Opportunities in Energy Efficiency: Green Building and the Industrial Sector

USAID's Energy Efficiency for Clean Development Program (EECDP)

January 12-13, 2015

Washington, D.C.

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Opportunities in Energy Efficiency

Green Buildings: Setting the Context

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Why Green Buildings?

From an energy, climate, and environmental impact perspective, the rationale for addressing buildings is clear

BUILDINGS =

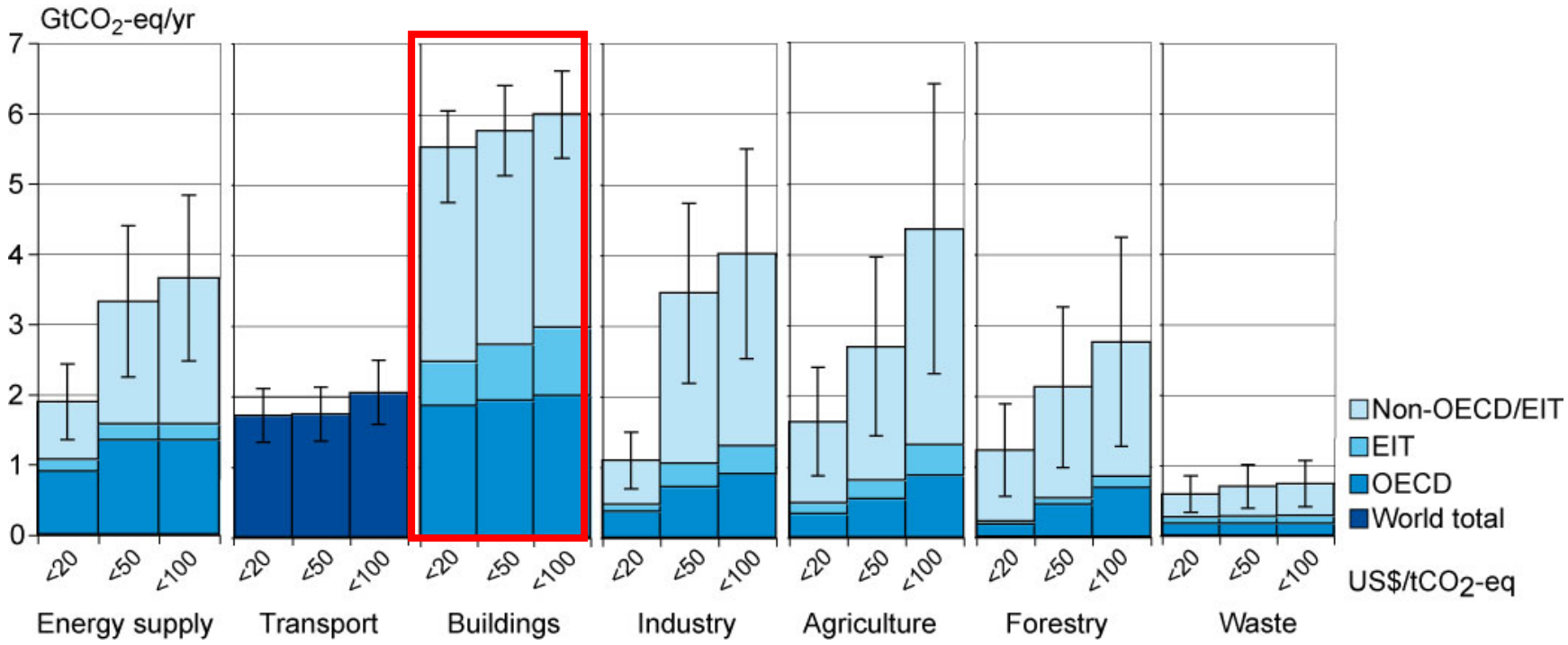
ENERGY CONSUMPTION =

BURNING FOSSIL FUEL =

GHG/pollutant emissions

Buildings Offer Attractive GHG Mitigation Opportunities

Reducing Impacts from buildings is one of the most cost-effective and achievable EE / GHG mitigation opportunities



Reference: IPCC

The Imperative and Opportunity in Developing Countries

- Globally, buildings are responsible for approximately 40% of energy use and up to 30% of global greenhouse gas (GHG) emissions.

