The Real Impact of Energy Efficiency on the Bottom Line

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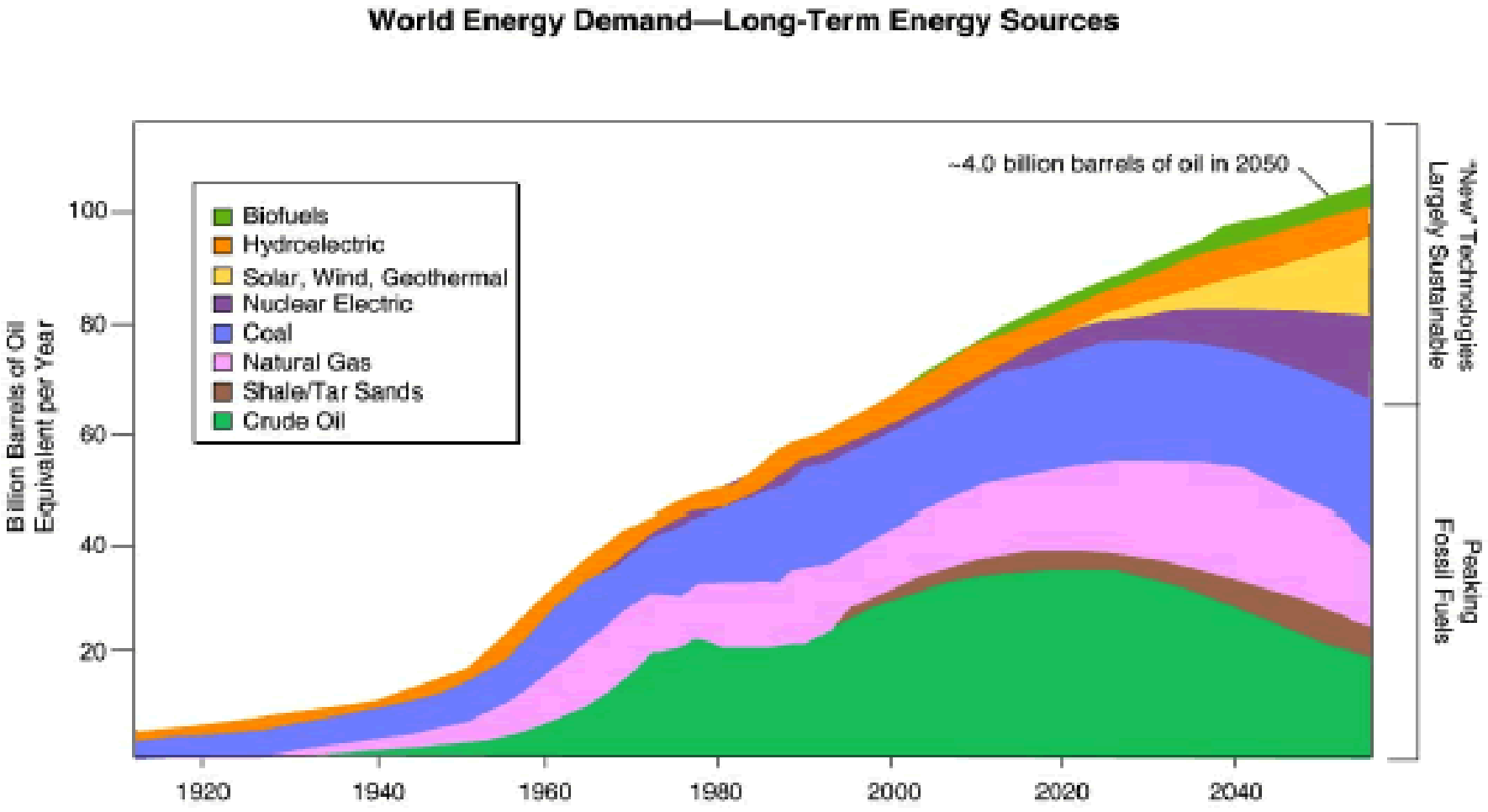
Energy Efficiency

A Personal Story

Excuses

- Don't have time.
- Don't know what the opportunities are.
- Other priorities.
- Not costly enough to value highly.
- Not enough cash on hand.
- May not stay in the house.
- Don't see connection between the projects and the bill.
- Don't trust the payback.

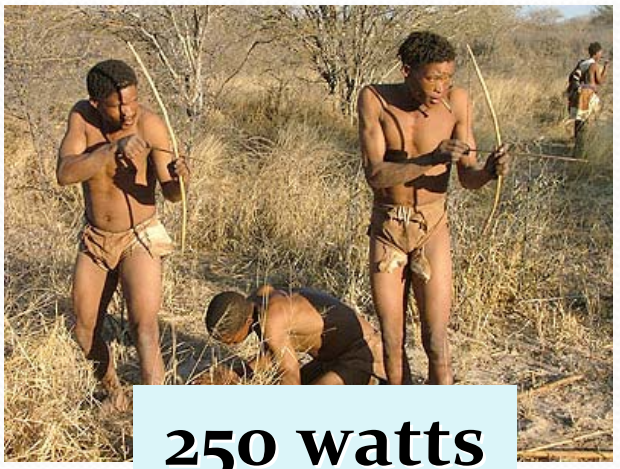
Energy – the global story



World energy demand expands by 45% between now and 2030 – an average rate of increase of 1.6% per year – with coal accounting for more than a third of the overall rise

In the developed world, we are living “larger than life.”

90 watts



250 watts

11,000 watts!

In the developing economies, a quest for the "3 Cs"

"The Good Life"

World's poor drive growth in global cell phone use
USA Today; Posted 3/2/2009

Six in 10 people around the world now have cell phone subscriptions, signaling that mobile phones are the communications technology of choice, particularly in poor countries, according to a U.N. report published Monday. By the end of last year there were an estimated 4.1 billion subscriptions globally.

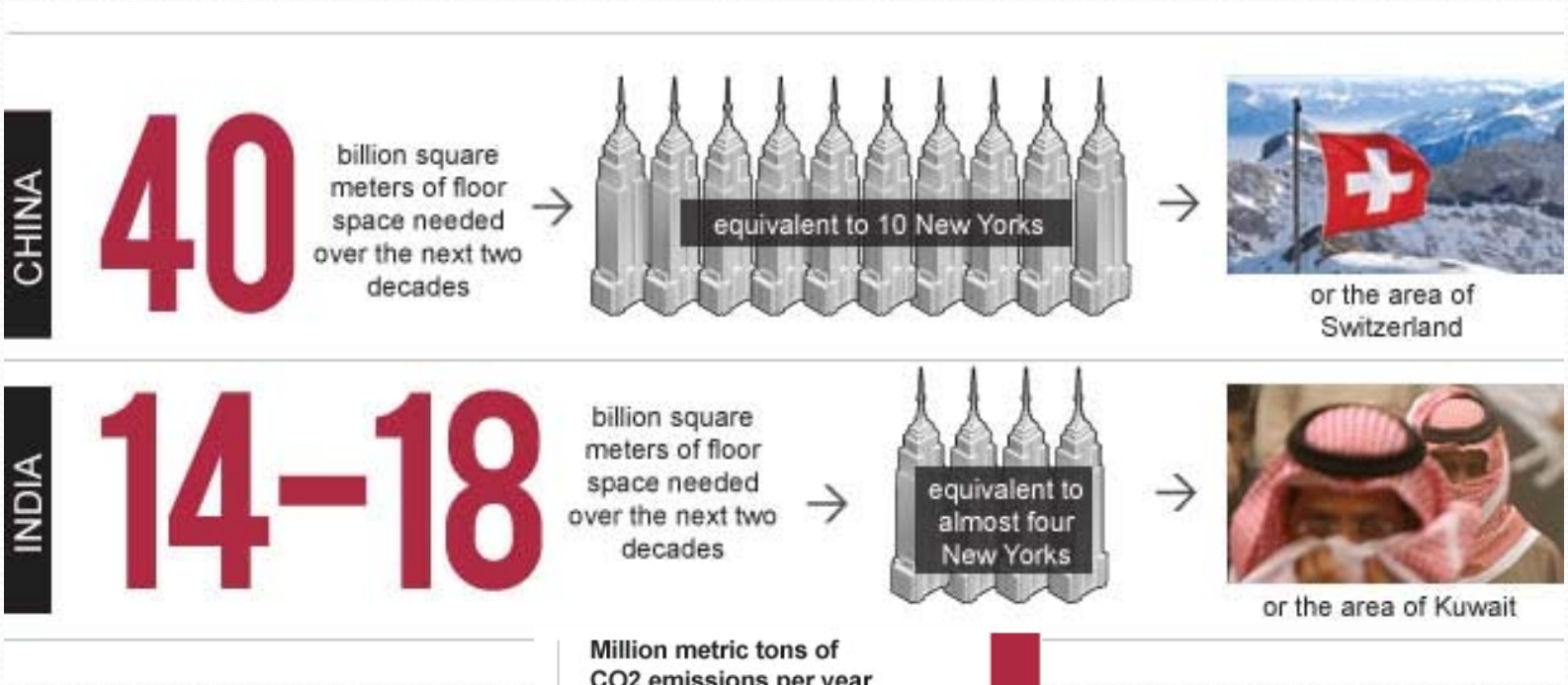
"it is hard to think of anything more important than urbanization in China. The sheer numbers of people involved is staggering: roughly one out of every 25 people in the world today is a resident of a Chinese city who arrived, or was born, since the current round of economic reforms began in 1978."

