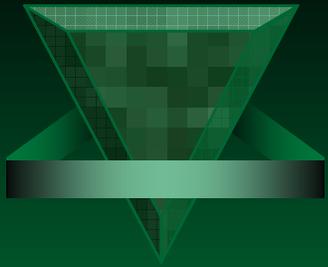


How U.S. Hotels Reduce Energy Use

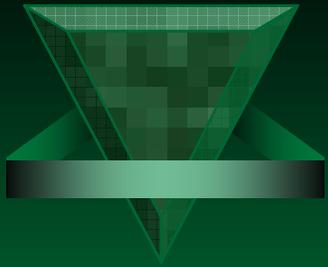
Dan Ruben
Boston Green Tourism





Step One: Benchmark, Identify Opportunities

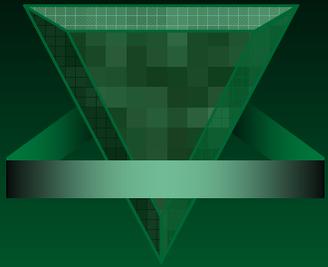
- ✔ Start with your own assessment
- ✔ Review this presentation and energy efficiency checklists
- ✔ Calculate your hotel's Energy Star score:
http://www.energystar.gov/index.cfm?c=hospitality.bus_hospitality;
track it over time
- ✔ Review the Hotels and Motels section of the Energy Star Building Upgrade Manual:
http://www.energystar.gov/index.cfm?c=business.bus_upgrade_manual
- ✔ Meters help hotels understand energy and water use for specific areas
- ✔ Get an energy audit: retro-commission or ASHRAE level 2 audit, if affordable; if not, get a less thorough audit



Where Can Hotels Save Energy?

Address these areas of your property:

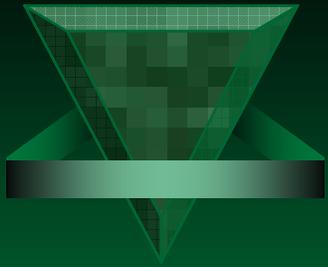
- Operations and maintenance
- Lighting
- Reduce plug load
- HVAC systems
- Kitchen
- Hot water
- Steam
- Other energy consuming systems
- Building shell
- Transformers
- Peak shaving, including Demand Response programs



Operations and Maintenance, 1

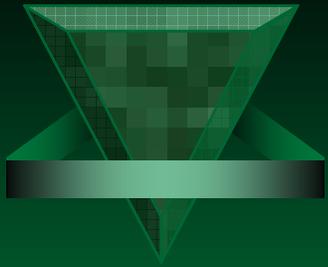
Some bldg managers ↓ energy use by 10% with a rigorous maintenance schedule. A few items on the list:

- clean coils
- clean PTAC units internally or with service companies
- replace filters
- calibrate controls
- lubricate and adjust equipment
- repair leaks in heating system ducts
- optimize fresh air economizer operations; assure outside air dampers on AHU's work well
- replace worn weather stripping and seals
- reset air handling unit static pressure to lowest pressure that operates the terminal boxes



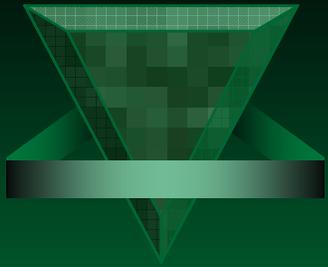
Operations and Maintenance, 2

- ✓ Turn off when not needed:
 - HVAC
 - lighting
 - electronics
- ✓ Best option for shutting down HVAC and lighting: EMS's with occupancy sensors; if not available, have staff do it
- ✓ Program mechanical equipment to operate only when needed
- ✓ Schedule function rooms tightly to reduce their HVAC needs