- This percentage will increase substantially, as current projections indicate that 70 percent of the world's population will live in cities by 2050.

- Most recent growth in building stock, and continued new construction will occur in developing countries. For example, more than half of the world's new buildings are constructed in Asia every year, and the building sector accounts for about one-quarter of Asia's final energy consumption.

- As buildings are at the core of urban landscapes, it is imperative to align building energy and resource use with economic, social, and environmental objectives.

What is a Green Building?

Green buildings can be defined in a variety of ways, but two definitions are most useful for considering positive interventions, and for addressing energy:

- A building that is designed and built “green” according to established certification standards, with benefits across energy use, water use, emissions, materials, and indoor air quality.

- A building (green or conventional) that uses substantially less energy either through adherence to building energy codes at the design stage, or through aggressive operation and management strategies once built and operating.

Nature of the Opportunity – Intervention Types

New Buildings

1. **Building energy code** development and uptake, to embed energy efficiency into new building design and construction.

2. Establishment and uptake of holistic **green building design and certification** models, which incorporate energy use and other criteria.

Existing Buildings

1. Development of **energy performance benchmarking** rating systems/tools to support assessment and improvement across the large existing building stock, and to support energy efficiency and green building certification.

2. Establishment of **green building certification for existing buildings**, and/or standalone building **energy efficiency certification** programs.

Benchmarking Energy Performance

What is benchmarking?

- Relative ranking based on energy performance. It provides a comparison between your building and other similar buildings.
- Provides a numerical **common metric** to allow for buildings to compare energy use in an easy to understand format.
- Can provide the foundation for a certification program, to support national regulations, or “voluntary” market-based programs.

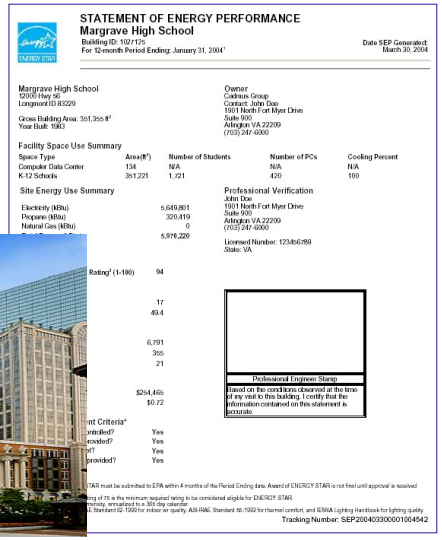
How is Benchmarking Useful?

Is Your Building Performing Well?
The Importance of Clear, Understandable Metrics

Fuel Efficiency

Km per Liter of Fuel

Is 0.25 kWh/SM/YR high or low for a building?



STATEMENT OF ENERGY PERFORMANCE
Margrave High School
Building ID: 102123
For 12-month Period Ending: January 31, 2004[1]

Date SEP Generated: March 30, 2004

Margrave High School
12000 Hwy 96
Longmont ID 83229

Gross Building Area: 351,356 ft²
Year Built: 1983

Owner
Cadmus Group
Contact: John Doe
1901 North Fort Myer Drive
Suite 900
Arlington VA 22209
(703) 247-6000

Facility Space Use Summary

Space Type	Area(ft²)	Number of Students	Number of PCs	Cooling Percent
Computer Data Center	134	N/A	N/A	N/A
K-12 Schools	351,221	1,121	420	100

Site Energy Use Summary

Electricity (kBtu)	5,649,801
Propane (kBtu)	320,419
Natural Gas (kBtu)	0
	5,970,220

Professional Verification
John Doe
1901 North Fort Myer Drive
Suite 900
Arlington VA 22209
(703) 247-6000