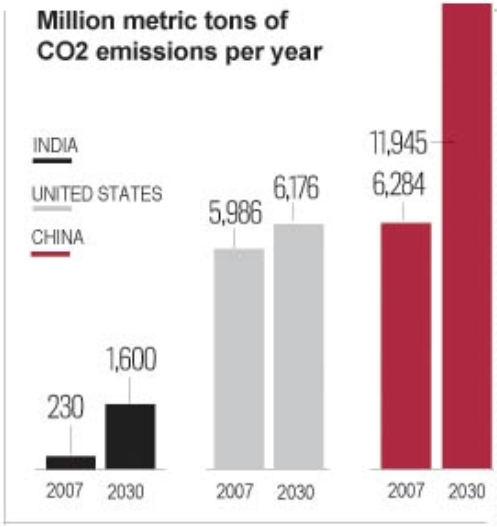
Kenneth Small

UC-Irvine

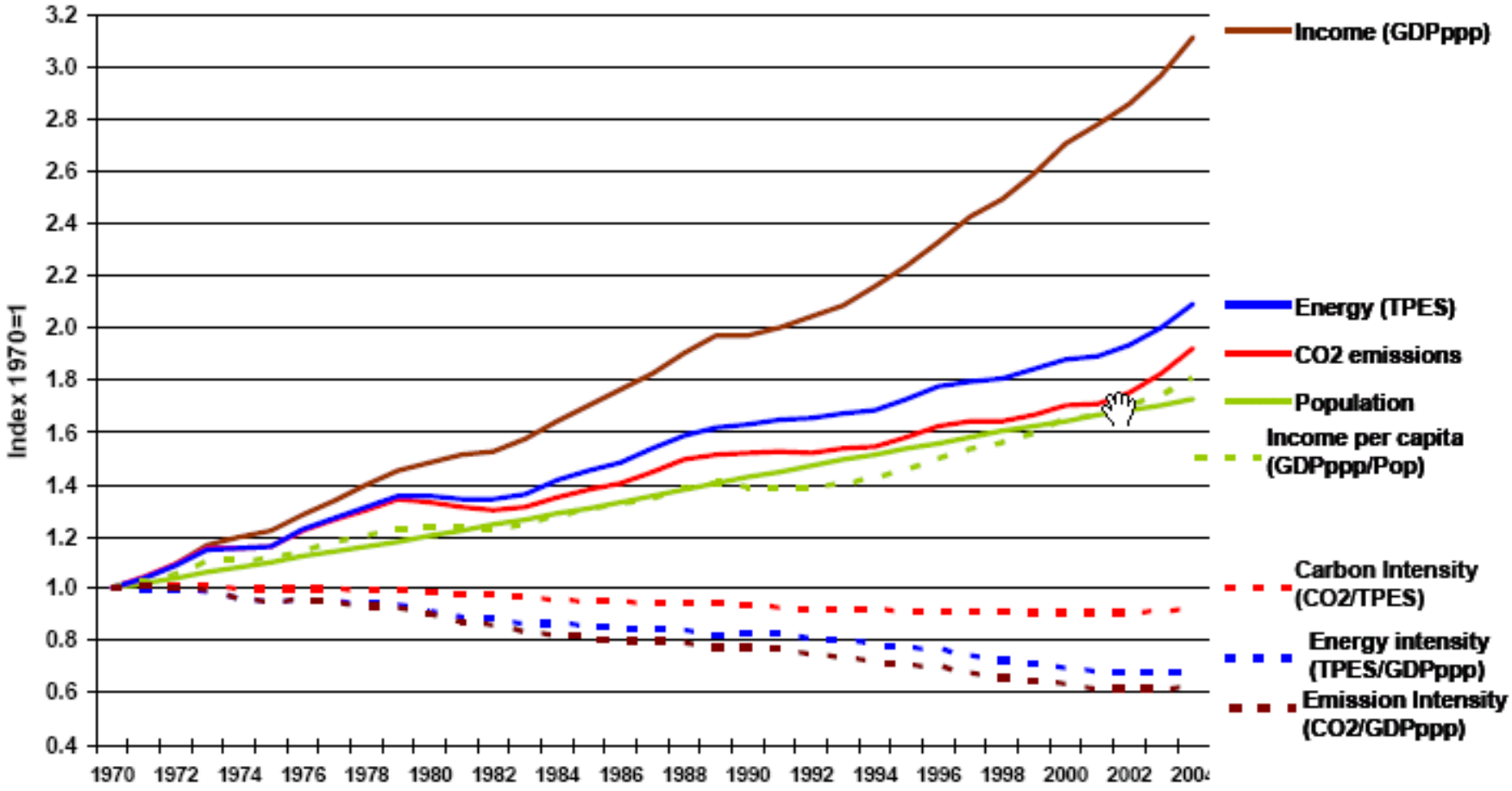
Beijing Hits 2,100 New Cars Per Day, and Welcomes More
... announcement yesterday by Beijing's environmental officials that the city was about to hit 4 million automobiles -- and could withstand more...
November 29, 2009

Centrality of China and India





Efficiency improving, but not keeping up with demand growth.