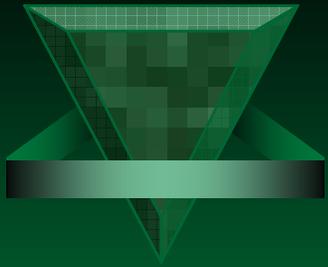
Operations and Maintenance, 3

- ✓ Drapes/Blinds: strategically open or close them; keep closed during cooling season to ↓ heat gain; keep open on sunny winter days to gain heat and free light
- ✓ De-lamp
- ✓ Towel and linen re-use program: design to be “opt-out” rather than “opt-in”
- ✓ Set guest room hot water at minimum necessary temp
- ✓ Building Operators Certification Program (<http://www.theboc.info/index.html>) trains staff on optimal maintenance



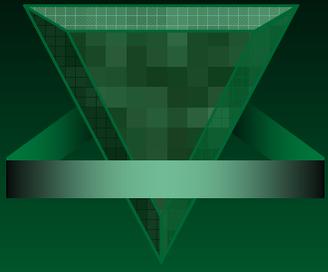
Lighting, 1

- ✔ Replace incandescent and fluorescent bulbs with LED's:
↓ energy, labor and a/c costs.
- ✔ Compared to fluorescents, LED's: last much longer, better dimming and color rendering. New products introduced monthly. Prices dropping.
- ✔ Avoid lemons: get Energy Star or DLC approved bulbs w/ long warranties from trusted companies. Test before purchasing.
- ✔ Tubes: replace T-12's with T-8's or T-5's. LED tube lights are often best option now—or will be soon.



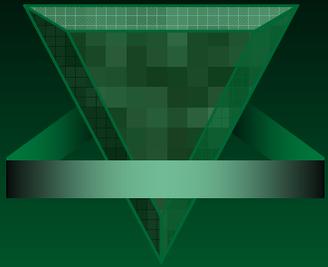
Lighting, 2

- ✔ Use natural light. Adjust lighting to daylight levels.
- ✔ Shut off unneeded lights with sensors or timers. Use photocells for exterior lights. Use dimmers.
- ✔ Give staff and guests personal lighting control.
- ✔ Stairwell motion detectors dim lights to 15% when unoccupied. ASHRAE 90.1 – 2010: stairwell lighting must have control devices that ↓ lighting by 50% or more.
- ✔ Other advanced lighting controls: variable load shedding in response to energy price spikes, task timing (↓ lighting after hours, etc.).



Reduce Plug Load

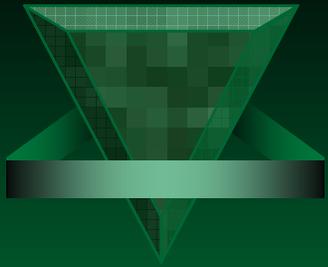
- ✓ Reduce plug load by purchasing Energy Star equipment for guest rooms, kitchens, offices, common areas, etc.:
http://www.energystar.gov/index.cfm?c=bulk_purchasing.bus_purchasing
- ✓ Choose the most energy efficient equipment that meets your needs.



HVAC Systems, 1

General Principles:

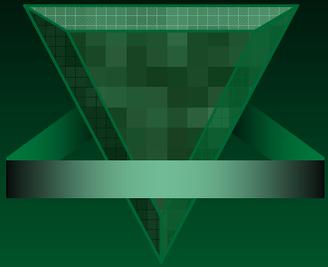
- ✓ Get an ASHRAE level 2 audit or a retro-commission study
- ✓ Proper size is important
- ✓ Schedule HVAC so it runs only when necessary, using both automation and daily management overview; most of the points below are about running the system less often or less wastefully
- ✓ Variable air volume (VAV) air handling systems
- ✓ Variable Speed Drives
- ✓ Common space automation (event rooms, restaurants, cafeteria, health club, lobby): demand control ventilation, temperature and lighting controls
- ✓ Guest Room Automation Systems: control temperature and lighting



HVAC Systems, 2

General Principles (continued)

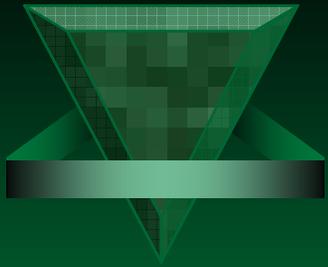
- ✓ Set AHU's static pressure as low as feasible
- ✓ Low pressure drop high efficiency filters for AHU's: coming to market: ↓ energy needed to push air through filters; improves IAQ; lasts longer: ↓ waste and labor. Cost effective with incentives?
- ✓ Use free cooling from outside air
- ✓ Consider energy recovery ventilation if hotel is configured to take advantage of it
- ✓ Bathroom ventilation: replace fans with Energy Star units when renovating, or if there are problems: ↓ energy, quieter; motors last longer. Get controls with humidity or moisture sensors.



