

**United
Technologies**

Energy Efficiency in Buildings:

*Innovative Technologies and Increased Efficiency in
the Building Sector*

Robert J. Tierney, PE, LEED® AP

UTC Power

August 7, 2007

Abstract

This presentation includes an overview of the World Business Council for Sustainable Development Energy Efficiency in Buildings project. The scope of the project is to provide a comprehensive action plan to industry to achieve zero net energy buildings by 2050. The recommendations will be based on current facts and trends, analytical modeling, benchmarking and scenario planning. The project, which was launched in 2006, is co-chaired by United Technologies Corporation and Lafarge and is joined by ten leading Global 500 corporations in the building and energy sectors. The project's key themes of market perceptions that shape financial mechanisms and institutional barriers, holistic technical approaches, and behaviors and awareness are highlighted. Finally, the presentation provides an assessment on the role of equipment and energy efficiency improvements and standards in driving down overall energy consumption in the US in various commercial and consumer product areas.



Our vision
A world where buildings
consume zero net energy

zero

WBCSD Project: Energy Efficiency in Buildings



Industry call to action to achieve
zero net energy use in buildings in
cooperation with **key stakeholders**

Energy Use in America



In the last decade...

National electrical use
up 21%

Foreign oil dependence
up 47%

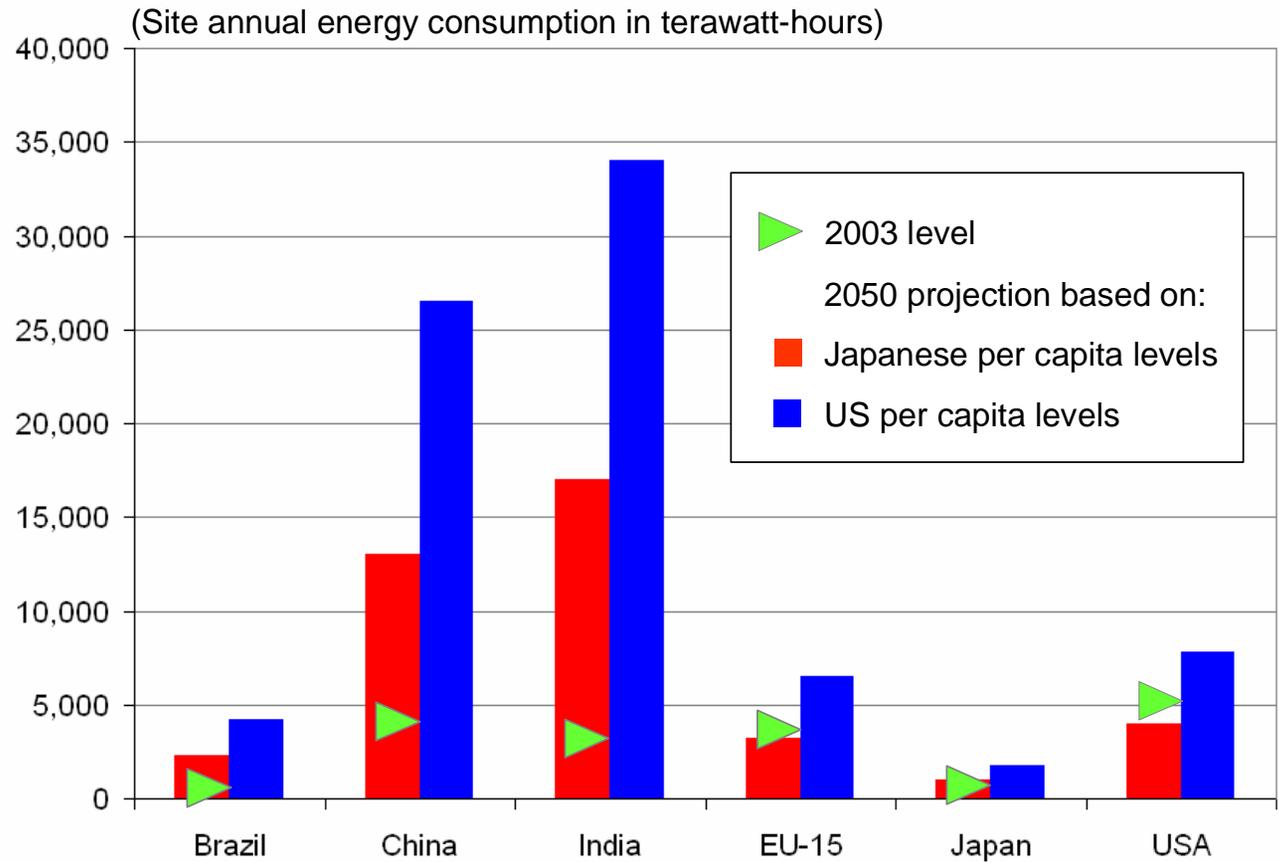
Buildings consume...

37% of total energy

68% of all electricity



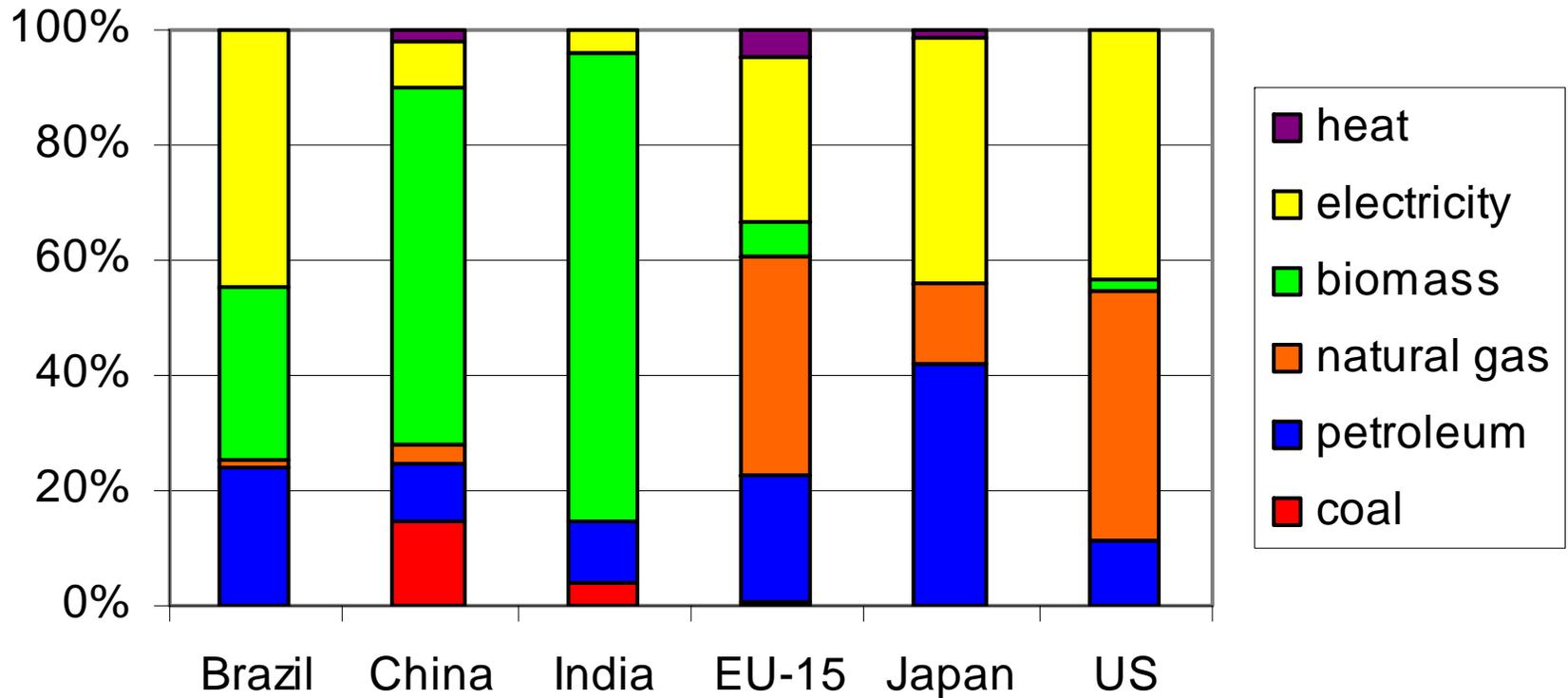
What if ?