GHG emissions→ temperature change

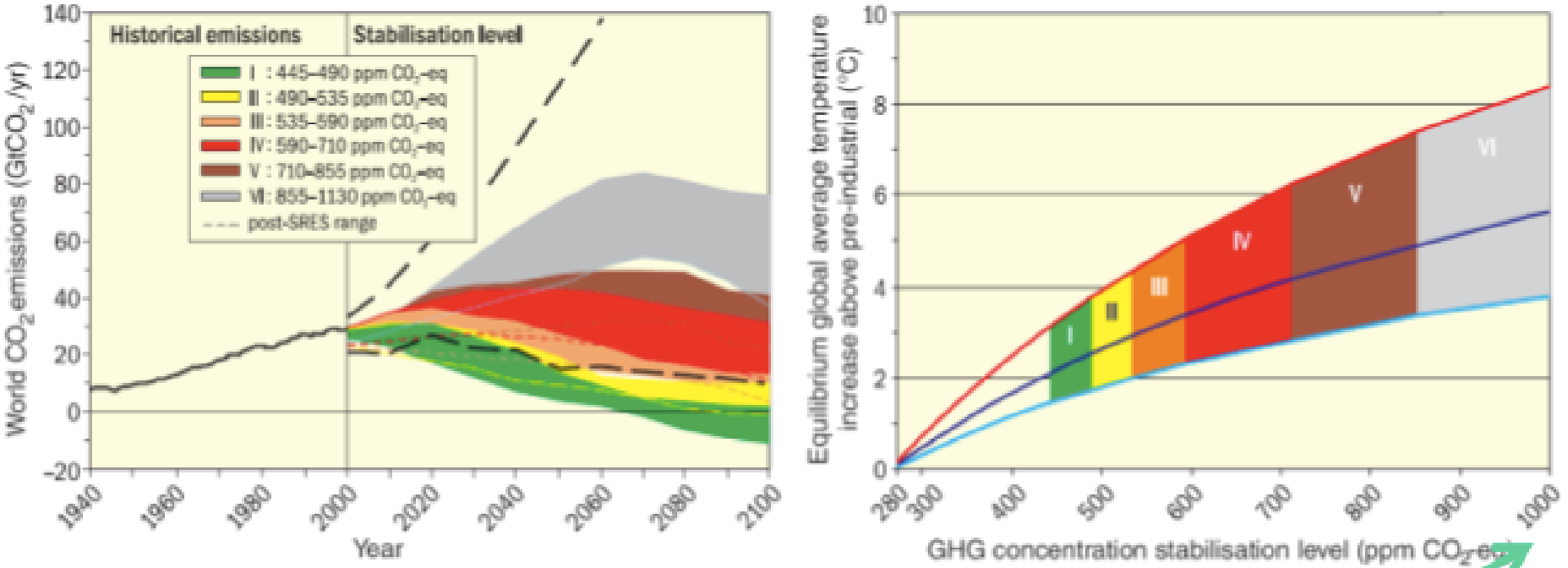
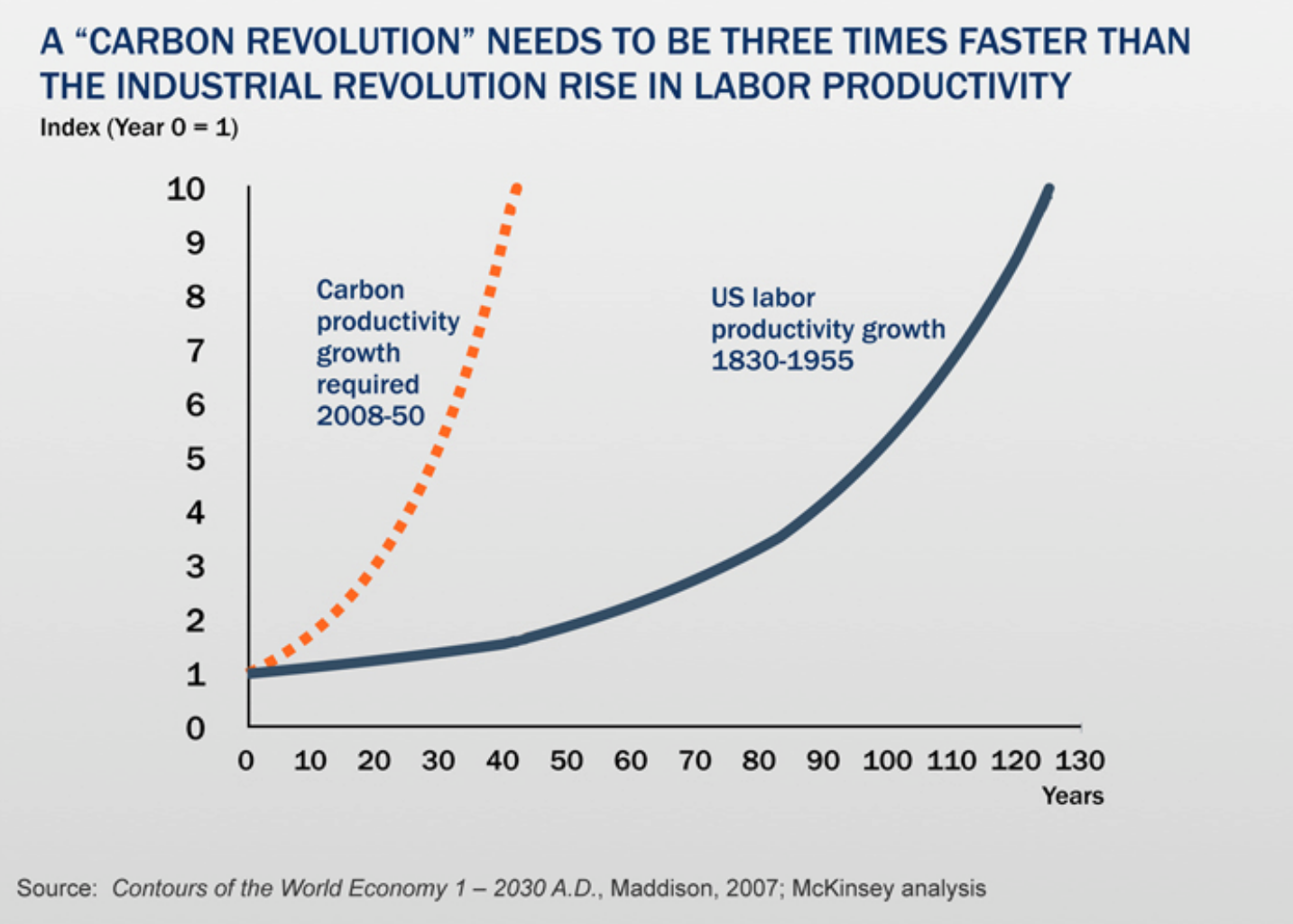


Figure 5.1. Global CO_2 emissions for 1940 to 2000 and emissions ranges for categories of stabilisation scenarios from 2000 to 2100 (left-hand panel); and the corresponding relationship between the stabilisation target and the likely equilibrium global average temperature increase above pre-industrial (right-hand panel). Approaching equilibrium can take several centuries, especially for scenarios with higher levels of stabilisation. Coloured shadings show stabilisation scenarios grouped according to different targets (stabilisation category I to VI). The right-hand panel shows ranges of global average temperature char… …oper bound of likely range of climate s… …e at bottom of shaded area). Black dashed lines in the left panel give the emissions range of recent baseline scenarios published since the SRES (2000). Emissions ranges of the stabilisation scenarios comprise CO_2-only and multigas scenarios and correspond to the 10th to 90th percentile of the full scenario distribution. Note: CO_2 emissions in most models do not include emissions from decay of above ground biomass that remains after logging and deforestation, and from peat fires and drained peat soils. (WGIII Figures SPM.7 and SPM.8)

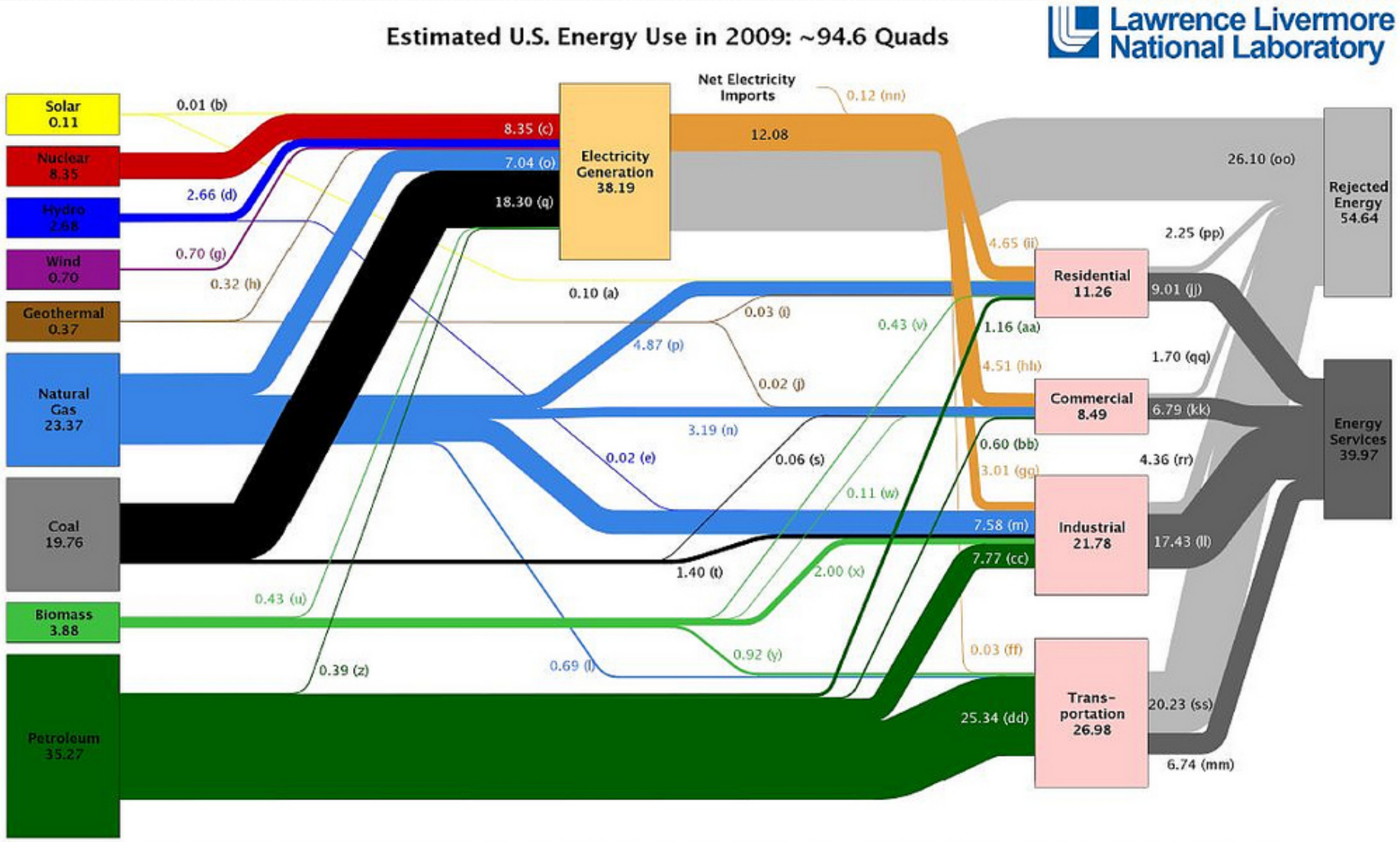
Projected concentrations may be headed here by 2100

Source: IPCC FAR (2007)

Can we rise to the challenge?



