American Council for an Energy-Efficient Economy (ACEEE) in conjunction with
Financial Research Associates, LLC and
New Energy Capital Present

The Energy Efficiency Finance Forum

The Next Frontier in Clean Energy Investing

April 12-13, 2007   The New York Helmsley Hotel

Dan Reicher, NEW ENERGY CAPITAL
Andrew Karsner, U.S. DEPARTMENT OF ENERGY
Kevin Walsh, GE ENERGY FINANCE
Dian Gruenich, CALIFORNIA PUBLIC UTILITIES COMMISSION
Stephen Cowell, CONSERVATION SERVICES GROUP
Andrew Musters, ROBECO
Ken Hubbard, GERALD HINES COMPANY
John Ravis, TD BANKNORTH PROJECT FINANCE
Patrick Henry Wood II, former Chairman, FEDERAL ENERGY REGULATORY COMMISSION
John Rowe, EXELON
Nancy Floyd, NTH POWER
Peter Liu, NEW RESOURCE BANK
Jeff Eckel, HANNON-ARMSTRONG
Thomas Martin, PACIFIC CORPORATE GROUP
Scott Barrington, PIPER JAFFRAY PRIVATE CAPITAL
Steve Morgan, AMERESCO
Bill Prindle, AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY
Neil Petchers, NORESCO
Chuck McDermott, ROCKPORT CAPITAL
Joyce Ferris, BLUE HILL PARTNERS
F. Henry "Hank" Habicht II, SAIL VENTURES
Chuck Goldman, LAWRENCE BERKELEY NATIONAL LABORATORY
John Beldock, Ph.D., ECOBROKER INTERNATIONAL
Jim Brodrick, U.S. DEPARTMENT OF ENERGY
Sean Casten, TURBOSTEAM CORPORATION
Robert Pratt, KENDALL FOUNDATION
Paul MacGregor, STERLING PLANET
Steven Baden, RESNET
Peter Molinaro, THE DOW CHEMICAL COMPANY
Gregory Kats, CAPITAL E
Peter Smith, NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY
Ed Feo, MILBANK, TWEED, HADLEY & MCCLOY LLP
Michael Dane, TURNER CONSTRUCTION
R. Neal Elliott, AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY
Stephen Selkowitz, LAWRENCE BERKELEY NATIONAL LABORATORY
Doug Foy, former MA Secretary for the OFFICE OF COMMONWEALTH DEVELOPMENT
Dan Adler, CALIFORNIA CLEAN ENERGY FUND

Key Issues to be Discussed:

- What's the market opportunity for energy efficiency investing?
- Successes and failures in energy efficiency technologies and projects
- Leading VC and Institutional Investor views on energy efficiency investing
- New developments in energy efficiency project financing
- Emerging energy efficiency technological developments worth investing in
- Innovative financing structures and business models in energy efficiency
- Monetizing energy efficiency through environmental credits, white tags, and beyond
- Corporate America's investments in energy efficiency
- Investing in the 'green building' boom

...and more

PLUS: Special Keynote Addresses by:

John Rowe, *Chairman and CEO,* EXELON
Patrick Henry Wood III, *Former Chairman,* FEDERAL REGULATORY COMMISSION
Amory Lovins, *CEO,* THE ROCKY MOUNTAIN INSTITUTE

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***** Revised Agenda*****

THE ENERGY EFFICIENCY FINANCE FORUM
The Next Frontier in Clean Energy Investing

April 12-13, 2007
The New York Helmsley Hotel
New York, NY

DAY ONE: **April 12, 2007**

8:00 AM *Registration and Continental Breakfast*

9:00 AM **Chair's Opening Remarks**
Dan Reicher, *Director of Climate Change and Energy Initiatives*
GOOGLE

Bill Prindle, *Deputy Director*
AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY

9:15 AM **Energy Efficiency: Surveying the Landscape**
R. Neal Elliott, *Industrial Program Director*
AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY

Pedro Haas, *Senior Practice Consultant*
MCKINSEY & CO.

9:45 AM **Executive Roundtable:**
Successes, Failures and Outlook for Financing Energy Efficiency

Moderator:
Dan Reicher, *Director of Climate Change and Energy Initiatives*
GOOGLE

Panelists:
John F. Mizroch, *Principal Deputy Assistant Secretary, Energy Efficiency and Renewable Energy*
U.S. DEPARTMENT OF ENERGY

Neil Petchers, *President*
NORESCO

Dan Adler, *Vice President*
CALIFORNIA CLEAN ENERGY FUND

Doug Foy, *former Massachusetts Secretary of*
THE OFFICE FOR COMMONWEALTH DEVELOPMENT

<u>Respondent</u>
Peter Fox-Penner, *Chairman*
THE BRATTLE GROUP

10:45 AM *Refreshment Break*

11:00 AM **Venture Capital Roundtable:**
Investment Opportunities in Energy Efficiency Technologies

<u>Moderator</u>:
F. Henry "Hank" Habicht II, *Managing Director*
SAIL VENTURES

<u>Panelists</u>:
Joyce Ferris, *Managing Partner*
BLUE HILL PARTNERS

Nancy Floyd, *Co-Founder and Managing Director*
NTH POWER

Chuck McDermott, *General Partner*
ROCKPORT CAPITAL

Philip J. Deutch, *Managing Partner*
NGP ENERGY TECHNOLOGY PARTNERS

12:00 PM **Luncheon Keynote Address:**

Amory Lovins, *CEO*
ROCKY MOUNTAIN INSTITUTE

1:15 PM **Project Finance Roundtable:**
Financing Energy Efficiency Projects

<u>Moderator</u>:
Dan Reicher, *Director of Climate Change and Energy Initiatives*
GOOGLE

<u>Panelists</u>:
Kevin Walsh, *Managing Director*
GE ENERGY FINANCIAL SERVICES

John G. Ravis, *Vice President*
TD BANKNORTH PROJECT FINANCE

Peter Liu, *Initial Founder and Vice Chairman*
NEW RESOURCE BANK

Chuck Goldman, *Group Leader, Markets and Policy Group*
LAWRENCE BERKELEY NATIONAL LABORATORY

2:15 PM **Technology Showcase:**
New Developments in Energy Efficiency Technologies

Moderator:
R. Neal Elliott, *Industrial Program Director*
AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY

Panelists:
Combined Heat & Power
Sean Casten, *President & CEO*
RECYCLED ENERGY DEVELOPMENT LLC (RED)

HVAC Innovations
Mike Thompson, *Environmental Affairs Director*
TRANE

Solid-State Lighting
Jim Brodrick, *Solid State Lighting Portfolio Manager*
U.S. Department of Energy

Building Technologies
Stephen Selkowitz, *Head*, *Building Technologies Department*
LAWRENCE BERKELEY NATIONAL LABORATORY

Monitoring and Communication Technologies
Dan Delurey, *Executive Director*
DEMAND RESPONSE AND ADVANCED METERING COALITION (DRAM).

3:30 PM *Refreshment Break*

3:45 PM **Panel Discussion**
Innovative Financing Structures and Business Models

Moderator:
Ed Feo, *Partner*
MILBANK, TWEED, HADLEY & MCCLOY, LLP

Panelists:
Jeff Eckel, *President & CEO*
HANNON-ARMSTRONG

Stephen Cowell, *Chairman and CEO*
CONSERVATION SERVICES GROUP

Robert Pratt, *Sr. Vice President, Climate Change/Energy*
KENDALL FOUNDATION

Richard Cowart, *Director*
REGULATORY ASSISTANCE PROJECT

DAY TWO: **April 13, 2007**

8:00 AM *Continental Breakfast*

8:30 AM **Chair's Recap of Day One**
Dan Reicher, *Director of Climate Change and Energy Initiatives*
GOOGLE

Bill Prindle, *Deputy Director*
AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY

8:45 AM **Keynote Address**
James E. Rogers, *President and CEO*
DUKE ENERGY

Jon Wellinghoff, *Commissioner*
FEDERAL ENERGY REGULATORY COMMISSION

9:45 AM **Monetizing Energy Efficiency: Environmental Credits, White Tags and Beyond**

Moderator:
Bill Prindle, *Deputy Director*
AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY

Panelists:
Kelly Bennett
STERLING PLANET, INC.

Steve Baden, *Executive Director*
RESNET

Steven Schiller
SCHILLER CONSULTING

Michael Winka, *Director*
OFFICE OF CLEAN ENERGY NJBPU

10:45 AM *Refreshment Break*

11:00 AM **Institutional Investor Roundtable:**
Perspectives on Investing in Energy Efficiency

Moderator:
Everett Smith III, *Chief Financial Officer*
NEW ENERGY CAPITAL

Panelists:
Scott Barrington, *Director of Private Equity*
PIPER JAFFRAY PRIVAL CAPITAL

Thomas Martin, *Vice President*
PACIFIC CORPORATE GROUP

Andrew Musters, *Partner, Alternative Investments*
ROBECO

12:00 PM **Luncheon Keynote**
Andy Karsner, *Assistant Secretary for Energy Efficiency and Renewable Energy*
U.S. DEPARTMENT OF ENERGY

1:15 PM **What is Corporate America Doing to Invest in Energy Efficiency?**

Moderator:
Brian Castelli, *Executive Vice President*
ALLIANCE TO SAVE ENERGY

Panelists:
Peter Molinaro, *VP Government Affairs*
THE DOW CHEMICAL COMPANY

James Stanway, *Sr. Dir. Global Supplier Initiatives - Energy*
WAL-MART ENERGY DEPARTMENT

Rick Meidel, *Vice President, Power Projects*
EXXONMOBIL POWER & GAS SERVICES, INC

2:15 PM *Refreshment Break*

2:30 PM **Investing in Energy Efficiency Through 'Green' Building Technologies and Projects**
James R. Green, CPE, LEED Accredited Professional, *VP Engineering*
GERALD HINES COMPANY

John Beldock, Ph.D., *President & CEO*
ECOBROKER INTERNATIONAL

Fiona Cousins, *Principal*
ARUP

3:30 PM **Keynote Panel Discussion:**
The Role of Utilities and Regulators in Energy-Efficiency Investing

Moderator:
Dan Reicher, *Director of Climate Change and Energy Initiatives*
GOOGLE

Panelists:
John Rowe, *Chairman and CEO*
EXELON

Patrick Henry Wood III, *former Chairman, Federal Energy Regulatory Commission*
WOOD3 RESOURCES

Peter R. Smith, *President*
NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY

4:30 PM **Chair's Closing Remarks**
Conference Concludes

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Dear Conference Participant:

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We have developed this event based on extensive industry research, structuring the topics and gathering together the speaker faculty based on feedback from numerous industry participants. Our goal is to provide you with the most up-to-date industry information possible, along with top-notch networking opportunities. Every effort has been made on our part to obtain the speakers presentation to be included in the book that you have received. If a speaker's presentation is not in the book, we would ask that you contact the speaker directly. If we have failed to meet your expectations in any way, please let us know by completing the evaluation form provided at this event. Of course, we would like to hear positive feedback as well!

We appreciate that you have chosen to spend your time and training dollars with us, and we're committed to satisfying your informational needs. Again, welcome to this event and thank you for your participation--we truly value your business.

Sincerely,

Lori Medlen, President
Financial Research Associates, LLC

Financial Research Associates, LLC

If you have any additional questions or requests for information beyond what is in this document book, please feel free to contact us at any time.

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American Council for an Energy-Efficient Economy

For 27 years, ACEEE's energy efficiency experts have helped to shape our nation's energy efficiency research and policy agenda. We achieve our success through…

ECONOMIC PROSPERITY
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…conducting in-depth technical & policy analyses

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Collaboration is key to ACEEE's success. We work with organizations around the globe including federal, state, and local government agencies, utilities, research institutions, businesses, and public interest groups. We focus on 5 primary program areas:

- **Energy Policy**
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ACEEE is leading the development of technology and policy solutions that ensure the security of our energy systems. As energy leaders, we promote the vibrancy of the American economy and the sustainability of the environment world-wide.

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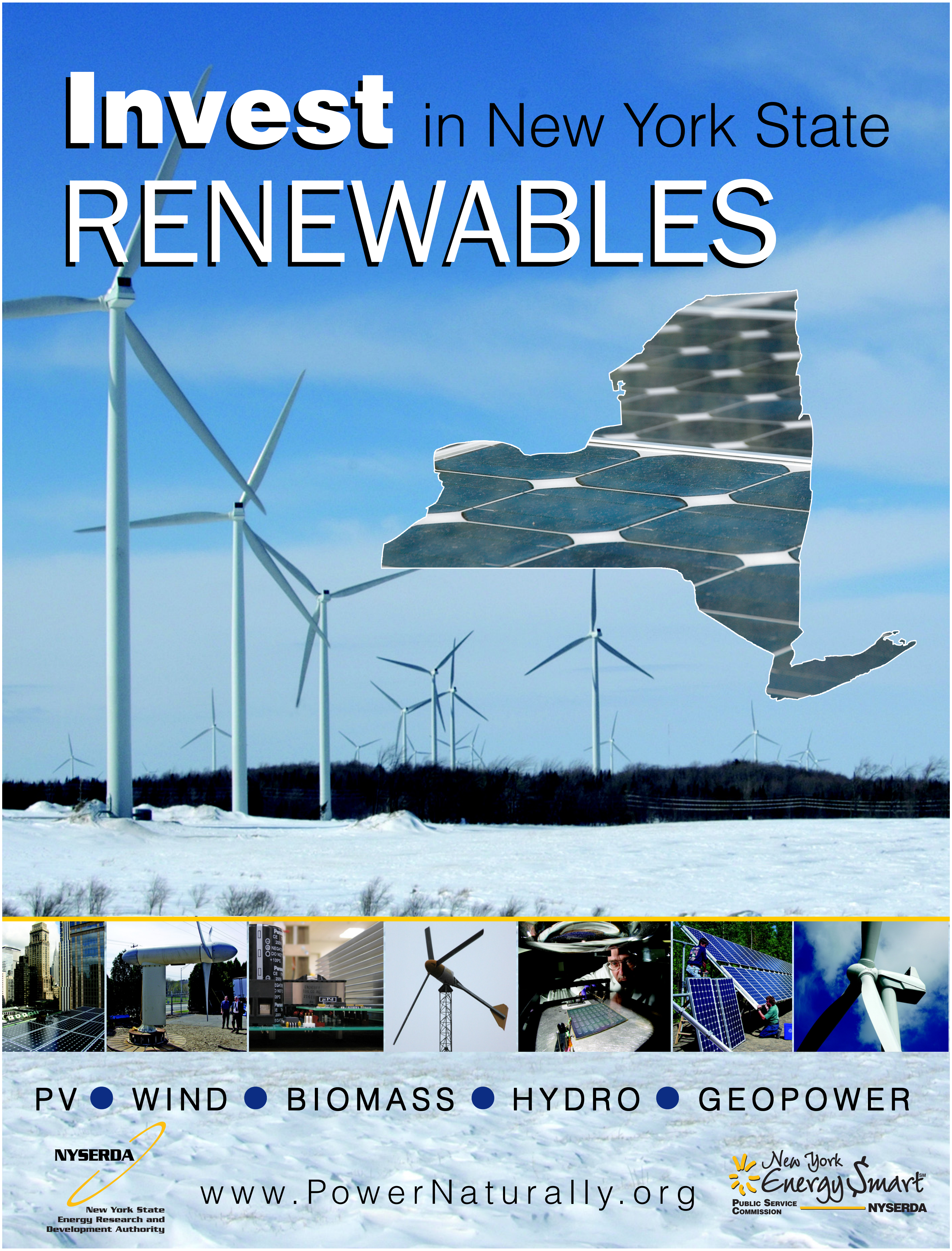
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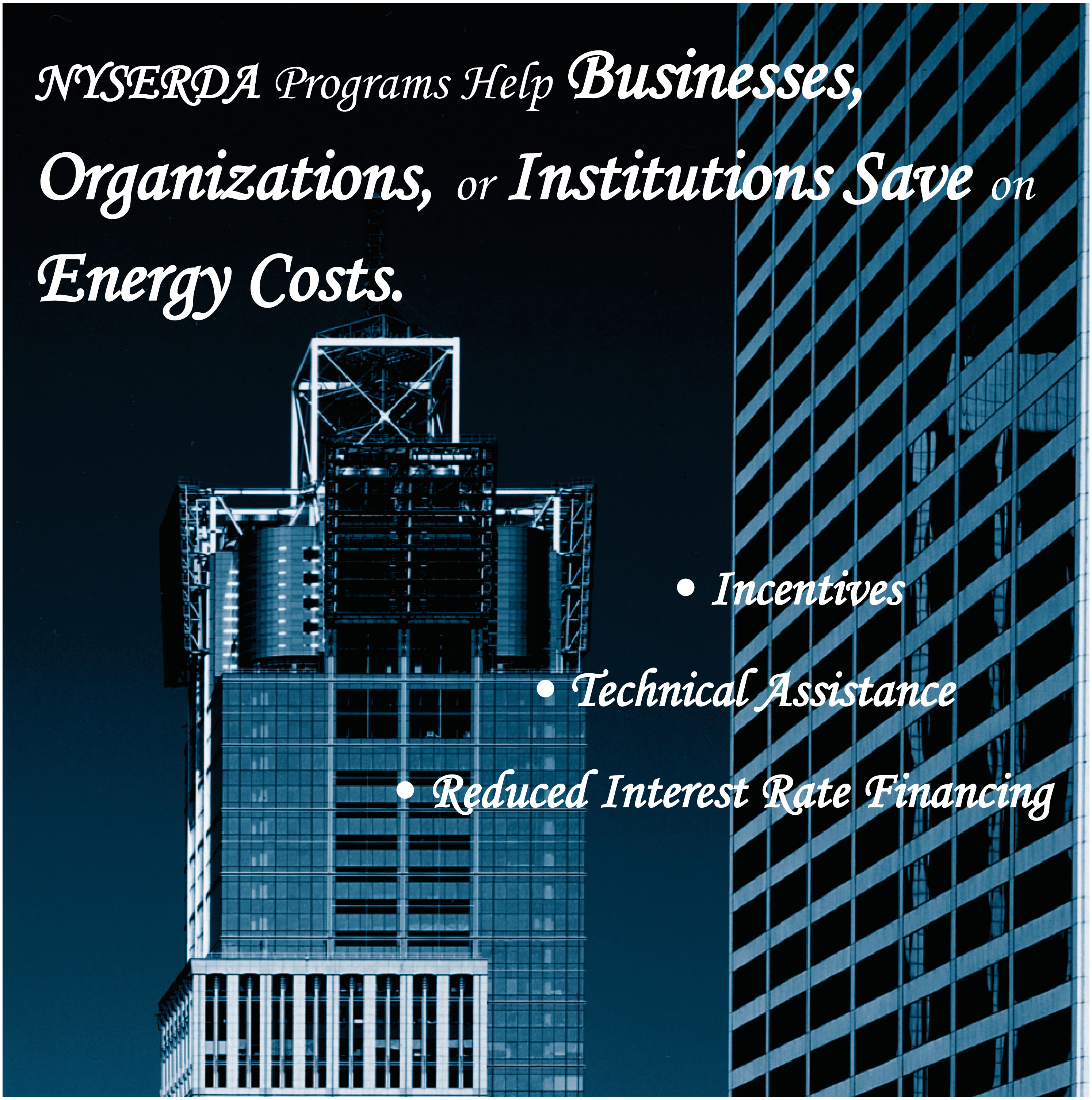
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30 years
Creating an Energy-Efficient World

For more information on the Alliance to Save Energy, or for valuable energy-saving tips, visit

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THE ENERGY EFFICIENCY FINANCE FORUM

April 12-13, 2007

The New York Helmsley
New York, NY

DAY ONE: April 12, 2007

Registration and Continental Breakfast

Chair's Opening Remarks

Dan Reicher, *Director of Climate Change and Energy Initiatives*
GOOGLE

Bill Prindle, *Deputy Director*
AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY

Dan W. Reicher has over 20 years of experience in business, government and non-governmental organizations focused on energy and environmental technology, policy, finance and law. He recently joined Google where he serves as Director of Climate Change and Energy Initiatives for the company's new venture called Google.org. Google.org has been capitalized with more than $1 billion of Google stock to make investments and advance policy in the areas of climate change and energy, global poverty, and global health.

Prior to his recent position at Google, Mr. Reicher served as President and Co-Founder of New Energy Capital Corp., a New England-based company that develops, invests in, owns and operates renewable energy and distributed generation projects. Mr. Reicher is also a member of General Electric's Ecomagination Advisory Board.

From 1997-2001, Mr. Reicher was Assistant Secretary of Energy for Energy Efficiency and Renewable Energy at the U.S. Department of Energy (DOE). As Assistant Secretary, he directed annually more than $1 billion in investments in energy research, development and deployment related to renewable energy, distributed generation and energy efficiency. Prior to that position, Mr. Reicher was DOE Chief of Staff (1996-97), Assistant Secretary of Energy for Policy (Acting) (1995-1996), and Deputy Chief of Staff and Counselor to the Secretary (1993-1995). He was also a member of the U.S. Delegation to the Climate Change Negotiations, Co-Chair of the U.S. Biomass Research and Development Board, and a member of the board of the government-industry Partnership for a New Generation of Vehicles. After leaving the Clinton Administration in 2001 he was a consultant to the Senate Environment and Public Works Committee and a Visiting Fellow at the World Resources Institute.

In 2002, Mr. Reicher became Executive Vice President of Northern Power Systems, a venture capital-backed renewable energy and distributed generation engineering, services and technology company with installations in more than forty-five countries. Mr. Reicher led the renewable energy sales group at Northern and also was actively involved with the company's project finance, government relations and public affairs initiatives. He also played a significant role in the successful sale of the company to Proton Energy Systems, a leading hydrogen company, and the simultaneous creation of Distributed Energy Systems, a new NASDAQ-listed holding company that now owns both Northern Power and Proton Energy.

Prior to his roles at the Department of Energy and in the business community, Mr. Reicher was a senior attorney with the Natural Resources Defense Council where he focused on the federal government's energy and nuclear programs as well as environmental law and policy issues in the former Soviet Union. He was also previously Assistant Attorney General for Environmental Protection in Massachusetts, a law clerk to a federal district court judge in Boston, a legal assistant in the Hazardous Waste Section of the U.S. Department of Justice, and a staff member of President Carter's Commission on the Accident at Three Mile Island.

Mr. Reicher currently is co-chairman of the advisory board of the American Council on Renewable Energy and a member of the boards of the American Council for an Energy Efficient Economy, the Vermont Energy Investment Corporation, the Keystone Center's Energy Program, and Circus Smirkus. He was also recently a member of the National Academy of Sciences Committee on Alternatives to Indian Point for Meeting Energy Needs.

Mr. Reicher also recently served as an adjunct professor at the Yale University School of Forestry and Environmental Studies and Vermont Law School. He holds a B.A. in Biology from Dartmouth College and a J.D. from Stanford Law School. He also studied at Harvard's Kennedy School of Government.

Mr. Reicher was a member of a National Geographic-sponsored expedition that was the first on record to navigate the entire 1888 mile Rio Grande and was also a member of the first group on record to kayak the Yangtze River in China.

Mr. Reicher is married to Carole Parker, who headed the Office of Pollution Prevention at the U.S. Department of Defense from 1994 to 1999. Carole and Dan have three children and live in Norwich Vermont. The family will be relocating to California in August 2007.

William R. Prindle
Acting Executive Director
American Council for an Energy-Efficient Economy

Mr. Prindle provides leadership and accountability for ACEEE. In addition, he directs ACEEE's energy policy program, which conducts policy analysis and advocacy on energy efficiency issues at the national and state levels. In more than 30 years in the energy field, he has worked in regional planning, corporate communications, management consulting, and association management. He has testified before Congress, appeared on radio and TV, and been published frequently as an expert on energy efficiency.

Bill earned a B.A. degree in Psychology from Swarthmore College and an M.S. from the University of Pennsylvania. He has served on the boards of such organizations as the Energy and Environmental Building Association, the Association of Energy Services Professionals, and the National Fenestration Rating Council.

About ACEEE: *The American Council for an Energy-Efficient Economy is an independent, nonprofit organization dedicated to advancing energy efficiency as a means of promoting both economic prosperity and environmental protection. Founded in 1980 by leading energy research experts, ACEEE has become a respected, independent voice for energy efficiency technology, policy, and consumer education. The organization conducts research, publishes technical and policy reports, holds conferences and other forums, and educates decision-makers, energy professionals, and consumers. For more information about ACEEE and its programs, publications, and conferences, contact ACEEE by mail at 1001 Connecticut Avenue, N.W., Suite 801, Washington, D.C. 20036-5525, by phone at 202-429-8873, or on the web at* *http://www.aceee.org*

Financing Energy Efficiency: the First Fuel in the Race for Clean Energy

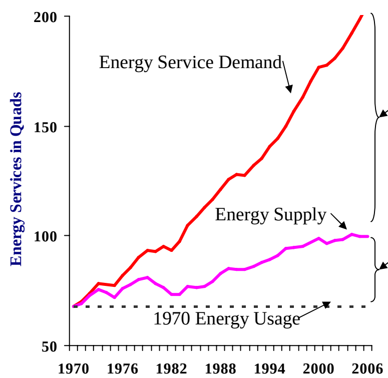
Bill Prindle
Acting Executive Director

Energy Efficiency Finance Forum
April 12, 2007

Overview

- What does energy efficiency contribute to the U.S. economy?
- What is efficiency's future potential?
- Why is energy efficiency such a good investment?
- Why doesn't the market "just do it"?
- The Climate Imperative
- Questions for the Forum

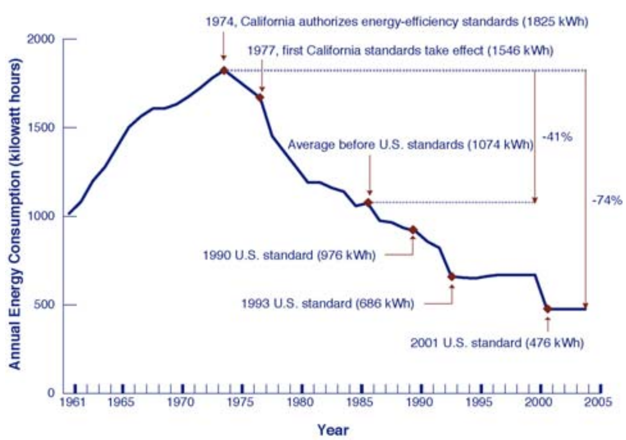
Energy Efficiency Gives More!