HVAC Systems, 3

General Principles (continued)

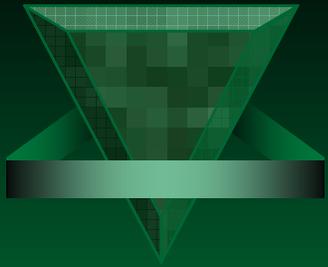
- ✓ Energy-efficient boilers: new condensing boilers are up to 97% efficient; existing boilers: upgrade burner controls so boilers run efficiently and match the building's needs.
- ✓ Energy-efficient magnetic bearing chillers; optimization software runs chillers at most efficient operating point.
- ✓ Chiller control valves: Pressure independent automatic balancing valves (FlowCon) prevent chiller plants from activating when it's unnecessary. More efficient than manual balancing valves.
- ✓ Combined heat and power (CHP, cogen): can be cost effective, with good incentives, for hotels with high hot water needs.



HVAC Systems, 4

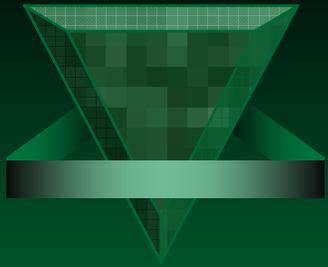
General Principles (continued)

- ✔ Use energy-efficient PTAC's, VTAC's and motors; replace AC motors with ECM's in fan coil units when there is a favorable ROI.
- ✔ Consider replacing PTAC's with heat pumps; heat pumps might be sensible when boilers must be replaced or for new additions.
- ✔ Use ceiling fans to augment a/c and heating.
- ✔ Use gas-fired infra-red heating for outside (patios, front entrance, valet parking areas) and high-ceiling lobbies.
- ✔ Energy Mgt. Systems: make sure they have good user interfaces, occupancy sensors, and scheduling and setback capabilities.
- ✔ Insulate ducts, hot water pipes, etc.



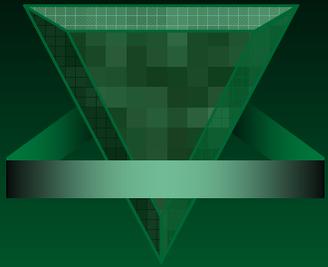
Maintain and Replace Motors

- ✔ Most motors: suboptimal performance and longer run times than necessary.
- ✔ Biggest maintenance problems: improper refrigerant charge, expansion valves need adjusting, dirty air filters. A good maintenance plan reduces costs!
Consider using a service to clean PTAC's, VTAC's, etc.
- ✔ For motors that operate frequently: replace old tech (shaded pole motors: 20-30% efficient; PSC motors: 40-60% efficient) with electronically commutated (ECM) motors (70-80% efficient). ECM's ↓ maintenance costs, too.
 - Replace refrigeration motors—often good ROI's, because they run 24/7.
 - Replace guest room fan motors with long run times.
 - ECM motor (and Energy Star) replacements for pool and spa filter pumps.
- ✔ To establish an ROI for motor replacement: have hotel motors assessed and identify the incentives.
- ✔ When replacing motors, consider ones that provide reports and alarms.