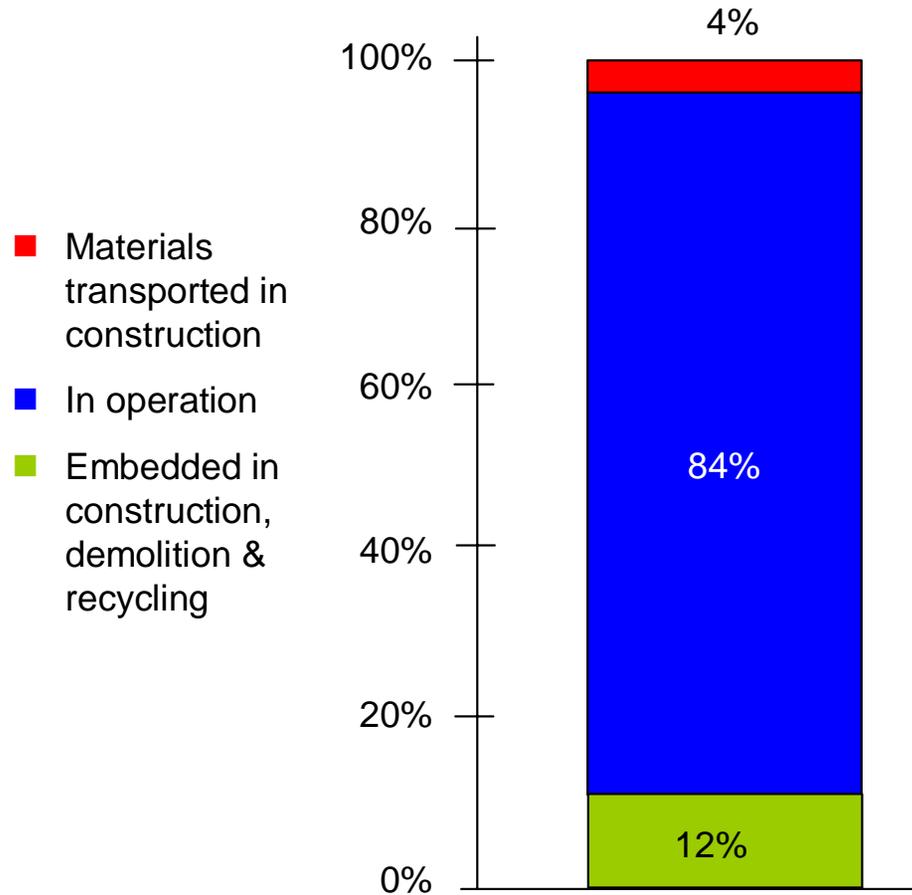
Where will energy come from?



Buildings' Site Energy by Fuel, 2003



Need for Life Cycle Thinking



Source: Technical University of Lund, Sweden (2000)

Project Co-chairs



- United Technologies Corporation (UTC)
- Lafarge
- World Business Council for Sustainable Development (WBCSD)

Why UTC?



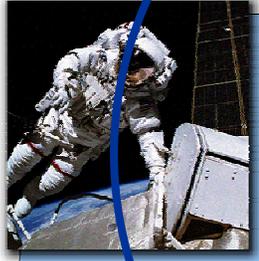
Pratt & Whitney



power solutions

aerospace systems

Hamilton Sundstrand



CARRIER



UTC Power



UTC Fire & Security



OTIS



SIKORSKY



building systems



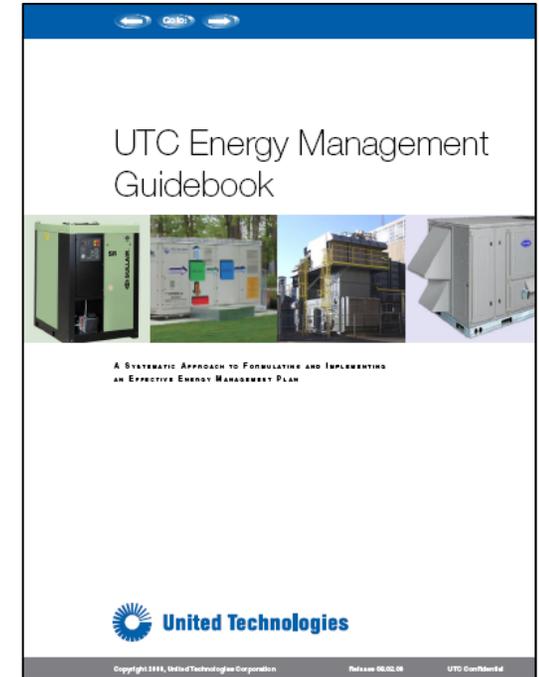
UTC Focus on Energy Efficiency



2007 – 2010: 12% Absolute GHG Reduction

"Conservation is the fastest, quickest, cheapest, most reliable way to solve the global warming problem ..." he told the approximately 300 MIT students in attendance. "An immediate solution to the energy issues we face today is conservation, which can be achieved through greater efficiency and improved processes."

George David at Massachusetts Institute of Technology's Sloan School of Management; Feb. 22, 2007



United Technologies Corporation 2006 Corporate Responsibility Report

At the Intersection

Objective 2:

Invest \$100 million over the next four years in energy conservation projects, including co-generation systems.

Practicing What We Preach



Otis Center - China



- 25% energy reduction
- 4% premium on initial cost
- Minimized water, materials usage
- USGBC LEED® Gold rating on track
- Materials of Concern Demonstration Project
- 1st UTC green factory in China
- Full occupancy June 2007
- Involves products and expertise from Otis, Carrier, UTCF&S, UTRC, Automated Logic

Contributing Organizations



Co-Chairs



Secretariat



Active Core



Sponsoring

Arcelor

BP

ITT

RioTinto

Discussion: Arup, GE, IKEA, JCI, Nexity, Owens Corning, Allianz, Shell, Skanska, Swiss Re ...

Institutions: Int'l Energy Agency, UN Environment Program, Lawrence Berkeley National Labs, Int'l Institute for Energy Efficiency Economy, PassivHaus, Renewable Energy and Energy Efficiency Partnership, China MOC...