In the US, our energy system is complex… and wasteful.



Source: LLNL 2010. Data is based on DOE/EIA-0384(2009), August 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 80% for the residential, commercial and industrial sectors, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

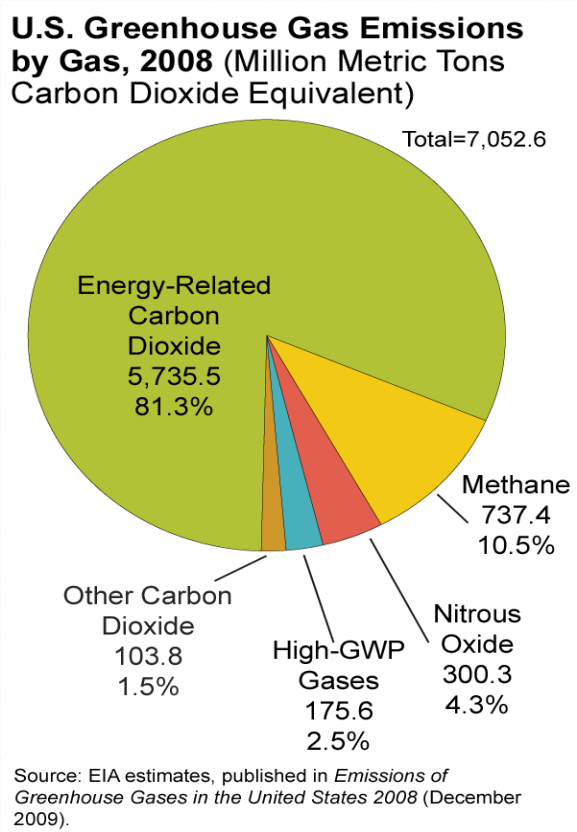
What is Energy Efficiency?

- **Definition**: a reduction in energy required for a given service (heating, lighting, etc.) or level of activity.
- Can result from new technology, better management and/or changed behaviors.
- Barriers and opportunities vary by target sector, technology, financial support, policy environment, available information, and other factors.
- Efficiency $\neq$ Conservation
- Related to Energy Productivity
  - Energy/GDP)
  - Economy-wide energy efficiency encompassing all changes resulting in decreased energy used to produce a unit of economic activity.
  - Driven by variety of factors, including structural change.

What's the big picture?

- Climate Change:

Energy use directly linked to GHG emissions..the U.S. example:



- Security:

Unchecked growth in energy demand can:

- Accelerate fossil fuel depletion
- Increase our reliance on foreign sources of energy

- Economy:

- Energy waste comes at high costs: "Business as usual" energy use will waste more than $1.2 trillion in the U.S. between now and 2020 in the U.S. alone – and this does not include transportation energy consumption!

The urgency of now

FT.com FINANCIAL TIMES

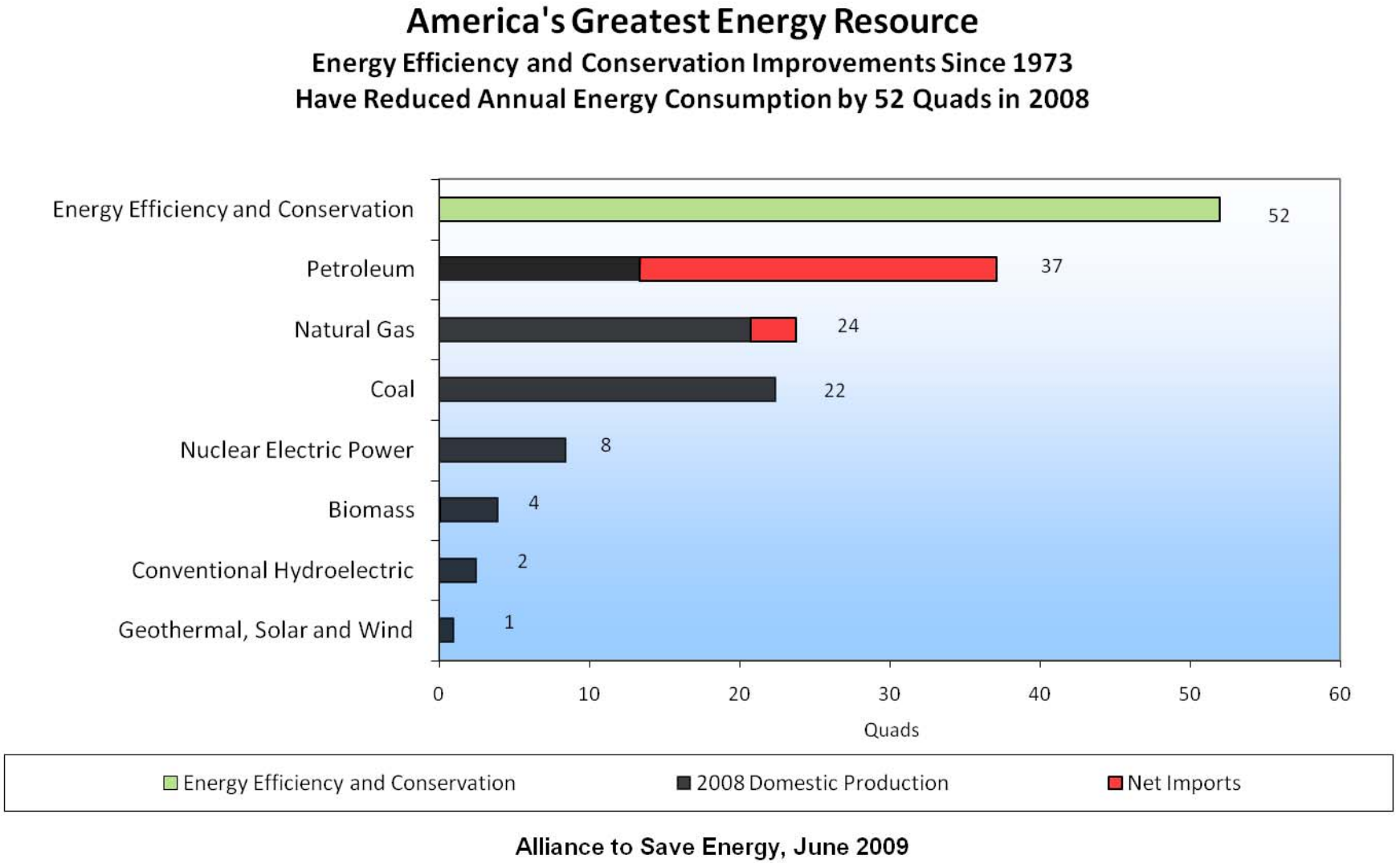
Hedge funds bet oil prices to rise past $150