- Since 1970, ***energy efficiency*** has met 77% of new energy service demands in the U.S, while ***new energy supplies*** have contributed only 23% of new energy service demands.

How Efficiency 'Gives More'

The humble refrigerator…….



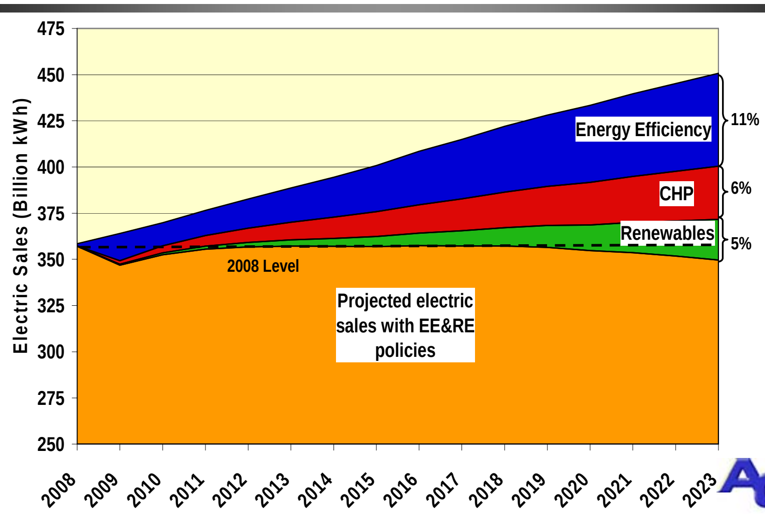
Energy Efficiency Investment is Big Business

- Total annual spending efficient technologies and services: $200 billion
- Total annual U.S. investment in energy supply infrastructure: $100 billion
- Inference: the “energy services” infrastructure is much larger than the “energy supply” infrastructure
- Question: How much additional efficiency spending can be tapped through financial investment mechanisms?

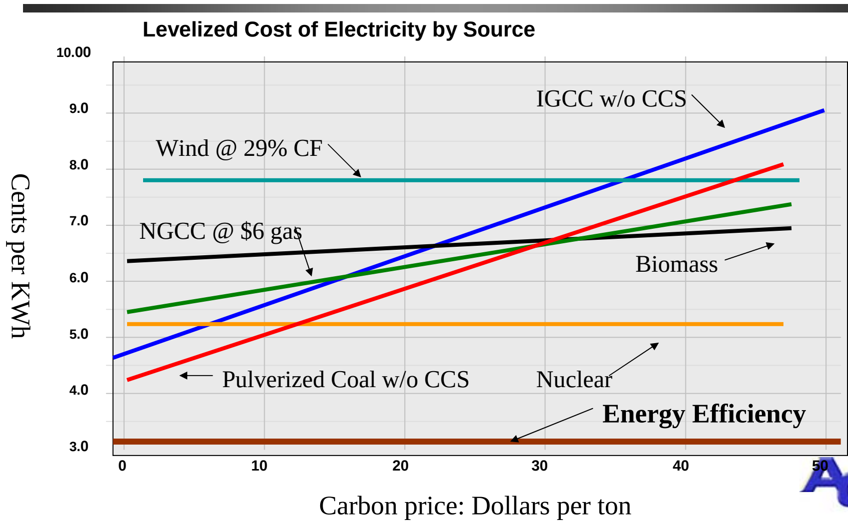
Efficiency Investment Could be a Much Bigger Business

- ACEEE estimates that annual energy efficiency spending could double to $400 billion annually
- Where will the additional $200 billion come from?
- How much of that additional $200 billion will go through the financial community?
- …that’s what we are here to find out

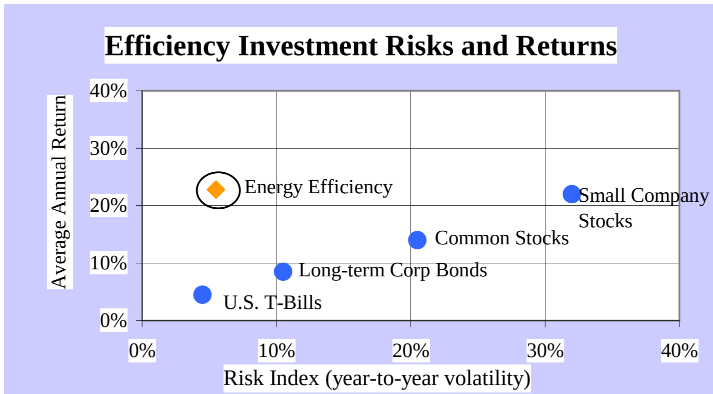
The Texas Example



Energy Efficiency: The Cheapest Resource



Energy Efficiency: Low Risk, High Return



But if it's such a good deal…..

Why won't the market just do it?

- Market barriers—principal-agent problem affects ~half of buildings energy use
- Regulatory barriers—utility regulation especially
- Financial hurdles—the "Warren Buffet problem"

The Warren Buffet Problem

When asked why he was buying PacifiCorp instead of individual powerplants:

- “It’s a lot easier to do one $10 billion deal than 10 $1 billion deals
- …which is a whole lot easier than doing 10 million $1000 deals!

Climate: the 21st Century Imperative

- Major cuts in carbon emissions need to start in next 10 years
- Efficiency is the only resource deployable that fast
- Curbing demand through efficiency essential to enabling clean supplies
- It’s a race against time, and energy efficiency is the first fuel

Questions for the Forum

- Where are the new technology opportunities?
- What new financing approaches can grow the efficiency market?
- What policies will it take to support better financing?
  - Utility sector
  - Credit enhancement
- “Who wants to make a deal”?

Energy Efficiency: Surveying the Landscape

R. Neal Elliott, *Industrial Program Director*
AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY

Pedro Haas, *Senior Practice Consultant*
MCKINSEY & CO.

R. Neal Elliott, Ph.D., P.E.

Neal Elliott has been Industrial and Agricultural Program Director with the American Council for an Energy-Efficient Economy (ACEEE), a nonprofit organization dedicated to advancing energy efficient technologies and policies since 1993. Elliott is an internationally recognized expert and author on energy efficiency in manufacturing and agriculture, industrial energy efficiency programs, motor systems, combined heat and power, analysis of energy efficiency and energy markets, and a frequent speaker at domestic and international conferences. Prior to joining ACEEE, Elliott was a leader of the industrial and agriculture energy efficiency programs at the N.C. Alternative Energy Corporation (now Advanced Energy), focusing particularly on chemicals, wood products, textiles, livestock and produce industries. Prior to joining NCAEC he was state wood energy coordinator with the Extension Service at North Carolina State University. Elliott received B.S. and M.S. degrees in Mechanical Engineering from North Carolina State University, a Ph.D. from Duke University, and is a registered professional engineer in North Carolina.

October 28, 2003

Efficiency Financing: A Way out of America's Energy and Climate Straitjacket

R. Neal Elliott, Ph.D., P.E.
Industrial Program Director
ACEEE

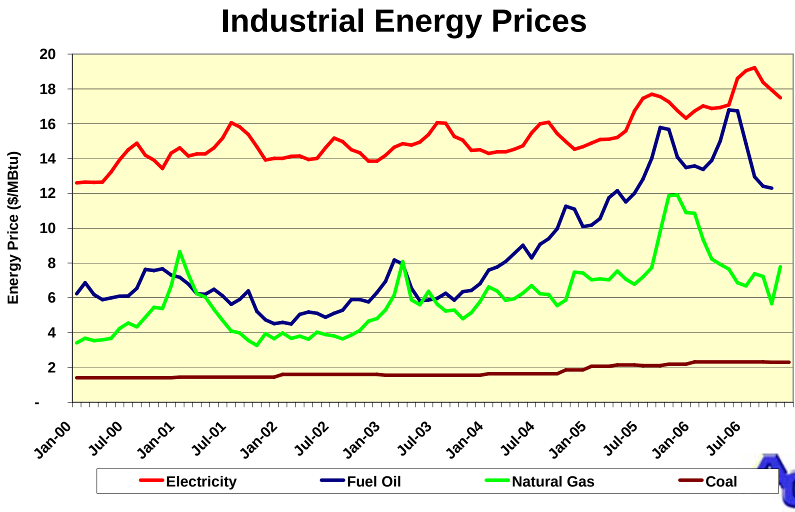
Still in an Energy Straightjacket

*"Not Your Parents' Energy Crisis" **

- No current "supply" limitations – rather "deliverability" limitations in all energy markets
- Oil markets constrained by refining
- Coal markets constrained by mining and rail capacity
- Electricity constrained by available fuel and transmission – high demand taxes infrastructure
- Renewables limited by equipment manufacturing
- Fuel switching limited by tight markets

* Tom Friedman 2006

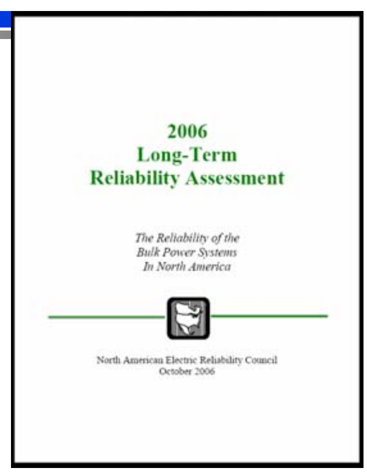
Straitjacket Manifested by Increased Prices and Volatility



Source: ACEEE from EIA 2007

Concerns about Electric Adequacy

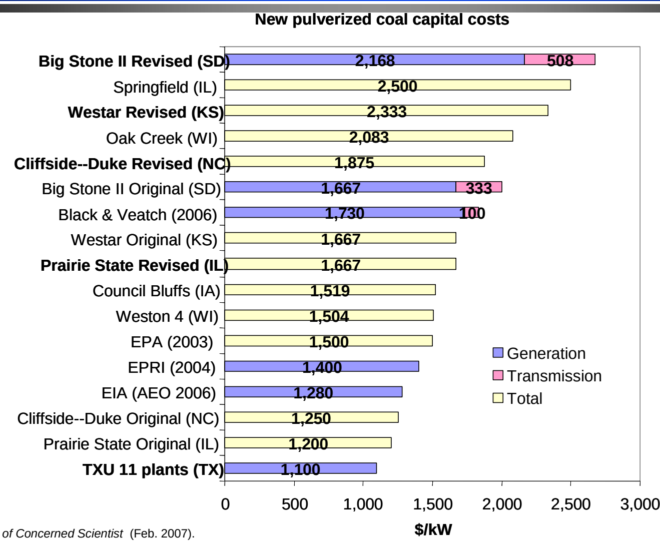
- Reserve margins falling – CC-GT's no longer economic
- Concerns about gas supplies continue
- LNG imports down
- Electric demand surging
- Rate caps coming off
- Prices increasing rapidly
- Public discontent growing
- Pressure for new coal plants


2006
Long-Term
Reliability Assessment

The Reliability of the Bulk Power Systems In North America

North American Electric Reliability Council
October 2006

Coal No Longer the Least-Cost Resource



Source: *Union of Concerned Scientist* (Feb. 2007).

Efficiency: a Way Out of the Straitjacket

- Market fundamentals show no signs of changing for ~10 years
- Efficiency can bring balance to energy markets—reduce electricity and gas prices
- Efficiency enables clean tech—without demand reduction, no clean supplies can catch up
- Climate trumps all—efficiency is the best down payment on climate stabilization

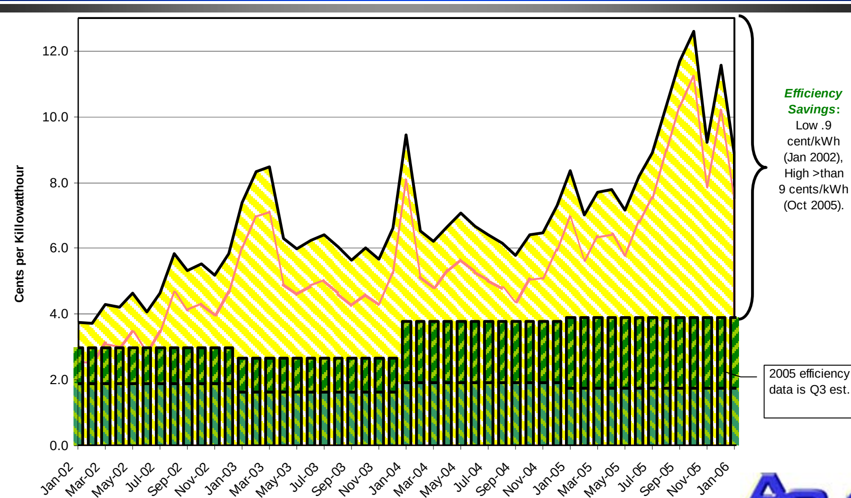
What is Energy Efficiency?

- Distinguishing between energy services and energy commodities
- We want energy services—lighting, cooling, shaft power, hot water—not energy commodities—oil, gas, electricity
- Efficiency means meeting energy service demands with less energy commodity
- Requires more-productive technology investment

Energy Efficiency as a Resource

- Can be quickly deployed
- Is cost effective – less than 4¢ / kWh
- Large potential available – most states haven't tapped more than a fraction
- Many states achieving impressive results – CA, WA, OR, TX, MN, NY, VT, MA
- State efforts leading national policy

How Much Does it Cost?



Source: Dworkin 2007
from VT-PSC data

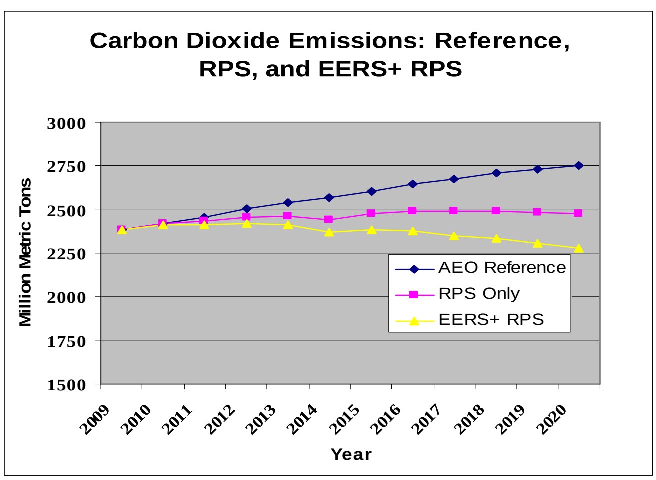
Efficiency Enables Renewable Projects

- At the micro level, reducing on-site energy use through efficiency can:
  - Increase the fraction of a project's energy needs that can be met from renewables – reducing risks from volatile energy prices
  - reduce size of renewable investment required to meet remaining on-site energy needs
  - Increase renewable energy available for sale to the electricity grid for "green tags"

Efficiency Enables Renewables

- At the macro level, efficiency moderates demand growth, so that renewables can begin reducing carbon emissions
- Realistic market analysis shows that no renewables deployment scenario will work without first moderating demand growth
- That's another reason why efficiency is the 'first fuel' in the race for clean energy
- Energy Efficiency Resource Standards (EERS) and Renewable Portfolio Standards (RPS) make the perfect couple—several states have both—CA, NV, CO, TX, PA, CT

EERS and RPS Impacts



What is Efficiency Investment?

- Investment in equipment, materials and practices that offer equivalent or superior energy services with less energy commodity consumption.
- Examples:
  - Industrial productivity improvements
  - High-performance building systems upgrades
  - State of the art building construction
- It can't be metered, but it can be measured:
  - For larger projects: Engineering protocols (IPMVP)—Efficiency Valuation Organization
  - For common measures: Deemed savings
  - For new construction: software simulations

How Can Efficiency Be Financed?

- Owner-installed – cash or conventional debt
- Third Party project finance:
  - Utility/energy provider
  - Energy Service Company (ESCo)
  - Vendor offering value added services
- Institutional debt mechanisms
  - Home mortgage mechanisms—Energy Efficient Mortgages
  - Commercial real estate portfolio investment
  - Bond financing
- Equity mechanisms
  - Private equity and venture capital
  - Stock offerings
- Combination of Equity and Debt
- ….***Your innovation here!***

Pedro F. Haas

Pedro Haas is a Senior Practice Consultant with McKinsey & Company, with expertise in trading and risk management in the petroleum industry, as well as mergers and acquisitions, exploration and production, refining, and gas. Working with McKinsey, he has helped a large integrated oil company understand opportunities in third-party petroleum trading, has collaborated in various studies involving trading and risk management issues for the Firm, has supported E&P opportunity valuation for both crude oil and gas, and has worked on E&P strategy issues with independent and major companies.

Fluent in three languages, below is an overview of positions and responsibilities he has held, including:

¶ CEO of KoSa (a joint venture between Koch Industries and Isaac Saba, a Mexican investor, which included most of the polyester assets of Hoechst AG).

¶ Managing Director for Latin America for Koch Industries, Inc., responsible for developing new business for Koch throughout the region, including upstream, refining, and chemical projects.

¶ Various positions with Pemex: CEO of Pemex Gas (Mexico City), the unit responsible for natural gas and LPG fractionation, transportation, and marketing; CEO of PMI, the international trading subsidiary; Managing Director for Pemex in Europe (London and Paris), responsible for crude oil sales in Europe, oil market intelligence, and attendance to OPEC meetings; and Deputy General Manager (Mexico City), Crude Oil Exports, International Trade Department.

¶ Economic Counselor to the Mexican Embassy in Japan (Tokyo).

In addition to his years in the industry's corporate sector, Mr. Haas was on the board of the Institute of the Americas, and has served on the boards of Profalca, SA (Caracas); Repsol, SA (Madrid); and Petronor, SA (Madrid/Bilbao). He is an annual lecturer at the Oxford Energy Seminar and is a member of the Oxford Energy policy Club.

Mr. Haas studied Economics at the Universidad Nacional Autonoma de Mexico, and obtained a BA in Economics (cum laude) from Vanderbilt University. He did graduate work in economics at Cambridge University.

McKinsey Global Institute

CONFIDENTIAL

Global energy demand growth and productivity : a microeconomic perspective

McKinsey Global Institute and
McKinsey's Global Energy and Materials Practice

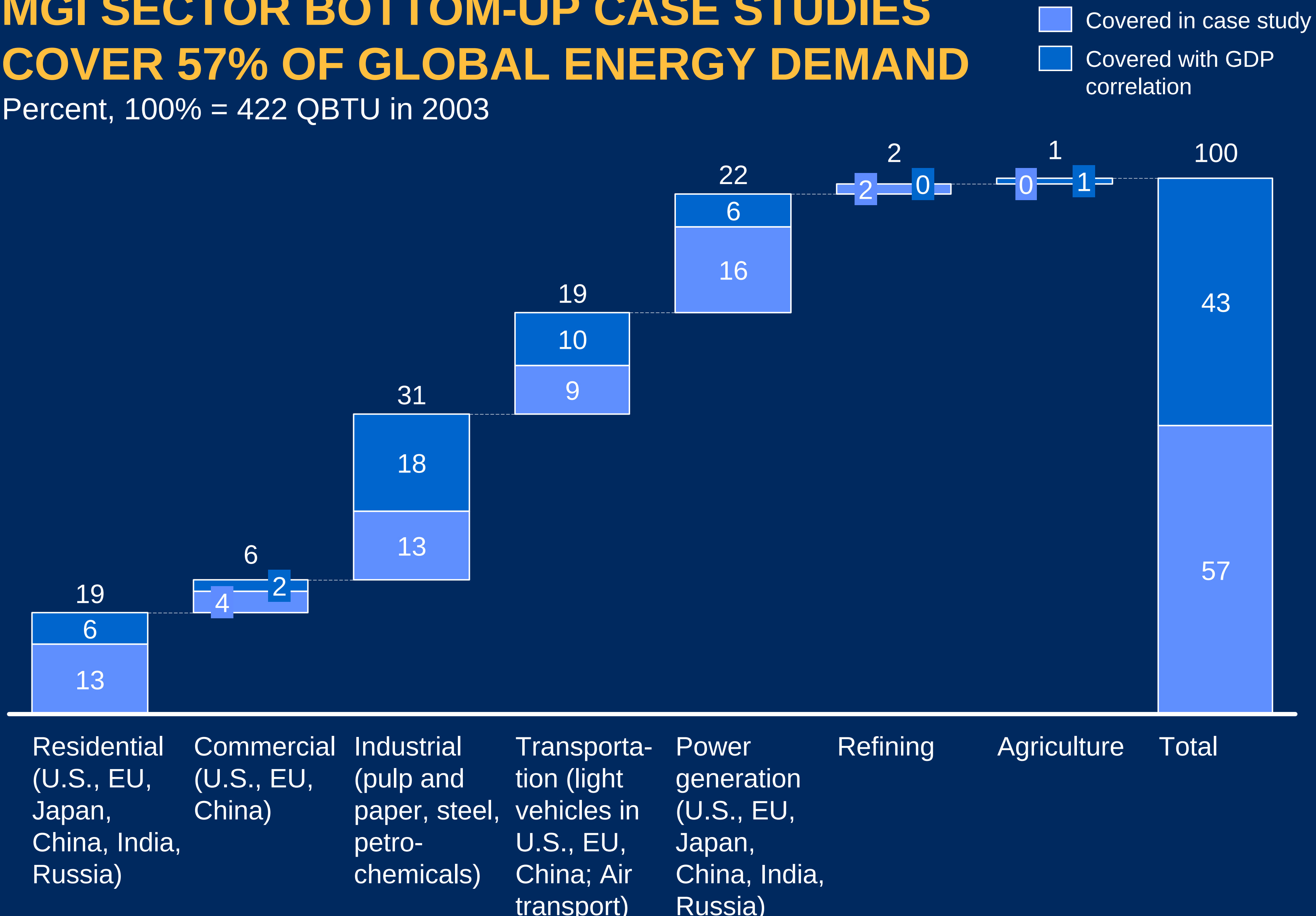
April 12, 2007

McKINSEY GLOBAL INSTITUTE (MGI)

- McKinsey's internal economics think tank
- Founded in 1990: its mission is to offer insights into the most important economic issues relevant to global corporate and policy leaders
- Combines the depth of real business management experience unique to McKinsey with the rigor of world-class economic analysis
- Results fully syndicated with Academic Advisory Boards composed of premier academic thinkers

MGI SECTOR BOTTOM-UP CASE STUDIES COVER 57% OF GLOBAL ENERGY DEMAND

Percent, 100% = 422 QBTU in 2003

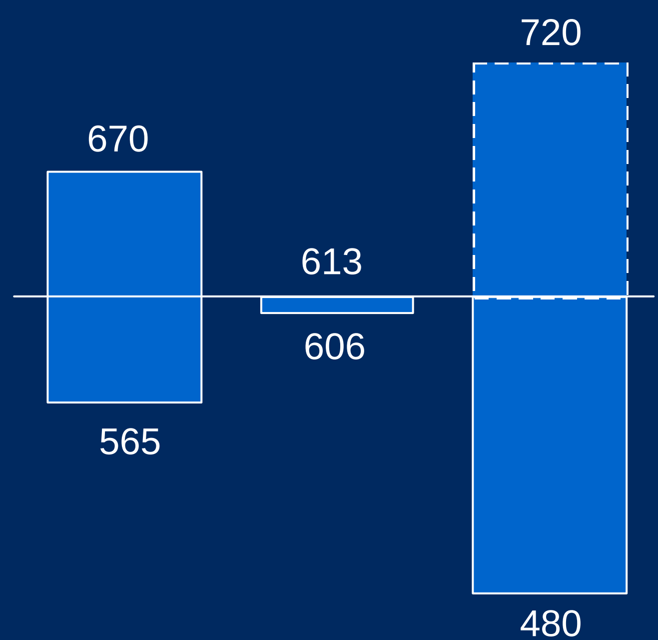


Source: IEA, MGI analysis

ENERGY PRODUCTIVITY AND GDP GROWTH, NOT OIL PRICE, MAIN SOURCES OF UNCERTAINTY (AND OPPORTUNITY)

Scenarios	GDP*	Oil price**	Energy productivity***

2020
base case demand
= 613 QBTU
= 2.2 % growth p.a.