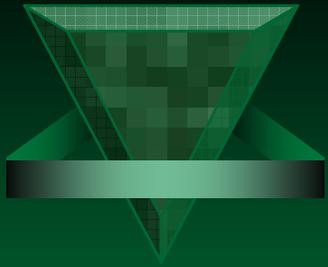
Kitchens, 1

- ✓ Air balance
- ✓ Add variable speed fan control on kitchen ventilation hoods; add side panels to hoods
- ✓ Dishwasher exhaust should run only when unit is on
- ✓ New dishwashers use $< \frac{1}{2}$ the hot water of older units
- ✓ Add strip curtains and automatic door closers to your walk-in refrigerator
- ✓ Maintain refrigerators: check and replace door gaskets, clean evaporator and condenser coils, check refrigerant charge, etc.



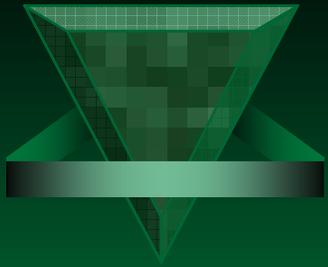
Kitchens, 2

- ✔ Install ECM motors on refrigerator and freezer evaporator and condenser fans
- ✔ Don't set refrigerator and freezer temps too low—each degree ↑ costs by 3-5%
- ✔ Buy Energy Star cooking appliances, refrigerators, ice machines; an example: new Energy Star broilers ↓ energy use by 25%
- ✔ Defrost meat in refrigerator--not under running water



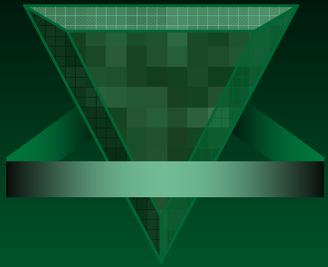
↓ Hot Water Use, 1

- ✓ VFD water pumps slow down when there's little demand for hot water; see if they're compatible with your boiler system before installing
- ✓ Computerized Boiler Controls: adjust burner run patterns to match system's heat load
- ✓ Heat Recovery: use a heat exchanger to transfer waste heat from cooling, refrigeration and laundry equipment to water tank
- ✓ Guest room hot water: tank-less systems



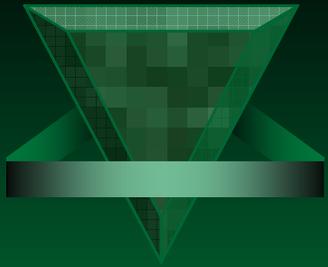
↓ Hot Water Use, 2

- ✓ Laundry:
 - Ozone (~80% less energy, uses cold water for most cycles, less water and fewer chemicals); can be problematic if not maintained well
 - Tunnel washers and other modern equipment ↓ energy and water, too
 - Wash full loads only
 - Cold water detergents
 - Dryers with sensors that stop the machines when laundry is dry; water extraction presses save drying time, too
 - Outsourcing might be more efficient
- ✓ Swimming pools and hot tubs: use physical covers or “liquid pool covers.” Liquid pool covers reduce humidity, too. Very good ROI.
- ✓ Insulate hot water pipes and boilers



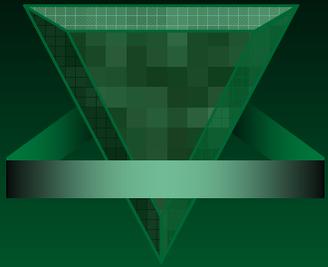
↓ Hot Water Use, 3

- ✓ Combined Heat and Power (CHP): Generate electricity and use the waste heat for hot water or space heating.
 - Most economical for hotels with high hot water use
 - One of best ways to ↓ energy use
 - A source of back-up power during blackouts
 - Consider Power Purchase Agreements (PPA's): vendor owns and maintains the CHP unit; they sell the hotel the power guaranteed discounts



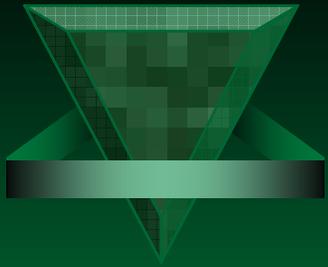
↓ Use of Steam

- ✓ Inspect and repair steam traps
- ✓ For systems with no condensate return, pump hot condensate water through a heat exchanger to preheat the bldg's hot water and domestic water systems
 - ↓ need for steam
 - ↓ water needed to temper the hot condensate
 - ↓ water goes down the sewer