Project Plan

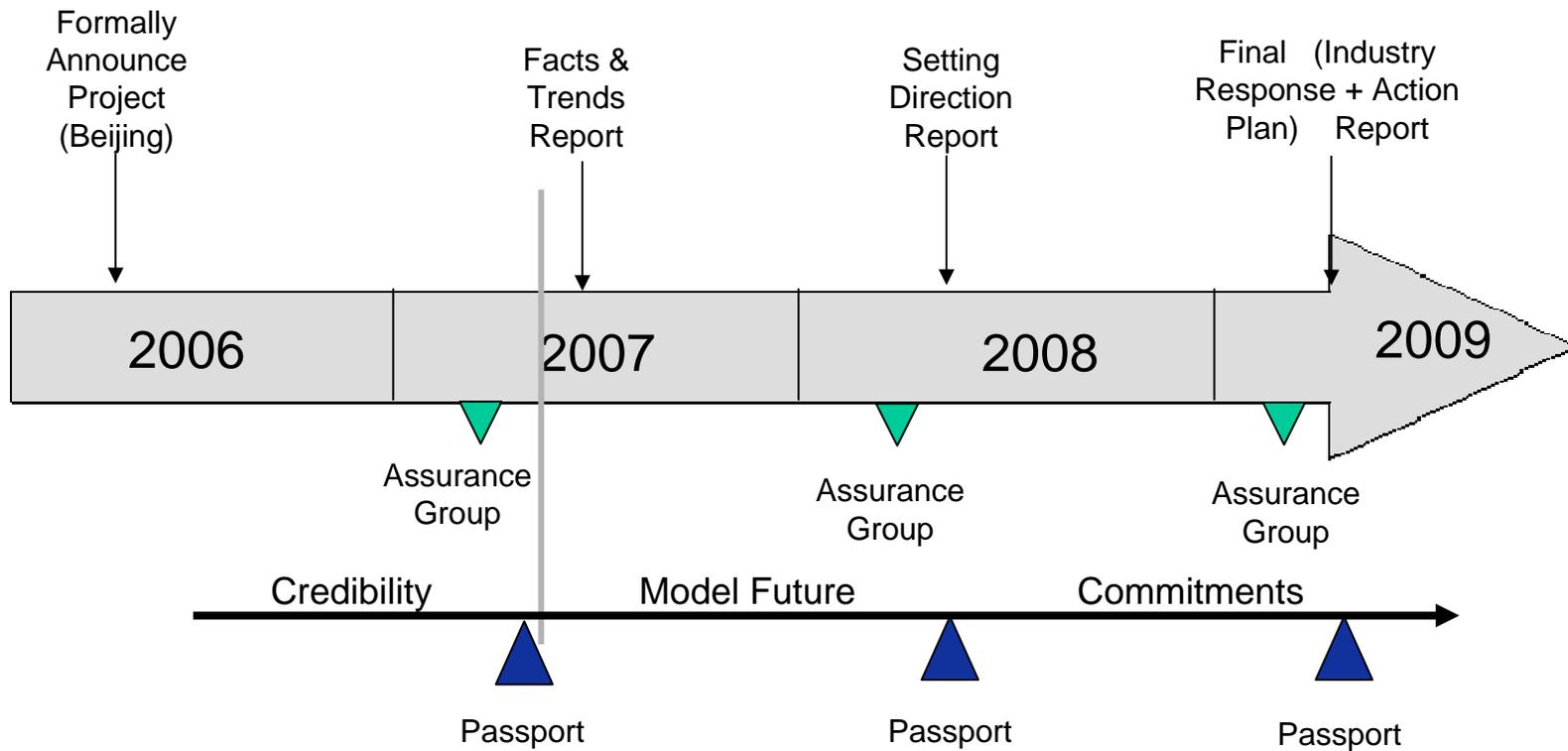


May 2007: Define and promote the current state and challenges to business in the building industry;

May 2008: From scenarios develop and promote a draft action plan;

June 2009: Gain stakeholder commitments to measurable action and promote a validated final action plan.

Detailed Work Plan





Klaus Töpfer, Chair, former UN Undersecretary General

Eileen Claussen, Pew Center

Thomas Johansson, Lund University

Vivian Loftness, Carnegie Mellon University

Shin-ichi Tanabe, Waseda University

JIANG Yi, Tsinghua University

Facts & Trends Key Findings



As it relates to energy efficiency and buildings ...

Market
Perceptions

Low awareness of impact & cost of green
No one is taking the lead
Know-how and experience is lacking

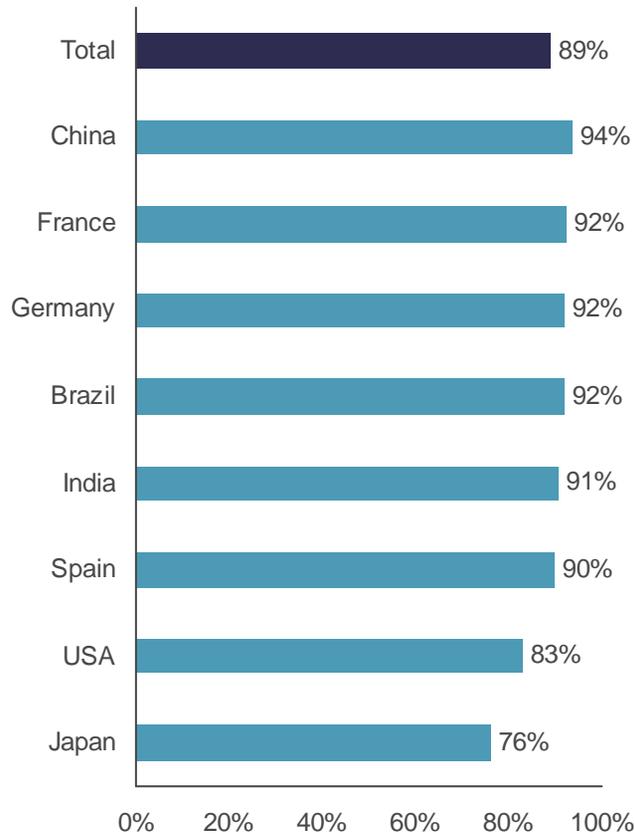
Business
Levers

Broadly pursue holistic approach
Introduce new financial instruments
Legitimize energy efficiency as investment criteria
Influence behavior and cultural lifestyles

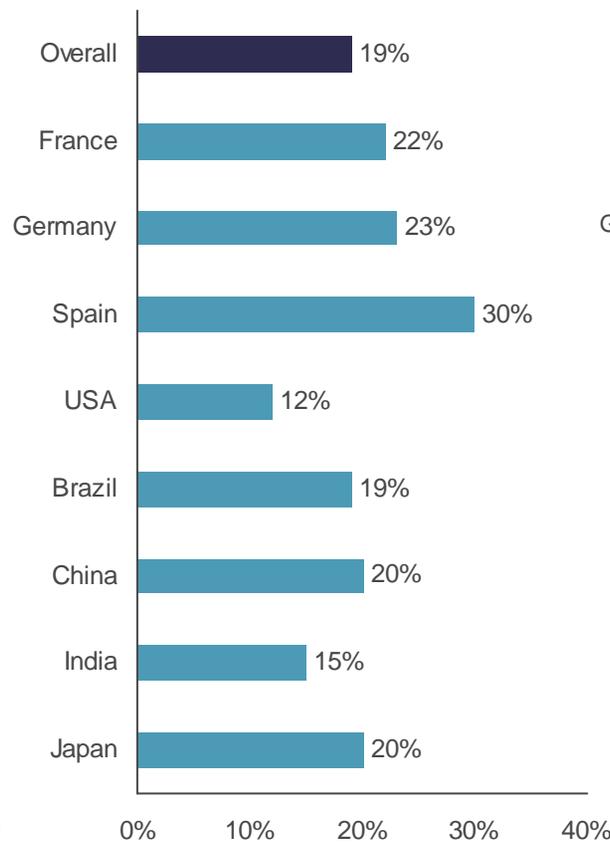
Misconception - Awareness



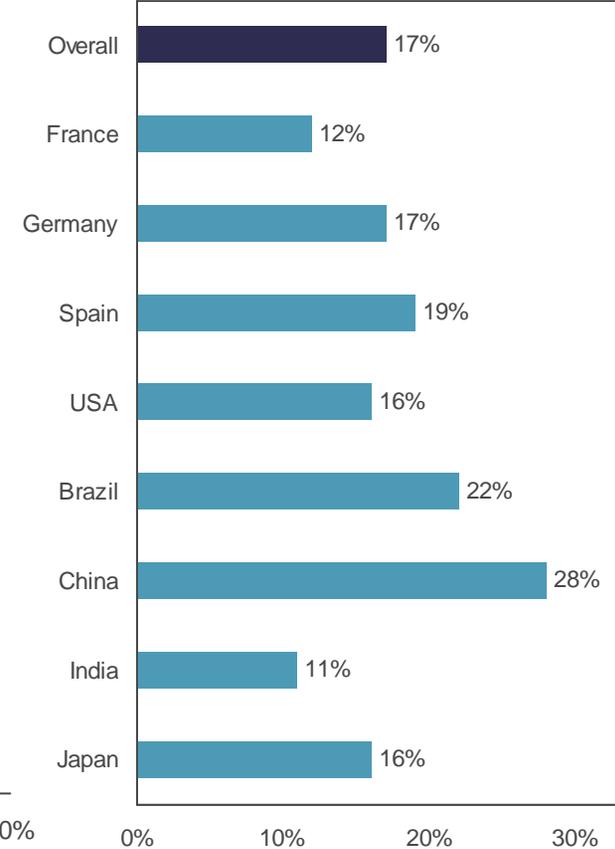
Q3. **How important** do you think green/ sustainable buildings are in helping to protect the environment?



