



Technology and Practice: Integrated Mechanisms to Support Sustainable Energy Use

Prepared for:

**Expert's Group on R&D Priority Setting
and Evaluation (EGRD)**

**Energy Technology R&D Needs of
Emerging Economies**

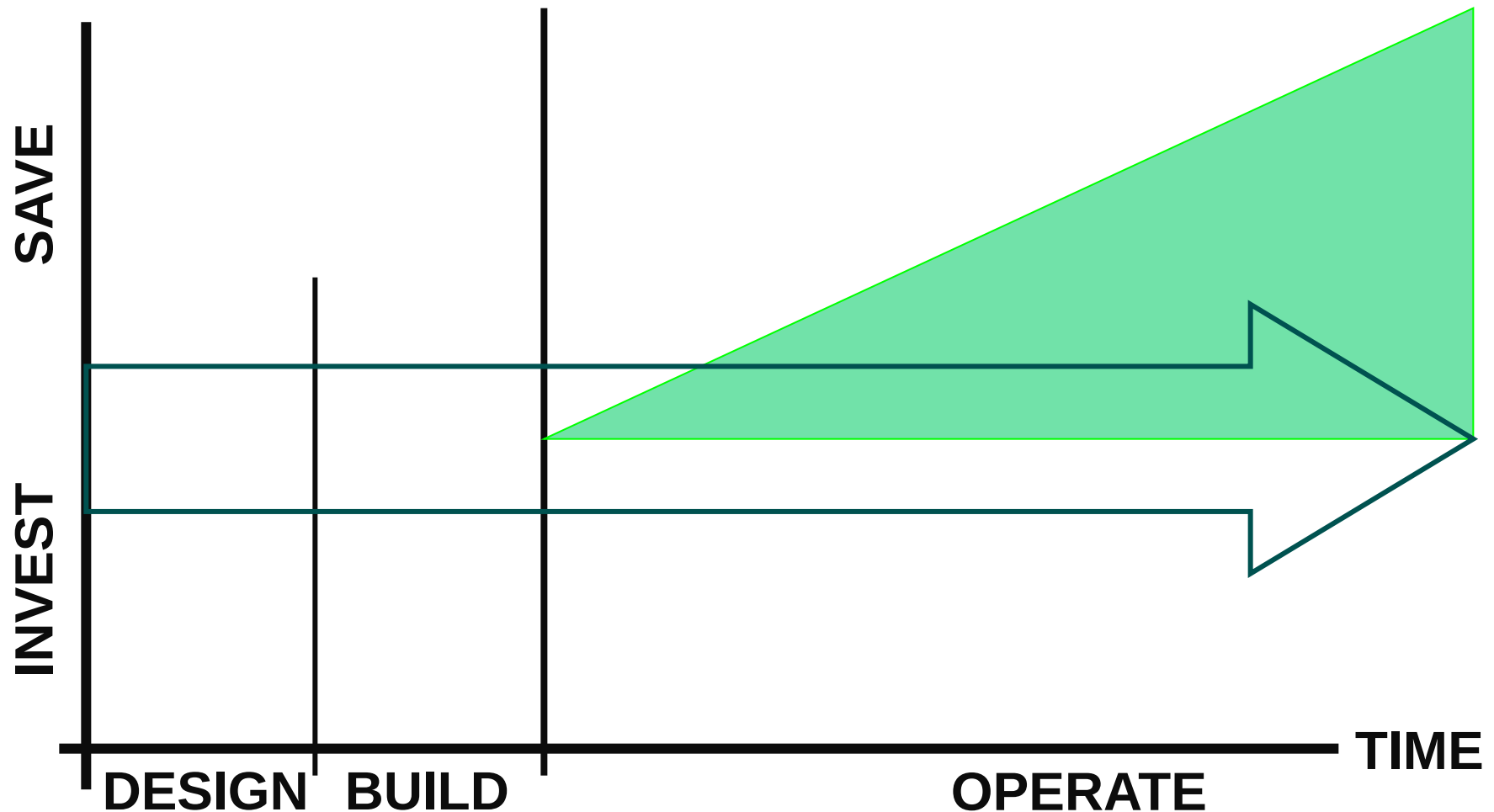
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Key Ideas