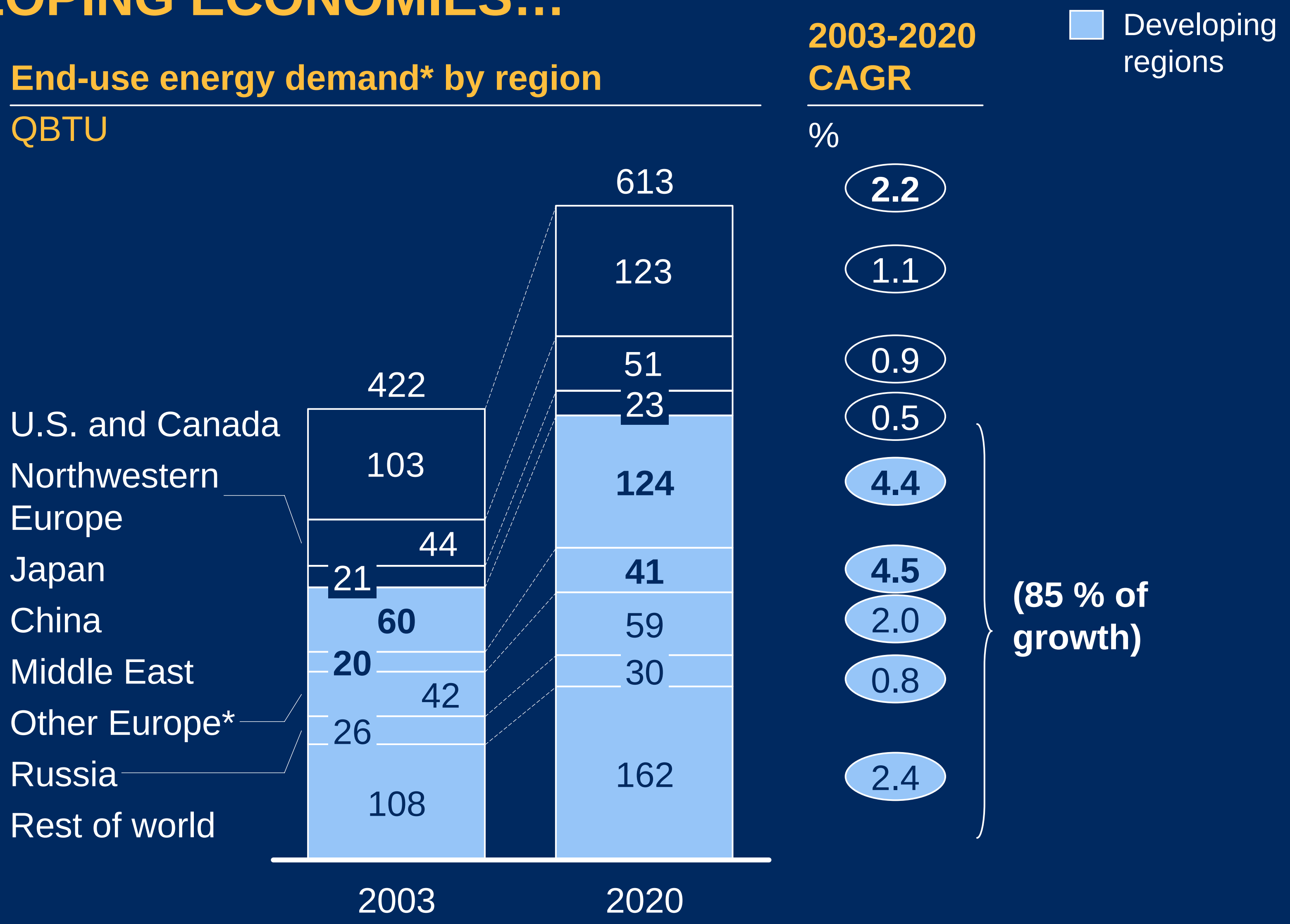
Global demand growth to 2020 Percent			
High	2.8	2.2	3.2
Low	1.7	2.1	0.7

* ± 2% for China and India, ± 1% for other developing regions, and ± 0.5% for developed economies
** 30, 50, 70 $/bbl crude oil respectively
*** 107 QBTU of additional demand in a "frozen technology" case without energy productivity improvements
Source: BP; MGI Global Energy Demand Model

MOST DEMAND GROWTH COMES FROM DEVELOPING ECONOMIES…

End-use energy demand* by region

QBTU



* Transformation losses (power generation. refining) allocated to end-use segments.

** Includes Baltic / Eastern and Mediterranean Europe and North Africa

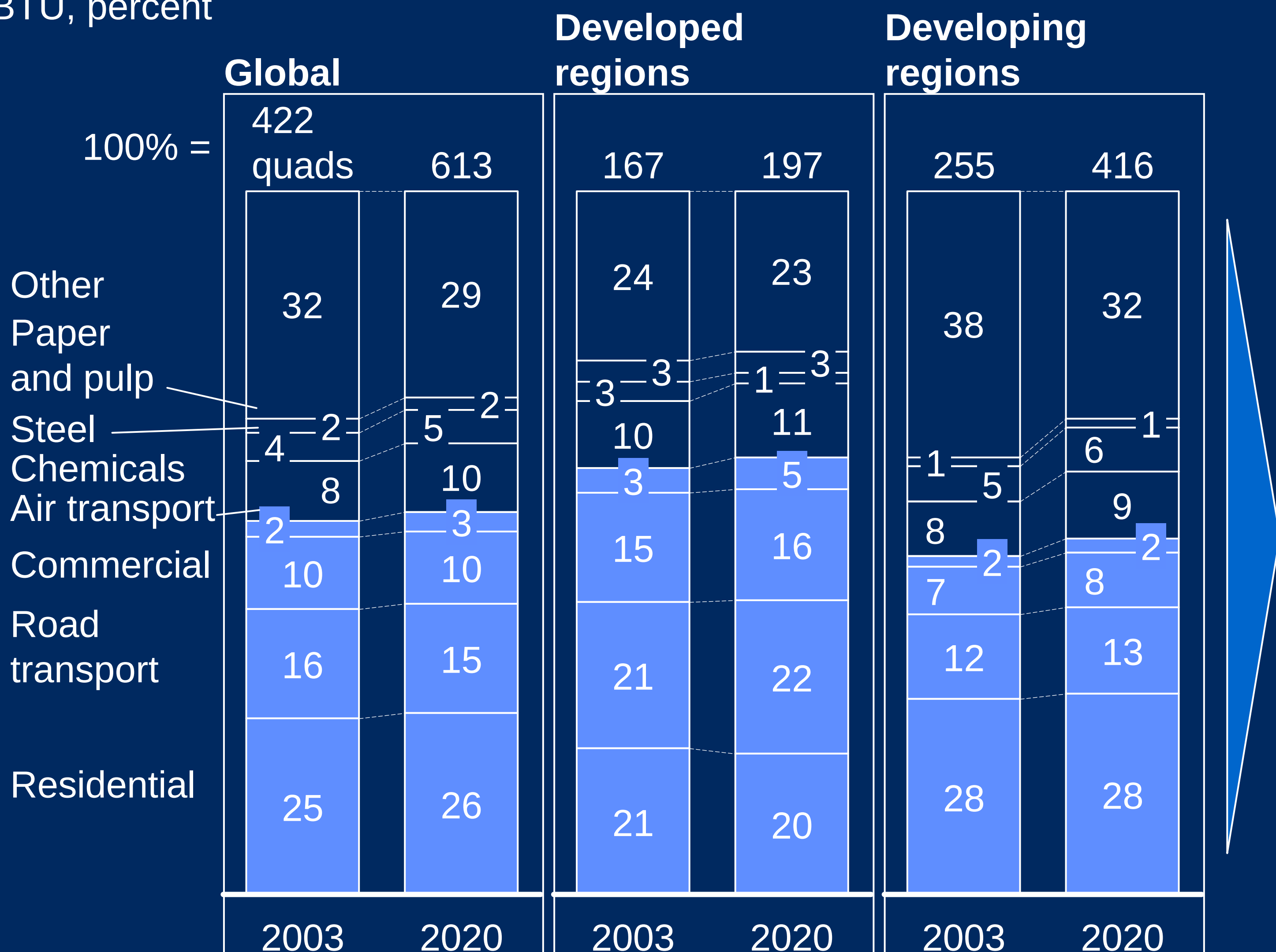
Source: MGI Global Energy Demand Model

...AND FROM CONSUMER-DRIVEN SECTORS, PARTICULARLY IN DEVELOPED ECONOMIES

$50 OIL SCENARIO
BASE CASE GDP

End-use energy demand 2003-2020 by region*

QBTU, percent

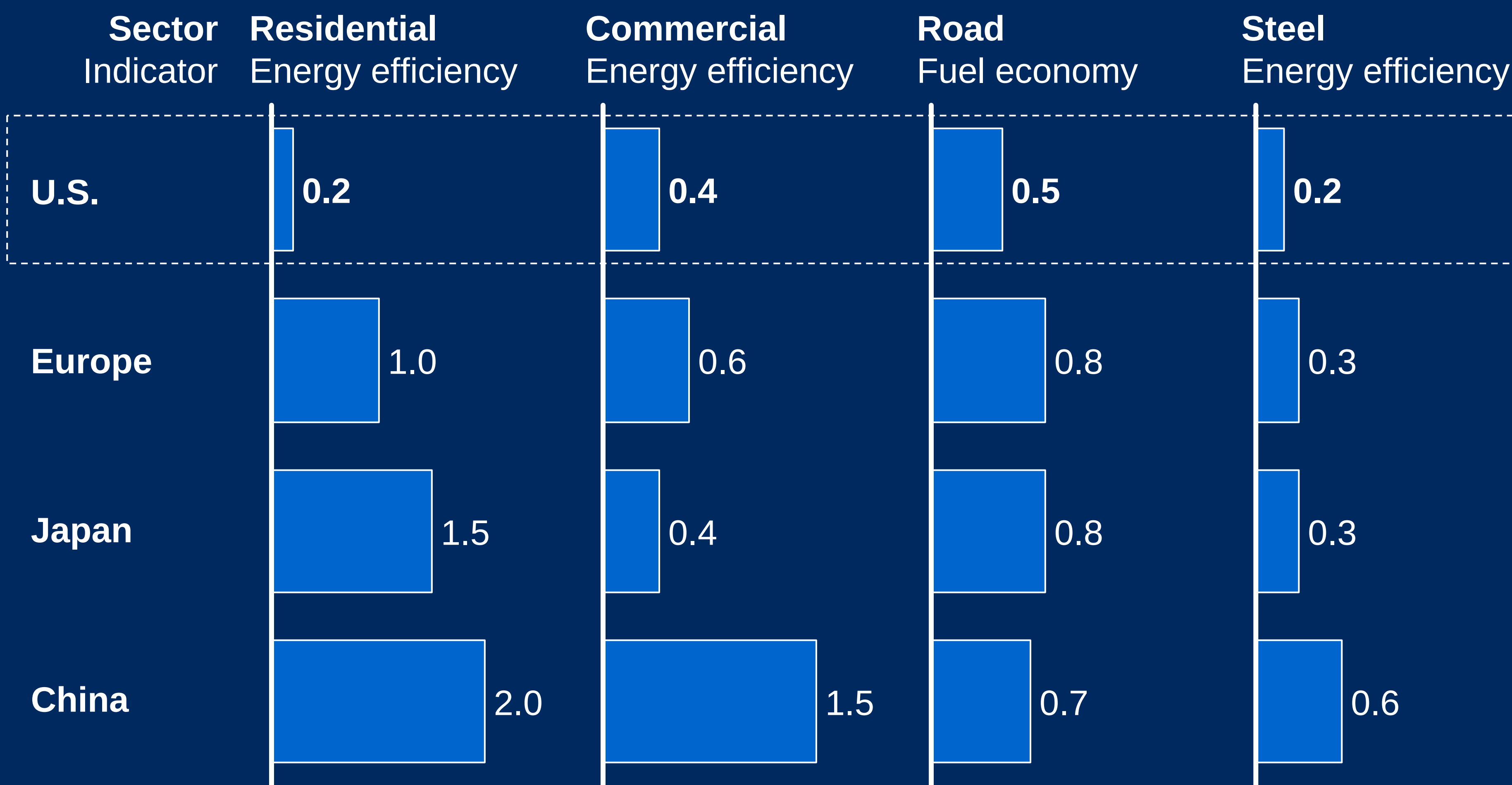


- The share of global demand driven by consumers increases from 53% to 54%
- Consumers drive 57% of global demand growth (70% in developed regions, 55% in developing regions)

Source: MGI Global Energy Demand Model

ENERGY PRODUCTIVITY IMPROVEMENTS ARE LOWER IN THE U.S. ACROSS ALL SECTORS

Base case annual improvement of energy-productivity indicators, 2003-2020

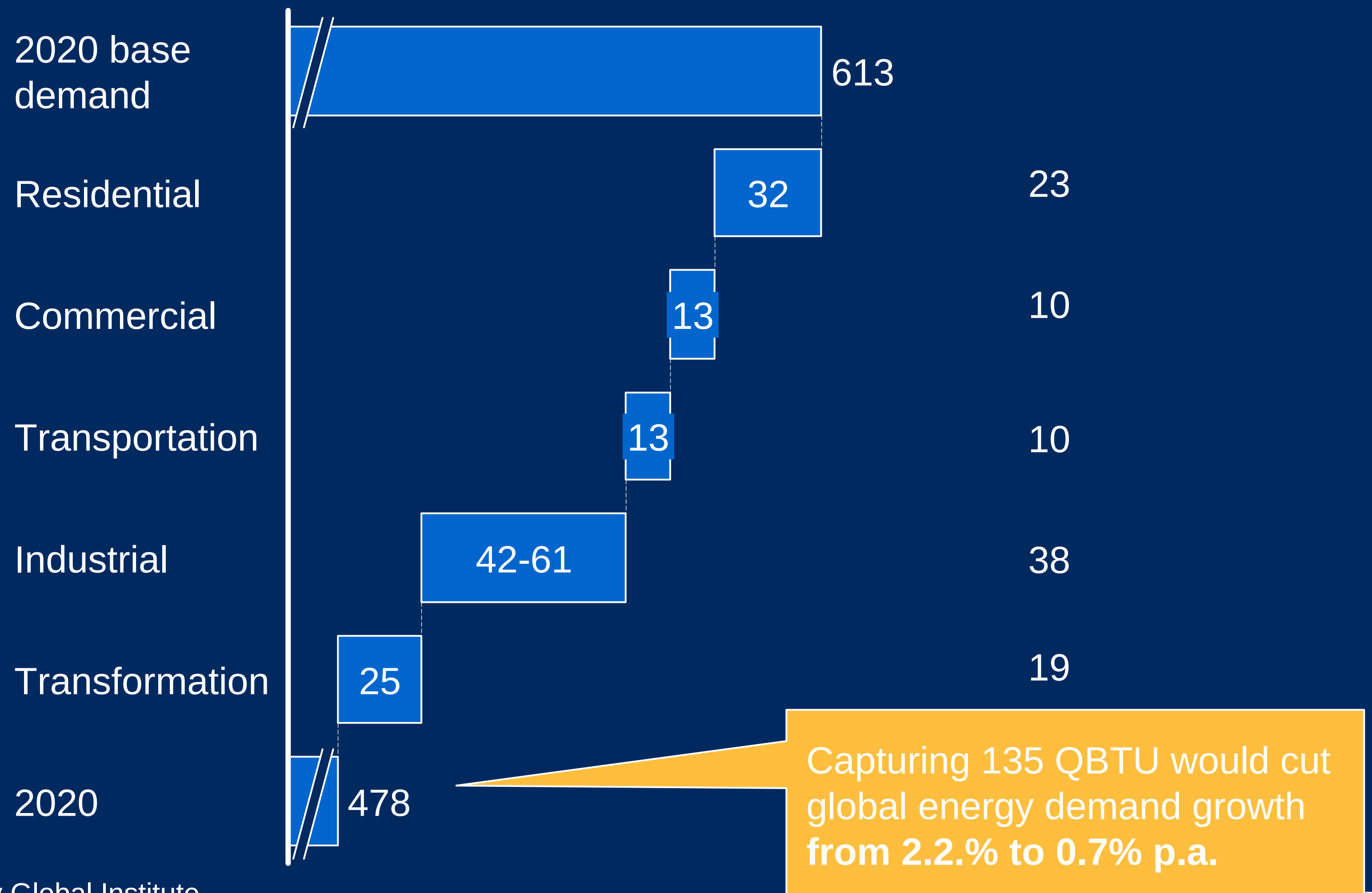


Source: EIA, Lawrence Berkeley National Lab China Energy Group, McKinsey Global Institute

LARGE OPPORTUNITIES FOR ENERGY PRODUCTIVITY IMPROVEMENTS ACROSS SECTORS

Potential demand reduction in 2020 through enhanced energy productivity
QBTU

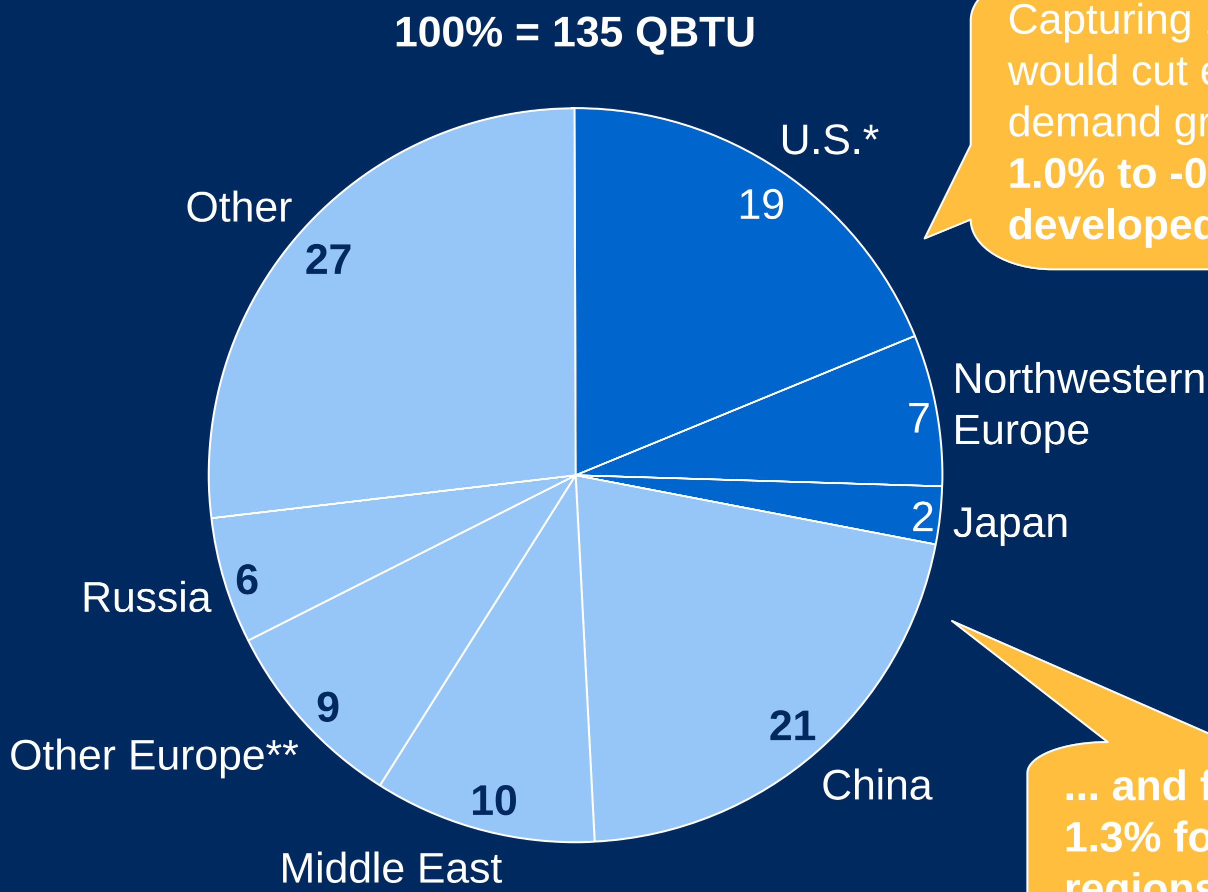
Percent of total opportunity



Source: McKinsey Global Institute

... AND ACROSS REGIONS

Developing regions



Capturing 135 QBTU would cut energy demand growth **from 1.0% to -0.3% for developed regions...**

... and from 2.9.% to 1.3% for developing regions

* Includes Canada (2.3 - 2.6 QBTU opportunity)

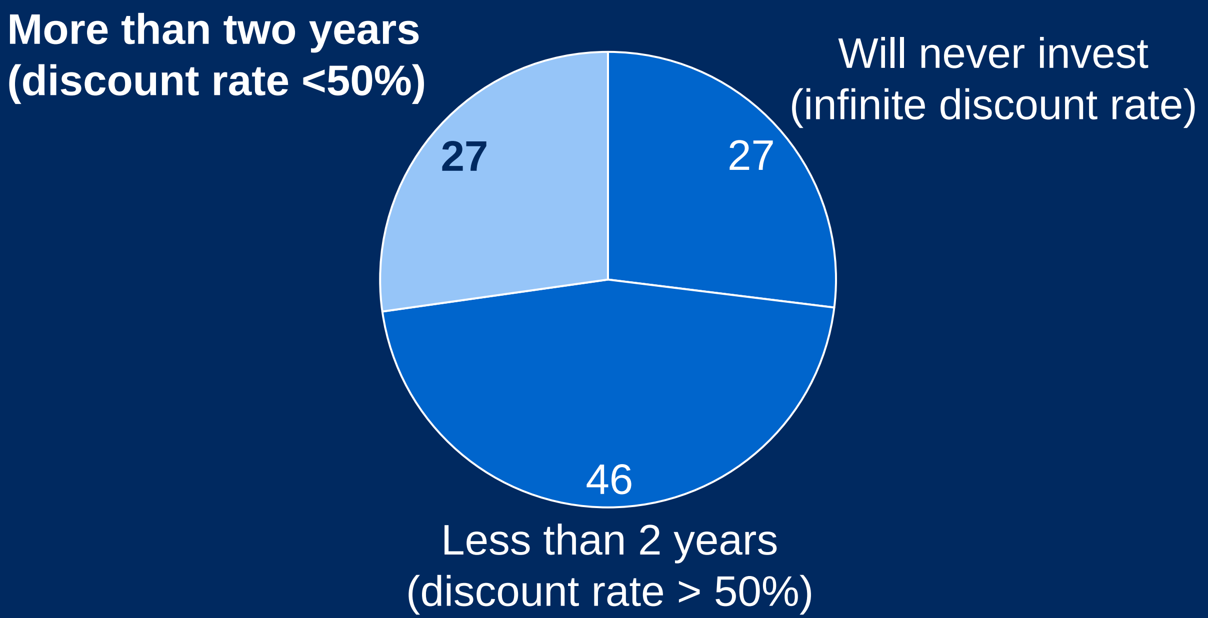
** Includes Baltic/Eastern and Mediterranean Europe and North Africa

Source: MGI analysis

HIGH HURDLE RATES REDUCE THE AMOUNT OF EFFICIENCY INVESTMENTS

COMMERCIAL SECTOR EXAMPLE

Distribution of required payback of US commercial-sector consumers



73% of users will disregard energy-efficiency investments with a payback time above two years (IRR < 50%)

Interview with manufacturer of energy-efficient equipment

"In the commercial sector, many energy-efficiency investments have 6- to 12-year paybacks, way above the typical 2-year cutoff used in capital budgeting."

Source: EIA NEMS Commercial Model Documentation, 2005; disguised client interview, May 2006

HIGH HURDLES RATES ARE LINKED TO OBSTACLES FACED BY ENERGY PRODUCTIVITY CAPEX

Obstacle	Key issues
• No infor-mation	• Aggregate metering and billing for all appliances • Reliability and ease of access to information
• No mate-riality	• Energy only a small part of the cost of owning and operating a device or building – E.g., gains from TV standby efficiency = $5/TV per year
• Capital constraints	• Immediate disbursement for future returns
• Split incentives	• Purchaser or operator of building/appliance distinct from entity paying energy bill – E.g., landlord/tenant relationship

Source: Interlaboratory Working Group. 2000. *Scenarios for a Clean Energy Future* (Oak Ridge, TN; Oak Ridge National Laboratory and Berkeley, CA; Lawrence Berkeley National Lab)

GLOBAL ENERGY DEMAND – KEY INSIGHTS

- Global energy demand 422 QBTU in 2003--historical growth of 1.7% p.a.
- Going forward, demand growth accelerates to 2.2% p.a., bringing demand to 613 QBTU in 2020
- 85% of global growth comes from developing economies—China demand approaches US demand and the Middle East approaches EU15 demand levels
- Consumers drive 70% of energy demand growth in developed regions and 55% in developing regions—consumer behavior is key
- 135 QBTU in untapped opportunities for energy productivity improvement–if captured, they would cut global energy demand growth to 0.7% p.a.
- ***Capturing these opportunities requires policy makers to address market inefficiencies and obstacles***

THANK YOU

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Executive Roundtable:
Successes, Failures and Outlook for Financing Energy Efficiency

Moderator:
Dan Reicher, *Director of Climate Change and Energy Initiatives*
GOOGLE

Panelists:
Andy Karsner, *Assistant Secretary for Energy Efficiency and Renewable Energy*
U.S. DEPARTMENT OF ENERGY

Neil Petchers, *President*
NORESCO

Dan Adler, *Vice President*
CALIFORNIA CLEAN ENERGY FUND

Doug Foy, *former Massachusetts Secretary of*
THE OFFICE FOR COMMONWEALTH DEVELOPMENT

Dan W. Reicher has over 20 years of experience in business, government and non-governmental organizations focused on energy and environmental technology, policy, finance and law. He recently joined Google where he serves as Director of Climate Change and Energy Initiatives for the company's new venture called Google.org. Google.org has been capitalized with more than $1 billion of Google stock to make investments and advance policy in the areas of climate change and energy, global poverty, and global health.