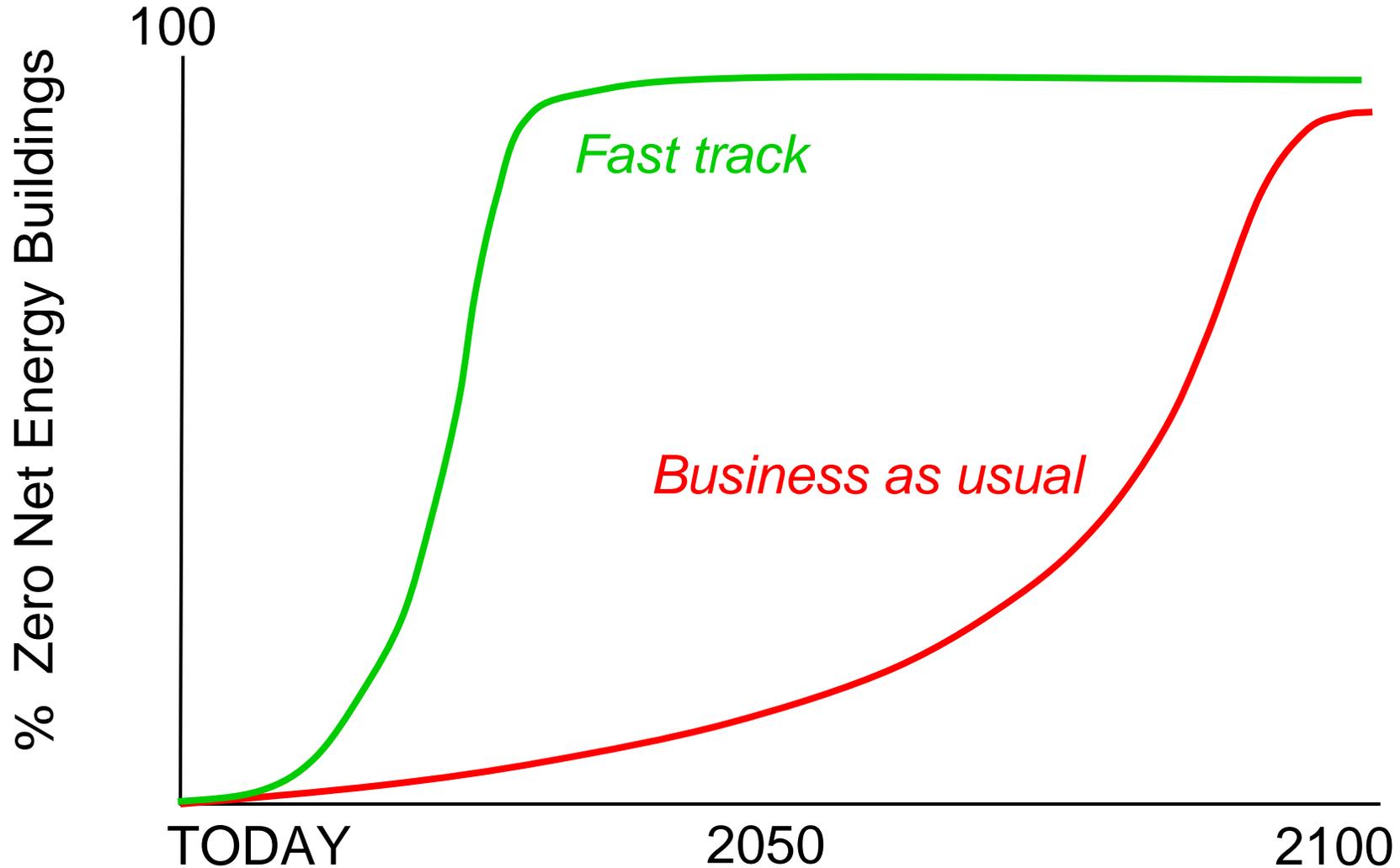
Q10. What **percentage of CO₂ emissions** do you think buildings give rise to (directly and indirectly)?



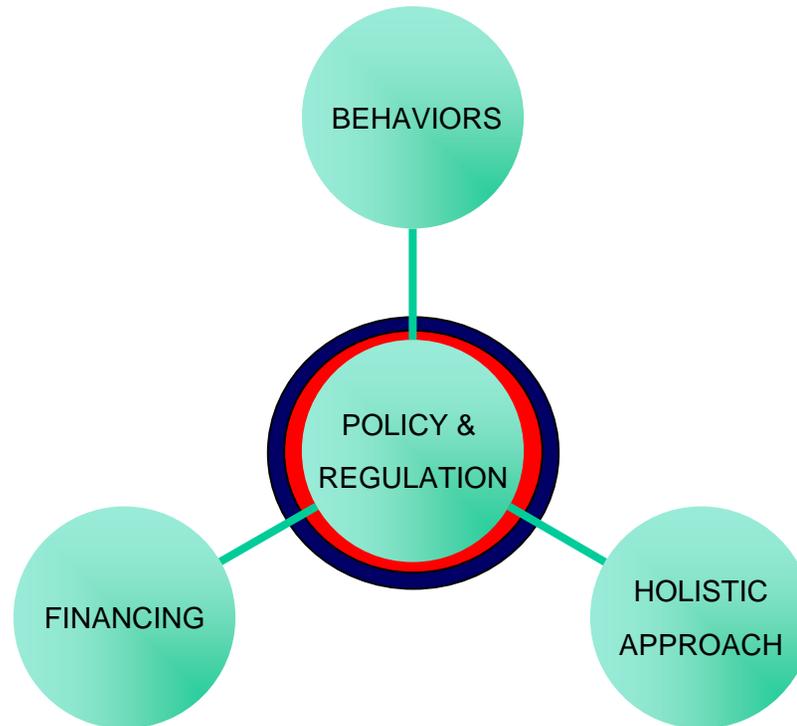
Q9. How much do you think a certified sustainable building would **cost to build** relative to a normal building?



