ENERGY EFFICIENCY 101

What Works best in the Tropics

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SLAVERY

- Fierce debate reigned in the English Parliament of 1805 over the abolition of slavery. Slavery proponents pointed out that the trade accounted for 25% of England's GDP, and the country's economy would collapse if it were abolished.

THE BIRTH OF THE INDUSTRIAL REVOLUTION

"Parliament abolished slavery outright. Instead of collapsing, Britain's economy accelerated. Creativity and productivity surged. Entrepreneurs seeking new sources of energy launched the industrial revolution and inaugurated an era of the greatest wealth production in human history." Robert F. Kennedy Jr.

AMERICAN SLAVERY, 2008

"The practice of borrowing a billion dollars each day to buy foreign oil has caused the American dollar to implode. More than a trillion dollars in annual subsidies to coal and oil producers has beggared a nation that four decades ago owned half the globe's wealth. Carbon dependence has eroded our moral authority and endangered out national security." Robert F. Kennedy Jr.

OPPORTUNITY FOR ENERGY REVOLUTION

- “You never want a crisis to go to waste,”
- Rahm Emanuel, Chief of Staff
- “This is not a cycle, it’s a reset.” Jeff Immelt, CEO, General Electric Co.
- “There is nothing like $147/barrel oil to create a crisis and trigger a reset.” Howard C. Wiig

$100/BARREL OIL IS ENTIRELY POSSIBLE

- Oil production is set at about 83 million barrels a day. There is no more easy oil, except in Iraq.
- Economic recovery will increase demand.
- Chinese and Indian economics are growing.
- A production collapse could occur in Saudi Arabia, Iran, Venezuela, Nigeria or in the Gulf of Mexico—another Katrina.

HOW IMPORTANT ARE ENERGY CODES?

- Of all the renewable energy and energy efficiency options, energy codes emerge as the most cost-effective means of transforming markets from wasteful to efficient equipment and keeping money in the pockets of residents instead of shipping it to petro-dictators.

WHAT IS EFFICIENCY?

- For our purposes, efficiency means doing the same amount of work with less energy. Examples: a 1976 Oldsmobile vs. a 2008 Hybrid—15 mpg vs. 50 mpg. A 100 watt incandescent to a 25w CFL—15 lpw to 60 lpw. An old residential 8 SEER AC unit vs. a new 21SEER unit. In all cases, far less heat is produced—an added bonus in the tropics.

EXAMPLE 1: 100W INCANDESCENT VS. 25W CFL

- Over 10,000 hours,100w incandescents will use 100w x 10,000 hours=1 million watt-hours or 1,000 kWh. 1,000 kWh x $0.30/kWh=$300. 13 replacements needed over 10,000 hours.
- One 25w CFL over 10,000 hours uses 250 kWh = $75 and produces only 25% the heat.

EXAMPLE 2: 100W INCANDESCENT TO 10W LED

- Over 30,000 hours, 100w incandescents will use 100 x 30,000= 3 million watt-hours or 3,000 kWh. 3,000 kWh x $0.30=$900. A 10w LED delivering the same foot-candles to task totals $90 in energy costs, saving $810. Is the $35 initial cost a wise investment?

EXAMPLE 3: MAINTANENCE COSTS

- Generally, less heat=longer life. A 10w LED produces 10% the heat of a 100w incandescent. An incandescent has a burning life of 750 hours; an Energy Star CFL, 10,000 hours, and an LED, between 30,000 and 50,000 hours. In a commercial facility, lamp replacement may cost between $2 and $5 per replacement.

HEAT REDUCTION IN TROPICAL CLIMATES

- The last thing buildings and homes in tropical climates need is more heat. Incandescent lamps can reach temperatures of 460F. A rule of thumb is that for every 3 watts of heat eliminated, AC load is reduced by 1w. Occupants are more comfortable and quality of life improves.

HOW DOES THIS RELATE TO ENERGY CODES?

- Fire codes minimize the danger of fire in buildings. Energy codes minimize energy use in buildings. Energy code provisions must be cost-effective (<5-year payback), specify readily accessible equipment and consider longevity and ease of maintenance.
- High-efficiency lamps are the best examples.

CNMI'S TROPICAL CODE

- On May 1, 2009, CNMI adopted the Tropical Code, a collaboration led by consultant Charles Eley with input from Hawaii, the US Virgin Islands, Puerto Rico, Guam and of course, CNMI. While the HVAC and lighting sections are the same as national codes, the envelope sections are perhaps unlike any in the world.

NEW STEALTH DEFENSE: REDUCE OIL IMPORTS

THE IMPORTANCE OF REFLECTIVITY

- The Tropical Code emphasizes roof reflectivity because, a) the sun is very high in tropical latitudes, b) reflectivity performs much better than conventional insulation, which depends on a dramatic temperature drop when the sun goes down.