- Technology can drive energy savings
- People who manage technology can drive energy savings
- Problems during planning and installation of technology within facilities can result in non-optimized systems that do not save energy
- There are too many energy-intensive facilities (buildings, industrial sites, etc.) already built and operating to be addressed only through new technology and retrofits
- Integrated policy/program frameworks that address both technology and energy management and operations are critical to ensuring maximum energy efficiency

Stating the Obvious: Operation Matters

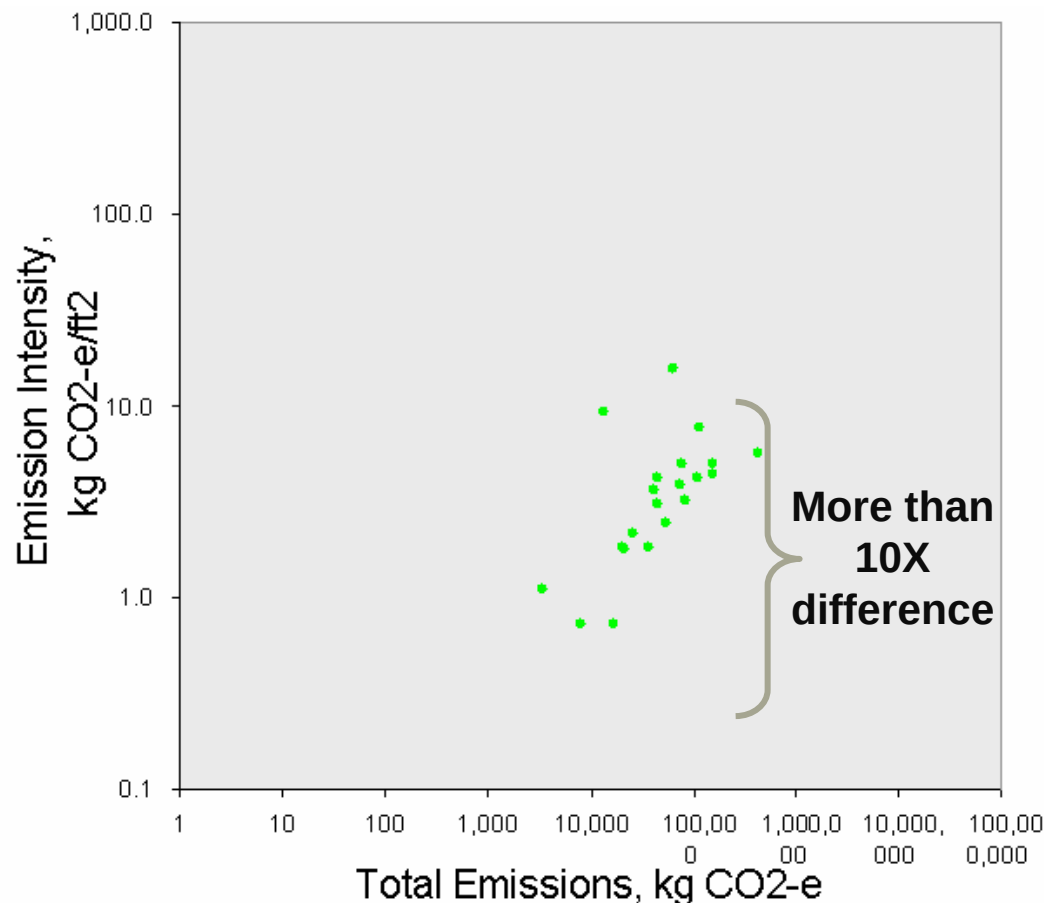
Energy Saving Begins Only After a Facility Begins Operating...



Challenge: Sites Operate Differently



- Moderate variation in energy intensity at similar facilities is expected.
- However, these variations sometimes point to much larger problems in operations and management.
- This graphic shows a single company's energy intensity across a **homogenous** set of space types that should operate similarly, but do not.



Typical Problems in Application of Technology, and Operations: Examples from Buildings



Typical Findings:

- 60% fan systems oversized by 60%.
- Chillers oversized 50% to 200%.
- Improper installation and poor maintenance.
- Buildings can exceed code, but not perform as intended.
- “Class of 1999, 2000, and 2001” research (US EPA) of high performing buildings found technology is not driving great performance.