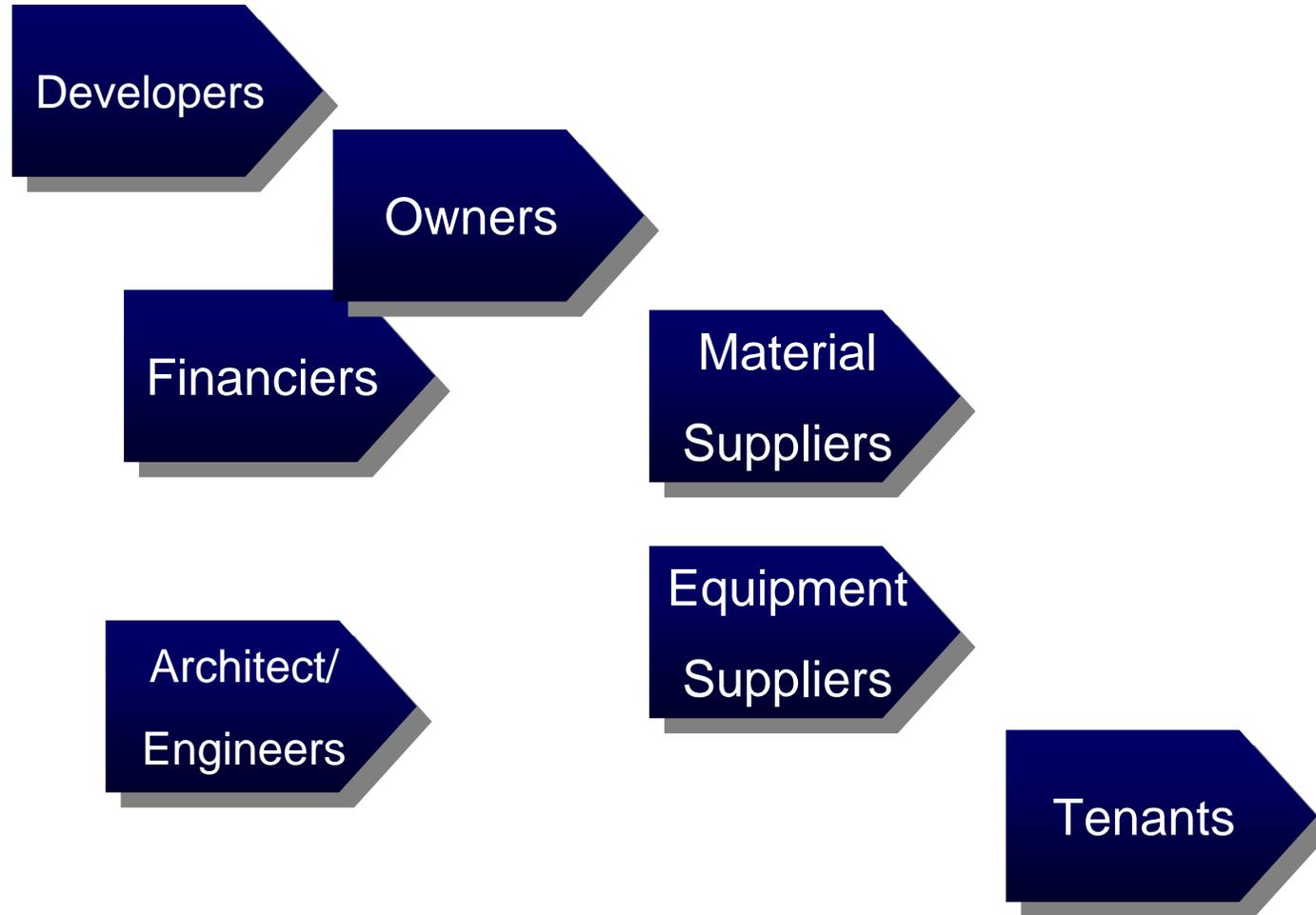
Getting on the Right Path



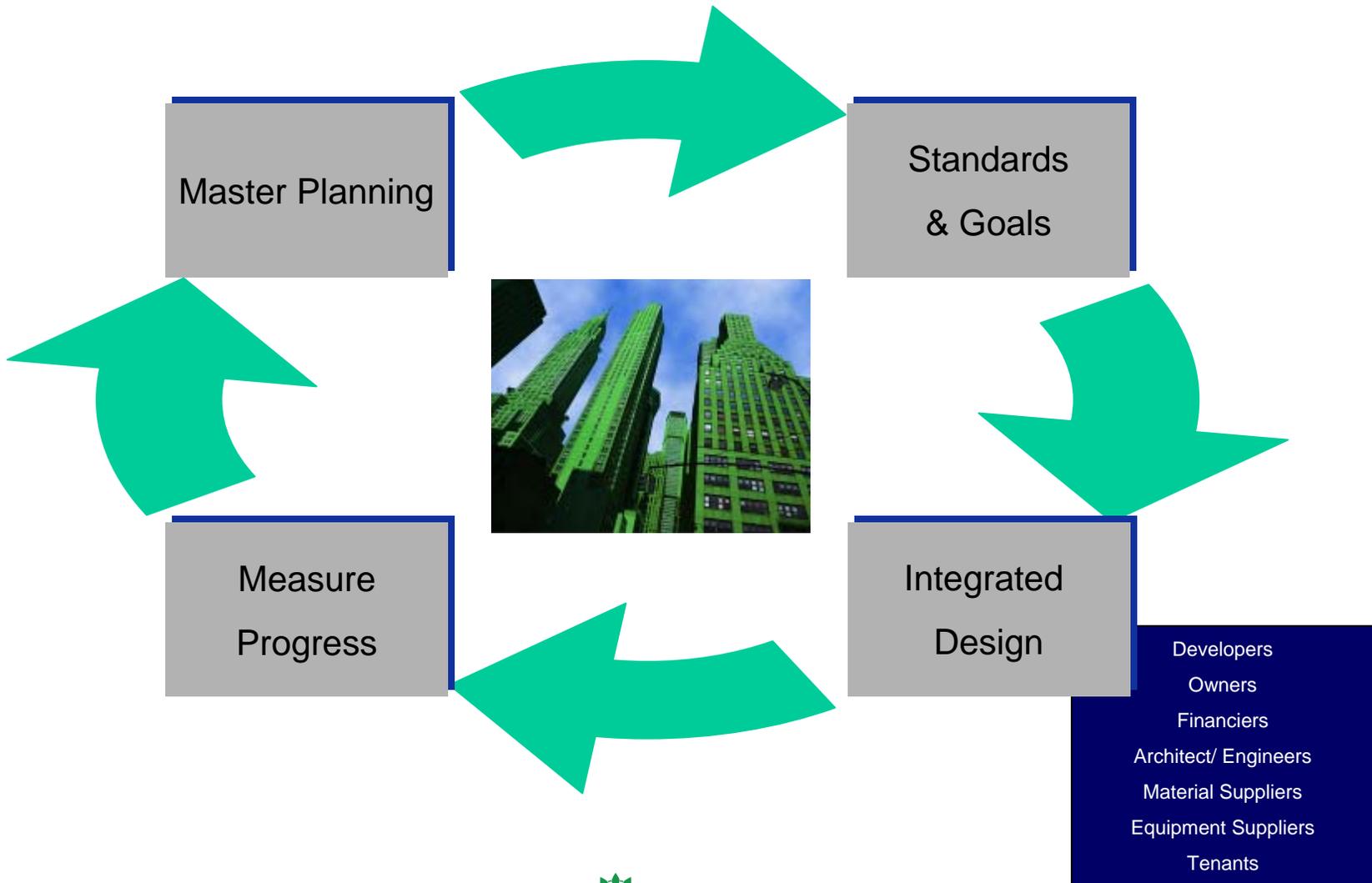
Four Levers for Faster Change



Today's Stove-pipe Approach



Holistic Approach



Holistic Approach

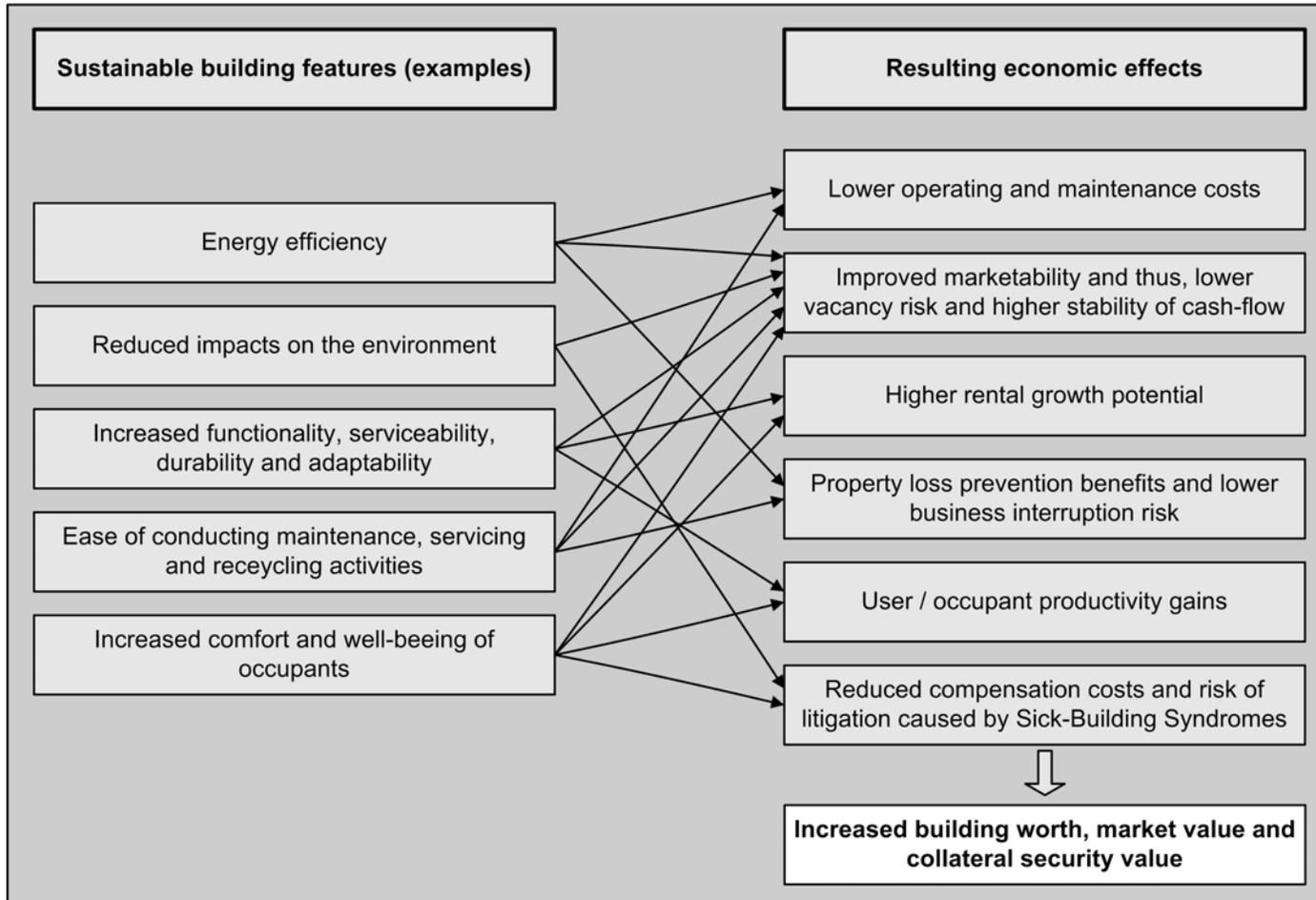


Strategies (residential)	Potential Energy Reduction	Incremental Investment Required
Architecture	Up to 50%	-
Construction Method	Up to 35%	Minimal
Equipment/Technologies	Up to 80%	Moderate
Usage (behavior)	~50%	-

Source: Minergie of Switzerland



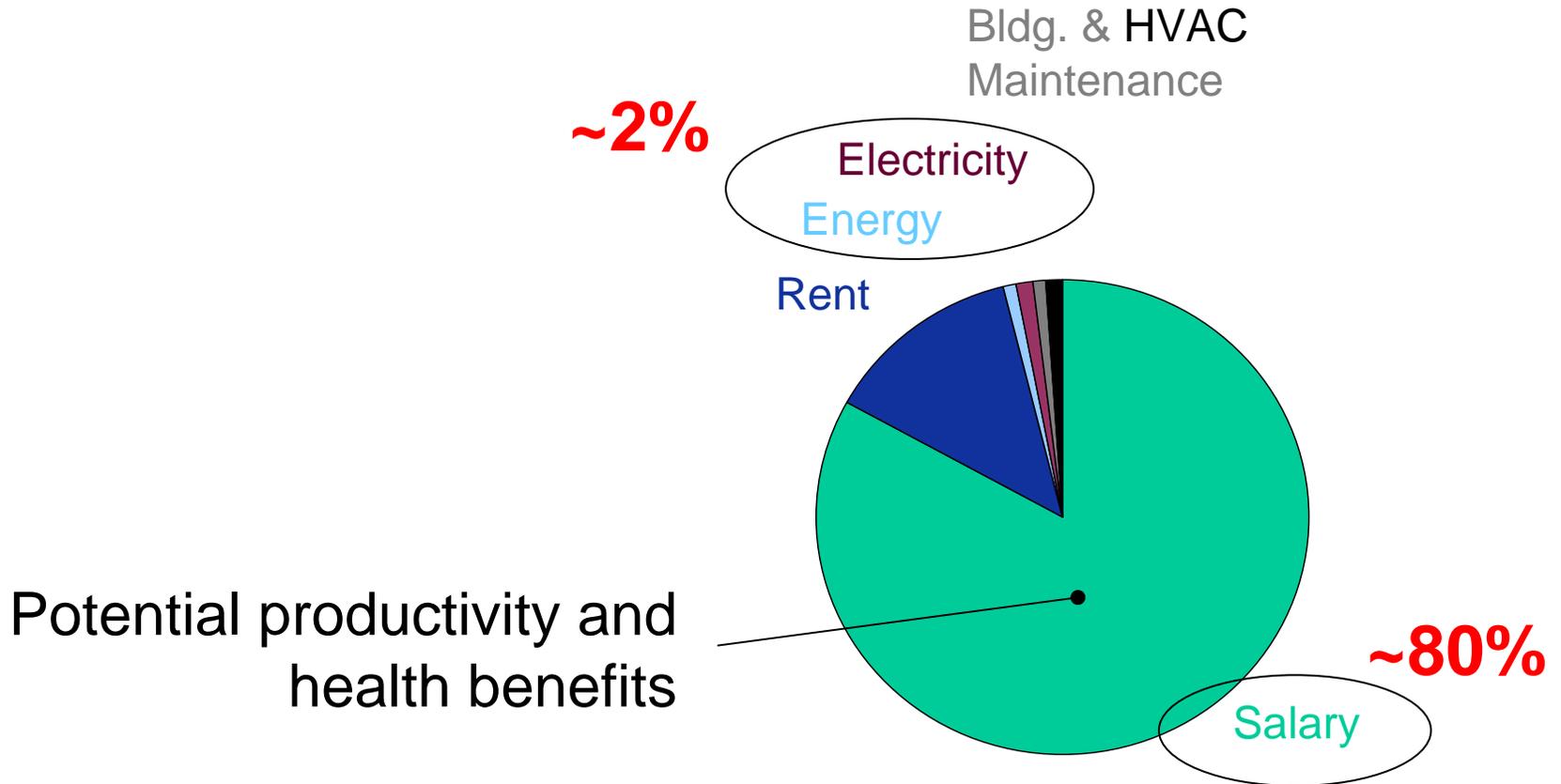
Benefits of sustainable design and resulting economic effects



Collateral Benefits?



Example: Annual Costs of Commercial/ Office Building





Information and Education

Importance of labeling programs

Knowledge of Energy Consumption

EPRI (2005) reports that technical devices with information on energy consumption (immediate feedback) cuts up to 20% energy use.

Policy and Regulation



41.2003 2003 DIRECTORATE OF THE SUSTAINABLE DEVELOPMENT OF THE COUNCIL

1003 DIRECTORATE OF THE SUSTAINABLE DEVELOPMENT OF THE COUNCIL

of 14 December 2002

on the energy performance of buildings

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION

have adopted this Directive on the energy performance of buildings in the following text:

Having regard to the proposal from the Commission;

Having regard to the opinion of the Economic and Social Committee;

Having regard to the opinion of the Council of the Regions;

Article 17 of the Treaty on European Union;

Article 25 of the Treaty on European Union;

Article 175 of the Treaty on European Union;

Article 176 of the Treaty on European Union;

Article 177 of the Treaty on European Union;

Article 178 of the Treaty on European Union;

Article 179 of the Treaty on European Union;

Article 180 of the Treaty on European Union;

Article 181 of the Treaty on European Union;

Article 182 of the Treaty on European Union;

Article 183 of the Treaty on European Union;

Article 184 of the Treaty on European Union;

Article 185 of the Treaty on European Union;

Article 186 of the Treaty on European Union;

Article 187 of the Treaty on European Union;

Article 188 of the Treaty on European Union;

Article 189 of the Treaty on European Union;

Article 190 of the Treaty on European Union;

Article 191 of the Treaty on European Union;

Article 192 of the Treaty on European Union;

Article 193 of the Treaty on European Union;

Article 194 of the Treaty on European Union;

Article 195 of the Treaty on European Union;

Article 196 of the Treaty on European Union;

Article 197 of the Treaty on European Union;

Article 198 of the Treaty on European Union;

Article 199 of the Treaty on European Union;