Prior to his recent position at Google, Mr. Reicher served as President and Co-Founder of New Energy Capital Corp., a New England-based company that develops, invests in, owns and operates renewable energy and distributed generation projects. Mr. Reicher is also a member of General Electric's Ecomagination Advisory Board.

From 1997-2001, Mr. Reicher was Assistant Secretary of Energy for Energy Efficiency and Renewable Energy at the U.S. Department of Energy (DOE). As Assistant Secretary, he directed annually more than $1 billion in investments in energy research, development and deployment related to renewable energy, distributed generation and energy efficiency. Prior to that position, Mr. Reicher was DOE Chief of Staff (1996-97), Assistant Secretary of Energy for Policy (Acting) (1995-1996), and Deputy Chief of Staff and Counselor to the Secretary (1993-1995). He was also a member of the U.S. Delegation to the Climate Change Negotiations, Co-Chair of the U.S. Biomass Research and Development Board, and a member of the board of the government-industry Partnership for a New Generation of Vehicles. After leaving the Clinton Administration in 2001 he was a consultant to the Senate Environment and Public Works Committee and a Visiting Fellow at the World Resources Institute.

In 2002, Mr. Reicher became Executive Vice President of Northern Power Systems, a venture capital-backed renewable energy and distributed generation engineering, services and technology company with installations in more than forty-five countries. Mr. Reicher led the renewable energy sales group at Northern and also was actively involved with the company's project finance, government relations and public affairs initiatives. He also played a significant role in the successful sale of the company to Proton Energy Systems, a leading hydrogen company, and the simultaneous creation of Distributed Energy Systems, a new NASDAQ-listed holding company that now owns both Northern Power and Proton Energy.

Prior to his roles at the Department of Energy and in the business community, Mr. Reicher was a senior attorney with the Natural Resources Defense Council where he focused on the federal government's energy and nuclear programs as well as environmental law and policy issues in the former Soviet Union. He was also previously Assistant Attorney General for Environmental Protection in Massachusetts, a law clerk to a federal district court judge in Boston, a legal assistant in the Hazardous Waste Section of the U.S. Department of Justice, and a staff member of President Carter's Commission on the Accident at Three Mile Island.

Mr. Reicher currently is co-chairman of the advisory board of the American Council on Renewable Energy and a member of the boards of the American Council for an Energy Efficient Economy, the Vermont Energy Investment Corporation, the Keystone Center's Energy Program, and Circus Smirkus. He was also recently a member of the National Academy of Sciences Committee on Alternatives to Indian Point for Meeting Energy Needs.

Mr. Reicher also recently served as an adjunct professor at the Yale University School of Forestry and Environmental Studies and Vermont Law School. He holds a B.A. in Biology from Dartmouth College and a J.D. from Stanford Law School. He also studied at Harvard's Kennedy School of Government.

Mr. Reicher was a member of a National Geographic-sponsored expedition that was the first on record to navigate the entire 1888 mile Rio Grande and was also a member of the first group on record to kayak the Yangtze River in China.

Mr. Reicher is married to Carole Parker, who headed the Office of Pollution Prevention at the U.S. Department of Defense from 1994 to 1999. Carole and Dan have three children and live in Norwich Vermont. The family will be relocating to California in August 2007.

Energy Efficiency and Renewable Energy

Alexander “Andy” Karsner
Assistant Secretary

Alexander "Andy" Karsner was unanimously confirmed by the Senate as America’s ninth Assistant Secretary for Energy Efficiency and Renewable Energy (EERE) and sworn-in as a member of the sub-cabinet by Secretary of Energy Samuel W. Bodman on March 23, 2006.

The Assistant Secretary manages the Department of Energy's (DOE) $1.47 billion applied science, research, development, and deployment portfolio, which promotes marketplace integration of renewable and environmentally sound energy technologies. His Office also bears primary responsibility for education, conservation, regulation and efficient use of our nation's energy resources, including federal energy management, building codes, appliance standards, and the Energy Star program, amongst others. Assistant Secretary Karsner leads Administration efforts to implement several prominent Presidential Initiatives, including “ The 20 in 10 Plan” to reduce our dependency on gasoline 20% by 2017; and “The Advanced Energy Initiative” which aims to accelerate breakthroughs in the way we power our cars, homes, and businesses; both announced by President Bush in consecutive State of the Union Addresses.

Previously, Assistant Secretary Karsner served as an international infrastructure developer and energy entrepreneur in the private sector on a wide range of technologies including heavy fuel oil, distillates, natural gas, coal, wood waste/biomass, wind energy and distributed generation based upon renewable technologies. He has been responsible for managing and financing large-scale power projects in North America, Asia, the Middle East, and North Africa, including unprecedented projects structuring in the Philippines and Pakistan.

In 2002, Assistant Secretary Karsner led his company, Enercorp, to win a global competition to develop the world's largest private wind farm outside the United States at that time. He has worked with Tondu Energy Systems of Texas, Wartsila Power Development of Finland, and prominent multinational energy firms and developers including ABB of Sweden, RES of the UK, Tacke of Germany (now known as GE Wind), and Vestas of Denmark.

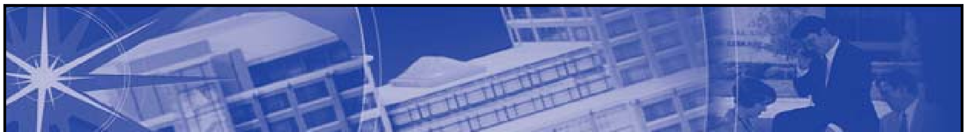
Assistant Secretary Karsner is currently leading the Department's support for the Asia Pacific Partnership addressing Clean Development and Climate to address global emissions with market-based mechanisms and contributes substantially to the EU-US Transatlantic Dialogue on Biofuels and Renewables; as well as numerous, high-level bilateral and multilateral relationships, including Brazil and Western Hemispheric biofuel producer nations.

The Assistant Secretary is an accomplished scholar, was a Rotary International Fellow, and received an MA from Hong Kong University. He graduated with Honors from Rice University and subsequently received the prestigious Hugh Scott Cameron Award as Outstanding Alumnus. Mr. Karsner and his wife are multilingual, have visited every continent and more than hundred nations for work and pleasure, and reside with their growing family in Alexandria, Virginia.

Neil Petchers is President and Chief Executive Officer of NORESCO, a leading energy services company (ESCO) that has developed, engineered, financed, installed, and maintained more than $2 billion in integrated energy efficiency projects. Under his leadership, the company has implemented major energy conservation and infrastructure upgrade projects for Government and private industry clients throughout the World, including landmark facilities such as the U.S. Capitol Complex and National Gallery of Art and distant projects in Kodiak, Alaska and Guam. Projects have spanned more than one hundred different technology applications from conventional chillers, boilers and lighting to cogeneration, fuel cells, wind turbines and photovoltaics. Under Mr. Petchers' direction, NORESCO has consistently ranked as the leading energy services company in the United States in competitive evaluation by the Department of Energy.

Mr. Petchers has twenty five years of energy industry-related experience, with specific expertise in the development and implementation of performance-based energy and resource cost reduction projects. He previously held several management positions in the utility, consulting, and engineering and design-build contracting businesses. His utility industry experience included development and management of both supply- and demand-side programs, including conservation, environmental planning, cogeneration, and other alternative energy technologies. Currently, Mr. Petchers is serving as Chairman of the Alliance to Save Energy's Government Energy Leadership Task Force.

Mr. Petchers holds a Bachelor of Political Science degree from Brandies University and a Master of Science degree in Energy Management from New York Institute of Technology, where he received the "Energy and Environment Award for Outstanding Academic Achievement." Mr. Petchers is the author of "Combined Heating, Cooling & Power Handbook: Technologies & Applications; An Integrated Approach to Energy Resource Optimization" published in 2003 by The Fairmont Press and Marcel Dekker.



Leadership Through Example: Capitalizing on Energy Efficiency Opportunities in the Federal System

THE ENERGY EFFICIENCY FINANCE FORUM:
Advancing the Next Frontier in Clean Energy Investing

April 12, 2007

Presented By:
Neil Petchers, President & CEO
NORESCO

NORESCO

About NORESCO

- Energy Services Company (ESCO)
  - Our core business is energy conservation and infrastructure solutions
  - 25 years experience in the energy services industry
  - Over $2 Billion in proven energy savings solutions implemented in over 2,200 facilities
- Development & Construction Capabilities
  - In-house analysis, engineering, design, and construction management services
  - Over 60 project managers and over 50 engineers
  - Only ESCO to implement wind and PV under a Federal ESPC
- Operations & Maintenance Capabilities
  - 90 O&M personnel
  - Flexible O&M offering
  - 24/7 staffing, nationwide call center

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Government Energy Efficiency Opportunities

- Government is missing more efficiency opportunities than it is taking
- Significant increase in Government energy efficiency projects is needed, and achievable
- Knocking down several known barriers can unleash significant (10x?) private investment in Government projects

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Advancing the Next Frontier in Clean Energy Investing

Program Barriers and Solutions

Barrier: (1) Government Approach Lacks Accountability and Has Misaligned Incentive

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Program Barriers and Solutions

- Barier: (1) Government Approach Lacks Accountability and Has Misaligned Incentive
  - Federal energy managers lack accountability for the achievement of goals
  - Have no incentives for meeting or exceeding goals
  - Face no penalties for inaction
  - Policies work against Government energy managers seeking to advance efficiency projects
  - Alternative financing programs are held to a higher standard than appropriated projects
  - Redundant review and a contract approval process that seeks to eliminate rather than manage risk
  - Government audits have focused only on problems with implemented projects
  - No audits of missed opportunities, inaction or under-performance of appropriated projects
  - Currently, the fear of action is greater than the fear of inaction

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Advancing the Next Frontier in Clean Energy Investing

Program Barriers and Solutions

- Solution: (1) Government Approach Lacks Accountability and Has Misaligned Incentives
  - Implement a facility level web-based certification process
  - Certify that all efficiency improvements with a simple payback of 15-years or less have been identified
  - Couple with a revised system of incentives, penalties and performance metrics
  - Ensure that all program participants are enablers of the process
  - Government audits must include performance metrics for what has not been accomplished (avoidable wasting of energy, etc.)

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Program Barriers and Solutions

Barrier: (2) Program Structures are Ineffective

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Advancing the Next Frontier in Clean Energy Investing

Program Barriers and Solutions

- Barrier: (2) Program Structures are Ineffective
  - Energy reduction goals are:
    - Established for entire agencies and
    - Not effectively translated into actions and results at most facilities
  - Administrative procedures are inefficient
  - There are no uniform investment criteria to:
    - Guide facility managers in making informed decisions
    - Facilitate action on project investment
  - There are also no requirements to:
    - Produce timely results
    - Utilize alternative financing vehicles in the event that appropriated funds are not available
    - Mix funding sources to achieve the maximum leverage of appropriated funds

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Program Barriers and Solutions

- Solution: (2) Program Structures are Ineffective
  - Establish clear agency-wide investment criteria
    - (i.e. all projects with a payback of 15 years or less)
    - Allow facilities to make project investment decisions from the bottom up,
    - Eliminate duplicative bureaucratic reviews
    - Ensure the application of consistent, objective project criteria
  - Eliminate agency caps and other process barriers to the use of alternative finance projects
  - Require facilities to conduct a detailed energy and water audit that will:
    - Identify all economical projects
    - Recognize all available savings and benefits
  - Execute projects
    - With either appropriated funds, or
    - Alternative financing, or
    - A combination of both (preferred)
  - Execute within a prescribed timeframe

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Program Barriers and Solutions

Barrier: (3) All Achievable Savings & Benefits are not Identified and Utilized

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Advancing the Next Frontier in Clean Energy Investing

Program Barriers and Solutions

- Barier: (3) All Achievable Savings & Benefits are not Identified and Utilized
  - Restrictions on the recognition of all sources of real savings and financial benefits artificially reduces the apparent return on investment
  - Failure to recognize all sources of savings limits the work that can be done under alternative financing programs, such as ESPC, which are paid for by the recognized savings they generate

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Advancing the Next Frontier in Clean Energy Investing

Program Barriers and Solutions

- Solution: (3) All Achievable Savings & Benefits are not Identified and Utilized
  - Require all project initiatives to support investments
    - Identify all savings and benefits
    - Recognize all savings and benefits
    - Utilize all savings and benefits
  - Use same requirements for all projects
    - Appropriated
    - Financed
  - Real benefits that can be quantified and claimed as savings include
    - Maintenance & repair savings
    - Avoided costs of expanded mission profile
    - GHG reduction
    - Conversion of tangible positive environmental impacts
    - Oil dependency reductions
    - Renewable energy benefits

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Program Barriers and Solutions

Barrier: (4) Current Investment Levels are Insufficient – Tenfold Increase Required

Program Barriers and Solutions

- Barrier: (4) Current Investment Levels are Insufficient – Tenfold Increase Required
  - Limited flow of investment dollars
    - Scarce appropriations
    - Excessive restrictions on financing contract vehicles
  - Too little has been invested in efficiency improvements to achieve previous goals
  - Much of what was accomplished in agency percentage reductions came from base and facility closures
  - New goals established without a plan for funding work that will have to be executed to meet the goals
  - No expansion of appropriations requested or expected
  - Agencies capping alternative finance project investment to limit long-term payment obligations

Program Barriers and Solutions

- Solution: (4) Current Investment Levels are Insufficient –Tenfold Increase Required
  - Secure a tenfold increase in investment rate
    - Modest increase appropriations
    - Unleash private sector investment
  - Sufficient private sector funds will become available if
    - Restrictions lifted on blending financing and appropriations
    - Use of financing required for all unfunded efficiency improvements
  - Prohibit agency caps on third-party investment
    - Agencies should be provided assurances that future budgets will not be penalized as a result

Success Stories

DOE Pantex Plant
Amarillo, TX

Reference:
Susan Nelson, (806) 447-7187

Type of Contract: DOE Central ESPC
Term of Contract: 18 Years, 19 Years (2 DOs)
Total Contract Cost: $24,439,626
Total Annual Savings: $2,617,208
Technologies:

- 3,500 point EMCS using fiber-optic network
- Solar domestic hot water heating
- Replaced or retrofitted over 22,000 lighting fixtures
- Replacement of 17 air and water cooled chillers with six new air cooled chillers and associated piping
- Replacement of over 400 steam traps and 30 condensate return units
- Dehumidification system upgrades
- Replaced 7 inefficient roof top units on 3 buildings
- New high efficiency laundry facility to process over 1 million pounds of laundry each year

THE ENERGY EFFICIENCY FINANCE FORUM
Advancing the Next Frontier in Clean Energy Investing

Success Stories

U.S. Naval Station Guantanamo Bay, Cuba

Reference:
Bev Wade, (757) 847-7962

FEMP *2006 Renewable Energy Project Award Winner*

Facility Type: Naval Base
Facility Size: 5,412,267 sq. ft.
Type of Contract: Navy Caribbean ESPC
Term of Contract: 12 & 14 years
Total Capital Cost: $26,000,000
Total Annual Savings: $3,200,000
Technologies:

- Wind turbines installed and integrated into electrical grid. This 3.8 MW project will reduce toxic emissions by over 13,000,000 lbs per year
- Higher efficiency diesel generators (7.2 MW) installed for central power plant. Substantial electrical grid improvements also being made to ensure reliability and support increase of mission.
- Energy efficient lighting and water conservation in over 850 family housing units and 100 commercial buildings.

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THE ENERGY EFFICIENCY FINANCE FORUM
Advancing the Next Frontier in Clean Energy Investing

Success Stories

Federal Corrections Center Victorville, CA

Reference:
Greg Britt, (925) 803-4707

FEMP *2006 Renewable Energy Project Award Winner*

Facility Type: Federal Prison
Facility Size: 2,000,000 sq. ft.
Type of Contract: DOE West ESPC
Term of Contract: 19 Years
Total Capital Cost: $5,947,862
Total Annual Savings: $420,589
Technologies:

- 66 kW solar PV covered parking structure
- A single 750 kW electricity generating wind turbine
- HVAC and controls systems improvements

NORESCO

Success Stories

Navy Region Southwest California

Reference:
John Thomas, (619) 556-7989

ENERGY USER NEWS *Project of the Year*

Facility Type: Navy Base
Facility Size: 9,500,000 sq. ft.
Type of Contract: DOE West ESPC
Term of Contract: All DO's 10 Years or Less
Total Capital Cost: $33,217,000
Total Annual Savings: $5,085,000
Technologies:

- 750 kW solar PV parking structure and 30 kW roof PV array
- Two 60 kW microturbines w/ heat recovery heat exchangers
- Energy efficient lighting; daylighting and control system
- Controls conversion to DDC connected to Area-Wide EMCS
- Irrigation centralized control system; upgrade and expansion of the existing underground irrigation system
- HVAC system upgrades
- Major improvements to compressed air plants and systems
- 5 MW steam turbine generator

THE ENERGY EFFICIENCY FINANCE FORUM
Advancing the Next Frontier in Clean Energy Investing

Success Stories

Mount Wachusett Community College Gardner, MA

Reference:
Ed Terceiro (978) 632-6600 x102

Facility Type: Community College
Type of Contract: ESPC
Term of Contract: 10 Years
Total Capital Cost: $4,300,000
Total Annual Savings: $272,826
Technologies:

- Replacement of more than 4,400 lighting fixtures in various buildings. This included retrofit of all T-12 fixtures with energy efficient T-8 fixtures and mercury vapor and incandescent lighting with metal halide and compact fluorescent units
- Retrofit of urinals and sinks with low-flow flushometers and aerators. Replacement of toilets with 1.6 gallon per flush units.
- Installation of VFDs on air handling unit supply and return fans to vary electric consumption in accordance with heating and cooling demand.
- Construction of a 320 bhp low emission advanced biomass boiler plant with 300 bhp oil backup to replace the college's inefficient electric resistance heating system. Connection of new hot water distribution piping to existing chilled water mains and retrofit of unit ventilators and heating and ventilation units with hydronic coils.

NORESCO

THE ENERGY EFFICIENCY FINANCE FORUM
Advancing the Next Frontier in Clean Energy Investing

Success Stories

U.S. Coast Guard Integrated Support Command Kodiak, AK

Reference:
Michael Brown (907) 487-5320 x229

Facility Type: Coast Guard Base
Facility Size: 2,666,487 sq.ft.
Type of Contract: DOE West ESPC
Term of Contract: 8 Years
Total Capital Cost: $4,670,000
Total Annual Savings: $894,000
Technologies:

- Installation of an O^2 trim system, burner retrofit, new feedwater heaters (economizers) and controls on four 800 hp fire-tube boilers.
- Energy efficient lighting upgrade including replacement or retrofit of 9,674 fixtures, lamps, and ballasts.
- Replacement of existing EMS with a new DDC EMS
- Retrofit three 15 hp pumps and motors to replace the existing units
- Installation of VFDs on the existing constant volume fans to integrate into the base-wide EMS.
- Replacement of 60 French doors with new French doors.
- 1,500,000 gallon fuel tank conversion (JP-5 to DF-2) and install 4,500 linear feet of fuel piping.
- 348 storm doors with weather stripping on 174 housing units.

NORESCO

THE ENERGY EFFICIENCY FINANCE FORUM
Advancing the Next Frontier in Clean Energy Investing

Success Stories

General Services Administration Atlanta, GA

Reference:
Floria Standifer (404) 331-5308

Facility Type: Administration
Facility Size: 2,298,475 sq.ft.
Type of Contract: DOE Southeast ESPC
Term of Contract: 20 Years
Total Capital Cost: $7,279,005
Total Annual Savings: $499,091
Technologies:

- Energy efficient lighting upgrade - retrofit of 18,400 fixtures.
- VFDs on fans in Richard B. Russell Building - install VFDs in 22 major fan systems.
- New chillers in RBR - replacement of two 1,850 ton CFC chillers with three 1,000 ton new premium-efficiency units.
- New chillers in Summit Building - replacement of two 1,250 ton CFC chillers with three 650 ton new premium-efficiency units.
- Outside air reduction in Summit Building - installation of two-speed motors to reduce ventilation-related energy costs, peak cooling demand and peak chiller capacity needs.

NORESCO

Dan Adler is Vice President of the California Clean Energy Fund (CalCEF), a nonprofit venture capital fund created to accelerate investment in California's clean energy economy. In 2006 CalCEF founded the nation's first university center on energy efficiency, the Energy Efficiency Center at the University of California at Davis, with an explicit emphasis on broad commercialization of efficiency technologies. Prior to joining CalCEF, Mr. Adler was a senior analyst in the Division of Strategic Planning at the California Public Utilities Commission, where he was responsible for the design and implementation of California's Renewables Portfolio Standard and was senior staff for climate change policy. In addition to energy issues, Mr. Adler has professional experience in international trade policy and socially responsible investment. He has a B.A. in Political Science from the University of California at Berkeley and an M.A. in Public Policy from Harvard University.

CalCEF

California Clean Energy Fund

Financing Efficiency: California & the Venture Model

For the ACEEE Energy Efficiency Finance Forum

April 12th, 2007

The Continuum of Technology Development

Government and Public Sector Supported Funding → First Institutional Funding → Venture Capital Funding → Potential IPO /Debt Funding → Growth-Sustaining Consumer Demand

• New technologies must navigate most if not all of these stages.

• Each stage presents different policy, technology and financial challenges.

• No technologies remain unchanged through this cycle; no entrepreneur has mastered the dynamics of each stage; no financier is comfortable with the risks inherent in each category.

• This process is essential to the energy challenge - and is probably more difficult here than in any other type of technology.

CalCEF

California Clean Energy Fund

CalCEF Strategies and Programs - Close the Gaps in Clean Energy Finance

Government and Public Sector Supported Funding → First Institutional Funding → Venture Capital Funding → Potential Public Market Funding → Public & Consumer Demand

UC Davis Energy Efficiency Center

- Commercialization focus
- Window on new technologies
- Business partner outreach
- Efficiency awareness

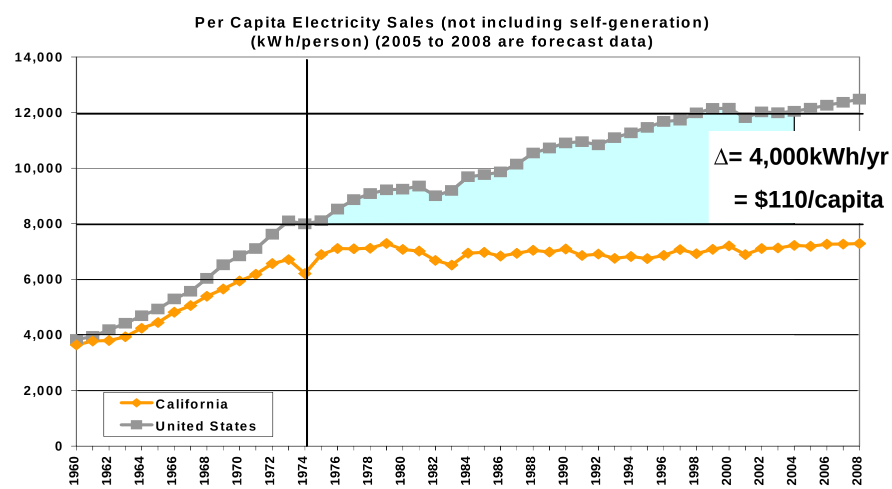
Seed Funding and Strategy Development Programs

- Pre-investment company support
- Growth strategies focused on deep market knowledge
- Stakeholder outreach: PIER, LBL, PARC, NREL

CalCEF Fund I

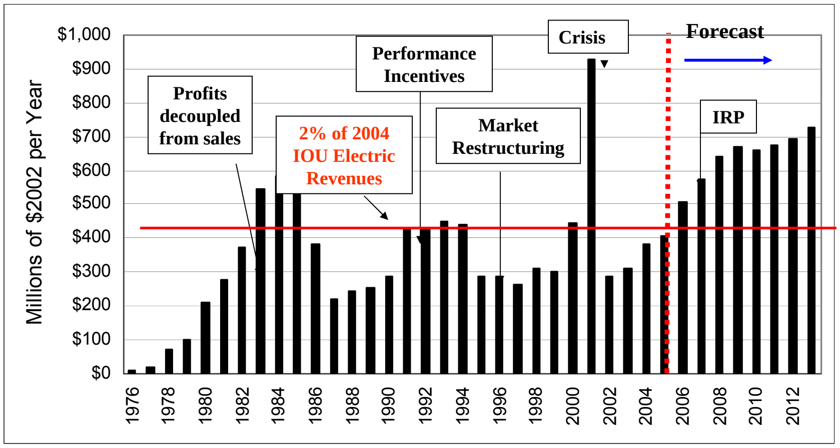
- Company mentoring
- Convening meetings
- Thought leadership
- Deal flow analysis

California's Energy Efficiency Record



Source: A. Rosenfeld

California IOU Investment in Energy Efficiency -The Steady Hand of Regulation



Source: A. Rosenfeld

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The California Way of Efficiency

An Outline of the California Program for Investor-Owned Utilities:

- **Decoupling Sales from Revenues:** California IOUs deliver energy *services*, and get paid for the efficiency they enable.
- **Predictable and Sound Cost Recovery**: The regulatory apparatus is solid.
- **Solid Analytic Basis:** Market segment potentials are closely analyzed, and programs designed to achieve maximum cost-effective savings levels.
- **Lots of Money:** $2.7 billion over three years, 2006-2008. IOUs both administer programs and provide third-party market opportunities to other service providers.