Studies Show Disconnect Between Technology and Performance

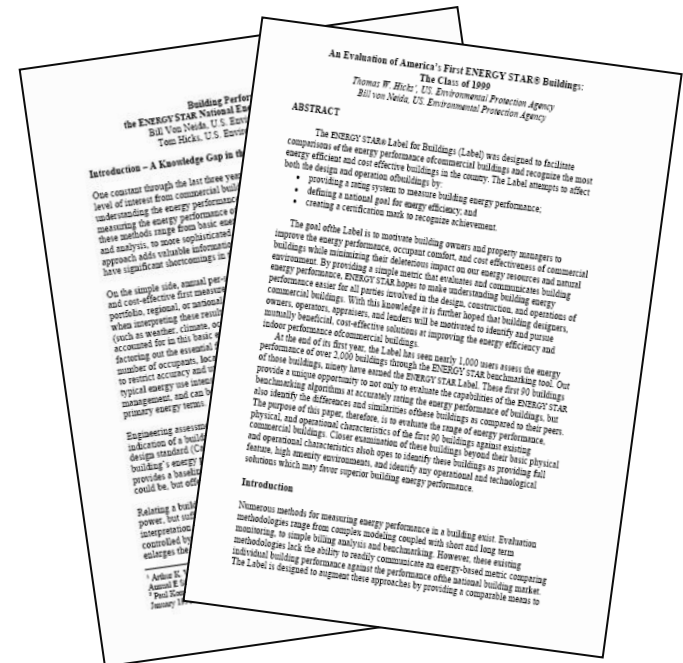
Findings:

- The most energy-efficient buildings in the US (40% more efficient than average) typically **do not have** the most efficient technology.
- These buildings **do have** aggressive operations and maintenance programs.

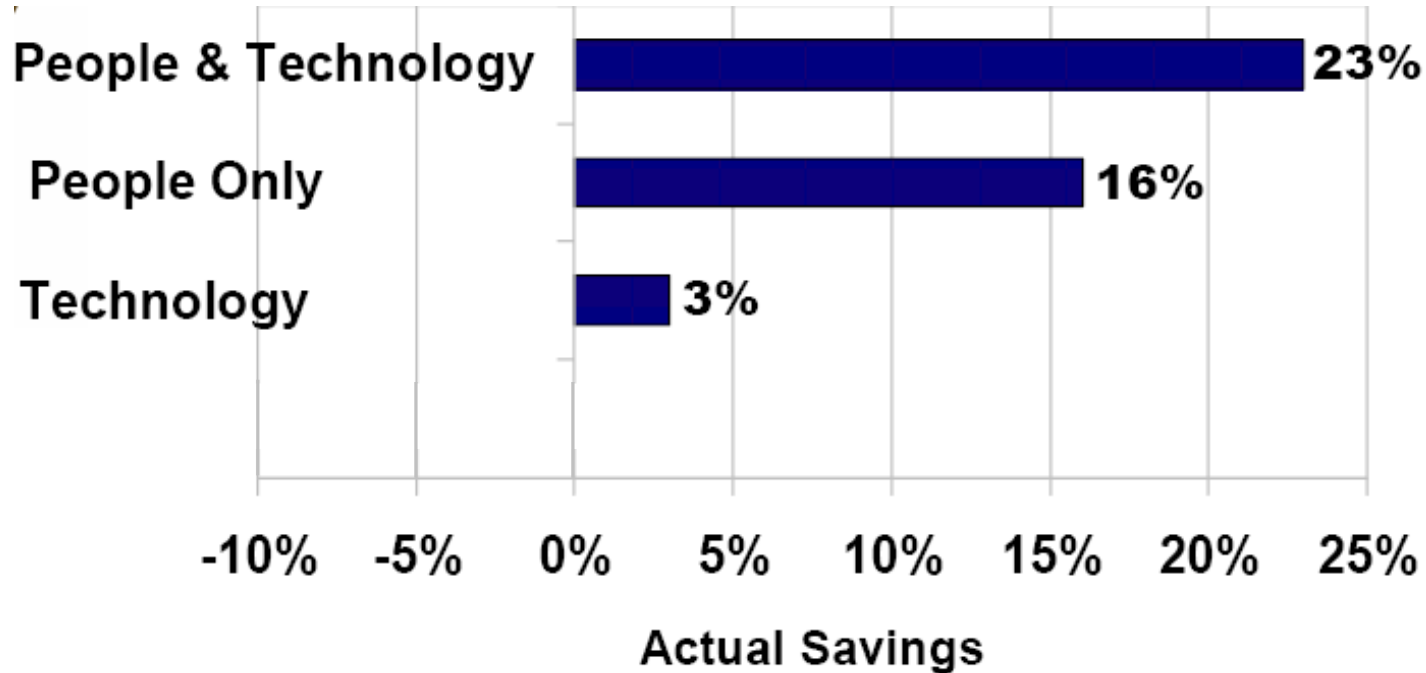
Possible Interpretations:

- Technology may not be the first place to look for savings.
- Buildings with less efficient mechanical systems and building materials can still achieve savings and high performance.
- Buildings with all of the right equipment can still be operated inefficiently.

US EPA Studies on high performing buildings, 1999-2001



Industrial EE Example: People and Technology



Source: Natural Resources Canada – Dollars to Sense Workshop

- This case study involved implementation of three variations in energy saving strategies across three similar sites owned by the same company.

Solutions: Savings Approaches Can be Integrated

Example: a large petrochemical facility in China



Measure Description	Type of Measure	Relative Implementation Cost	Relative Implementation Difficulty	NG Measure % Savings	Electricity Measure % Savings	RPP Measure % Savings	Coal Measure % Savings	Other Fuel Measure % Savings	Measure Life (Years)
Sub-Metering and Interval Metering	Control	Medium	Medium	5.00%	5.00%	0.00%	0.00%	0.00%	15
Integrated control system	Control	High	High	8.00%	8.00%	8.00%	8.00%	0.00%	10
HE Transformers	Equipment	High	High	0.00%	1.00%	0.00%	0.00%	0.00%	30
Energy Management Systems	Control	Low	Low	2.50%	2.50%	2.50%	2.50%	0.00%	5
Waste Heat Recovery	Auxiliary	Medium	Medium	15.00%	15.00%	15.00%	15.00%	0.00%	15
Seasonal Temperature Settings Adjustments	Control	Low	Low	7.00%	7.00%	7.00%	7.00%	0.00%	NA
Boiler right sizing	Operational	High	Medium	10 to 50%	0.00%	10 to 50%	10 to 50%	0.00%	20
Boiler load management	Operational	High	Medium	10 to 50%	0.00%	10 to 50%	10 to 50%	0.00%	20