By Gregory Meyer in New York

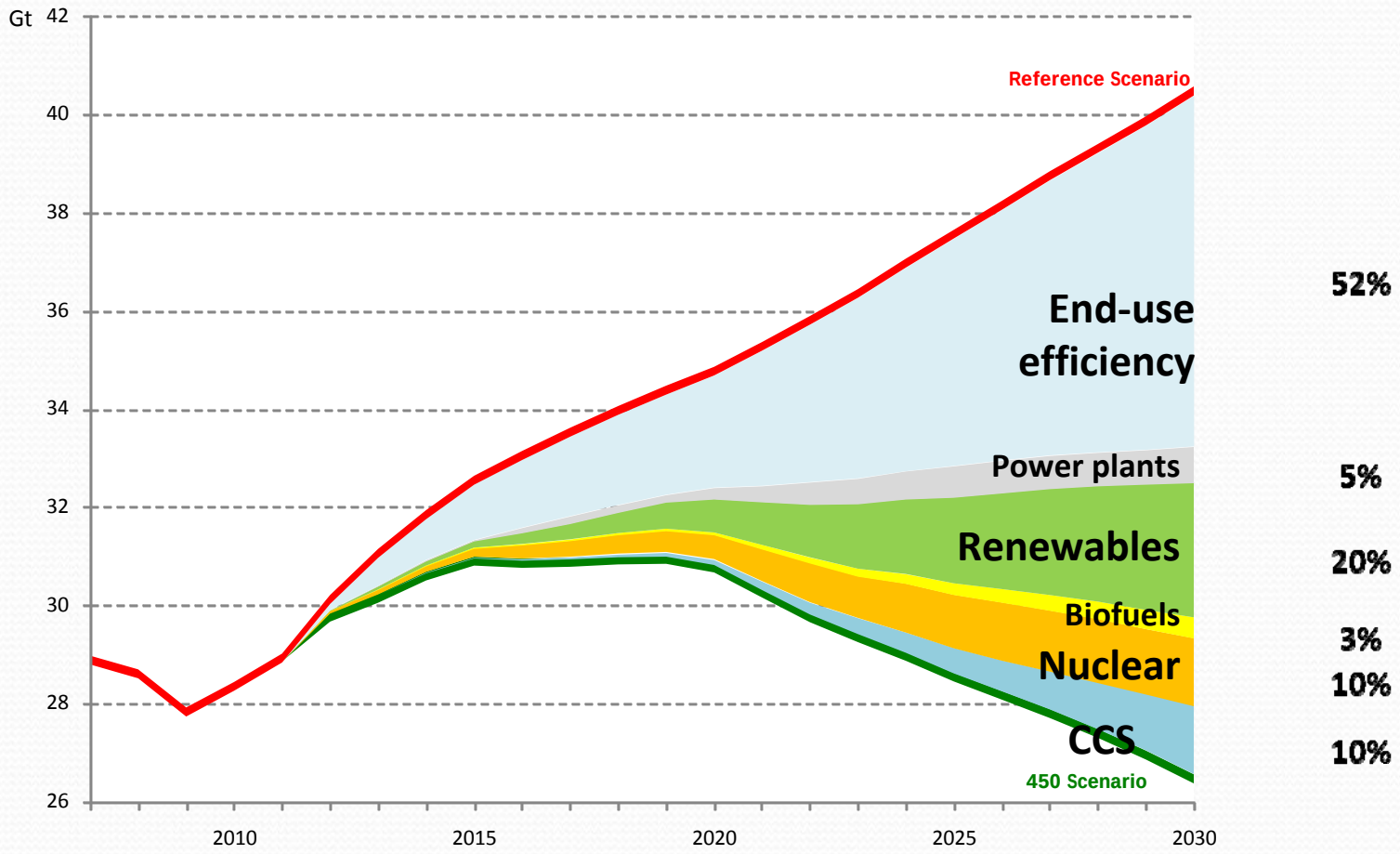
Published: March 8, 2011

Hedge funds are placing aggressive bets that crude prices could rise past $150 a barrel if the unrest in the Middle East spills over into Saudi Arabia, the world's top oil exporter.

Efficiency: A History of Success



The Future Imperative



Source: International Energy Agency, 2010

Efficiency Arenas

Residential

Commercial

Industrial

Transportation

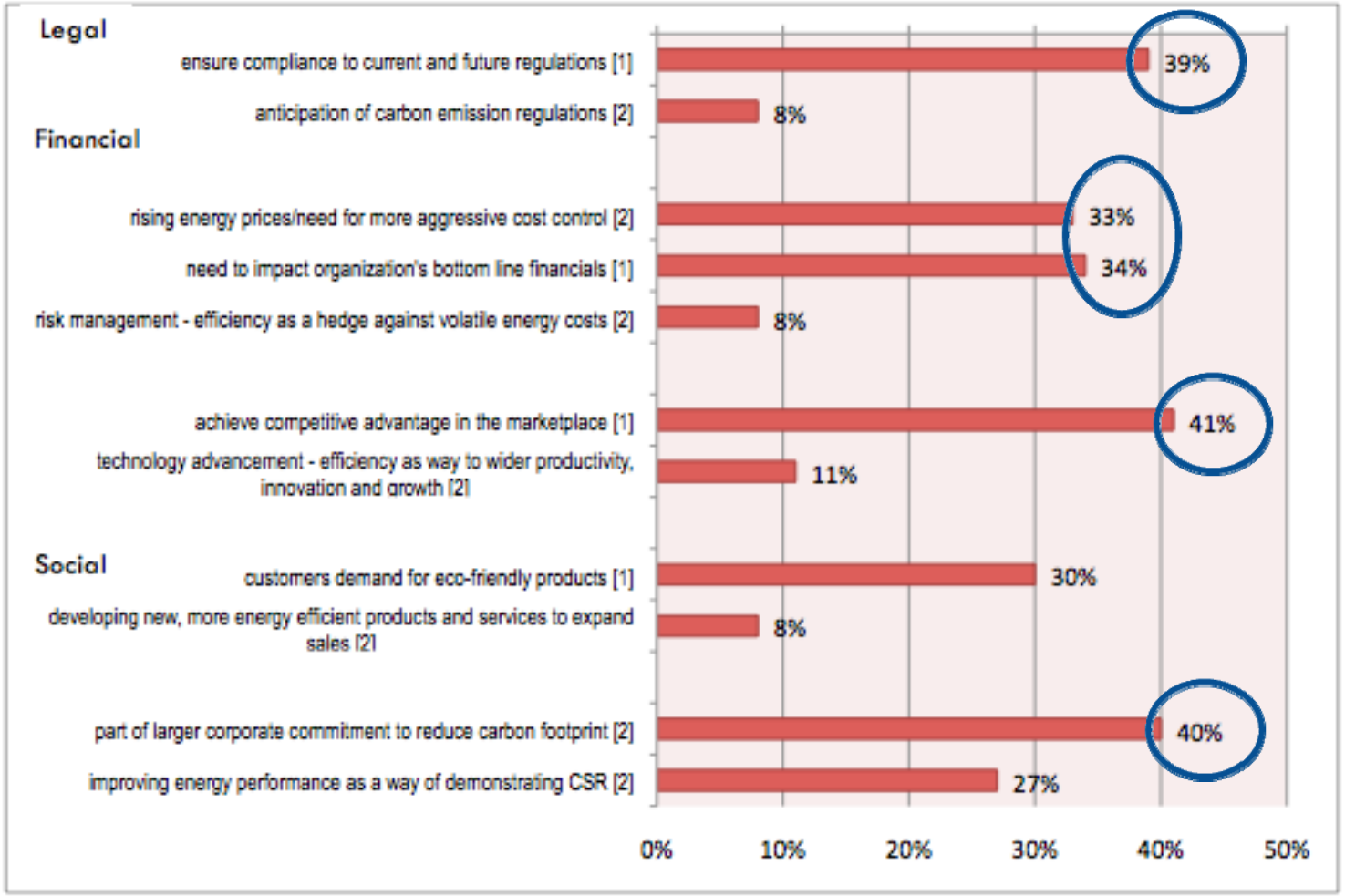
Why do companies care?

Efficiency can deliver multiple benefits, including:

1. Compliance with regulations
2. Cost Savings
3. Risk Mitigation
4. Competitive position and Brand Enhancement
5. Catalyst for Innovation