Bottom Line:

- **$2.7 billion in budgeted costs yields $5.4 billion in estimated savings.**
- **90+% of cost-effective potential savings targeted.**
- **Avoiding one large new coal plant per year.**

CalCEF
California Clean Energy Fund

The Venture View of Energy Efficiency

Venture Capital - and Venture Capitalists - have been grabbing headlines, and until recently have controlled most of the cleantech money. What do they say about energy efficiency?

1. **The Market is Complex** - Dominated by obscure utility and regulatory practices.
2. **Customers are Diffuse** - Acquisition costs are high, hence sales margins low.
3. **IP Protection is Poor** - Multiple competitors (including utilities) means "venture-grade returns" are unlikely.
   - Note: this is less true for new technologies like BPL than for efficient lighting, windows, ducts etc.

The "sexiness" debate is off point - if 10X returns are available, VCs will find a path into any market. Arguing "EE investing is not sexy" restates the problem; it does not answer the question.

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2006 Venture Capital Flows

VC investment in clean energy technologies exploded in 2006:

- Up 260% in North America to $2.4 billion into 140 companies

The broad category of "Energy Intelligence" (including EE, Demand Response & Smart Grid/Broadband Over Powerline) was up 174% to $476M, just under 20%.

- **However - two deals, both in BPL, accounted for one-third of this amount - Current Communications and BPL Global**
  - Sources: CleanEdge/Nth Power and Venture Power/Eric Wesoff

What's Wrong With This Picture - If Anything?

CalCEF
California Clean Energy Fund

Is Venture Investing the Best Model for Near-Term Efficiency Development?

No.

The game now, from a climate perspective, is rapid scaling of multiple existing efficiency technologies - many of which are nominally in competition with one another. We ask too much of venture capital to play a lead role in this environment.

- *Policy programs like California's can open the utility market broadly and with speed.*
- *Project-finance-style funds in efficiency can support ESCOs in utility partnerships, and may offer attractive returns at scale.*

The X Factor: Carbon

- *Additionality rules and bundled incentives make carbon credits hard to parse.*
- *Is the upside potential great enough to justify this challenging policy effort?*

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California Clean Energy Fund

CalCEF

CalCEF
California Clean Energy Fund

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CalCEF
California Clean Energy Fund

Douglas I. Foy

Douglas Foy is President of DIF Enterprises, a company devoted to sustainable business practices and the development of social enterprises.

Prior to founding DIF Enterprises in 2006, Mr. Foy served as the first Secretary of Commonwealth Development in the administration of Massachusetts Governor Mitt Romney. In leading this "super-Secretariat", Mr. Foy oversaw the agencies of Transportation, Housing, Environment, and Energy, with combined annual capital budgets of $5 billion, operating budgets of $500 million, and a total workforce of more than 11,000. These four agencies are responsible for all infrastructure (other than schools) in the Commonwealth, including roads, bridges, transit, parks, sewers, water supply, energy, and housing. During his government service, Foy's agencies developed Massachusetts' first comprehensive transportation plan (with an emphasis on transit and fix-it-first); the nation's most comprehensive climate action plan; and numerous programs, policies, and investments to promote sustainable development and smart growth throughout Massachusetts.

Before his service in the Romney administration, Mr. Foy served for 25 years as the President of the Conservation Law Foundation, New England's premier environmental advocacy organization. Among its hundreds of prominent cases, CLF lawsuits forced the cleanup of Boston Harbor, prevented offshore oil drilling on the prime fishing grounds of Georges Bank, banned off-road vehicles from the beaches and dunes of the Cape Cod National Seashore, prevented the construction of the Seabrook 2 nuclear power plant, and dramatically reduced childhood lead poisoning throughout the region. CLF had offices in all six New England states.

Among other awards, Mr. Foy has received the President's Environmental and Conservation Challenge Award, the country's highest conservation award, and the Woodrow Wilson Award for Public Service from the Woodrow Wilson Center, the national memorial to President Wilson. Mr. Foy, a member of the 1968 USA Olympic Rowing Team and the 1969 USA National Rowing Team, graduated from Princeton University as a University Scholar in engineering and physics, attended Cambridge University in England as a Churchill Scholar in geophysics, and graduated from Harvard Law School.

By 2010, New York will have added a population the size of Salt Lake City By 2015, our temperatures will have risen by half a degree By 2020, 40% of our power plants will be more than 50 years old By 2025, more than 2 million people will live more than 10 minutes from a park **By 2030, will you still love New York?**

It's up to you.

planYC

Hon. Michael R. Bloomberg, Mayor
City of New York

The Mayor's Sustainability Advisory Board

Hon. Daniel L. Doctoroff, Chair
Deputy Mayor for Economic Development and Rebuilding

Hon. Christine C. Quinn
Speaker, New York City Council

Carlton Brown
Principal and COO, Full Spectrum NY, LLC

Marcia Bystryn
Executive Director, New York League of Conservation Voters

Robert Fox
Partner, Cook + Fox Architects

Ester Fuchs
Professor of International and Public Affairs and Political Science, Columbia University

Andrew H. Darrell
Regional Director, Environmental Defense

Hon. James F. Gennaro
Council Member and Chair, Committee on Environmental Protection

Ashok Gupta
Air & Energy Program Director, Natural Resources Defense Council

Michael Northrop
Program Director, Sustainable Development Program, Rockefeller Brothers Fund

Ed Ott
Executive Director, NYC Central Labor Council

Elizabeth C. Girardi Schoen
Senior Director, Global Environment, Health, and Safety, Pfizer, Inc.

Peggy M. Shepard
Executive Director and Co-Founder, West Harlem Environmental Action, Inc. (WE ACT)

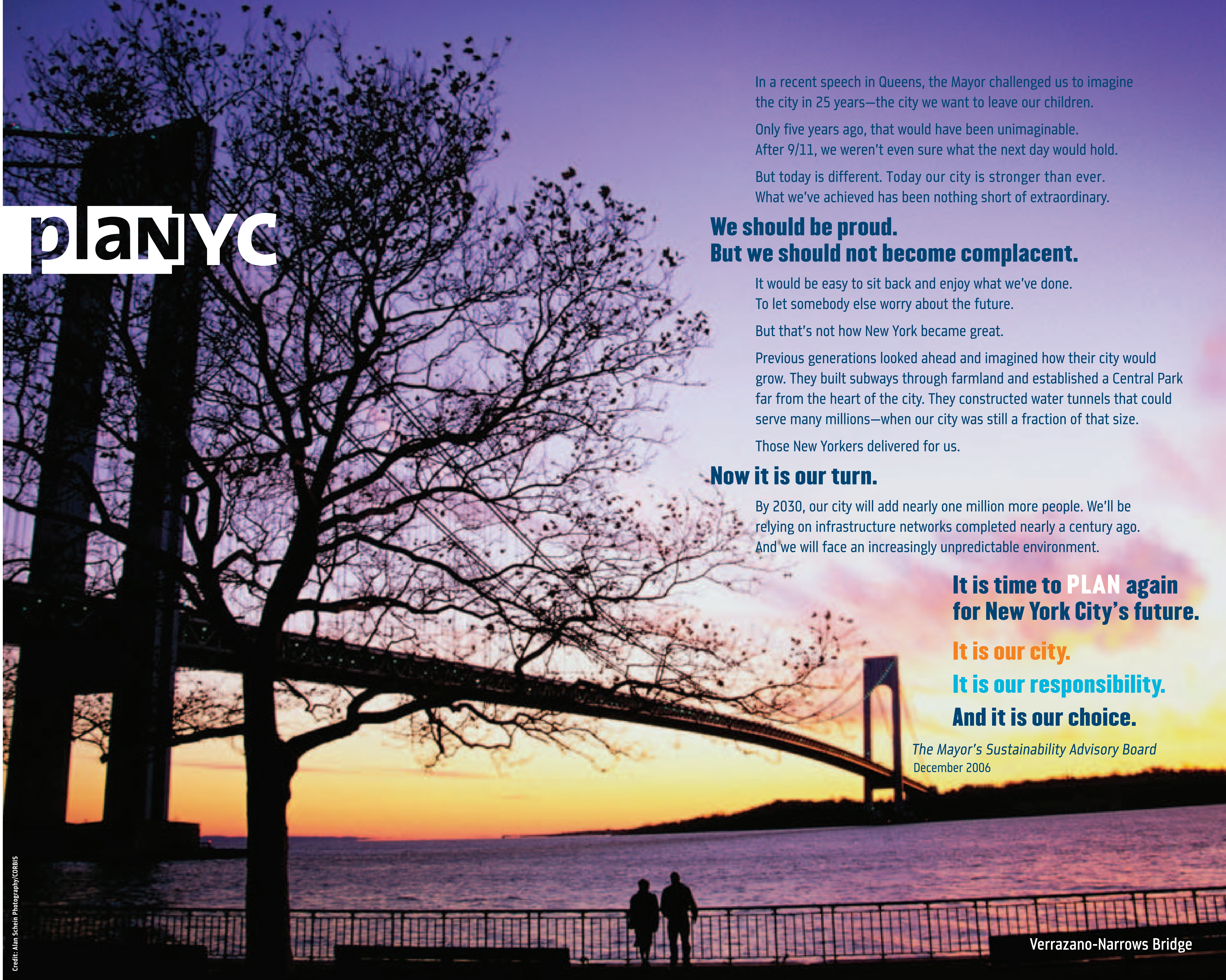
Steven Spinola
President, Real Estate Board of New York (REBNY)

Daniel R. Tishman
Chairman and CEO, Tishman Construction Corporation

Kathryn Wylde
President and CEO, Partnership for New York City

Robert D. Yaro
President, Regional Plan Association

Elizabeth C. Yeampierre, Esq.
Executive Director, United Puerto Rican Organization of Sunset Park (UPROSE)



planYC

In a recent speech in Queens, the Mayor challenged us to imagine the city in 25 years—the city we want to leave our children.

Only five years ago, that would have been unimaginable. After 9/11, we weren't even sure what the next day would hold.

But today is different. Today our city is stronger than ever. What we've achieved has been nothing short of extraordinary.

We should be proud. But we should not become complacent.

It would be easy to sit back and enjoy what we've done. To let somebody else worry about the future.

But that's not how New York became great.

Previous generations looked ahead and imagined how their city would grow. They built subways through farmland and established a Central Park far from the heart of the city. They constructed water tunnels that could serve many millions—when our city was still a fraction of that size.

Those New Yorkers delivered for us.

Now it is our turn.

By 2030, our city will add nearly one million more people. We'll be relying on infrastructure networks completed nearly a century ago. And we will face an increasingly unpredictable environment.

It is time to PLAN again for New York City's future.

It is our city.

It is our responsibility.

And it is our choice.

The Mayor's Sustainability Advisory Board
December 2006

Verrazano-Narrows Bridge

Credit: Alan Schein Photography/CORBIS

A lot can change in 25 years.

The New York of 1981 is almost unfathomable today. As our city faced near-bankruptcy, basic services—like schools, safety, and sanitation—deteriorated. A graffitied subway car, torched housing by landlords, and the seedy streets of Times Square became national symbols of urban blight. And our population plummeted.

Since then, almost everything—except our city's essential magic—has changed. We are the safest big city in theUnited States—and one of the greenest, too. Our economy is strong. We have some of the best schools and the cleanest streets. And our population has soared.

But success brings its own challenges. Now we are ready to launch the next phase of creating a stronger city for all New Yorkers: addressing the physical barriers to maintaining and improving our quality of life.

To sustain the city we love today, we must begin planning for tomorrow. We invite you to explore the changes ahead—and join us in shaping the future.

The solutions won't be easy. They'll require smart investments, tough choices, and creative thinking.

Together, we can create a sustainable city, leaving our children and grandchildren the New York they deserve.

By 2030, nearly one million more people will live in New York.

The top three things you should know about New York over the next 25 years

1 We will be getting BIGGER.

(Much bigger)

Our spectacular recovery has catapulted our population to a record high—8.2 million. By 2030, more than nine million people will live in New York. We'll also be adding three quarters of a million new jobs and millions more visitors. If we're not careful, this growth could result in overdevelopment; but it can also generate tens of billions of dollars that can be reinvested in our city. We can preserve the character of our neighborhoods *and* continue to welcome newcomers from around the world—if we plan now.

Together we can openNYC

2 Our infrastructure will be getting OLDER.

(And it's pretty old to begin with)

We've seen during power outages or train delays what happens when our infrastructure fails—and it's not getting any younger. We developed our subway signaling technology before the 1940s. We finished the city's two water tunnels by 1936. We built our energy grid during the 1920s. Not only is old infrastructure less efficient and more polluting—it is at a greater risk of breakdown. We can ensure a more reliable, dependable city—if we plan now.

Together we can maintainNYC

3 Our environment will be AT RISK.

(And that's not a risk worth taking)

New York is one of the world's most environmentally-efficient cities. Our air and water haven't been this clean since the 1800s. But our air still fails to meet federal standards and thousands of acres of land remain severely polluted, often in neighborhoods least able to handle it. We also face the growing impact of climate change. Hotter temperatures, intensified storms, and rising sea levels cannot be ignored. We can protect, preserve, and renew our city—if we plan now.

Together we can greenNYC

NEW YORK CITY POPULATION (IN MILLIONS)

Source: US Census Bureau and NYC Department of City Planning, Population Division

9 | 8.75 | 8.5 | 8.25 | 8 | 7.75 | 7.5 | 7.25

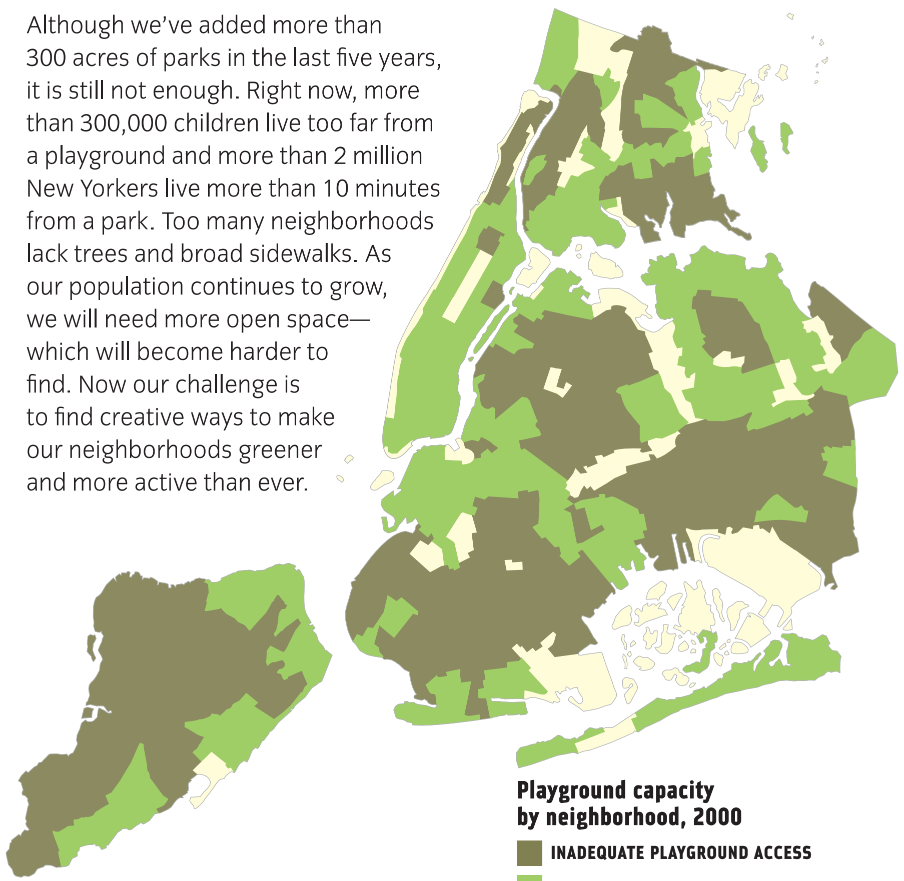
1960 | 1970 | 1980 | 1990 | 2000 | 2006 | 2010 | 2020 | 2030

Gridlock, Times Square

THE CHALLENGES WE FACE

PUBLIC REALM
By 2030, nearly 100 neighborhoods will need more playgrounds.

Although we've added more than 300 acres of parks in the last five years, it is still not enough. Right now, more than 300,000 children live too far from a playground and more than 2 million New Yorkers live more than 10 minutes from a park. Too many neighborhoods lack trees and broad sidewalks. As our population continues to grow, we will need more open space—which will become harder to find. Now our challenge is to find creative ways to make our neighborhoods greener and more active than ever.



Playground capacity by neighborhood, 2000

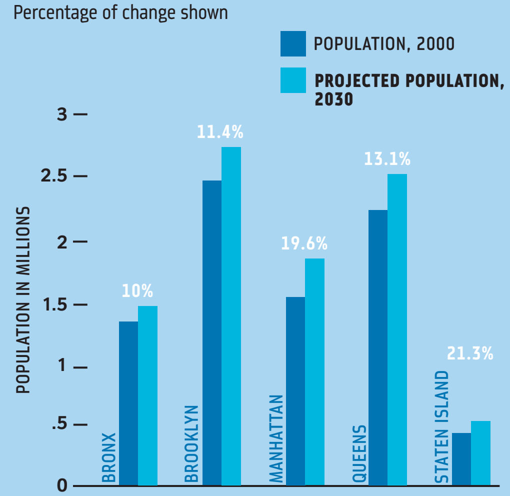
- INADEQUATE PLAYGROUND ACCESS
- ADEQUATE PLAYGROUND ACCESS

Source: NYC Department of Parks and Recreation, GIS Division

HOUSING We'll need 265,000 more housing units for our new population. But that won't be enough.

In order to welcome New Yorkers from every background, we must also fix the persistent housing and land shortage that's driven prices to record levels. Already, nearly a third of renters in New York City pay more than 50% of their income toward rent. The Mayor's ambitious affordable housing plan and innovative rezonings are helping to address this challenge, creating 92,000 affordable units by 2013. But over the long term, we can—and we must—do more.

Borough population projections
Percentage of change shown

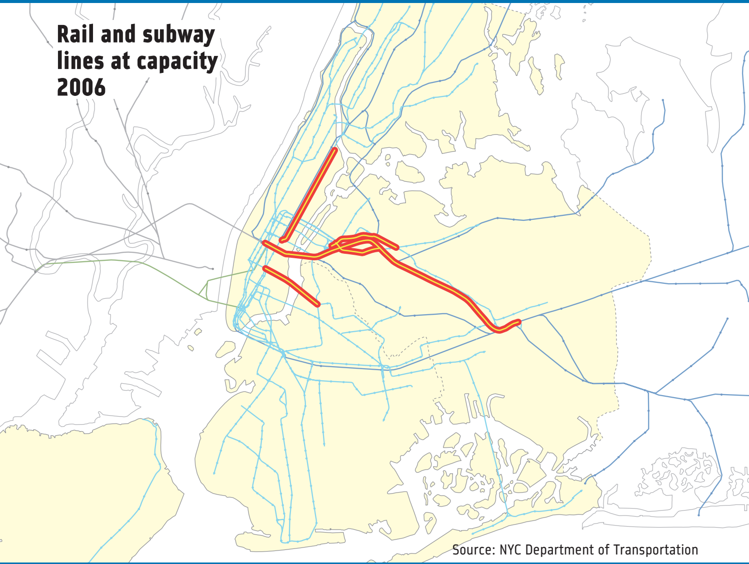


Source: NYC Department of City Planning, Population Division

CONGESTION
In 25 years, rush hour could last 12 hours every day.

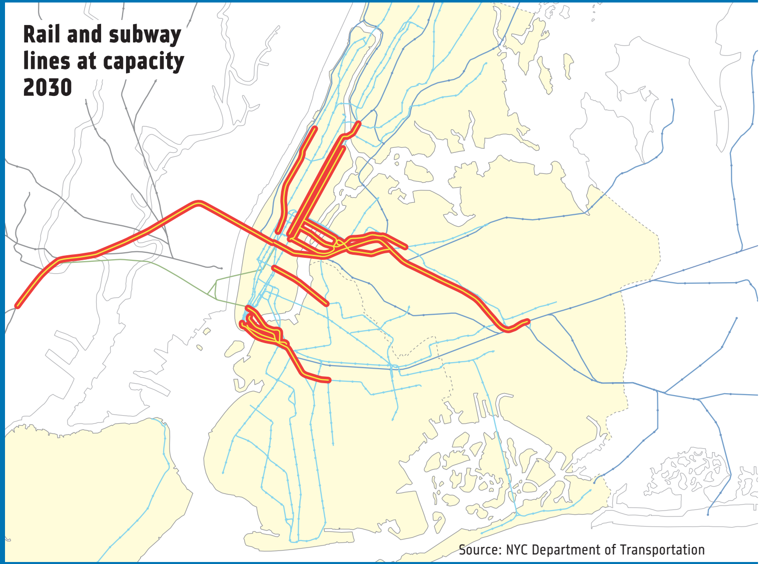
Congestion already costs our region more than $5 billion in lost time alone every year. Unless we expand our transportation network, by 2030 virtually every subway line—and our commuter lines—will be crammed beyond capacity. Buses will fight with over 100,000 more cars to make headway through city streets. We cannot let unpleasant crowding grind our economy to a halt. Our challenge is to keep New York—and New Yorkers—moving forward.

Rail and subway lines at capacity 2006



Source: NYC Department of Transportation

Rail and subway lines at capacity 2030



Source: NYC Department of Transportation

Together we can

Create homes for almost a million more New Yorkers, while making housing more affordable and sustainable

Improve travel times by adding transit capacity for millions more residents, visitors, and workers

Ensure that all New Yorkers in every neighborhood live within a 10-minute walk of a park

openNYC

New York City blackout, 2003

Construction of City Tunnel #1 in 1913.
Source: NYC Department of Environmental Protection

WATER

By 2030, virtually all of our major water infrastructure will be more than a century old.

New York City has one of the cleanest and most reliable drinking water systems in the world. But that infrastructure is already more than 70 years old and has never been inspected. We are nearing completion of Water Tunnel #3, which will allow us to examine and repair our tunnels in the city. Our challenge now is to bring that same vision and resolve to the upstate supply system, which already leaks up to 20 million gallons a day.

TRANSPORTATION

According to the MTA, nearly 60% of our subway stations are not in good repair.

We've come a long way in maintaining our region's roads, bridges, and trains, but we still need to spend $15 billion to achieve acceptable conditions across the system. Closing this gap would bring us more reliable signaling systems that can handle more trains, stations that don't leak, and tunnels that have good lighting in case of emergencies. It would repave nearly 3,000 lane-miles of deteriorated roads. Our world-class transportation system helped create today's New York—now our challenge is to keep it great for tomorrow.