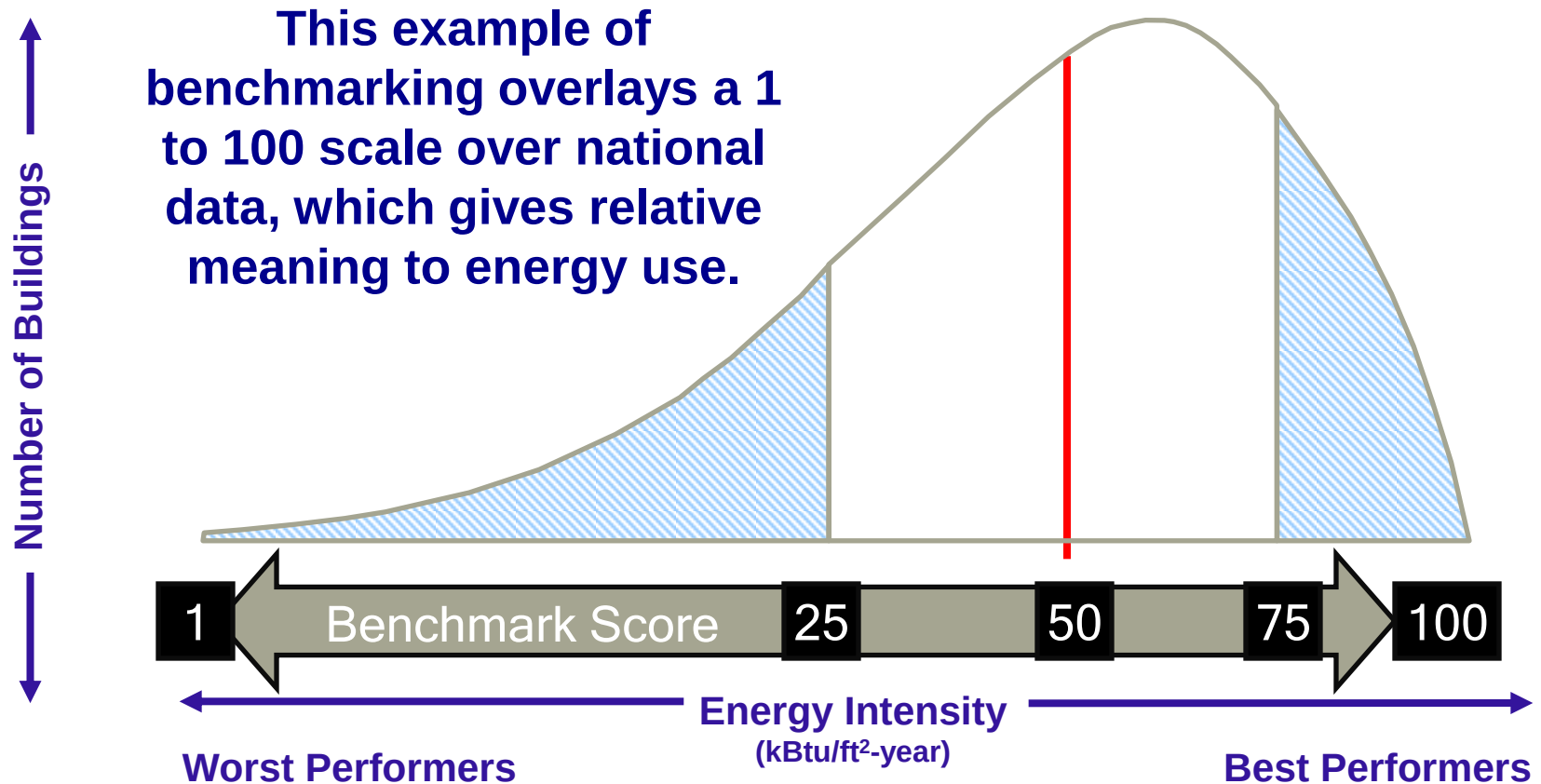
Solutions: Savings Approaches Can be Integrated

Example: a large petrochemical facility in China

Energy End-Use	Best Practice	Savings per year in 2015 (TCE)	Savings (% of 2015 energy consumption)
Whole Petrochemical Facility	Waste gas recovery	144,564	11.19%
	Long-cycle running technology	3,998	0.50%
	Waste heat recovery	2,142	0.27%
	Optimized facility water flow	362	0.05%
Whole Petrochemical Facility Total		155,135	12.00%
Steam Generating Equipment	Air preheater	6,257	0.79%
	Minimize deaerator vent losses	2,067	0.26%
	Efficient coking inhibitor	41	0.01%
Steam Generating Equipment Total		13,578	1.05%
Distillation Columns	Distillation column flooding predictor	3,865	0.46%
	Optimization of reflux ratios	1,039	0.13%
	Optimized operational condition of separation tower	937	0.11%
	Preheating of column feed	455	0.05%
	Add column insulation	378	0.05%
	Seasonal operating pressure adjustments	258	0.03%
	Avoid overpurifying product	254	0.03%
	Stripper optimization	74	0.01%
Distillation Columns Total		11,281	0.87%

Solutions: Performance Assessment Platforms

Example: Building Energy Performance Benchmarking



How to Achieve Integrated Energy Savings?



Some Observations:

- Industry engagement programs need to accompany R&D and new technologies.
- Holistic assessment platforms that do not only look at technology specifications will more effectively assess overall site energy use, and can provide useful comparisons (e.g., energy performance benchmarking).
- Subsidy and retrofit programs should be accompanied by technical assistance for improving operational energy use.
- The use of large-scale platforms that rely on strategic and limited use of government funds can result in large savings (e.g., US DOE and EPA voluntary programs: USD \$1 in program infrastructure investment by government = USD \$75 in savings to the economy)

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