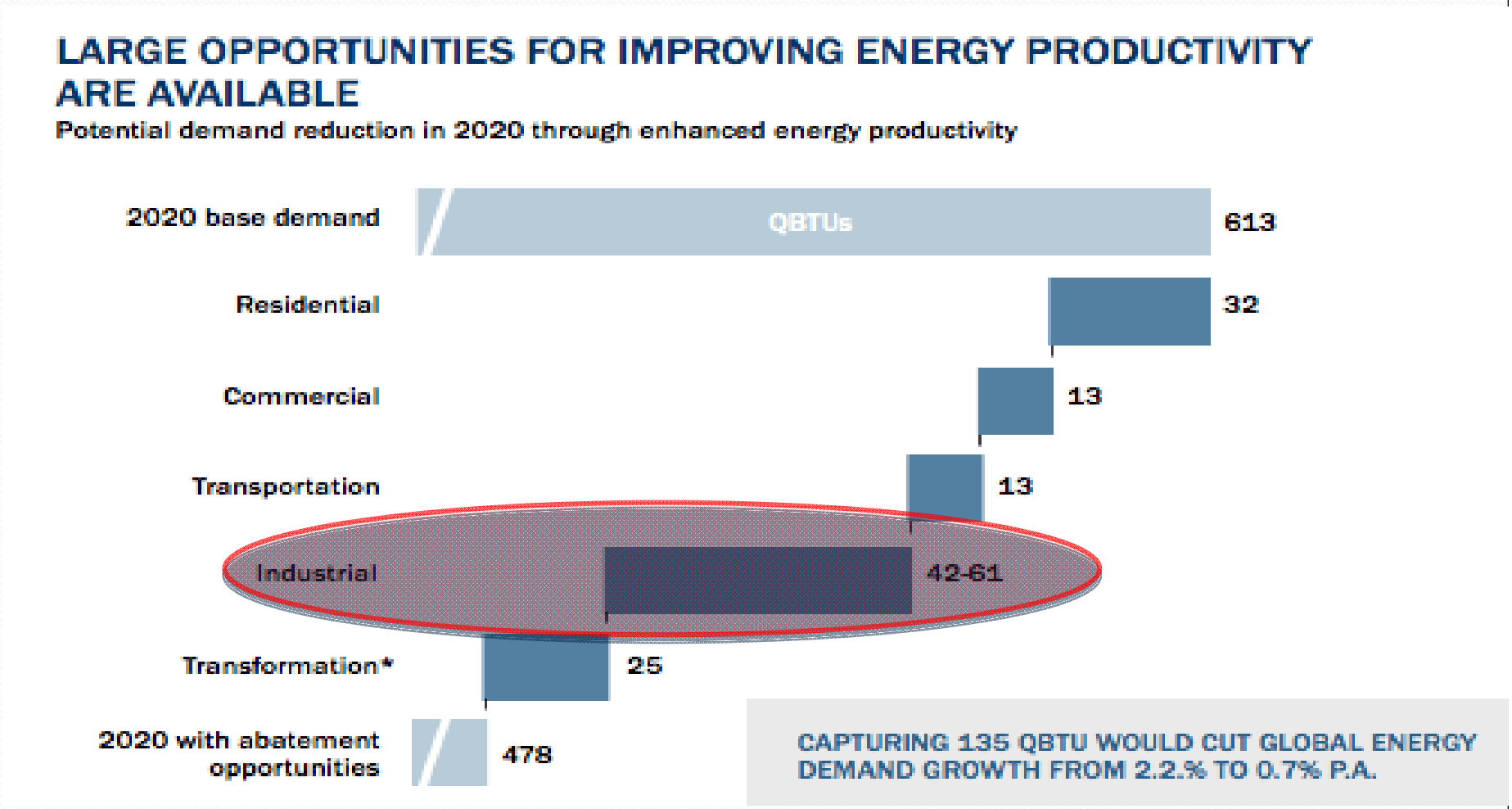
Expanding the vision

FIGURE 1: COMPANIES' MOTIVATIONS FOR ENERGY EFFICIENCY



Source: Aberdeen Group, 2009 [1]; Pew Center, 2009 [2].

How big is the opportunity?

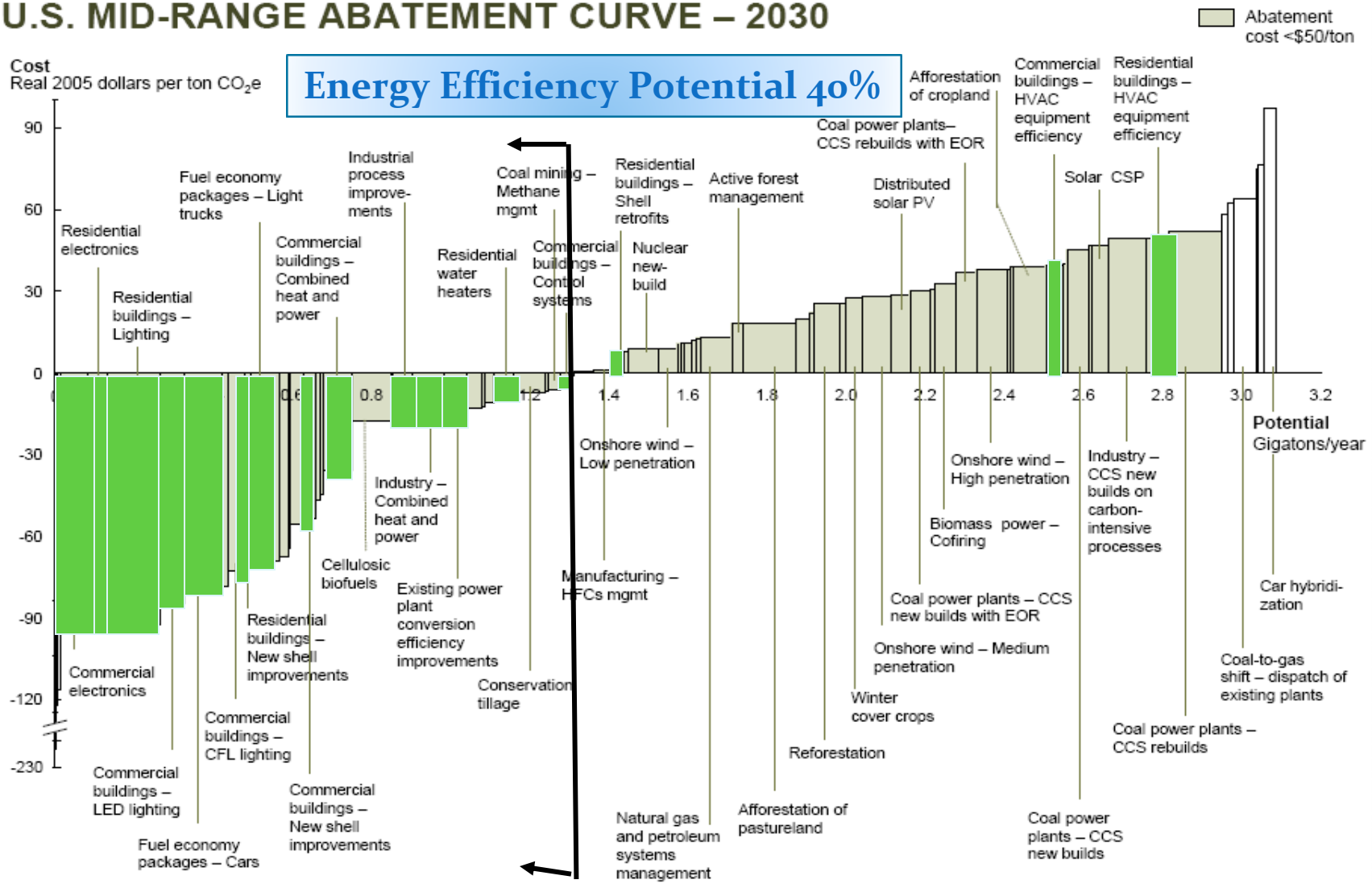


Source: McKinsey Global Institute

Where to focus?

Exhibit B

U.S. MID-RANGE ABATEMENT CURVE – 2030



Adapted from McKinsey Analysis

Not all companies are created equal

TABLE 2: ENERGY USE AND INTENSITY, BY INDUSTRY

Industry	2010 Energy Use (Trillion BTU)	2010 Energy Intensity (thousand BTU per $ of output)
Energy Intensive Manufacturing		
Food	1,182	2.2
Paper	2,986	16.3
Bulk Chemicals	7,921	39.5
Petroleum Refining	3,922	30.3
Glass	219	8.3
Cement	399	61.8
Steel	1,531	19.5
Aluminum	428	10.1
Non-Intensive Manufacturing		
Metal-based durables	2,199	0.8
Balance of mfg.	3,503	2.6

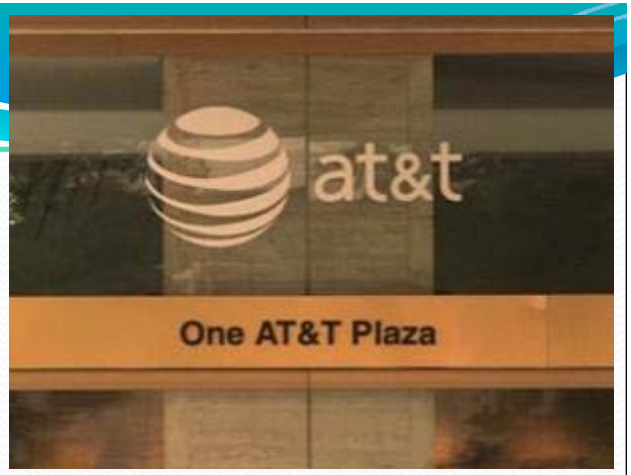
Source: EIA, 2002

Variables in the EE equation

- **Who are the early adopters?**
  - Energy intensive
  - Large
  - Consumer-facing
  - Consumer product supplier
  - "Green Club" member

Best practice

AT&T



- In 2010, AT&T implemented 4,200 efficiency projects, generating $44 million in annualized energy savings.
- **Success factors:**
  - Hired a full-time energy director
  - Set 2010 15% energy intensity (kw/terabyte of data) reduction goal.
  - Developed Energy Scorecard to grade performance of 500 most energy-intensive facilities, each with its own energy champion.
  - Trained 500 new Energy Star champions, and participated in EDF Climate Corps.
    - Focus on lighting use and sensors.

"My biggest piece of advice is once you establish a goal, characterize it as an aspiration. It doesn't just happen, it takes investment and study. It's very important to make sure you can get alignment of all the people needed to make this happen."