Licensed Number: 123456789
State: VA

Rating[2] (1-100) 94

17
89.4

6,791
355
21

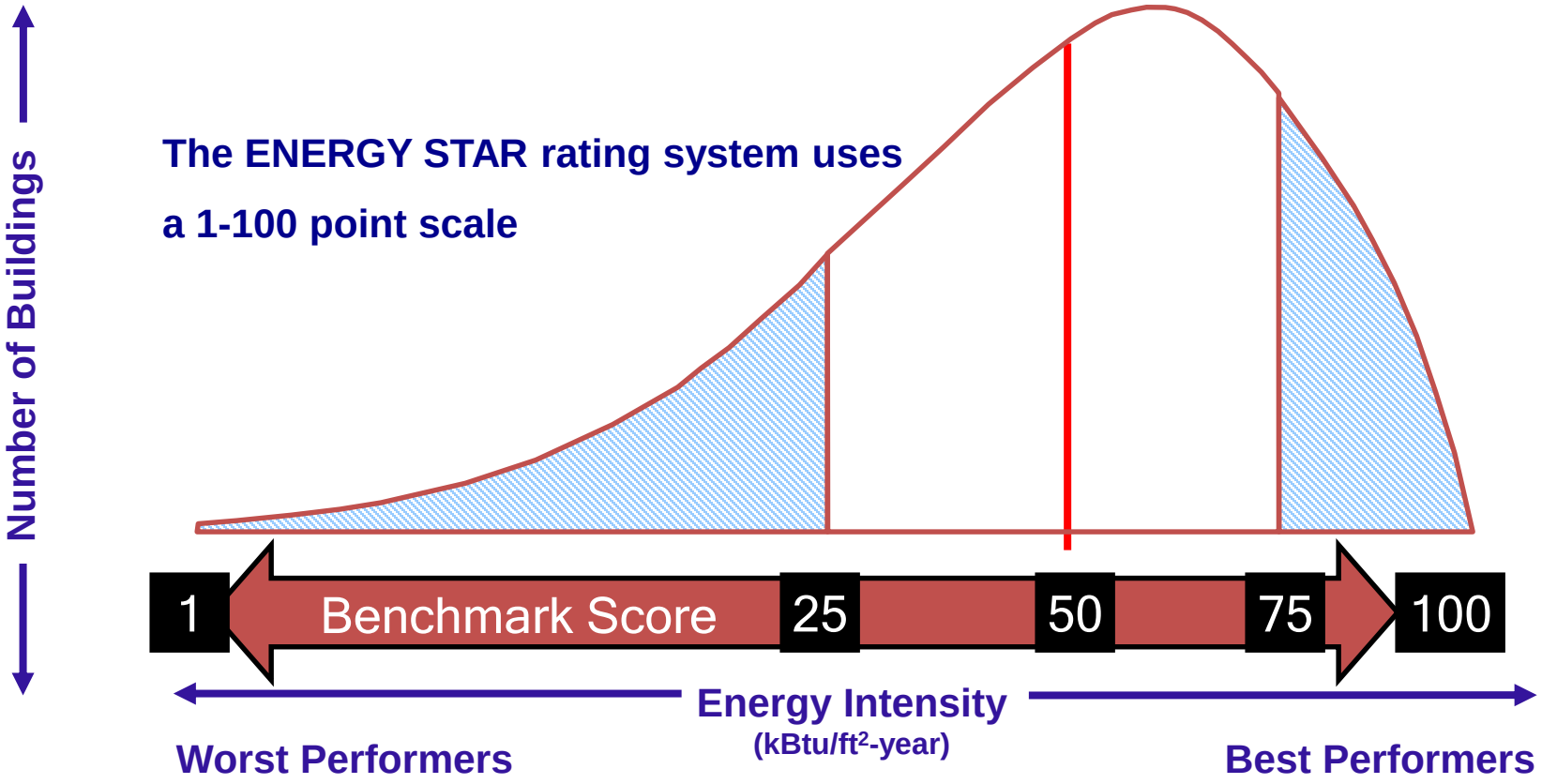
$254,485
$0.72

Professional Engineer Stamp
Based on the conditions observed at the time of my visit to this building, I certify that the information contained on this statement is accurate.