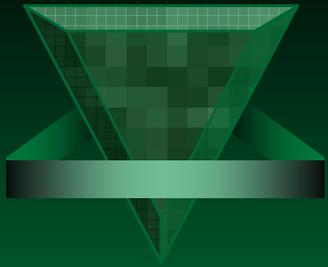
Other Energy Consuming Systems

- ✔ Elevators: new efficient elevators use 50+% less energy; that fact doesn't justify a new elevator on its own
- ✔ Computers: ↓ energy use by up to 50% by using Energy Star equipment, laptops, power management, web-based software, fewer servers; assure staff turn off at night
- ✔ Vending machines: use vending misers or EC motors



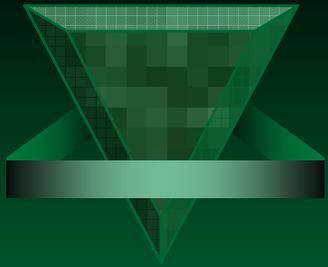
Building Shell

- ✓ ↓ solar gain with window film, awnings, overhangs, light shelves, reflective shades. EnerLogic window film adds insulation, too.
- ✓ Windows: consider high-performance windows if replacement is necessary. Insulate with energy-efficient shades that close at bottom, drapes, window film. Weather strip to eliminate air penetration.
- ✓ Revolving doors keep weather out.
- ✓ Infra-red analysis discovers insulation and moisture problems.
- ✓ Small properties, such as inns: improve air sealing and add insulation.
- ✓ Green roofs add insulation and beauty, extend roof life, ↓ storm water runoff ; the cost reduction doesn't justify this project on its own.



Transformers

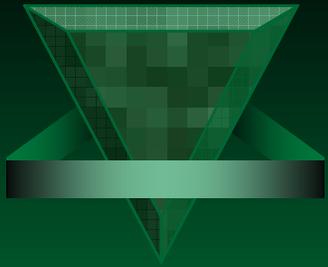
- ✓ If transformers are >20 years old, consider replacing them before they die (their life expectancy is 32 yrs.); avoid a 1-3 day downtime without electricity
- ✓ New, energy efficient transformers ↓ electricity use; cast off less heat--↓ a/c bills



Peak Shaving / Demand Response Programs

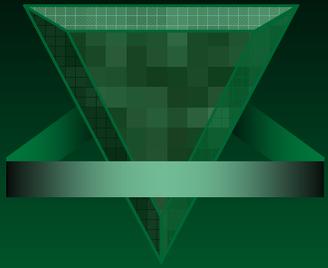
Electricity bills are based on total kWh's *and* kWh's during the highest use period of the month.

- ✔ Peak Shaving: Use batteries to store energy at night and release it during peak periods. Offered by Stem (so far only in CA) and Solar City for its solar customers.
- ✔ Demand Response: Agree to cut power on peak demand days (hottest days); in return, earn a monthly check.



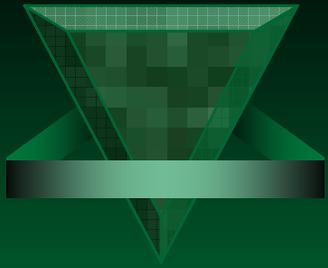
Renewable Energy

- ✓ Solar electricity (PV): attractive ROI with right circumstances and strong incentives; need considerable amount of unshaded roof space to make a dent in property's electricity use
- ✓ PV decreasing in price quickly--but incentives will decrease, too
- ✓ Power Purchase Agreement might make PV economical now
- ✓ Solar thermal (hot water): more expensive than most efficiency measures; doesn't need as much roof space as PV to have an impact
- ✓ Purchasing renewable electricity: often more expensive; consider reverse auctions or purchasing a modest amount (10%); select green-e certified
- ✓ Solar panels and green energy purchases can be a marketing tool



Conclusion

Hotels can sharply reduce their energy bills by making smart investments and using good management practices.



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