John Schinter
At&T Energy Director

Efficiency Challenge

US Military

Source: "Energy Efficiency Has Yet to Learn the Drill in the Military"
Published: NYT, April 5, 2011

- The business case : 70% DoD energy use from shipping and protecting fuel.
- The rise and fall of spray-on foam.
  - "We can have all the bumper stickers in the world saying we are going to do this and do that, but … who is going to push this forward? There is no advocate for these technologies."
- Tactical Garbage to Energy Refinery : converts food waste, plastic, paper and styrofoam into synthetic gas/ethanol.
  - Tested in April 2008; now in US warehouse
  - Current mandate: use off the shelf technology only
  - DoD developing new energy strategy, but "assigning specific energy reduction numbers is a challenge since "fighter capability is the top priority and war requirements may be in flux."

Understanding the Efficiency Gap

Barrier	Claim
Cost of energy	• Energy costs as proportion of operating costs are low, which results in insignificant savings of energy-efficiency projects to the firm. • Uncertainty in energy costs makes payback calculations difficult to evaluate
Investment barriers	• Insufficient payback • Insufficient access to capital • Growth bias of manufacturing firms • Cyclicality of industrial investment decision-making
Imperfect information	• Lack of information • Lack of expertise • Lack of time/ other priorities
Split incentives	• Landlord/Tenant: neither the landlord nor the tenant have incentives to invest in energy efficiency because they do not realize its returns • Buyer/User: buyer of industrial equipment is concerned with purchase price and reliability of capital rather than energy operating costs
Organizational barriers	• Separate capital and operating budgets • Lack of built-in incentives (bonuses and other pay structures) to reward energy efficiency • Lack of ownership for energy/carbon emissions within the company/ no departmental accountability • Managers stay in posts only for a short time

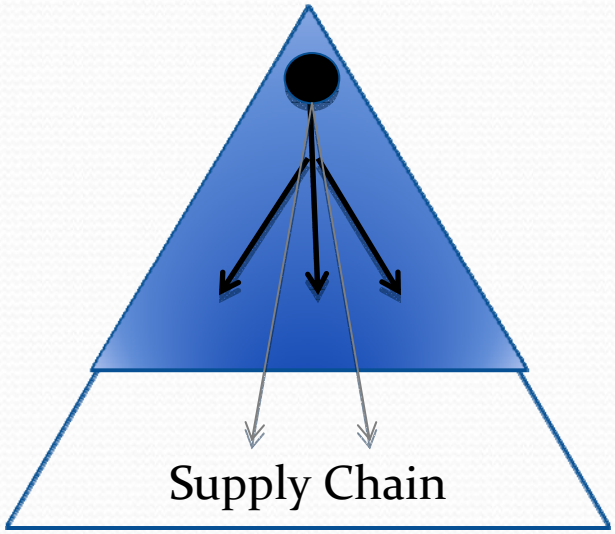
Source: Adapted from Sorrell et al., 2004 and Schleich, 2009.

The Energy Efficiency Process

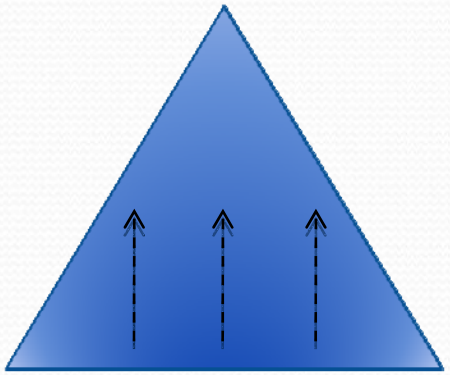
- **Goal-setting:** How were goals for energy efficiency set? Who set them?
- **Identification:** How was information about opportunities gathered? What actors or organizations were involved?
- **Financing**: How were energy-efficiency projects financed? What financing mechanisms were put in place? What payback thresholds existed for projects?
- **Implementation**: Who was responsible for implementing energy efficiency? What incentives were provided for organizational or behavioral changes?
- **Measurement, Benchmarking and Reporting:** How is energy measured and monitored? Were industry standards used to benchmark the organization's progress? How is the firm's energy management reported to internal or external audiences? How do they affect goal-setting?

Goal setting

- Top-down
  - Set by senior management for whole company/supply chain.
  - Signals importance, creates excitement, and forces action.
  - Disadvantage: no analytic foundation; can be confusing.



- Bottom-up
  - "Boiler-room" approach: plant workers identify improvements to drive cost reductions.
  - Goals are clear and achievable; specific actors or plants can be held accountable for implementation.
  - Disadvantage: incremental, safe, time-intensive, and disconnected from broader strategy.



Identification

- **3 sources**
  - Internal sourcing relies on company employees to identify opportunities (e.g. company "treasure hunts").
  - External sourcing uses external actors (ESCOs, utilities, or government.
  - Lateral sourcing starts with proven improvements, then disseminates them widely across the firm.
- **2 types**
  - *Process improvements* include discovering ways to improve methods by optimizing equipment operation, eliminating production steps, or adopting new production techniques.
  - *Capital improvements* include purchasing more energy-efficient equipment, substituting the current energy system, or redesigning production facilities.

Financing

- Financial analysis methods and sophistication vary widely.
  - Methods include simple payback, net present value, return on investment, and internal rate of return.
  - NPV generally most appropriate

- Novel approaches
  - Extending payback length for energy-efficiency investments
  - Including carbon emission costs
  - Establishing different levels of project risk
  - Portfolio method
  - Capital set-asides
  - External financing

Implementation

- Organizing energy expertise
  - Corporate “pit teams”: effective, targeted at highest value opportunities, can coordinate and disseminate.
  - Plant-level champions: knowledgeable about plant history and performance.
- Incentives
  - Financial
  - Included in performance review
  - Cultural value

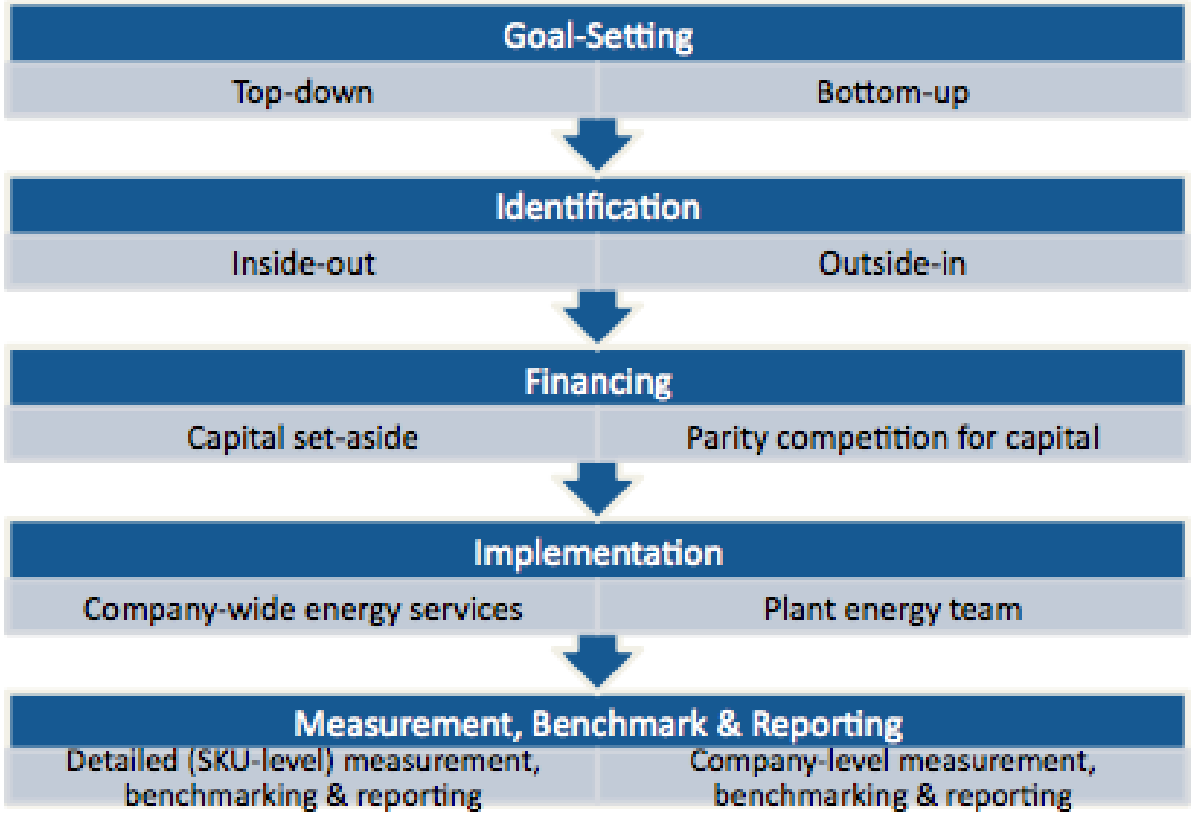
Measurement, benchmarking, and reporting

- What's the bottom line?
  - Many companies measure total energy/units, but this does not separate baseline from marginal energy use.
  - Lack of sub-metering makes it difficult to isolate use and efficiency opportunities.
  - Market for energy use software and dashboards is growing rapidly.