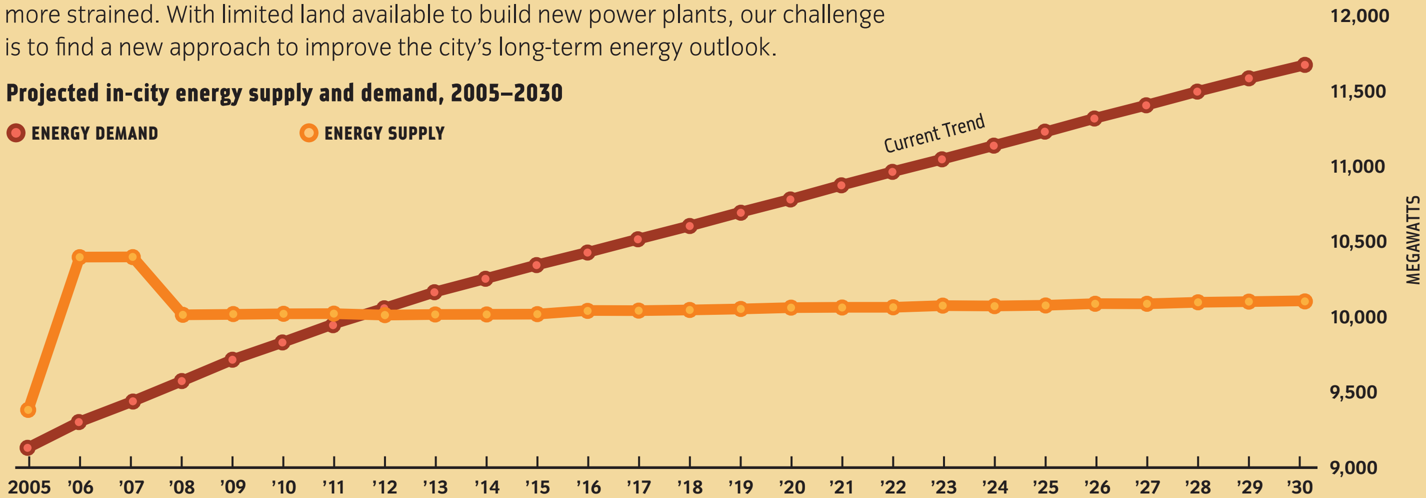
New York City subway stations
State of good repair status

Source: MTA New York City Transit

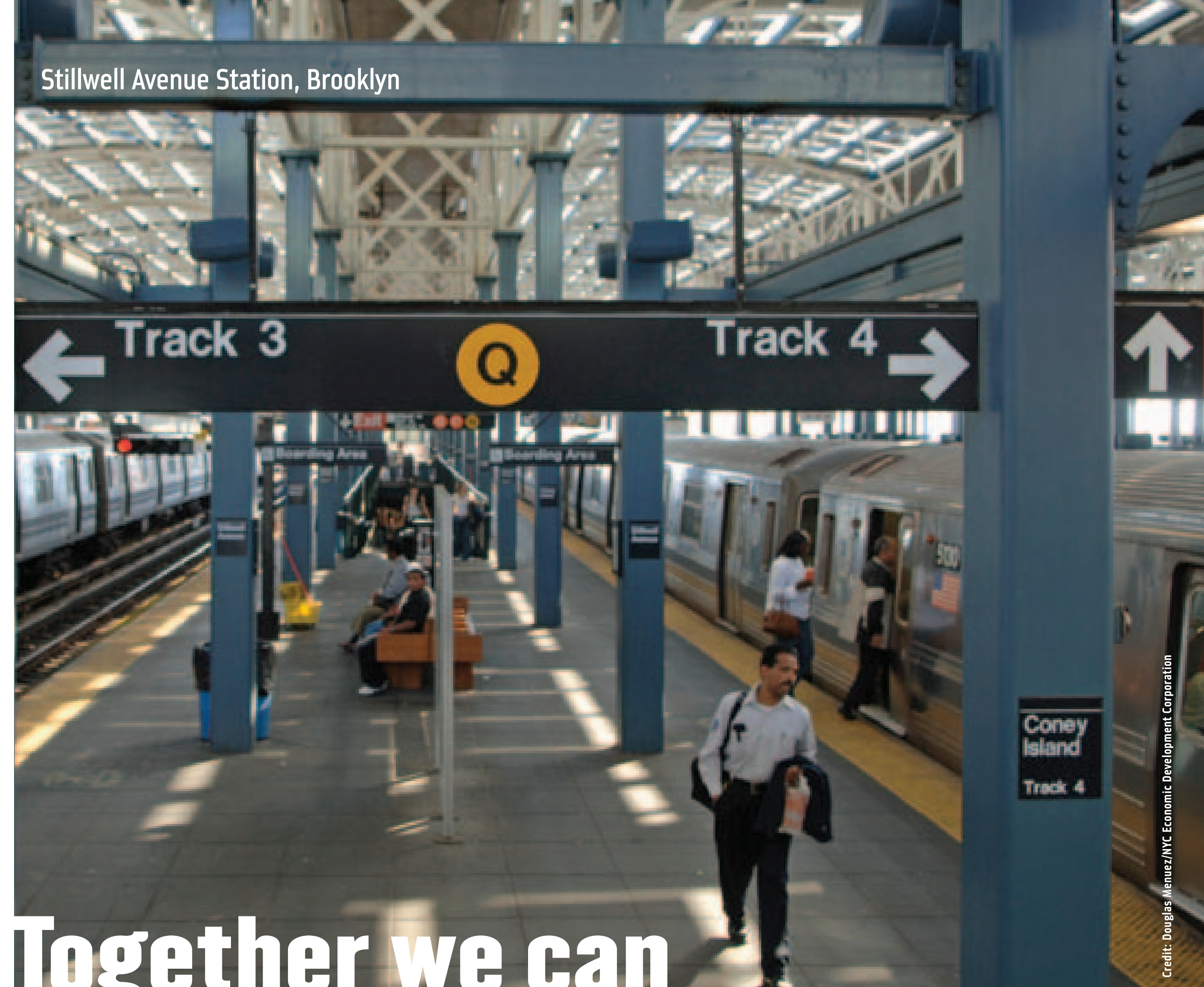
ENERGY By 2030, nearly 70% of our power plants will be more than 50 years old.

Older plants use more than 50% more fossil fuels than new ones, raising energy bills for New Yorkers and harming the environment. By 2030, demand could increase by more than 25% and our century-old distribution system will be even more strained. With limited land available to build new power plants, our challenge is to find a new approach to improve the city's long-term energy outlook.

Projected in-city energy supply and demand, 2005–2030



Source: NYC Economic Development Corporation



Stillwell Avenue Station, Brooklyn

Credit: Douglas Menuez/NYC Economic Development Corporation

Together we can

Develop critical back-up systems for our aging water network to ensure long-term reliability

Reach a full "state of good repair" on New York City's roads, subways, and rails for the first time in history

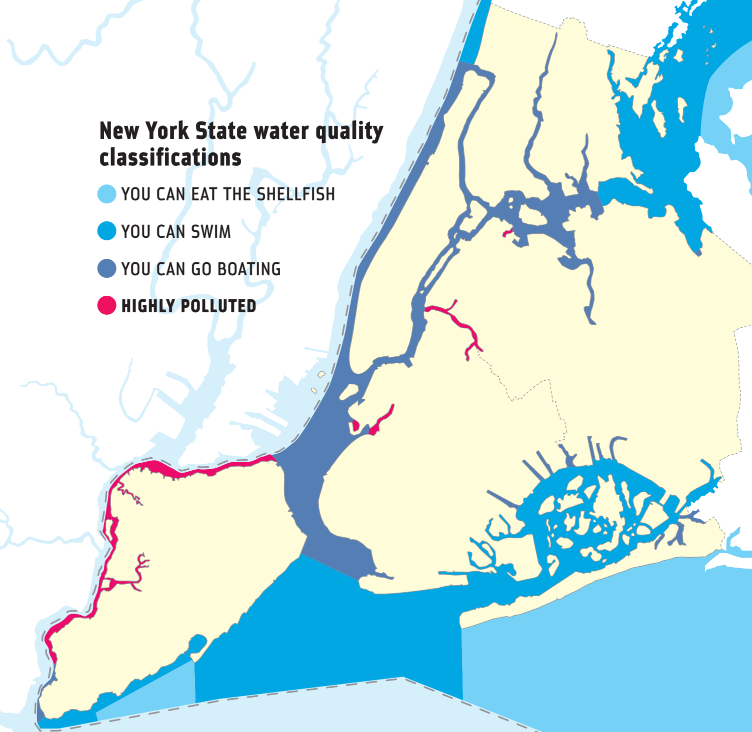
Provide cleaner, more reliable power for every New Yorker by upgrading our energy infrastructure

maintaiNYC

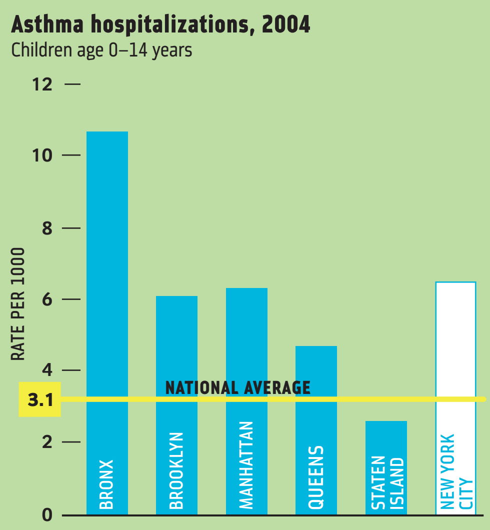
Flooding in Brooklyn, 2004
Credit: Seth Wenig/The New York Times

WATERWAYS Today our harbor is cleaner than it's been in more than 50 years. But it still takes only 1/10 of an inch of hard rain for sewage to enter our waterways.

We have made great strides in restoring access to New York City's waterfront. But too many areas remain off-limits to fishing, swimming or even boating. Despite substantially reducing sewage overflows, two billion gallons still enter our waterways every year. And natural areas like wetlands that protect our water systems have plunged by 85% since 1900. As we reconnect our waterfront to neighborhoods, our challenge now is to continue renewing our city's greatest resource: the water itself.



Source: NYC Department of Environmental Protection



Source: NYS Department of Health (analyzed by NYC Department of Health and Mental Hygiene) and Centers for Disease Control

AIR Our child asthma hospitalization rates are more than twice the national average.

Despite recent dramatic air quality improvements, New York City still falls short of meeting federal standards. Our ozone levels are too high and soot levels are 27% above national requirements in parts of the city. The U.S. Environmental Protection Agency (EPA) has linked both substances to asthma attacks and other damaging respiratory diseases. Now our challenge is to make sure that New Yorkers in every neighborhood have clean, safe air to breathe.

Credit: NYC Office of Environmental Coordination

BROWNFIELDS More than 1,700 acres of land in New York are severely polluted—an area more than twice the size of Central Park.

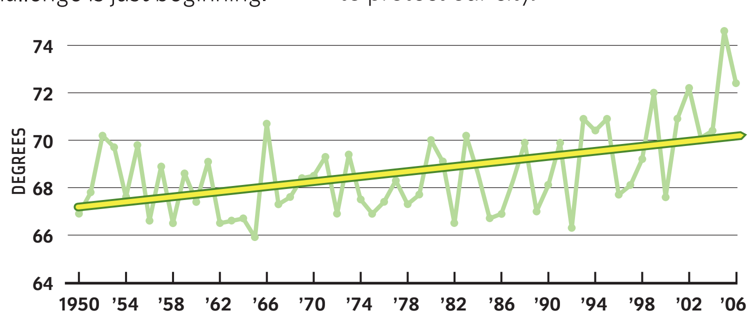
Real or perceived pollution has prevented thousands of acres of land from being used most productively across New York City. Hundreds of potentially contaminated sites are scattered across former industrial areas—sites that could be re-imagined to meet our infra-structure, manufacturing or community needs. As space becomes increasingly limited, our challenge is to reclaim and revitalize this polluted land.

CLIMATE CHANGE By 2030, average temperatures in New York City will have risen almost two degrees.

Nine of the last ten summers have set records for the hottest temperatures. As a city surrounded by water, we are more vulnerable to sea level rise and the growing possibility of violent storms. Global warming is already changing our city and the challenge is just beginning.

That's why New York has joined the fight against climate change and begun to slash carbon emissions by reducing energy consumption and dependence on oil. Our challenge now is to develop a more ambitious environmental agenda to protect our city.

New York City summer temperature rise, 1950–2006



Source: National Oceanic and Atmospheric Administration, US Department of Commerce

Barretto Point Park, Bronx

Credit: Ira Steinberg/NYC Department of Parks and Recreation

Together we can

Reduce global warming emissions by more than 30%

Achieve the cleanest air of any big city in America

Clean up all contaminated land in New York City

Open 90% of our waterways for recreation by reducing water pollution and preserving our natural areas

greenNYC

NEW YORK CITY TIMELINE

1800

COMMISSIONERS ANNOUNCE MANHATTAN STREET GRID PLAN

1825

1850

PLANS UNVEILED FOR CENTRAL PARK

1875

THE FIRST SUBWAY LINE BEGINS SERVICE IN NEW YORK CITY

1900

1925

IDLEWILD AIRPORT OPENS—LATER KNOWN AS JFK INTERNATIONAL AIRPORT

1950

Credit for images (Central Park and subway): New York City Department of Records/ Municipal Archives

1975

2000

planYC

2025

Now is our moment
to make a difference in the future of our city

Throughout our history, there have been key moments when New Yorkers looked forward and took bold steps to prepare our city for its future.

The street grid plan of 1811 plotted out room for a million people—more than 10 times Manhattan's population at the time. In 1858, we unveiled plans for a Central Park devoted to the people—even though most New Yorkers still lived a mile away. Starting in 1901, we began building one of the world's largest subway systems when our city was mostly still farmland and fields. And 50 years ago, we transformed a golf course into the international aviation hub of the United States through the construction of JFK International Airport.

Now is our moment—and we need your help.

There are many ways to get involved.

Visit our website www.nyc.gov/planyc. Here you can learn more about each goal and share your ideas on how to reach them.

If you can't log on, **send us a letter.**

Look for a town hall meeting in your borough.

And most importantly, **tell your family and friends** so we can hear from them, too.

All of New York has a stake in this discussion—because every New Yorker will experience its impact.

And over the next three months, these ideas—your ideas—will shape a plan to secure our city's sustainable future.

Visit www.nyc.gov/planyc

Design: Two Twelve New York

Ten goals for creating a sustainable city over the next 25 years

openNYC

1. **Create** homes for almost a million more New Yorkers, while making housing more affordable and sustainable
2. **Improve** travel times by adding transit capacity for millions more residents, visitors, and workers
3. **Ensure** that all New Yorkers live within a 10-minute walk of a park

maintainNYC

4. **Develop** critical back-up systems for our aging water network to ensure long-term reliability
5. **Reach** a full "state of good repair" on New York City's roads, subways, and rails for the first time in history
6. **Provide** cleaner, more reliable power for every New Yorker by upgrading our energy infrastructure

greenNYC

7. **Reduce** global warming emissions by more than 30%
8. **Achieve** the cleanest air of any big city in America
9. **Clean up** all contaminated land in New York City
10. **Open** 90% of our waterways for recreation by reducing water pollution and preserving our natural areas

Together we can make the New York of 2030 cleaner, healthier, more reliable, and more sustainable than the city we love today.

To learn more visit our website

WWW.NYC.GOV/PLANYC2030

Sign up for opportunities to get involved

And send us your ideas— we want to hear them

Join the discussion

And help shape the direction of our city

New York City 2030:
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Refreshment Break

Venture Capital Roundtable:
Investment Opportunities in Energy Efficiency Technologies

Moderator:
F. Henry "Hank" Habicht II, *Managing Director*
SAIL VENTURES

Panelists:
Joyce Ferris, *Managing Partner*
BLUE HILL PARTNERS

Nancy Floyd, *Co-Founder and Managing Director*
NTH POWER

Chuck McDermott, *General Partner*
ROCKPORT CAPITAL

Philip J. Deutch, *Managing Partner*
NGP ENERGY TECHNOLOGY PARTNERS

F. Henry "Hank" Habicht II possesses an extensive environmental and energy background in both the public and private sectors. He currently serves as Managing Partner of SAIL Venture Partners, a leading venture capital fund investing in leading-edge clean energy, water and related technologies.

Prior to his SAIL affiliation, Mr. Habicht served as CEO of the Global Environment & Technology Foundation (GETF), where he now serves as Vice Chairman. GETF is a 501(c)3 not-for-profit corporation that fosters innovation in environmental management and applications of clean technology that make business and environmental sense. He is a founding Principal of Capital E, LLC, a firm that promotes investment in new energy technology and also serves as Commissioner on the National Commission on Energy Policy.

Previously, Mr. Habicht was Senior Vice President of Safety-Kleen Corporation, a provider of industrial and recycling services to 400,000 customers with sales of over $1 billion. Mr. Habicht's responsibilities included the three business and functional units of Corporate Development, Corporate Account sales and Environment, Health and Safety operations. Mr. Habicht acquired or assisted in the startup of several successful businesses which helped grow sales by over $100 million. His team also established environmental performance indicators and made dramatic improvements in all categories.

Prior to his position with Safety-Kleen, Mr. Habicht was Chief Operating Officer of U.S. EPA under Administrator William K. Reilly. Mr. Habicht's responsibilities included budget and program management authority for a $7 billion budget and 18,000 employees. Direct reports included all regional, financial and program operations. Mr. Habicht initiated quality-oriented management improvements to improve planning and integrate U.S. EPA's diverse science, policy and enforcement functions. In addition, Mr. Habicht chaired or served on several interagency work groups concerning risk assessment, energy, transportation, trade, and technology promotion.

From 1987 to 1989 Mr. Habicht was with William D. Ruckelshaus Associates as Vice President and Counsel. Mr. Habicht's responsibilities included counsel for companies on environment-related operational, legal and financial issues along with assisting in development of new business ventures. Prior to this position, Mr. Habicht was Assistant Attorney General of the United States where he directed the Land and Natural Resources Division with responsibility for all federal environmental enforcement, energy and natural resource litigation.

Mr. Habicht is a member of numerous boards and advisory councils. He has served as a Member of the Secretary of Energy Advisory Board; and is currently on the Steering Committee of the Energy Future Coalition; Chairman of Board of Resolve, Inc.; Director of 3E Company; and as a Member of NREL National Advisory Board; and the President's Advisory Committee on Trade Policy and Negotiation; and the Advisory Board for the National Leadership Summits for a Sustainable America. He also serves on the Dow Chemical Corporate Environmental Advisory Council, and the Princeton Environmental Institute and the National Pollution Prevention Roundtable Advisory Boards.

Education: J.D., University of Virginia; A.B., Princeton University

Joyce M. Ferris is a founder and Managing Partner of Blue Hill Partners, an investment firm focused exclusively in the Green Technology sector. Ms. Ferris has over 20 years of experience in the management, development and financing of energy and industrial technology companies and renewable energy projects. Ms. Ferris has had principal roles as an investor, technology and equipment provider, financial advisor and as a project developer. Ms. Ferris' project experience includes energy efficiency and on-site generation projects, biomass and agricultural waste fired energy projects, industrial waste disposal facilities, waste-coal fired power plants, geothermal, and hydroelectric projects. Ms. Ferris was a senior founding executive of Reading Energy Company where she managed financial transactions totaling over $900 million. Ms. Ferris was a major shareholder and Director of Business Development for Energy Products of Idaho, a combustion technology firm specializing in the conversion of a wide variety of solid waste material. Ms. Ferris has held numerous board positions and is currently on the board of Princeton Energy Systems, Encelium Technologies and Aircuity Inc.. She has been a speaker at industry conferences in the US and Europe. Ms. Ferris currently serves on the Pennsylvania Climate Change Working Group and the Pennsylvania Department of Environmental Protection Energy Advisory Board. Ms. Ferris is a member of the Advisory Board of the Green Building Products Economic Development Initiative in Pennsylvania and the Cleantech Venture Network. She holds a B.A. from Reed College and an M.S. from the University of Pennsylvania in Energy Management and Policy.

Nancy C. Floyd
Co-Founder and Managing Director
Nth Power, LLC

Nancy Floyd is Co-Founder and Managing Director of Nth Power, a venture capital firm that pioneered investment in energy technology. Nth Power has $400M under investment and its portfolio includes the market leaders in renewable energy, energy intelligence, power quality, advanced materials and clean transportation. Ms. Floyd has led Nth Power's investments in Silicon Energy (Nasdaq: ITRI), Northern Power (Nasdaq: DESC), Smartsynch, Serveron, SpectraSensors, Imperium Renewables and Thetus. Furthermore, Ms. Floyd sits on the boards of the Cleantech Venture Network, Center for Resource Solutions, ACORE, and Portland Family of Funds.

Prior to founding Nth Power, Ms. Floyd founded, managed and negotiated the sale of one of the country's first wind development firms, and a network management company for private voice and data. Ms. Floyd holds a masters degree in political science from Rutgers University where she was an Eagleton Fellow, and a bachelor's degree from Franklin and Marshall College where she currently serves as a Trustee.

Charles J. “Chuck” McDermott

Chuck McDermott is a General Partner of RockPort Capital Partners.

Mr. McDermott began working in the energy and environmental area in 1984, when he joined Citizens Energy Corporation as Manager of Project Development, helping to pioneer the creation of the nation's first bulk electric power trading company. He later served as Campaign Director and then as Chief of Staff for a U.S. Congressman from 1986-1990, directing all political, constituent, and legislative matters. In 1990, Mr. McDermott joined the government relations staff of Waste Management, Inc., the world’s largest environmental services company, and was made Vice President and officer of the corporation in 1993 responsible for the company’s federal advocacy before the White House, U.S. Congress, and other federal agencies. He relocated to Boston in 1998 and helped form RockPort’s merchant bank in that year and the venture fund in 2001.

He currently serves on the Boards of Directors of Cerox Corporation, Renaissance Lighting and Practical Instruments. He is also a Member of the Board of Directors and President of the CEO Coalition to Advance Sustainable Technologies, a member of the Board of Advisors to the Cleantech Venture Network, Chairman of the Gridwise Alliance and Board Member of the Flax Trust, a business incubator in Belfast, Northern Ireland.

Mr. McDermott studied at Yale University before becoming a producer, performer, writer and music company executive, recording three albums, and founding Homecoming Records with John Stewart in 1982.

Philip J. Deutch
Managing Partner

Prior to founding NGP Energy Technology Partners, Phil was a Managing Director at Perseus, LLC where he led, or co-led, the firm's energy investing activities and was on the firm's Executive Committee. Phil is one of the earliest private equity investors to focus on energy technology in the United States and since 1997 has led investments in energy companies in the areas of renewable energy, power quality/reliability, distributed generation, energy management and control, and power electronics. Phil is a member of the Boards of Directors of ISE Corp., Lehigh Technologies and Renewable Energy Group, Inc. and is a former board member of Evergreen Solar (NASDAQ:ESLR), Beacon Power (NASDAQ: BCON), Northern Power Systems and International Marketing Concepts. He is a former board observer to Encorp, Vision Solutions, SatCon Technology, and Proton Energy. Phil has spoken at energy conferences held by Goldman Sachs, Banc of America, Credit Suisse, Citigroup, the ACORE, Bear Stearns, Montreux Energy, the University of Virginia, and the FRA Renewable Energy Finance & Investment Summit. Phil served on the Advisory Committee for the 2005 and 2006 Energy Venture Fairs and the selection committees for the 2005 Cleantech Venture Forum and 2005 and 2006 NREL Industry Growth Forums. Articles written by Phil have appeared in Public Utility Fortnightly, Power Finance and Risk, and Foreign Policy. Prior to joining Perseus, Phil worked at Williams & Connolly and in the Mergers and Acquisitions Department of Morgan Stanley. Phil has also worked at the Council of Economic Advisors and for Senator J. Bennett Johnston (Chairman, Senate Energy and Commerce Committee). Phil holds a JD with distinction from Stanford Law School and a BA from Amherst College where he majored in Economics and was elected a member of Phi Beta Kappa. Phil is a director of the International Center for Research on Women.

• *Efficiency 3.0: Venture Capital Perspective*

The Energy Efficiency Finance Forum

New York, NY
April 12, 2007

The Crisis of Opportunity?

- Efficiency is cool again
- Climate change & energy “Headwinds”
  - Serious concern yields serious solutions (time frames)
- EE + Green Buildings = Growing % of Cleantech Deal Pipeline
- The innovation – adoption dialectic
- TXU deal implications?

Our Discussion

Hank Habicht, Managing Partner ***SAIL Venture Partners***	Moderator (www.sailvc.com)
Nancy Floyd, Co-Founder and Managing Director ***Nth Power***	Perspective 1997-2007, Challenges and Evolution (www.nthpower.com)
Philip Deutch, Managing Partner ***NGP Energy Technology Partners***	The Major Market Drivers (www.ngpetp.com)
Charles (Chuck) McDermott, General Partner ***RockPort Capital Partners***	The Promising Innovations (www.rockportcap.com)
Joyce Ferris, Founder and Managing Partner ***Blue Hill Partners LLC***	Government Policy Needs (www.bluehillpartners.com)

Historical Perspective Circa 1997

- Case Study: Electronic Lighting Inc.
- Investment thesis:
  - Dimming electronic ballast
  - Enabled daylight harvesting, occupancy sensing, task lighting
  - Up to 80% savings during peak periods
  - Paybacks averaging 2-4 years
  - Easily retrofittable

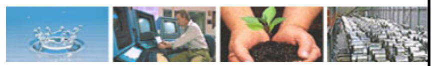
Historical Perspective Circa 1997

- Investment challenges
  - Energy too cheap to save in the U.S.
  - Energy savings a weak market driver
  - First cost issue was a major barrier
  - No clear channels to the market
    - ESCO's? Facility Managers? REITS?
  - Threats from lamp manufacturers to void warranties

Historical Perspective Circa 1997

- Investment Challenges
  - Utilities ambivalent about Demand Side Management
  - Unpredictable sales cycle
- Investment Outcome
  - Customer inertia won out over "nice to have" product
  - Sold company for less than capital invested
- Ten years later, this company might be wildly successful!