Article 200 of the Treaty on European Union;

Article 201 of the Treaty on European Union;

Article 202 of the Treaty on European Union;

Article 203 of the Treaty on European Union;

Article 204 of the Treaty on European Union;

Article 205 of the Treaty on European Union;

Article 206 of the Treaty on European Union;

Article 207 of the Treaty on European Union;

Article 208 of the Treaty on European Union;

Article 209 of the Treaty on European Union;

Article 210 of the Treaty on European Union;

Article 211 of the Treaty on European Union;

Article 212 of the Treaty on European Union;

Article 213 of the Treaty on European Union;

Article 214 of the Treaty on European Union;

Article 215 of the Treaty on European Union;

Article 216 of the Treaty on European Union;

Article 217 of the Treaty on European Union;

Article 218 of the Treaty on European Union;

Article 219 of the Treaty on European Union;

Article 220 of the Treaty on European Union;

Article 221 of the Treaty on European Union;

Article 222 of the Treaty on European Union;

Article 223 of the Treaty on European Union;

Article 224 of the Treaty on European Union;

Article 225 of the Treaty on European Union;

Article 226 of the Treaty on European Union;

Article 227 of the Treaty on European Union;

Article 228 of the Treaty on European Union;

Article 229 of the Treaty on European Union;

Article 230 of the Treaty on European Union;

Article 231 of the Treaty on European Union;

Article 232 of the Treaty on European Union;

Article 233 of the Treaty on European Union;

Article 234 of the Treaty on European Union;

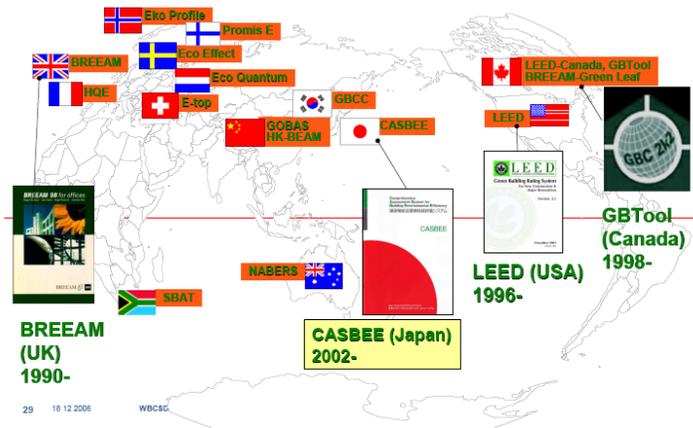


Energy efficiency standards to raise the minimum energy efficiency in new buildings

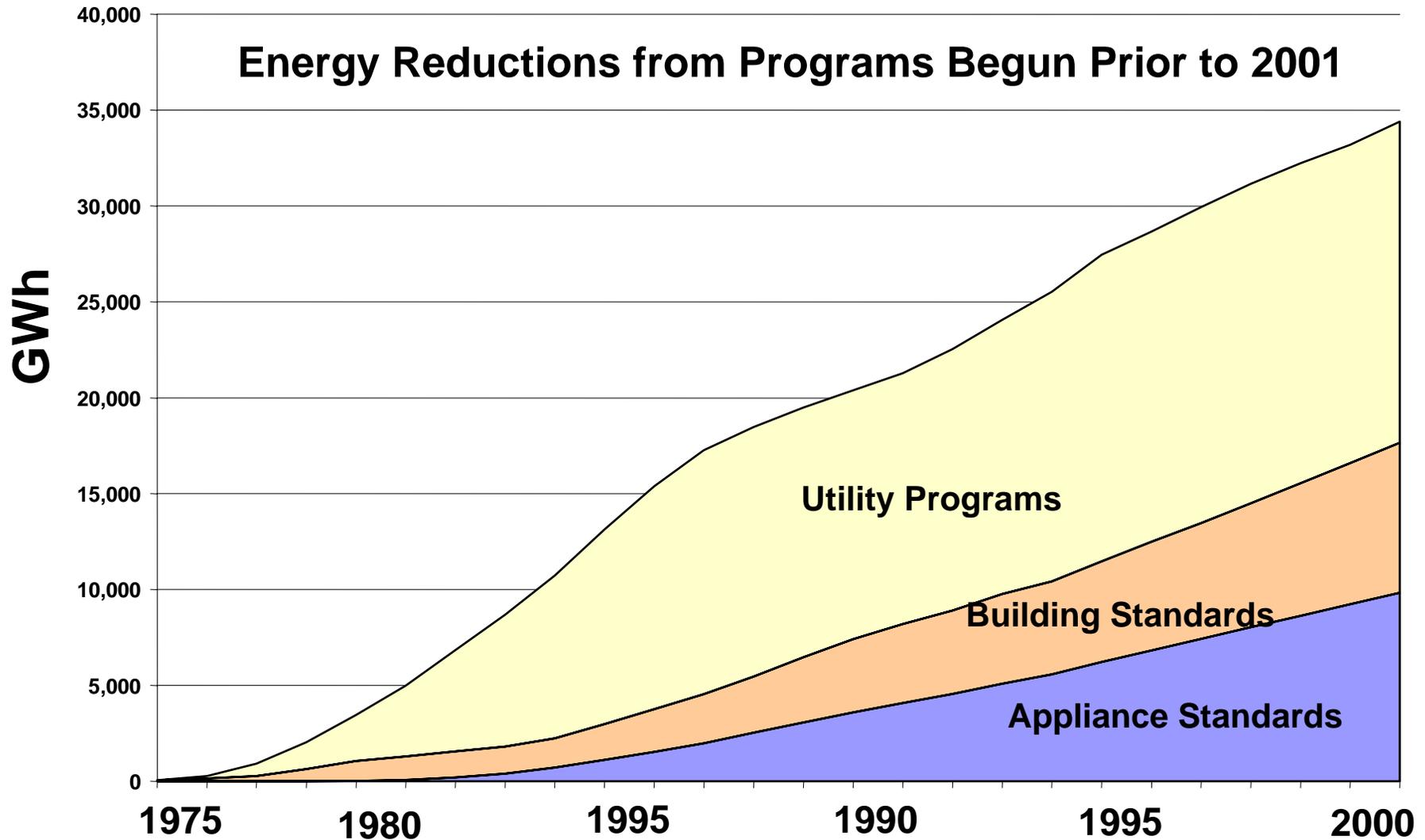
Labeling or certification supports zero net or very low energy buildings

Building regulation supports highly efficient buildings beyond the building codes