REFLECTANCE: WHAT MAKES THE CODE UNIQUE

- The Tropical Code calls for an aged roof reflectance factor of 55%. The initial reflectance factor must be at least 73%. The roof membrane must have an emittance of at least 75%.

STEALTH TECHNOLOGY ON ROOFS

- Titanium dioxide is the “ultimate whitener”. It is the brightener in paints, paper, pills, toothpaste—and even candy canes. The stealth technology has long been used in metal roof shingles which appear as conventional colors but have very high reflectance values, and more recently in roofing tiles which likewise appear as conventional colors.

CLIMATE CHANGE DELAYED?

- The California energy code strongly emphasizes cool roof technologies. The researchers estimate that if 360,000 square miles of urban rooftops worldwide were a light color, enough solar heat would be reflected back into space to delay climate change by 11 years.

REFLECTIVITY APPLIES TO WINDOWS

- Tropical codes should refer only to Solar Heat Gain Coefficient (SHGC), not U-values. For example a SHGC of 0.30 means that only 30% of the sun's heat penetrates the window. A single-pane window's SHGC is about 0.90, meaning that 90% of the sun's heat penetrates.

ALSO UNIQUE HIGHER WINDOW PERFORMANCE

- While the mainland code permits a maximum solar heat gain coefficient (SHGC) of .35, the Tropical Code calls for a maximum SHGC of .25 when windows are unshaded.

COST EFFECTIVENESS OF HIGH-PERFORMANCE WINDOWS

In Hawaii, window distributors say that the cost of 0.40, and even 0.30 SHGC windows are the same price of low-performance windows. The mainland demand for high-performance windows has caused mass production and resulting lower prices. Single-pane windows now must be custom-ordered.

Lotus Leaf: Purify Tropical Buildings

MOLD BUILDUP ON ROOFS

- The Tropical Codes mandates ¼ inch of slope per one foot of run to prevent “the swimming pool effect” on roofs, which hastens mold growth. New technologies, including “the lotus leaf effect,” are emerging, ensuring that white roofs won’t be very dark within a year due to mold growth.

LOTUS NANOTECHNOLOGY

- A German company takes reflective technology a step further by combining titanium dioxide with the nano-structure of the lotus leaf. The leaf grows in muck but sheds the muck in the first rainfall, thus magically “purifying”. The symbolism has endowed the plant with spiritual qualities in Southeast Asia. The Lotus’ secret is a surface of nano-fibers packed so densely that molecules remain suspended and are easily shed. By imitating Lotus surface structure in reflective wall coatings, the German company prevents the growth of mold in tropical settings.

Sea Otter: Air as Insulator

.AIR INSULATES BETTER THAN BLUBBER

- The effectiveness of “tight air” technology is best illustrated in the sea otter, a habitué of the cold waters from Alaska to Northern California. Unlike seals, whales and other cold-water marine animals, the Sea Otter has no blubber. It does have “pile,” an underlayer of nearly a million hairs per square inch. In comparison, humans have a sparse 100,000 hairs on their entire heads. The tight air spaces have four times the insulative value of blubber in whales and seals. Without the air spaces, the sea otters die of hypothermia.

SEA OTTER TECHNOLOGY AS PIPE WRAP

A recent Korean product is thickly-stitched glass with much tighter air gaps than conventional insulation. The manufacturer cites dramatically improved R-values. The tightly-stitched glass fibers have a similar density to the pile structure of the sea otter. The emergence tight-air insulation might also been seen in the promotion of lightweight concrete having a greater R-value than conventional concrete due to the predominance of tiny air pockets.

FINAL UNIQUENESS: COMFORT VENTILATION

- Section 4.2(4) of the Tropical Code calls for operable windows, louvers and doors that can be secured in the open position, and wiring for ceiling fans. This is to occupants to take advantage of cool outdoor conditions instead of air conditioning.

CREDITS AND REBATES

$110 Ductless Split Air conditioner Rebate for Energy Star listed $ units (Residential Only)
$50 Central Air conditioning Maintenance Rebate (Residential, Commercial and Military)
Commercial Rebate up to $840 on Fujitsu units installed in commercial applications.
In addition to HECO rebates, homeowners may also qualify for up to $1,500 in Federal Tax Rebates when they install energy efficient air conditions systems.
Energy Tax credits for Energy Star roofs and windows are available.

CODE COMPLIANCE AND PV TRAINING

- The ICC will provide code compliance training throughout Hawaii August 17-21 2009.
- CNMI may consider partnering with Guam and hiring an ICC trainer to conduct all-day code compliance classes.

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STEALTH BOMBERS
LOTUS LEAVES

QUESTIONS?

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