Investment Drivers



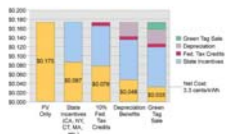
1. High Energy Prices
2. Imported Mideast Oil
3. Climate Change
4. Electric Grid Capacity Issues
5. Successful Cost Reductions/Technology Innovation
6. Public Awareness/Corporate Action

Investment Drivers

1. High Energy Prices
2. Imported Mideast Oil
3. Climate Change

Investment Drivers

4. Electric Grid Capacity Issues
5. Successful Cost Reductions/Technology Innovations



Investment Drivers

6. Public Awareness/Corporate Action

Innovations in Efficiency

1. Demand Side Management: The resurgence of "Negawatts"
2. Lighting: 30% of the load at 15% efficiency
3. Edison Vs. Tesla: AC Vs. DC
4. Green Buildings: Coming of Age, 20 years later

Demand Side Management

1. The cheapest barrel of oil is the one you don't use
2. Demand Side Management repackaged as "Virtual Peaking Capacity"
   - Valuing load shedding as capacity
3. Remote control, diagnostics and monitoring
   - Borrowing from Telco and the Web
4. "Smart" meters
   - They work, but who pays

Lighting

1. 30% of US electric power load –
   - and a typical incandescent bulb is 85% heat!
2. Compact fluorescents are dropping in price –
   - 60% efficient but do you like how you look?
3. Solid State Lighting: the Holy Grail
   - Pleasing white and "color changing"
   - Long life: 50,000 hrs vs 2,000 hrs
   - Brightness going up
   - Cost coming down

Edison Vs. Tesla: AC Vs. DC

- The grid is AC. Edison Lost.
- Many devices are DC – 60% of a commercial building (Edison won)
  - PC's
  - Cell phones
  - Fluorescent and LED lights
  - HVAC systems
  - Variable speed motors, etc
- 10-15% efficiency loss when switching between modes
- DC buss and DC-DC architecture

Green Buildings

1. A platform for multiple technologies
    - Combined heat and power systems
    - Nano-insulation
    - “Smart” windows
    - Advanced lighting applications
    - Renewable power sources

Current Enabling Policies and Regulations

- Tax Credits
    - Federal Tax Credit – Energy Policy Act of 2005
    - State Tax Credits – for green buildings and energy efficiency
- Utility Rebates
- Building Codes and Regulations
    - cities and municipalities
    - state or federal owned buildings
- Appliance Standards
- R + D – (including human resources)

Policy and Regulatory Barriers

- Utility Ratemaking
  - energy efficiency reduces revenue
- Utility Rate Design
  - does not encourage efficiency
- Utility Resource Planning
  - does not include efficiency
- Lack of Standard Measurement and Verification Protocol

States in the Lead

- Pacific Northwest
- California
- New York
- Nevada

Questions and Discussion

Luncheon Keynote Address:

Amory Lovins, *CEO*
ROCKY MOUNTAIN INSTITUTE

Amory Lovins, a MacArthur Fellow and consultant physicist, has advised the energy and other industries for more than three decades as well as the U.S. Departments of Energy and Defense. Published in 29 books and hundreds of papers, his work in 50+ countries has been recognized by the "Alternative Nobel," Onassis, Nissan, Shingo, and Mitchell Prizes, the Benjamin Franklin and Happold Medals, nine honorary doctorates, honorary membership of the American Institute of Architeects, and the Heinz, Lindbergh, Jean Meyer, *Time* Hero for the Planet, and World Technology Awards. A Harvard and Oxford dropout and former Oxford don (receiving in consequence an Oxford MA by Special Resolution), he advises industries and governments worldwide, and has briefed 19 heads of state. He cofounded and leads Rocky Mountain Institute (www.rmi.org), an independent, market-oriented, entrepreneurial, nonprofit, nonpartisan applied research center that creates abundance by design. Much of its pathfinding work on advanced resource productivity (typically with expanding returns to investment) and innovative business strategies is synthesized in *Natural Capitalism* (www.natcap.org). This intellectual capital provides most of RMI's revenue through private-sector consultancy that has served or been invited by more than 80 *Fortune* 500 firms, lately redesigning $30 billion worth of facilities spanning 29 sectors. RMI spun off E SOURCE (www.esource.com) in 1992 and Fiberforge, Inc. (www.fiberforge.com), a composites engineering firm that Mr. Lovins chairs, in 1999; its technology permits cost-effective manufacturing of the ultralight-hybrid Hypercar® vehicles he invented in 1991. His 28th book, *Small Is Profitable* (www.smallisprofitable.org), an *Economist* book of the year, was published in 2002, and his Pentagon-cosponsored 29th book, *Winning the Oil Endgame* (www.oilendgame.com), in 2004.


ROCKY MOUNTAIN
INSTITUTE

ACEEE Energy Efficiency Finance Forum, New York, 12 April 2007

The Most Transformational Investment Opportunity on Earth

To be truly radical is to make hope possible, not despair convincing.
—Raymond Williams

Amory B. Lovins

Chairman and Chief Scientist
Rocky Mountain Institute
www.rmi.org

Chairman Emeritus
FIBERFORGE
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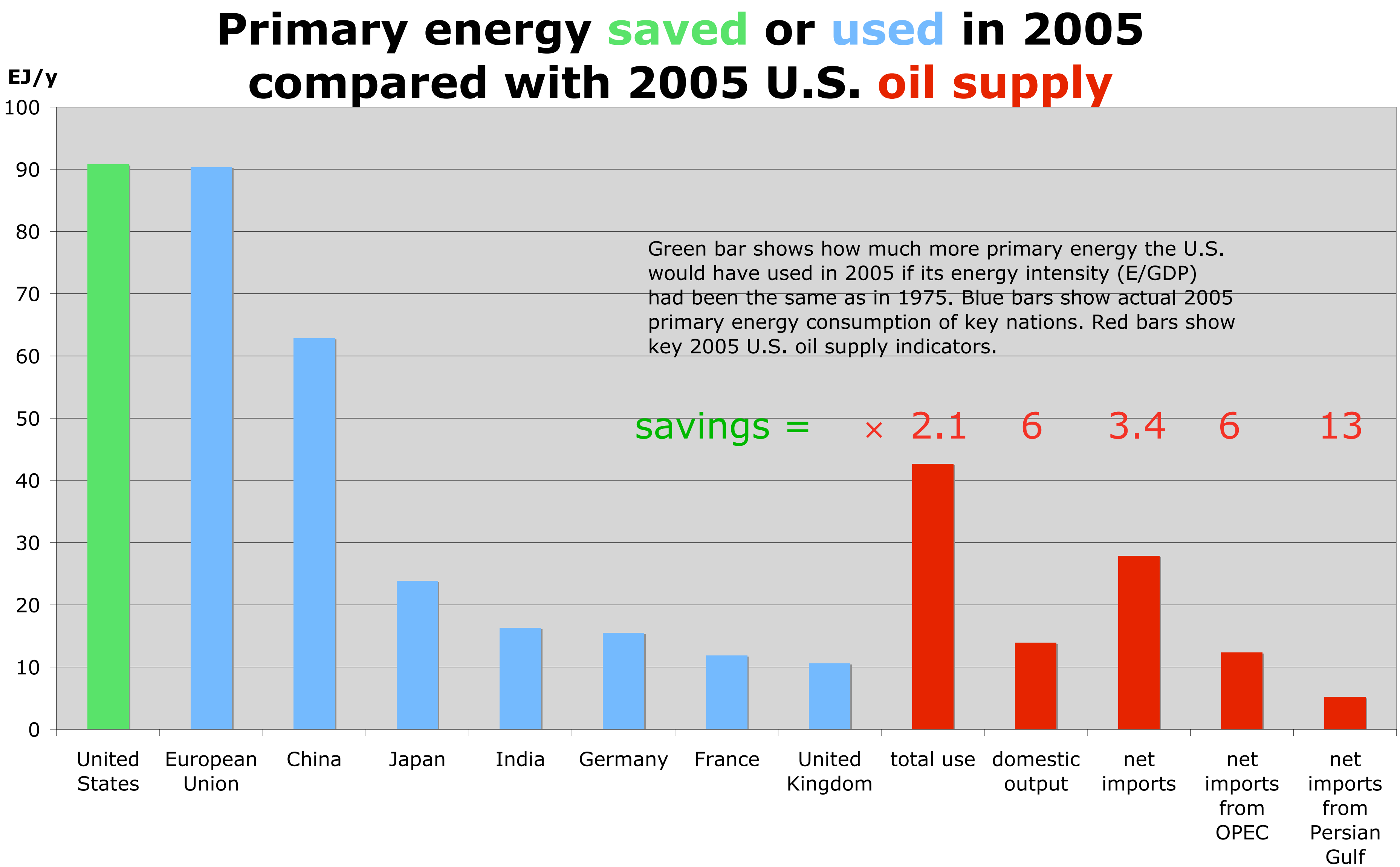
Of all energy options, end-use efficiency is by far the …

- Biggest
- Cheapest
- Fastest
- Most benign
- Least visible
- Least understood
- Least well measured (in most places)
- Most neglected in policy
- Most underinvested-in
  - …if measured by *marginal* investment to achieve efficiency, not *total* investment in an end-use device that happens to be of a more efficient type like Energy Star

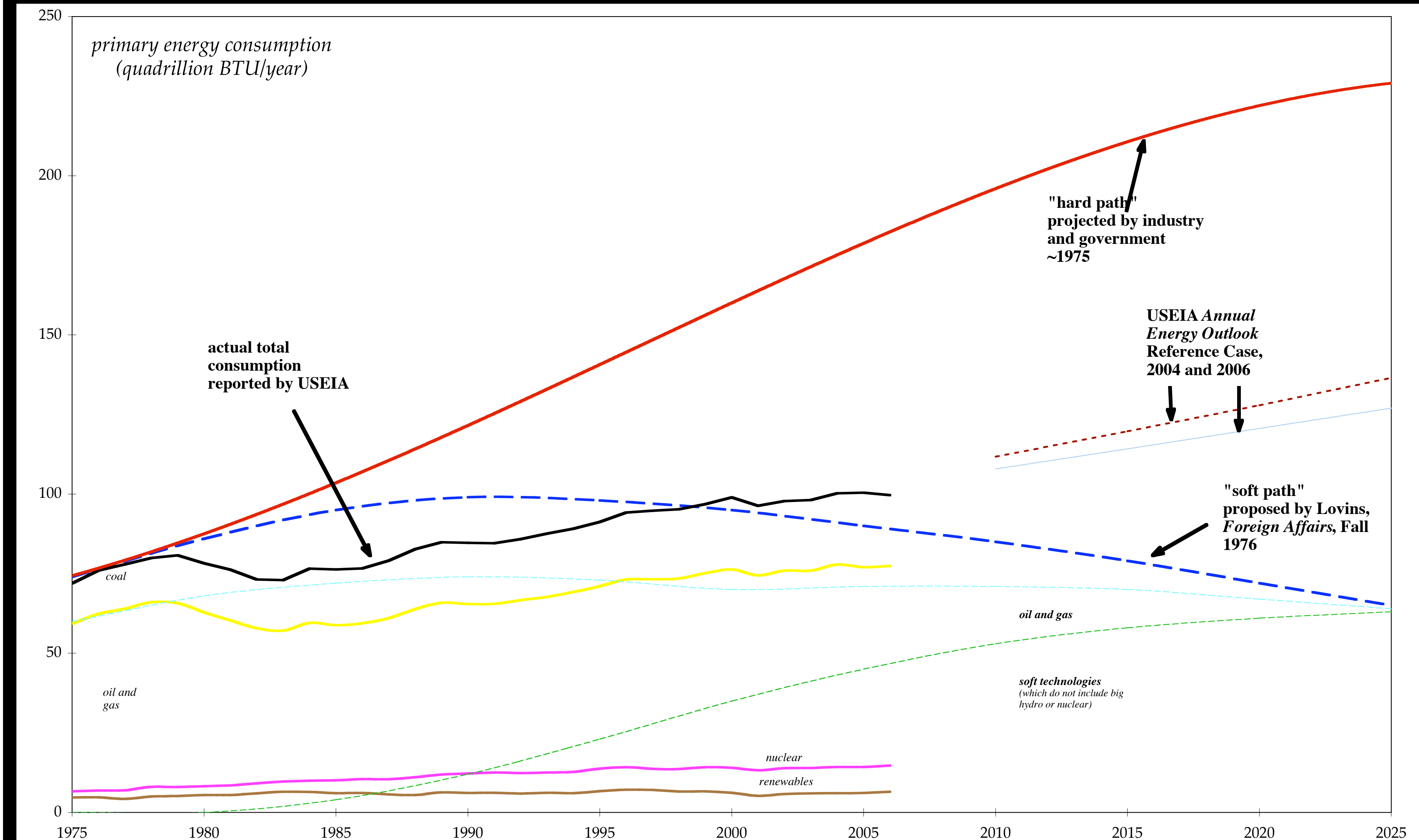
Seven fundamentals (no matter what your scale or risk appetite)

- Even after recent shifts from fossil & nuclear fuels to renewables and toward more appropriate scale, most (>90%?) energy capital remains misallocated
  - *E.g.*, by 1990, the U.S. misallocated ~$1 trillion just for ~200 million tons of air conditioning + its ~200 GW of power supplies
- Energy efficiency's untapped potential is far bigger and cheaper than widely assumed, is getting more so, and will for at least another century or so
- Biggest underinvestments are in saving el. and oil
- Improving technology is important—but much less important than *design to apply existing* technology
- Policy & marketing are as innovative as technology
- Some big leapfrogs assumed to need policy drivers will actually be driven by competitive strategy
- For starters, we must *track* efficiency, in J and $!

Just scratching the surface of U.S. efficiency potential has done a lot

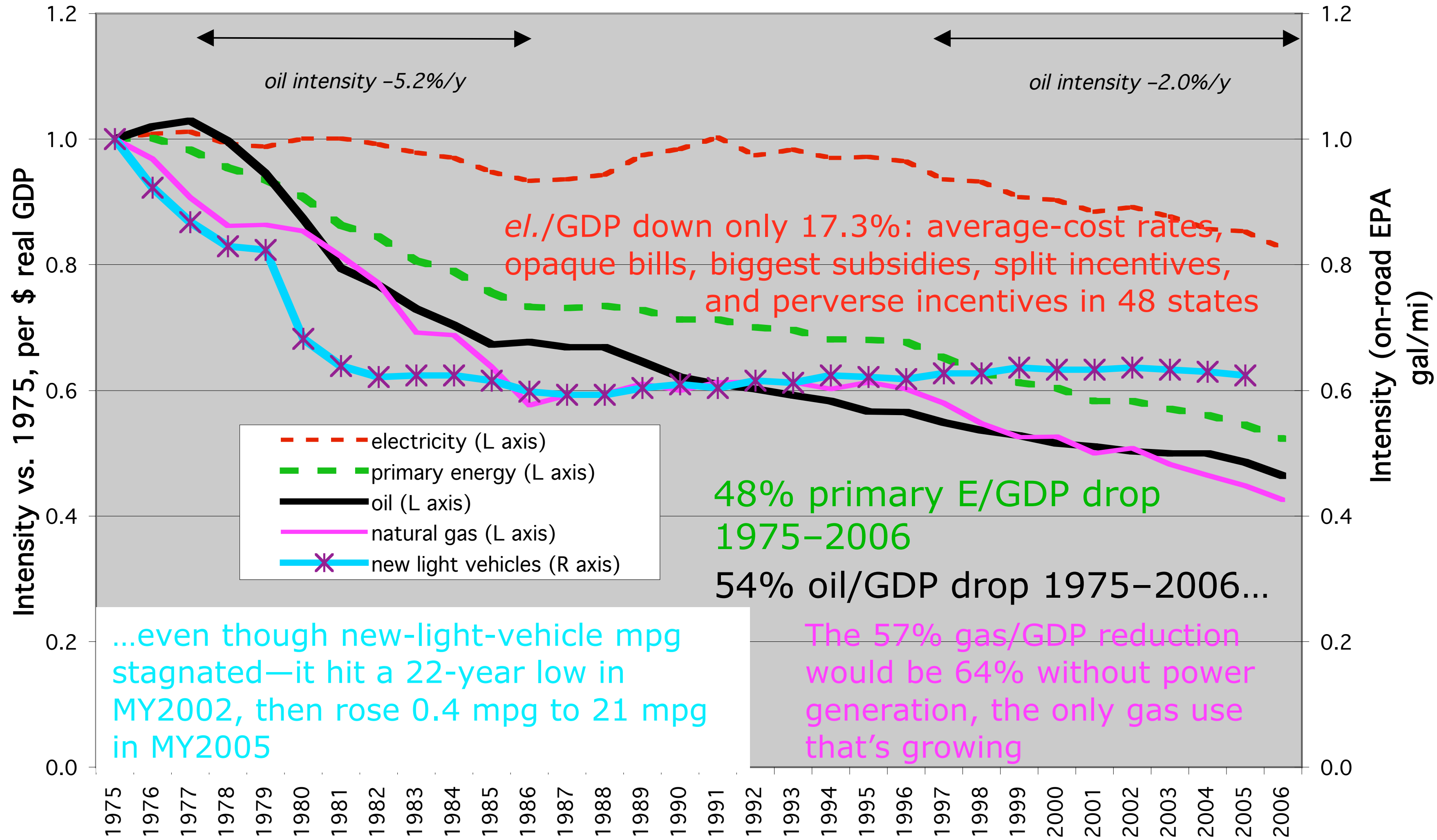


U.S. energy/GDP already cut 48%,
to very nearly the 1976 “soft path”



but that just scratches the surface (el/GDP down only 17%)

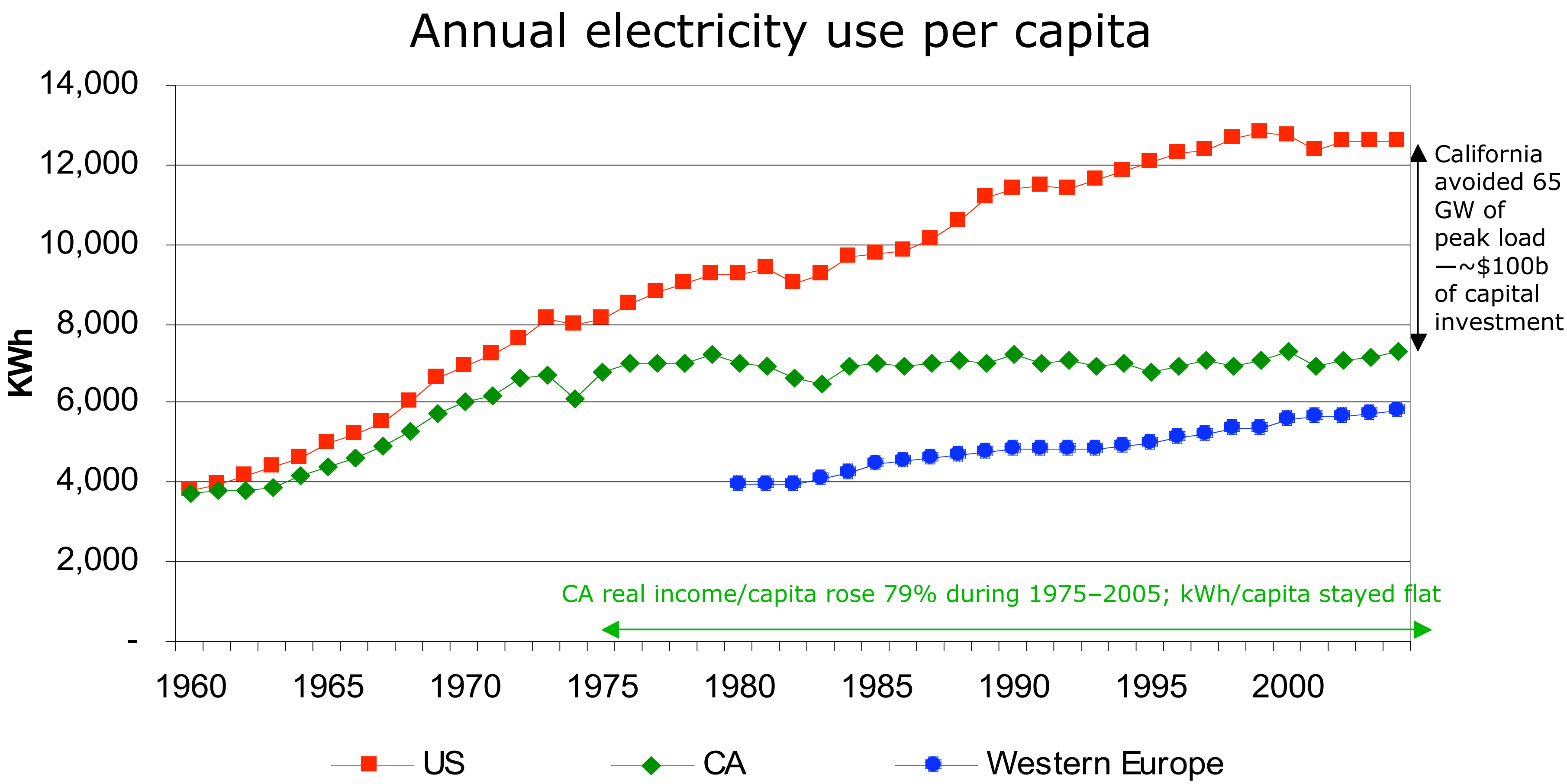
U.S. energy intensity since 1975



Data source: U.S. Energy Information Administration, *Annual* and *Monthly Energy Review*, www.eia.doe.gov/emeu/aer/contents.html

Light-vehicle data from *id.* and TEDB 23 (ORNL-6967), 2003, www-cta.ornl.gov/cta/data/index.html

National averages mislead: electric efficiency is far faster in California and New England than in rest of the U.S.



Source: California Energy Commission

CA savings came roughly half from appliance and building efficiency standards, half from rewarding utilities for cutting customers' bills—not for selling more energy

Just during 2006, the United States… (per preliminary EIA 3/07 *Monthly Energy Review* data)

- Cut primary energy use per dollar of real GDP by 4.0% (the fastest since 1985)
- Cut electricity use per dollar of real GDP by 3.1% (the fastest since 1989)

Despite…

- Essentially stagnant light-duty vehicle efficiency
- Utilities' being rewarded in 48 states for selling more electricity and natural gas
- Consumers' weak info and high discount rates
- A hostile or indifferent policy environment in most states and many Federal agencies

What more could truly engaged capitalists do?

If we got serious, what more could end-use efficiency do directly?

- Save more than half of U.S. oil at an average cost of \$12/bbl (SRMRAC, 2000 \$, 5%/y RDR)—1/5 price
- Save at least half of U.S. natural gas at an average cost <\$0.9/GJ—1/8 price
- Save at least three-fourths of U.S. electricity at an average cost ~1¢/kWh or less—1/8 price

Total *marginal* cost of achieving such savings overnight in 2006 would be only of order \$94b/y (2006 \$)

  - \$54b to save oil, \$11b gas, \$29b el., totals ~1/10th energy cost/y
  - Present value (~\$1.2T) slightly exceeds 1 y of U.S. energy costs

- Stretch all alternative supplies correspondingly
- Prolong cheaper options, delay costlier ones— *i.e.*, stay on the lower part of the supply curves
- Rebalance supply/demand, reduce volatility, gain spare capacity for supply interruptions

If we got serious, what more could end-use efficiency do indirectly?

- Cut and stabilize fuel prices—especially for world oil
  - Saving 1% of US el., incl. peak, cuts nat. gas use 2%, price 3–4%
  - Soften oil prices—huge benefits for global development and stability
  - Better energy services are worth far more than saved energy costs
- Increase global wealth and distribute it more fairly
  - ~10^4× capital leverage in the power sector (~1/4 global devel. cap.)
- Solve the oil, climate, and (largely) nuclear prolifera-tion problems—all led by private enterprise for profit
- Enable renewable sources to do more, sooner, cheaper
- Most precious—buy *time* to develop and deploy better technologies, learn more, make wiser choices
- The most versatile known "master key" on the planet
- That doesn't even count cogen (~3× better efficiency—can save 23% of U.S. CO_2 and tens of $b/y), cascading ind'l heat (save 11% of U.S. pri. E), etc.