nt Criteria*
ntrolled? Yes
ovided? Yes
e? Yes
provided? Yes

TAR must be submitted to EPA within 4 months of the Period Ending date. Award of ENERGY STAR is not final until approval is received
ing of 75 is the minimum required rating to be considered eligible for ENERGY STAR.
ntensity, annualized to a 365-day calendar.
E Standard 62-1999 for indoor air quality, ASHRAE Standard 55-1992 for thermal comfort, and IESNA Lighting Handbook for lighting quality.
Tracking Number: SEP20040330000001004542

Benchmarking Tools Are Fundamental to Enabling Energy Efficiency in Existing Buildings



Impacts Achievable in Developing Economies - *Scale*

The developing world represents the largest future growth in new buildings and existing buildings, and the most important opportunity to address building energy and environment impacts now:

- Establishment of energy efficiency and green building standards and certification now will affect enormous new building stock creation, helping to lock in energy savings and reduced environmental impacts.

- Design and use of energy performance benchmarking will facilitate rapid and substantial immediate energy savings in large existing building stocks.

- 30-50% in energy savings is the scale of the opportunity both in new building design and energy performance improvement in existing buildings. With energy use from buildings growing substantially as a percentage of total energy use in many developing countries, actions taken now will have substantial results in the future.

Impacts Achievable in Developing Economies: *Cost Savings / Return on Investment (ROI)*

- Energy efficiency is that it's one of the most cost-effective environmental impact reduction strategies available.

- Most large high-rise buildings can save 15-30% in energy use (and costs) if relatively easy operational strategies are put in to place – this can be done via capacity building and training initiatives, with no/low capital expenditure.

Building/Portfolio	Manager	Annual Energy Savings
Shanghai Information Tower	Jones Lang LaSalle	**15%**
Jin Mao Tower	J.M. Imtech	**20%**
New Town Mansion	Shanghai Hongqiao Economic/Tech Development Property Co.	**15%**
Urbn Hotel	Space Development	**27%**
Jiushi Building	Shanghai Pujiang	**30%**

- ROI potential is substantial. Through a combination of these low-cost measures and moderate equipment investments, energy efficiency can be more profitable than core business returns in many cases.

Impacts Achievable in Developing Economies – *Emissions and Ancillary Benefits*

- Energy efficiency has a direct effect on emissions, as most energy comes from thermal energy production.

- This brings substantial “co-benefits” vis-à-vis local air pollution in addition to GHG reductions. Impact reduction example from the *USAID US-China Green Buildings Partnership*:

  - 4,665 Chinese building management engineers/operators trained
  - Energy efficiency actions taken by SBP-trained managers generated energy savings of 3.4 Billion kWh within buildings under their management
  - GHG emission reductions of 2.82 million MtCO2e, equivalent to planting 72.4 million new trees

- Access to Energy / Resource Demand: If sufficient energy efficiency is undertaken across an economy or region, you reduce the need for additional power plant construction while expanding availability of energy, creating a virtual power plant (energy efficiency power plant).

Challenges

- Complete or partial lack of design or performance standards for energy use in buildings, and/or weak compliance or enforcement of standards.

- Policy targets without any enabling mechanisms to help the market learn and implement (e.g., energy use targets without a benchmarking system, or related capacity building and training programs).

- Instead of market-based strategies, a typical policy sequence includes:
  - Mandatory “energy audits” that are expensive, highly engineering based and technical, lengthy, with no action steps, cost analysis, sequencing recommendations, or implementation tools and roadmaps.
  - Codes with weak enforcement or support.
  - Programs tied closely to weak environmental agencies with no implementation expertise, staffing, or understanding of how to use market forces.
  - Lack of green building or EE certification programs

- Too early a focus on equipment / technology solutions which are capex heavy (high barrier), when equivalent savings can be achieved (up to ~30%) via capacity building for energy management, using no/low-cost solutions.