Adoption, adherence and enforcement factors



Regulations Work

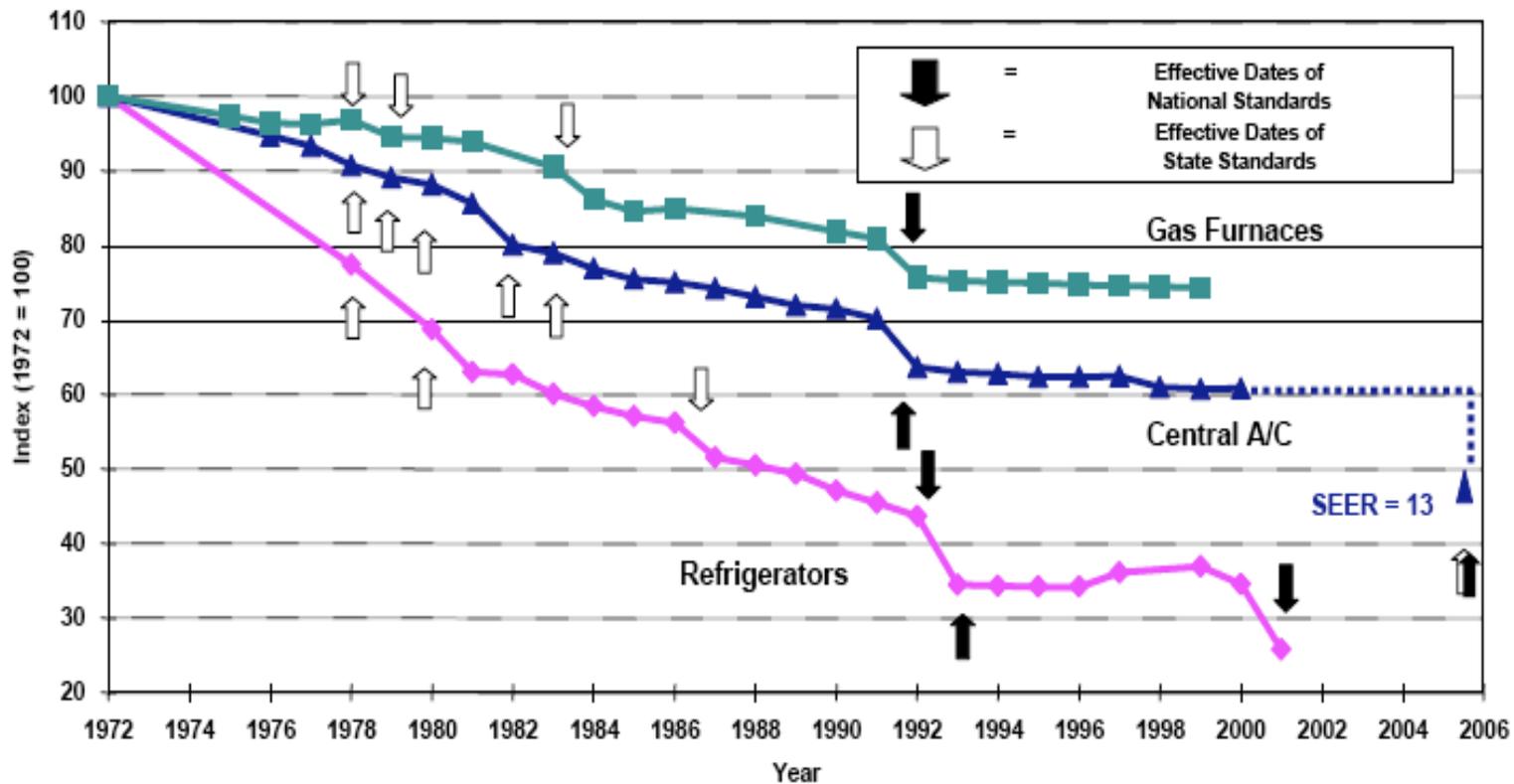


Source: Mike Messenger, Calif. Energy Commission Staff, April 2003

Standards Work

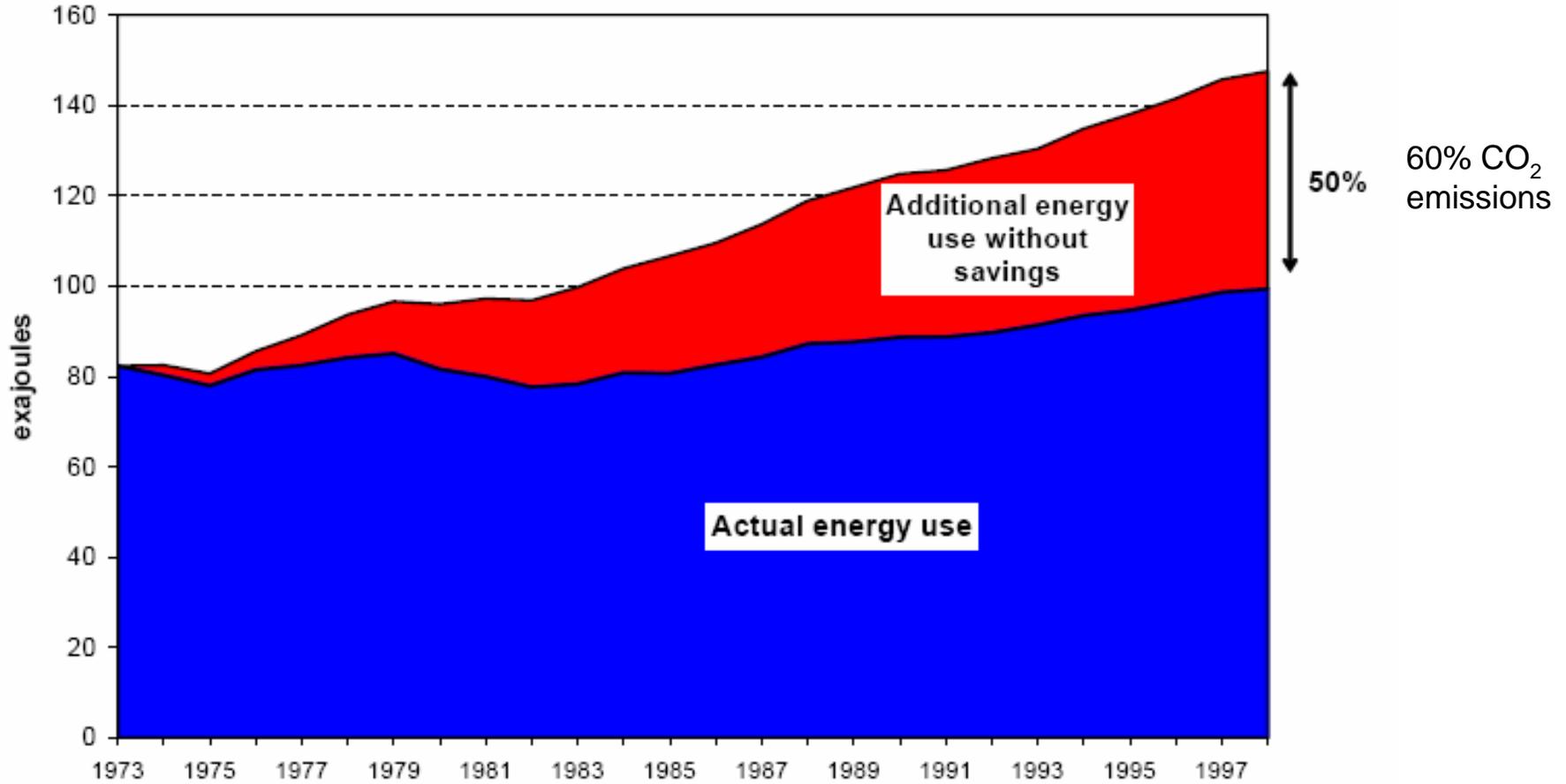


Impact of Standards on Efficiency of 3 Appliances



Source: S. Nadel, ACEEE ECEEE Summer Study, 2003

History Says It's Doable!



Source: International Energy Agency, IEA-11, Wilton Park Presentation 2006

UTC is Part of the Solution



Fuel Cell – Up to 90% Efficient



Microturbine – Up to 90% Efficient



52% Reduction in Cooling Costs



Regen Lift – 75% Efficiency Improved



Summary



Buildings large energy consumer

“Business-as-usual” not sustainable

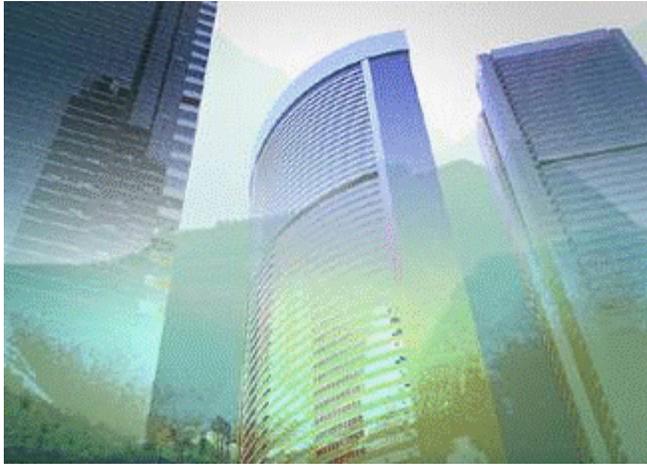
Large global companies can make difference

New policies required to accelerate change

Project Vision



A world where buildings consume zero net energy



For more info contact:

Bob Tierney 860 727 7054 robert.tierney@utcpower.com

