Is Energy Efficiency Being Overlooked as a Carbon-Abatement Solution?

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Are We at a Critical Stage?

- Earth’s highest mean surface temperature ever recorded
- Maui wildfires
- First tropical storm to reach California in 135 years
- Reliance on RECs and offsets?
- Too much trust in “carbon accounting”?
- Resistance to the rising cost of energy de-carbonization!
How Long Will Climate Solutions Take to Mature?

- Fusion?
- Fission reactors acceptable to the public?
- Seasonal/long-duration storage?
- Deep energy efficiency?
How Long Will Climate Solutions Take to Mature?

- Fusion - 3 decades?
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How Long Will Climate Solutions Take to Mature?

• Fusion - 3 decades?
• Fission reactors acceptable to the public - 15 years?
• Seasonal/long-duration storage - 20 years?
• Deep energy efficiency - 5 years!
Key Factors Enable *Deep* Energy Efficiency

- **Technology**: 49%
- **Attitude**: 51%
Engineers Challenged Culture of “Best Practices”

For example...

“more is better”

“___ is a standard design practice”

“always done that way”
What Is “Deep” Energy Efficiency?

“Deep” means challenge status quo assumptions and practices:

- A “good” energy project yields **10-15% efficiency improvement**
- A **3-year payback** is a “good” energy efficiency project or retrofit
- “**More is better**” when it comes to ventilation, exhaust, and lumens
- **RECs and offsets** are a credible alternative to an efficiency upgrade.
What Is “Deep” Energy Efficiency?

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- **Right-sizing** when it comes to ventilation, exhaust, and lumens
- RECs and offsets are temporary outsourcing of de-carbonization, which is **no substitute for a permanent efficiency upgrade**.
Three Forms of Financing

- “Energy bonds” 15 year revenue bonds
- Internal borrowing from cash reserves
- Different design priorities for new construction.
Building Organization and Massing
Life-Cycle Design Concepts
Structural and Foundation Systems
Building Mechanical Systems
Lighting Design Standards
Management of Solar Heat Gain
Roofing and Flashing
Site Development
Exterior Cladding and Interior Finishes
Priorities and Trade-offs
Benefits and Cost-Control Strategies
Results

www.youtube.com/watch?v=6tK9MYwwPcI
What Evidence Do We Have That These Strategies Work?
Three Decades of Energy Efficiency

- Business as usual
- Prioritized "deep efficiency"
- Adopted goal: LEED Gold
- American College & University Presidents' Climate Commitment
- Thermal energy storage
- Adopted goal: Beat Title 24 by 30% in new construction
Three Decades of Energy Efficiency

- 1990: Adopted goal: Beat Title 24 by 30% in new construction
- 2000: Thermal energy storage
- 2005: LEED Gold
- 2010: LEED Platinum
- 2012: U.S. EPA Climate Leadership Award
- 2012: Prioritized "deep efficiency"
- 2015: Inaugural partner President Obama’s Better Buildings Challenge
- 2016: American College & University Presidents' Climate Commitment

Source + Site Energy (billions of BTUs)
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- Would have been consumed without measures indicated
- Actually consumed (FY2023 projected)
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Source + Site Energy (billions of BTUs)


Would have been consumed without measures indicated
Actually consumed (FY2023 projected)

50.5%
## Cross-Checking Evidence that these Strategies Work

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Most Co-Benefits Yield Additional Economic Savings

- Real-time commissioning and rapid fault-detection
- Laboratories are safer
- Longer service life for reduced-speed, cooler mechanical components
- Cleaner indoor air and improved infection control
- Reduced costs for chillers, boilers, upstream infrastructure
- Avoided carbon costs
- Reduced operations and maintenance expense
- Deferred maintenance fixed/funded through energy savings
- Improved reliability of research environment.
Results and Conclusions

- Campus doubled size in 3 decades, but consumes no more energy
- Deep energy efficiency proven viable
- Zero budget augmentation for energy efficiency
- Many co-benefits attained in addition to energy savings
- **The lowest cost form of de-carbonization possible – ZERO!**
Life-Cycle and Sustainability Design Standards and Costs


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