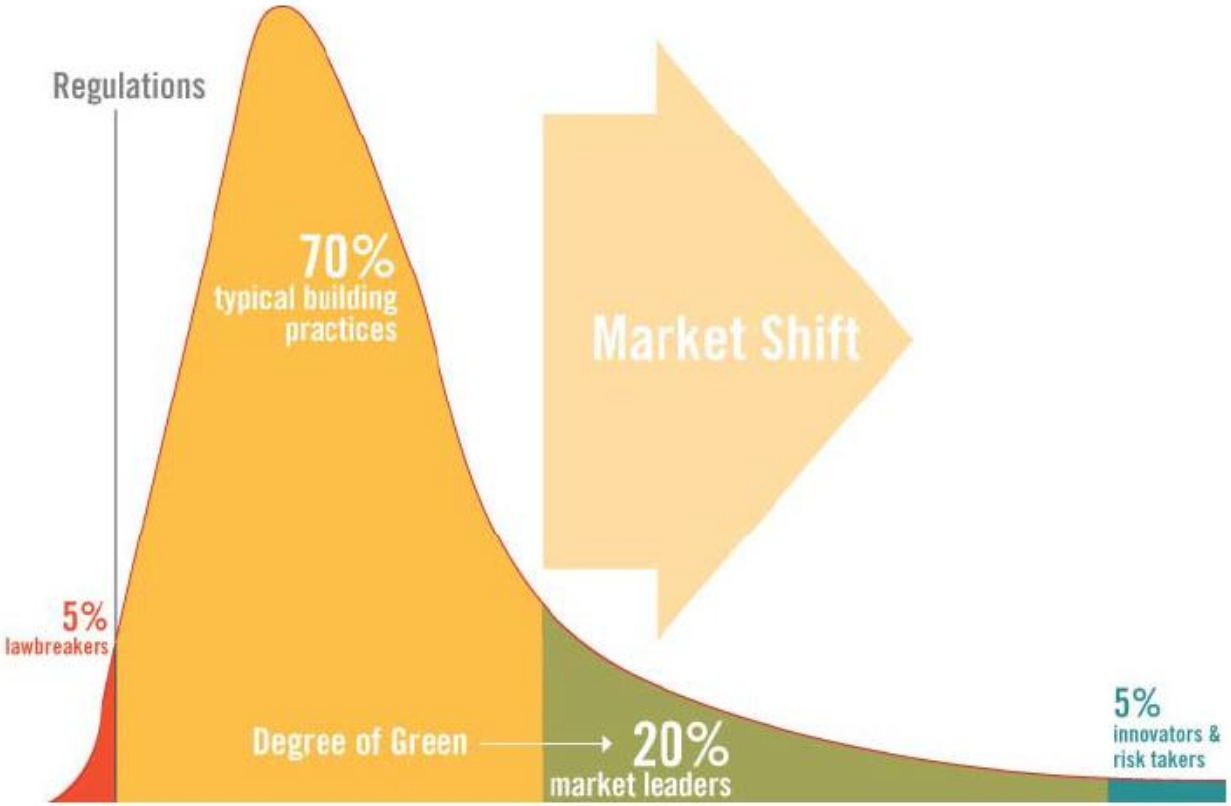
Finance Challenges

EE Finance should be ideally addressed within programs/initiatives that incorporate a mix of market outreach, capacity building, focus on low-cost operational improvements, and technology investment (finance).

- Engage building owners (large portfolios most effective) in documenting and understanding their energy use, and in understanding phased options for improvement, from initial operational improve through to capital investments.

- Rapid initial savings from no/low-cost improvements can provide financial savings to support moderate/high-cost improvements.

- For financing higher cost equipment/retrofit measures, best successes have come from programs that engage the financial industry directly, and broker finance partnerships with borrowers.
  - Banks do not typically understand EE, or how to lend for it. Educating lenders on how to lend to EE can be effective.
  - Providing building owners with objective information on the potential savings, and return on bank finance, can spur demand for finance.

Leverage Market-based Mechanisms

Codes and standards can ensure minimum acceptable energy use, while market mechanisms (green building/EE certification) will help drive much higher levels of green performance and energy savings.