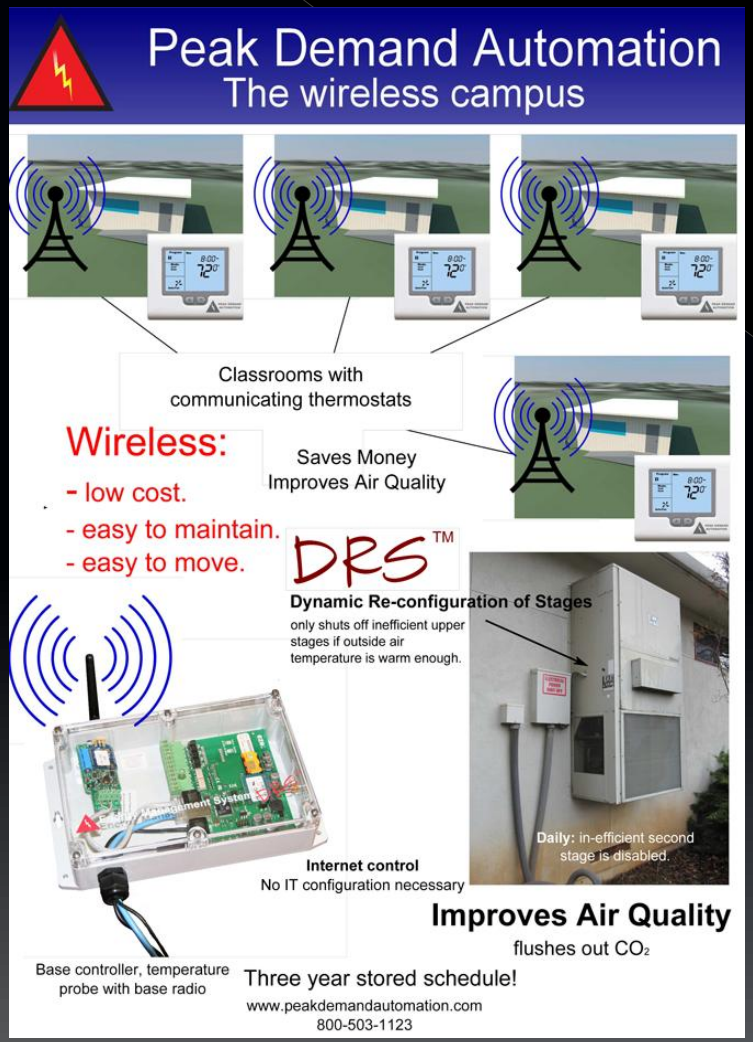
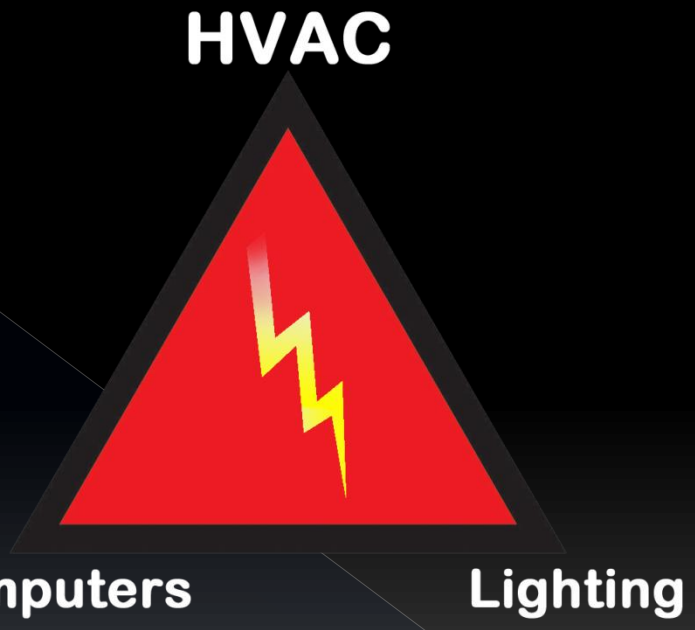
Peak Demand Automation

Reducing energy consumption in schools

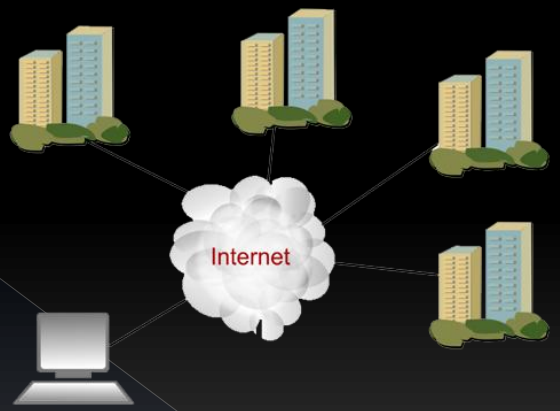




Energy Management System

Wireless ***Internet*** Gateway:

- Three years holidays pre-programmed
- Special events easy to add
- Smart-Meter ready!



