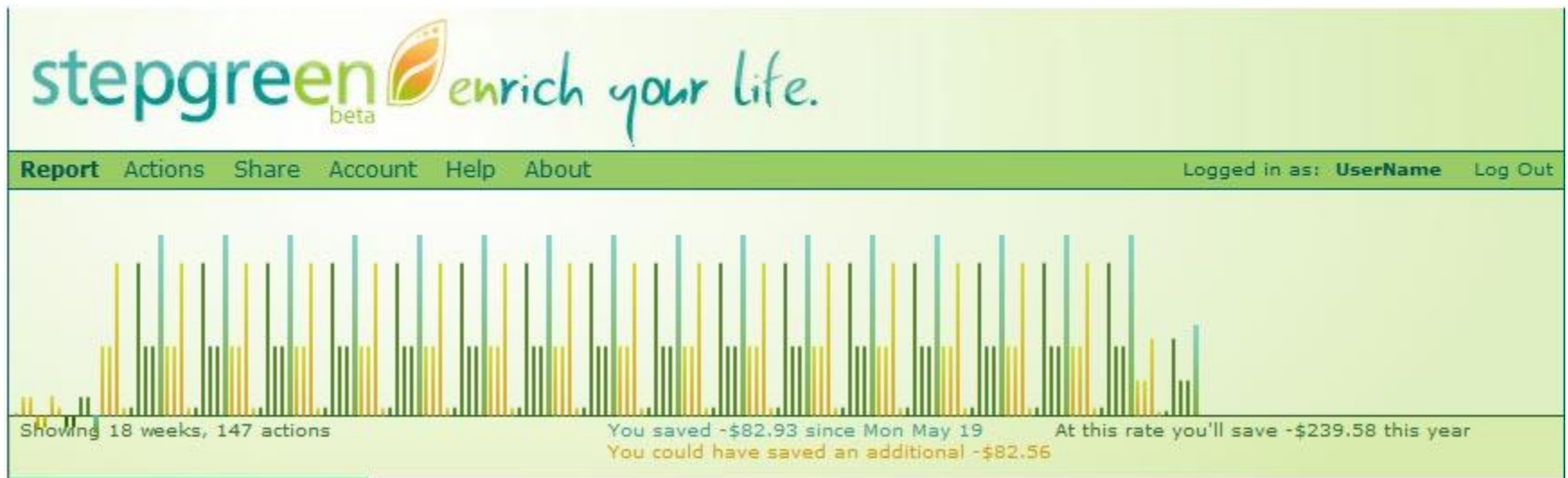


Compare your usage to others

Do you wonder how your energy use compares with others? Greenbox allows you to compare your usage anonymously with other homes like yours.

Your home	Community ave
997 W	272 W
79 W	98 W

social sharing



discuss

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What **presentation medium** should the feedback use?
How is it accessed? How often should it update?