- Companies also vary significantly in their capabilities and processes for internal and external reporting.
  - Engaging stakeholders on energy use is critical part of an effective energy strategy.

Choices in pursuing EE

FIGURE 5: THE MULTIPLE PATHWAYS TO ENERGY EFFICIENCY



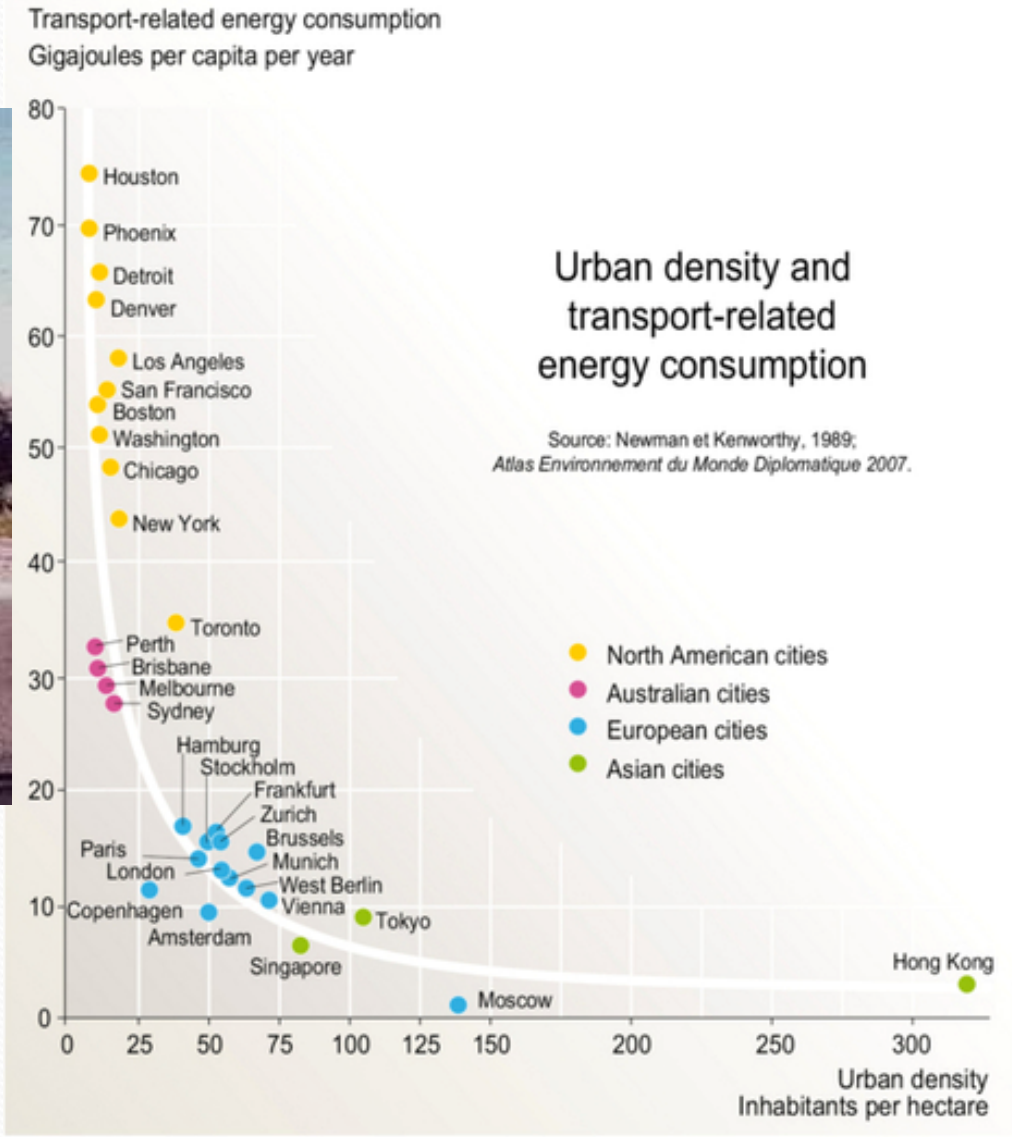
Source: CGGC, Duke University.

Limits of Efficiency

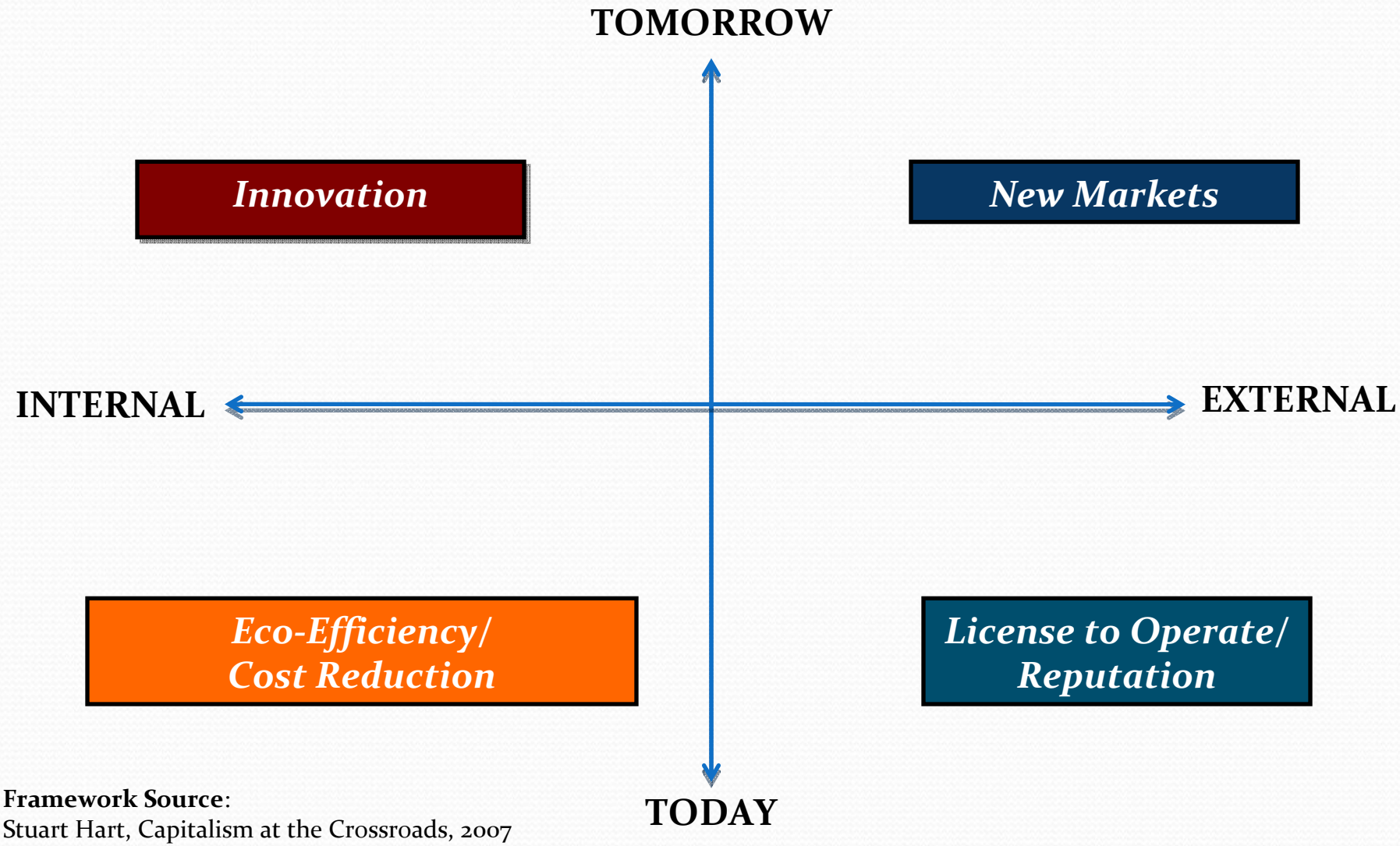
1. **Rebound Effect**
2. **Sustainability Challenge**

Rebound Effect

Efficiency and the automobile



Efficiency in Context of Sustainability



Framework Source:
Stuart Hart, Capitalism at the Crossroads, 2007

Conclusions

- We live in a "golden age" for efficiency.
  - The "efficiency gap" can be closed, but opportunities must be "investment grade."
- Efficiency is NOT a thing, but a process.
  - "Soft" factors (e.g. psychology, organization, culture) are critical efficiency enablers.
- Energy Efficiency is part of a broader strategic approach:
  - Not just energy, but carbon and climate factors.
  - Not only efficiency, but sustainability.
  - Not only velocity, but direction and purpose.

Q&A

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