Control costs from anywhere!

As low as $775 per room

Saves you money

You don't have to do anything!

Proposition 39

- Passed by voters in November 2012
- Dedicates $550 million per year to "green projects and jobs."
- The money will go to schools. K-12 and Community Colleges.
- Money will be spent starting in March 2014

Proposition 39 realities

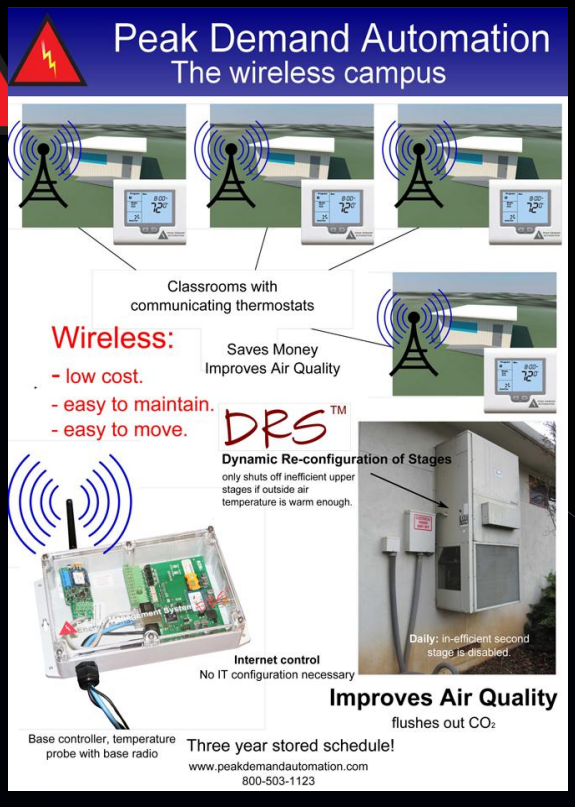
- Money is available.
- Energy managers are inundated.
- CEC implementation is complex and can be accessed once per year.
- Implementation took a very long time: ballot measure approved 11/2012, first spending 4/2014 (1.5 years!)

Proposition 39 realities

Prop 39: The California Clean Energy Jobs Act

- CEC requirements:
  - Must provide data on job creation.
  - Must provide data on labor savings.

The CEC encourages schools to have an energy manager and energy plan.



- 270,000 classrooms in California.
- 80,000 are "re-locatable."
- Re-locatable = low cost and flexible.
- Bad air and poor energy efficiency.
- Average cost for Electricity : $1400 for re-locatables, $400 can be saved.
- Average HVAC cost of "site built:" $1100, $150 can be saved.

Cost savings:

1. ***Suppression of strip heaters***
2. ***Scheduling***
3. Air Quality (no more open doors)
4. Door Lock-out (no heat or AC if door is open)

Scheduling offers the largest potential savings: forgetting to turn off nights, weekends and holidays.
Suppression of strip heaters is unique to the Peak Demand Automation Energy Management System and will reduce overall energy use over 9% by itself!

Stage suppression strategies:

(used in the past)

- Don't hook up the wire
- Time delay
- Internal temperature difference

Dynamic Suppression of strip heaters is unique to the Peak Demand Automation Energy Management System

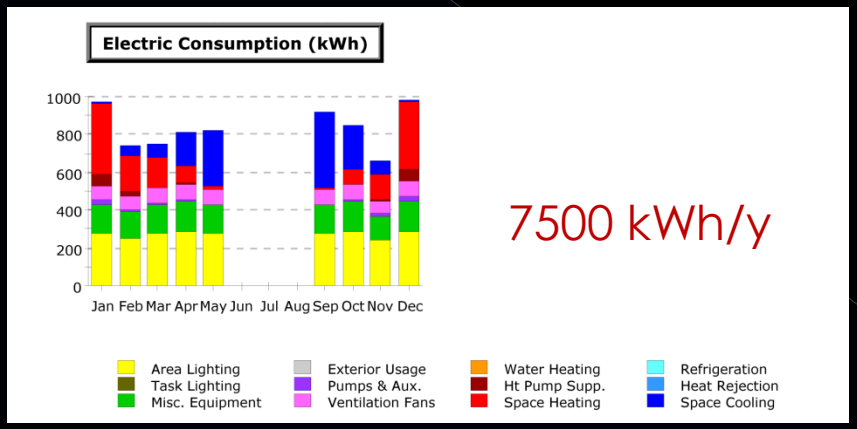
Portable (re-locatable) classrooms

	First stage	Second Stage	Combined
Heat delivered	10000	10000	20000
Watts used	3333	10000	13333
Effective COP	3	1	1.5