Utilities Turn Their Customers Green, With Envy



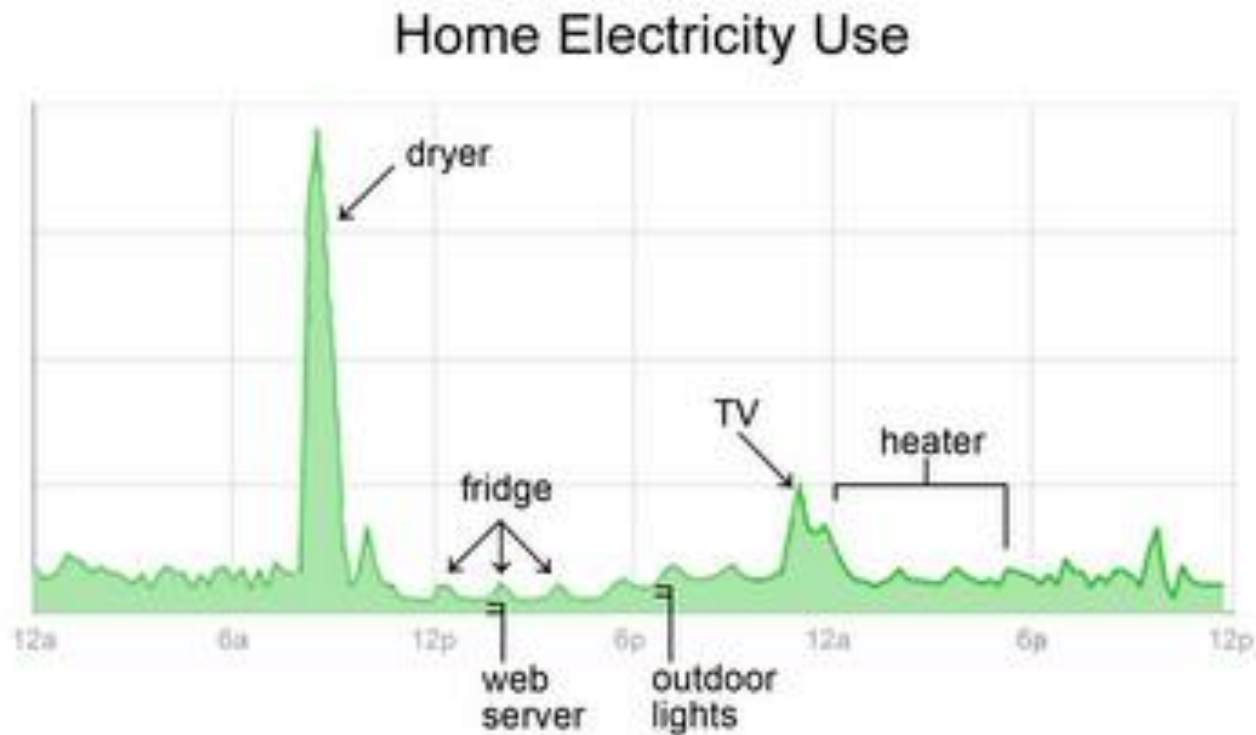
PowerCost home energy monitor

Mouse over an area on the display for more details



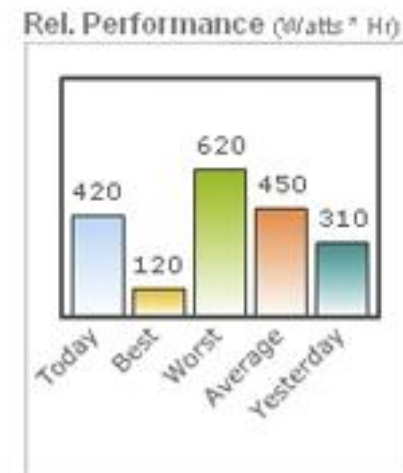
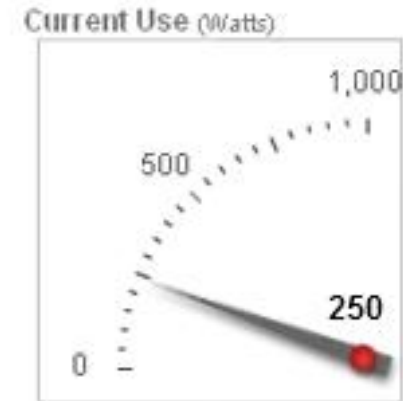
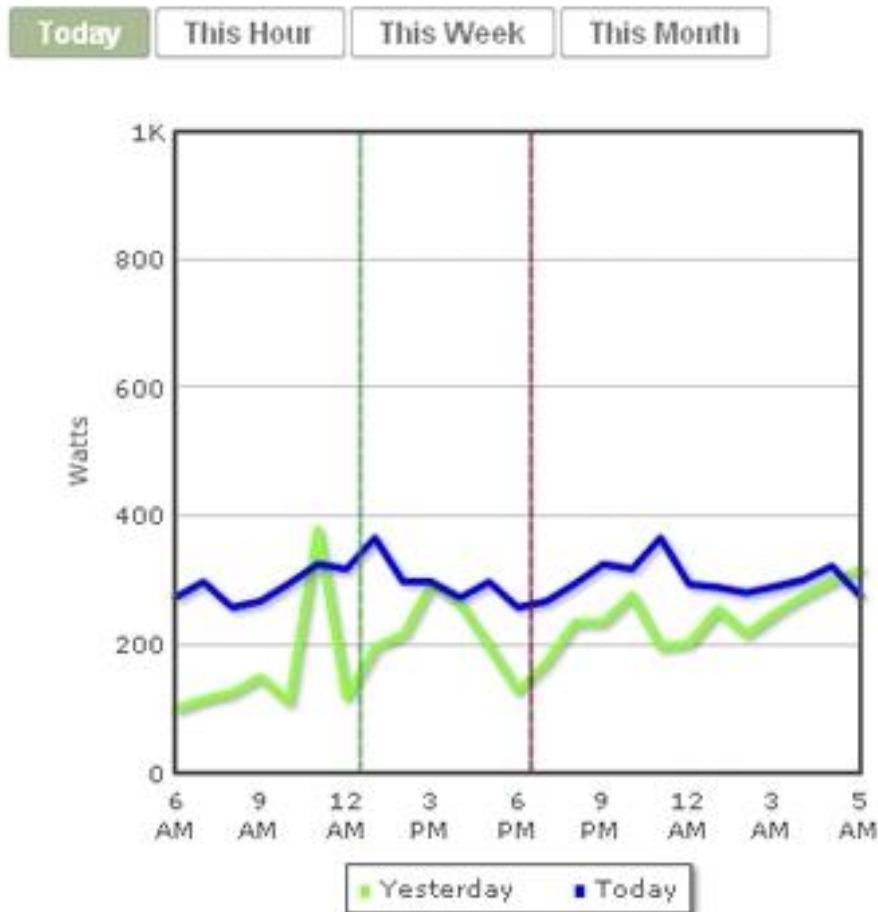
Google Power Meter