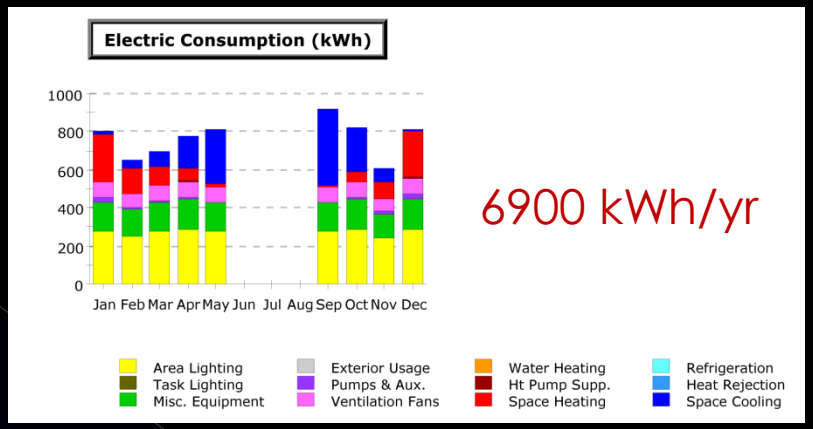
Only use the strip if needed!

- Sense outdoor temperature.
- Only activate strip for very low temperatures.
- Effectively limits the strip to less than ten days per year.

Computer models for strip suppression: Sacramento



7500 kWh/y



6900 kWh/yr

- With strip 7500 kwh/yr = $1350
- No strip 6900 kWh/yr = $1242 (-$110 or 9%)
- Additional savings due to automation (~15%)

CEC Calculator

(California Energy Commission)

- Reduce savings to lowest possible for this technology
- Satisfies CEC ECMS 11, 12, 13B and 16

By Campus	Gas Packs	Bards		Gas Pack savings	BARD savings	Cost, Installed	Utility Rebate	Simple payback, Years	SIR
All Bard Campus	0	10		$0.00	$1,484.16	$9,000.00	$0.00	6.1	2.17
All Gaspack Campus	10	0		$832.84	$0.00	$9,000.00	$0.00	10.8	1.20

Even with reduced savings estimates, SIR (savings to investment ratio)
Is 2.17 for portables and 1.20 for site built classrooms

Door Interlocks

- Use simple low cost door sensor as AC interlock.
- Turns off thermostat whenever door is open

CO_2 Sensing (Optional at extra cost)

- Excess CO_2 is present due to exhalation
- California standard is 1000 ppm
- Turn on fans whenever standard is exceeded.

Gas Sensing (Optional at extra cost)

- Windex
- Cleaning Fluid
- Carpet Glue
- Paint
- Low Cost Furniture

Turn on the fan whenever bad fumes are present

Radio topologies

- Wi-fi : ubiquitous high bandwidth but uses a commercially vulnerable TCP/IP connection!
- Zig-bee: Mesh standard
- ISM: Lower frequency allocated by FCC for instrumentation.

Radio Type	Power, milliWatts	Indoor range, ft
Zig-Bee	63	261 ft.
Wi_Fi	1000	793 ft.
ISM (900 MHz)	250	1000 ft.

The propagation loss is proportional to the square of the frequency: therefore there is seven (7) times more propagation loss at 2.4 GHz than at 900 MHz.

Effective radio range

- Wi-Fi : High bandwidth 2.4 GHz (uses vulnerable TCP packets)
- Zig-bee : Low bandwidth 2.4 GHz
- ISM: Low bandwidth 900 MHz

Wi-Fi and Zig-bee are on the same frequency

•Strongest wins

ISM = longest range

Actual campus map with outlying building

Wi-fi for schools?

Do you want dozens of students with laptops, tablets and smart-phones sharing a network with your thermostats?

Wi-Fi and Zig-bee are on the same frequency: there are well known interference issues!

Conclusion: Wi-Fi control is ok for the home, but wrong for schools.

Energy Management vs. programmable thermostat

- Central data and logging.
- Network connectivity to cloud or other analytics.
- Control based on other building elements.
- Can manage more than one energy consumer.
- User interface for multiple rooms/campuses.
- Secure system without reused passwords.

Energy Management vs. programmable thermostat part 2

- Add air quality monitoring.
- Selective power (energy monitoring).
- Are computers included? (These are big power wasters).
- Can you add motion detection?
- Integrated lighting controls.

If you cannot add these things you are NOT buying an "Energy Management System," just a bunch of programmable thermostats!

Conclusions

- Energy management systems for schools:
  - Save up to $337 per portable classroom.
  - Provide better air quality.
  - Reduce maintenance and enhance remote debug.
  - Provide a means for power, occupancy and lighting controls.
- Principal savings techniques:
  - Automation
  - Heat strip suppression ***only*** on Peak Demand Energy Management Systems

Wireless makes these systems cost effective and portable.

Demo at your campus

A travelling demo unit will come to your office: Just call 800-503-1123

or email:
sales@peakdemandautomation.com