- On your iGoogle page

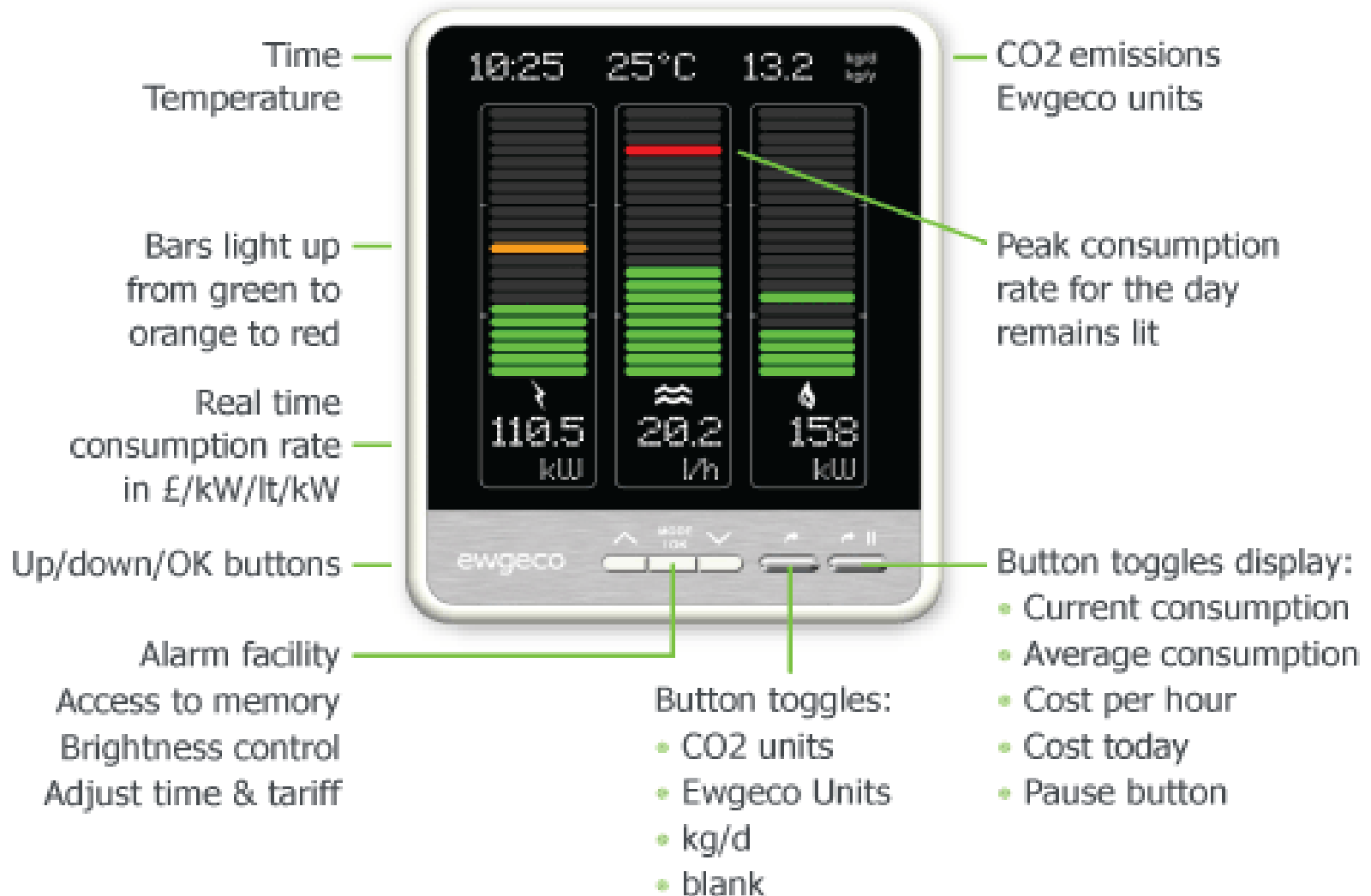


EcoBee web display:

EcoBee



ewgeco



EcoMagination



EnergyHub



Back Home Details 7:32 PM Thu Dec 18 2008

Switch	Appliance	Room	Power	Month to Date	Projected
	Window A/C	Studio	800.6 W	\$36.80	\$63.37
	Refrigerator	Studio	511.8 W	\$23.01	\$39.63
	Plasma TV	Studio	362.3 W	\$4.61	\$7.93
	Incandescent Lamp	Studio	103.6 W	\$2.65	\$4.57
	Cable Box	Studio	23.0 W	\$2.03	\$3.49
	MacBook	Studio	\$2.1 W	\$1.53	\$2.64
	CFL Lamp	Studio	19.2 W	\$0.50	\$0.86
Total			1,875.6 W	\$71.40	\$122.97

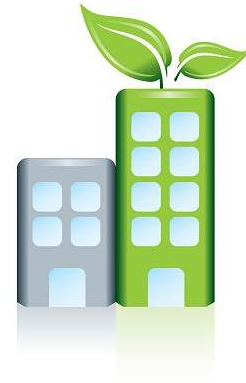
Goals



Transportation



Home



Campus



energy



water



gas

High



Low

Personal Control