A business-as-unusual future

- Prices will on the whole become less important, economic tools less informative, big energy institutions less essential, and capital velocity far higher
- Emphasis will shift from commodities to services and, for investors, from capital intensity to velocity
- Mature carbon markets will clear at very low prices
- Outcomes will be driven more by disruptive, convergent technologies and competitive strategies than by public policy, which will badly lag business
- Discontinuities and surprises (perhaps even wholly new sources) will accelerate; some very bad things will probably happen, tempting us to big mistakes
- Tech transfer and policy innovation will shift S→N
- Leapfrog development will be greatly facilitated
- Investors and strategy innovators will drive all this

Saving energy is cheaper than buying it (whether or not you believe in climate change!)—so firms are protecting climate

- IBM and STMicroelectronics
  - CO_2 emissions –6%/y, fast paybacks
- DuPont's 2000–2010 worldwide goals
  - Energy use/$ –6%/y, add renewables, cut greenhouse gas emissions by 65% below 1990
  - Actual by 2004: cut *72%*, 30% more output, 7% less energy, $2b net profit (by 2006, >$3b, savings 80%)
- BP's 2010 CO_2 goal met 8 y early, $1.6b profit
- GE pledged 2005 to boost its eff. 30% by 2012
- Interface: 1994–2005 GHG –56% (–7.5%/y)
- TI new chip fab: –20% en., –35% water, –30% capex
- So while the politicians endlessly debate the "costs," smart firms are racing to pocket the *profits!*

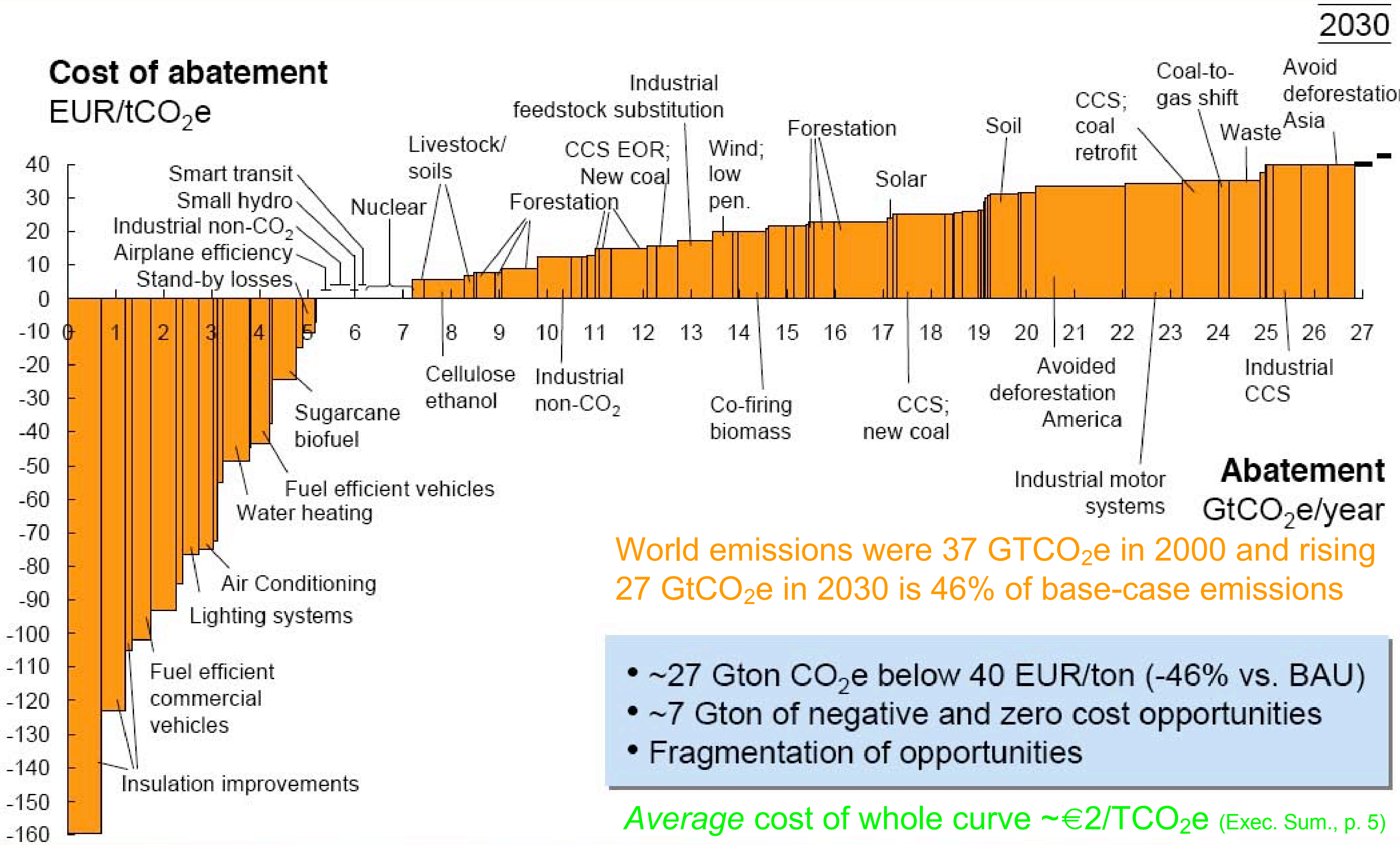
Profitable climate protection

- Global CO_2 emissions will triple by 2100 if we reduce E/GDP by 1%/y; level off if 2%/y; and drop—stabilizing the Earth's climate—if ~3%/y. Is that feasible?
- The U.S. has spontaneously saved >2%/y since 1997; 3.4%/y 1981–86; 3.2%/y in 2001 and 2005
- California was ~1 percentage point faster; its new homes use 75% less energy; still saving much more
- China did even better—saved >5%/y for >20 y, 7.9%/y 1997–2001; energy efficiency is top priority
- Attentive corporations routinely save ~6–8%/y
- U.S. wastes >50% of oil & gas, >75% of electricity
- Even Japan can profitably save 2/3 of *its* energy
- Oil causes 42% of all CO_2 emissions, electricity 40%

2007 Vattenfall/McKinsey supply curve for abating global greenhouse gases

(technologically *very* conservative, esp. for transport)

Global cost curve of GHG abatement opportunities beyond business as usual



World emissions were 37 $GTCO_2e$ in 2000 and rising
27 $GtCO_2e$ in 2030 is 46% of base-case emissions

- ~27 Gton CO_2e below 40 EUR/ton (-46% vs. BAU)
- ~7 Gton of negative and zero cost opportunities
- Fragmentation of opportunities

Average cost of whole curve ~€2/TCO_2e (Exec. Sum., p. 5)

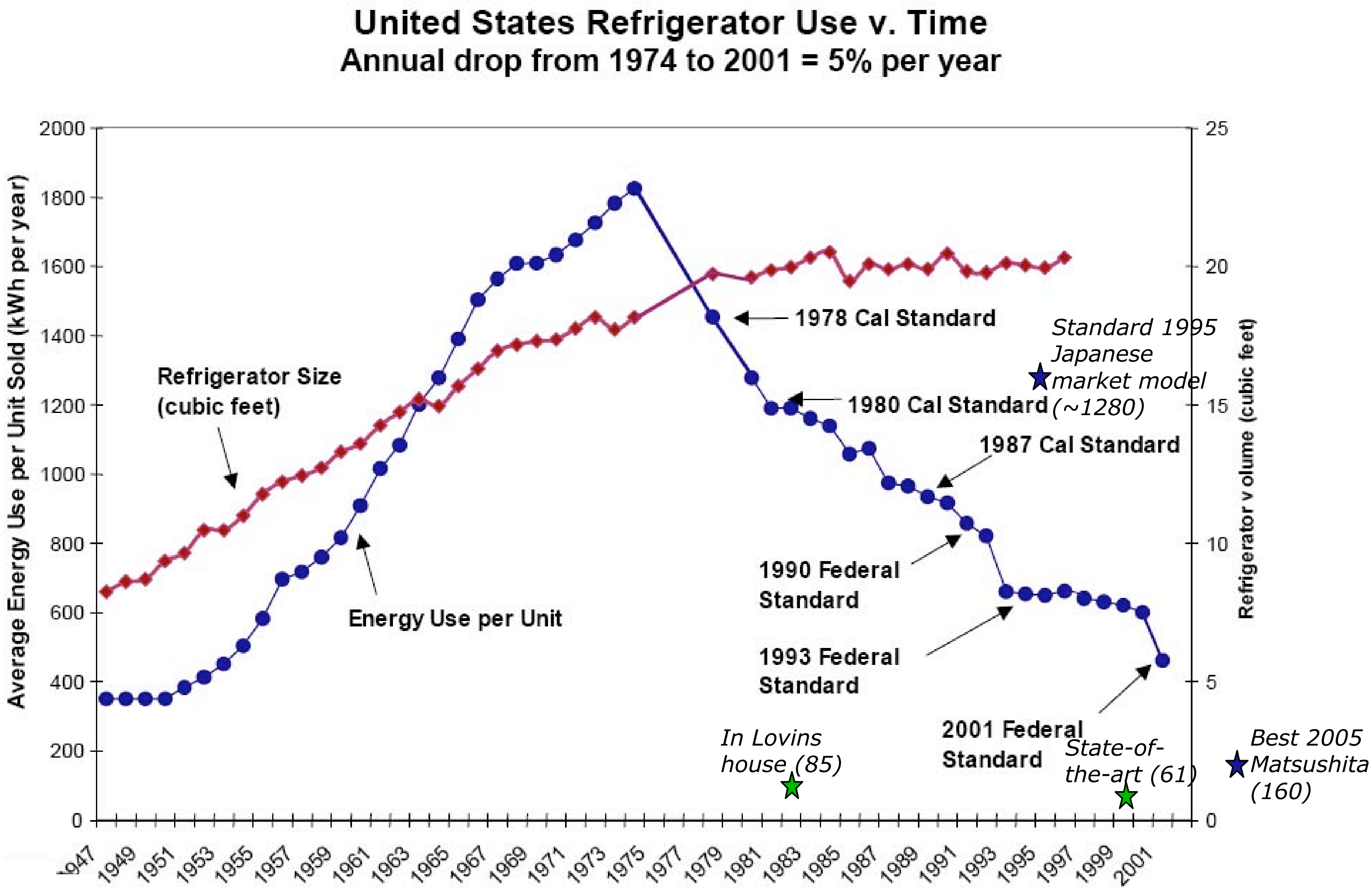
The efficiency resource is getting bigger and cheaper faster than we use it

- 1984–89: negawatt potential ×2, real cost ÷3 (RMI)
- Since 1990, add mass production (often offshore), cheaper electronics, competition, better technology

  Thanks to Jim Rogers PE for most of these examples, which we've converted to constant dollars

  - Compact fluorescent lamps: 85–94% cheaper 1983–2003 (>1b/y)
  - Electronic T8 ballasts: >90% cheaper 1990–2003 (& lux/W up 30%)
  - Direct/indirect luminaires: gone from premium to cheapest option
  - Industrial variable-speed drives: ~83–97% cheaper since 1990
  - Window a/c: 69% cheaper than 1993, 13% more efficient, digital
  - Low-E window coatings: ~84% cheaper than five years ago
- Delivery: scaleup, streamlining, integration
  - *E.g.*, a NE lighting retrofit firm halves the normal contractor price
- Design integration: huge, least exploited resource
  - Hardly used yet…but typically makes very big savings cost <0!

Efficiency is a rapidly moving target



Japan's standards aim to cut el. use 30% from ~1997 levels for refrigerators, 16% for TVs, 83% for PCs, 14% for air conditioners,…; all can go much lower

−47 to + 115 °F with no heating/cooling equipment, *less* construction cost

7,100′, frost any day, 39 days′ continuous midwinter cloud…yet 28 banana crops with no furnace

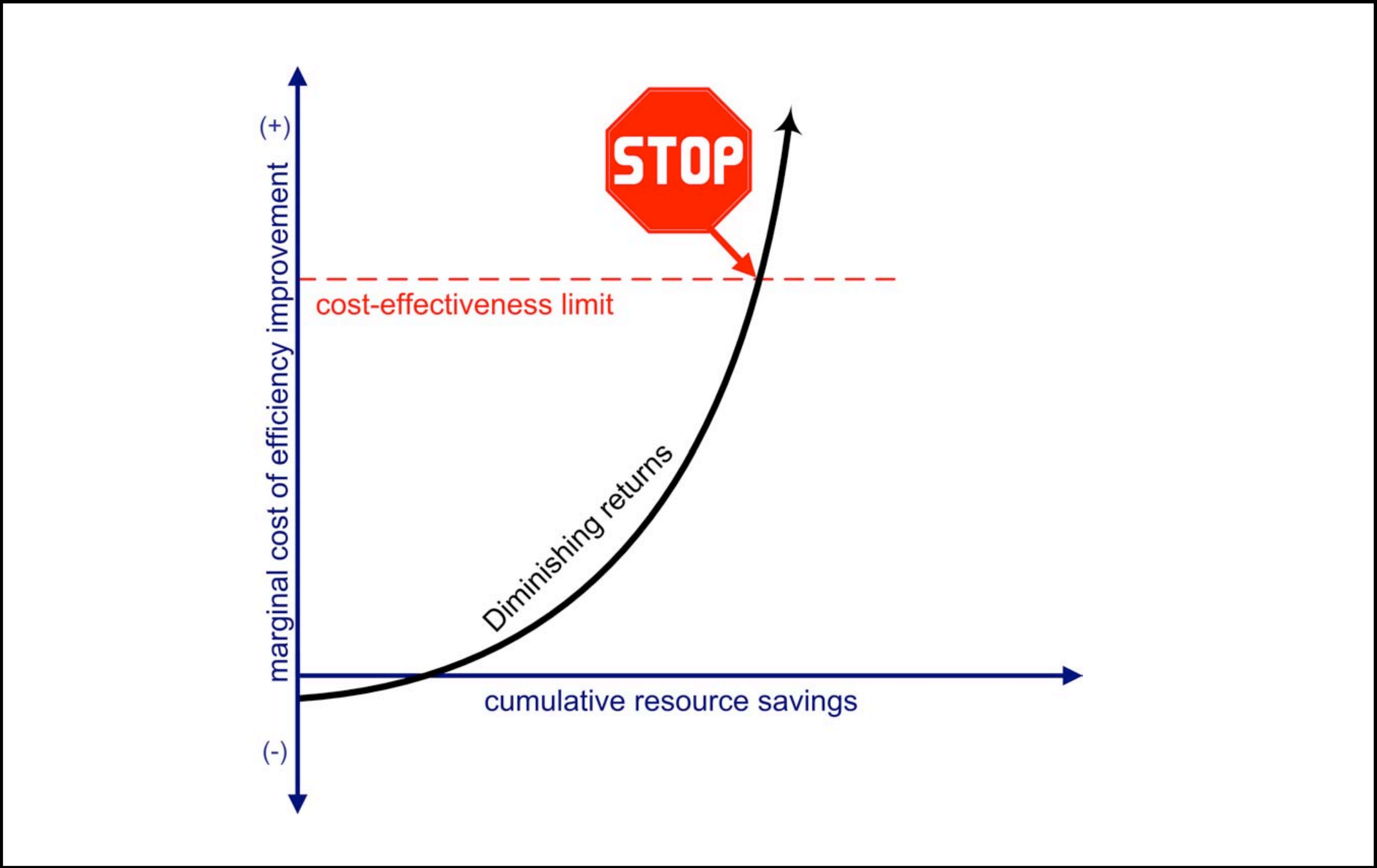
Key: integrative design—multiple benefits from single expenditures

- Lovins house / RMI HQ, Snowmass, Colorado, ′84
  - Saves 99% of space & water heating energy, 90% of home el. (4,000 ft^2 use ~120 W_{av} costing $5/month @ $0.07/kWh)
  - 10-month payback in 1983
- PG&E ACT2*, Davis CA, ′94
  - Mature-market cost −$1,800
  - Present-valued maint. −$1,600
  - 82% design saving from 1992 Ca code, ~90% from U.S. norm
- Prof. Soontorn Boonyatikarn house, Bangkok, Thailand, ′96
  - 84% less a/c capacity, ~90% less a/c energy, better comfort
  - No extra construction cost

*$18M experiment, 1990–97, 7 old & new bldgs, www.pge.com/003_save_energy/003c_edu_train/pec/info_resource/act2_proj.shtml

Rocky Mountain bananas with no furnace?

Old design mentality: always diminishing returns...



New design mentality: expanding returns, "tunneling through the cost barrier"

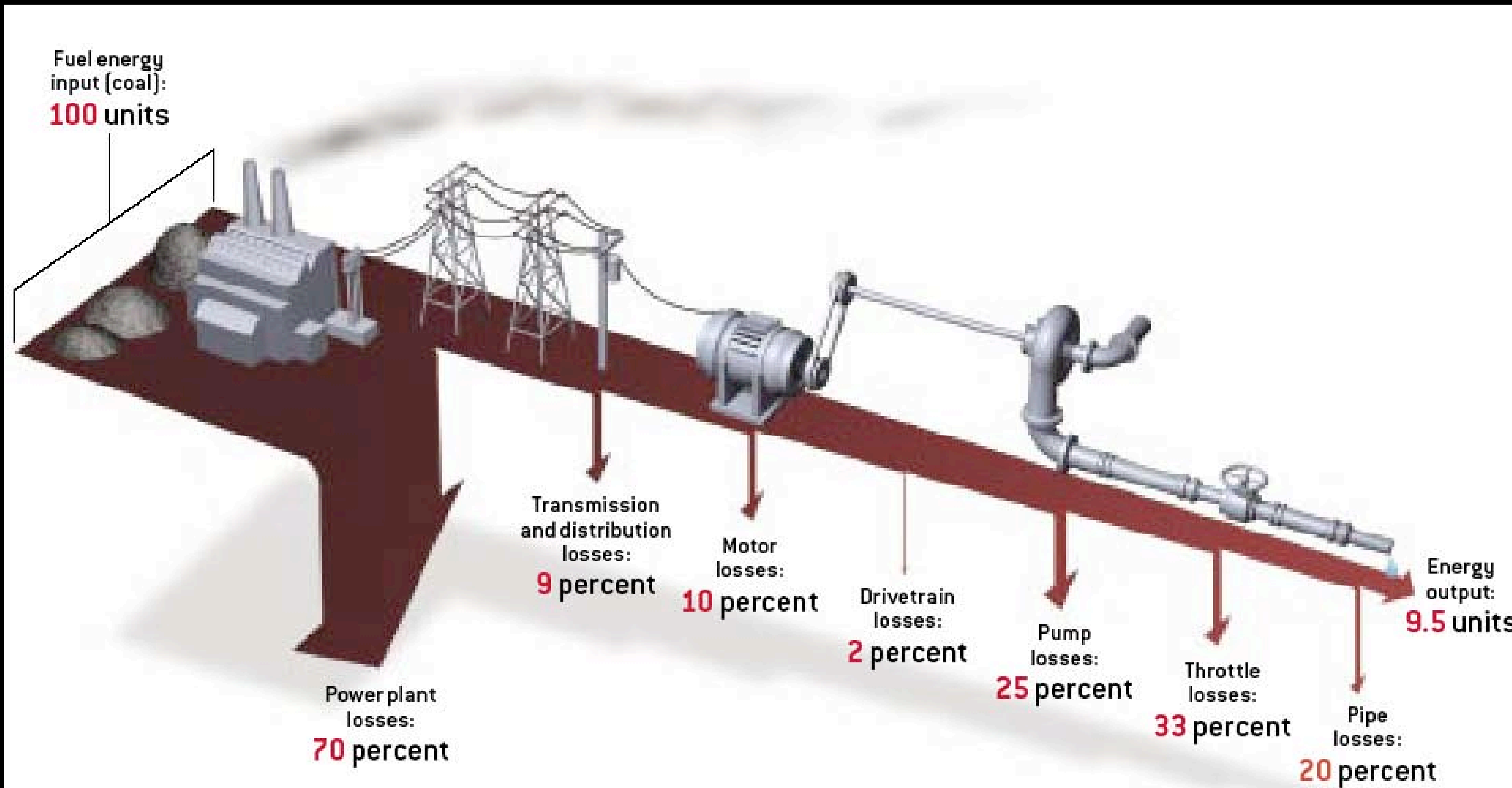
New design mentality: expanding returns, "tunneling through the cost barrier"

"Tunnel" straight to the superefficient lower-cost destination rather than taking the long way around

New design mentality

- ◇ Redesigning a standard (supposedly optimized) industrial runaround pumping loop cut its power use from 95 to 7 hp (–92%), cost less to build, worked better
- ◇ Two changes in design mentality, so we used fat short straight pipes—not skinny long crooked pipes
- ◇ Optimize system for multiple benefits, not a component for one benefit
- ◇ Should've saved ~98%!

Compounding losses…or savings…so start saving at the *downstream* end to save ten times as much energy at the power plant



Also makes upstream equipment smaller, simpler, cheaper

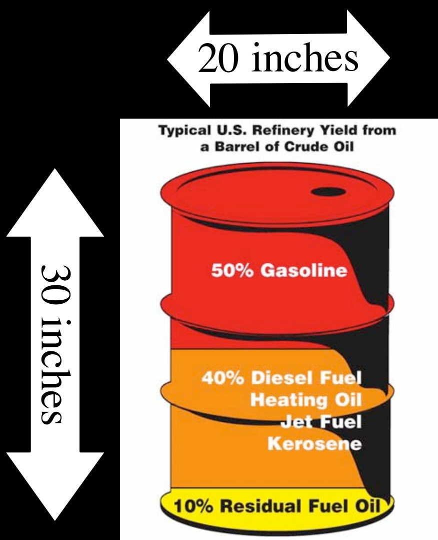
Examples from RMI's industrial practice (~$30b of facilities)

- Save half of motor-system electricity; retrofit payback typically <1 y
- Similar ROIs with 30–50+% retrofit savings of chip-fab HVAC power
- Retrofit very efficient oil refinery, save 42%, ~3-y payback
- Retrofit North Sea oil platform, save 50% el., get the rest from waste
- Retrofit USNavy *Aegis* cruiser's hotel loads, save ~50%, few-y paybacks
- Retrofit big LNG plant, ≥40% energy savings; ~60%? new, cost less
- Redesign $5b gas-to-liquids plant, –$1b capex, save >50% energy
- Redesign giant platinum mine, 43% energy savings, 2–3-y paybacks
- Redesign new data center, save 89%, cut capex & time, improve uptime
- Redesign next new chip fab, save ~67%, eliminate chillers, slash capex
- Redesign supermarket, save 70–90%, better sales, ?lower capex
- Redesign new chemical plant, save ~3/4 of electricity just in auxiliaries, cut construction time and cost by ~10%
- Redesign new 58m yacht, save 96% potable H_2O & 50% el., lower capex
- "Tunneling through the cost barrier" now observed in 29 sectors
- None of this would be possible if original designs had been good
- Needs engineering pedadogy/practice reforms; see www.10xE.org

The world consumes a cubic mile of oil per year—85 million barrels per day

[courtesy of CAPT Scott Pugh, USN Ret., RMI Military Principal]

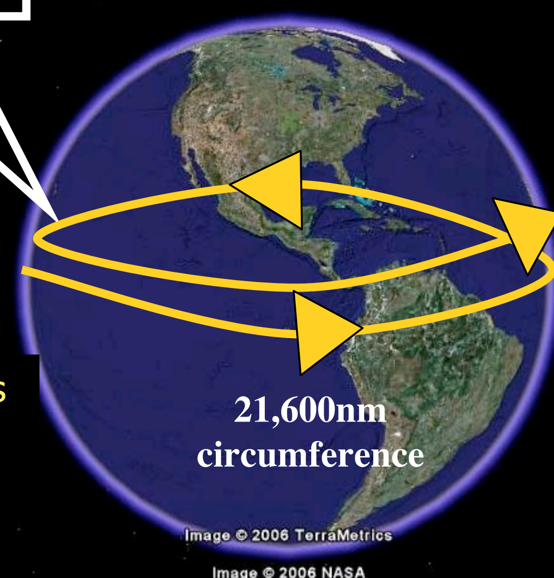
$$\frac{85{,}000{,}000 \times 30 \text{ inches}}{(12 \text{ inches/foot})(6{,}000 \text{ feet/nautical mile})} = 35{,}416 \text{ nautical miles}$$



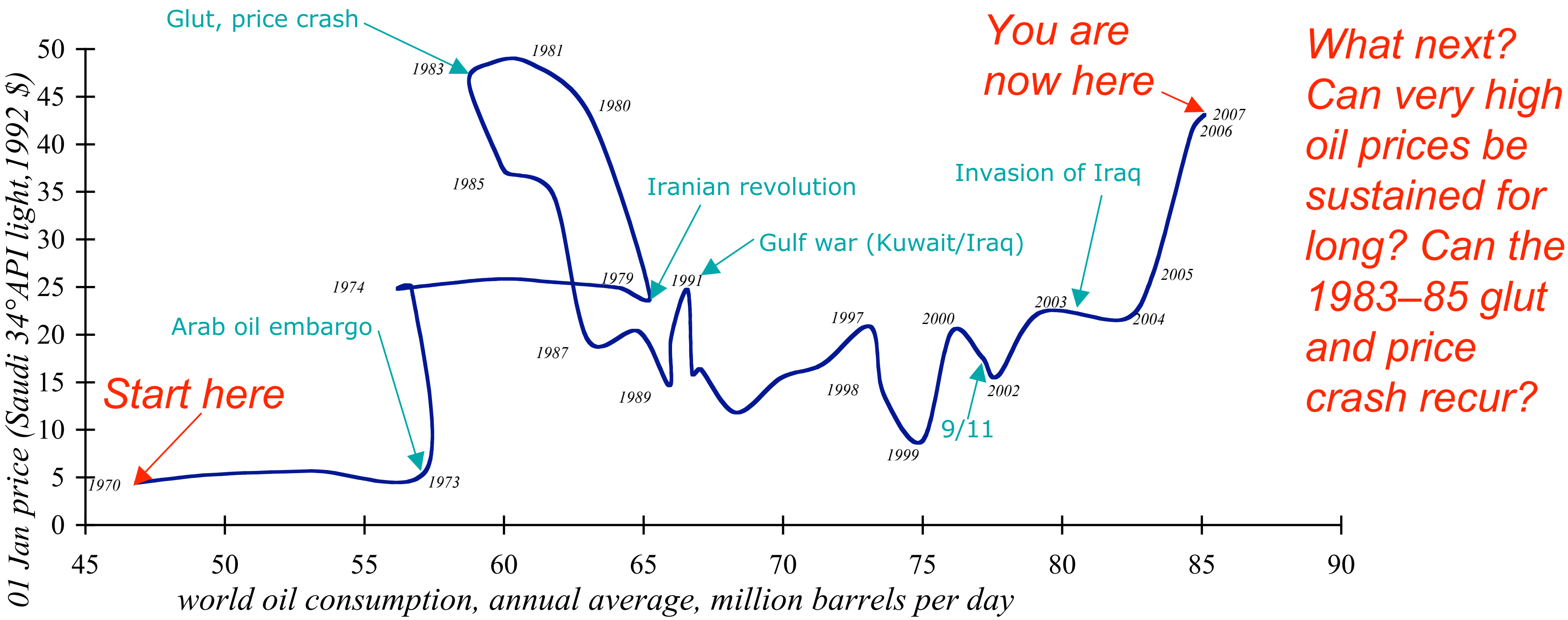
1 barrel of crude oil = 42 U.S. gallons

20-inch pipeline

$$\frac{35{,}416 \text{ nm}}{24 \text{ hours}} = 1{,}475 \text{ knots} \approx \text{Mach } 2$$



A short history of world oil consumption *vs.* real oil price, 1970–2006



At pre-1973 low prices, oil demand grew rapidly. After the 1973 price shock, demand grew more slowly. After the sharper 1979 price shock, demand shrank until 1983. Price fell and slow demand growth resumed. The 1991 Gulf war caused a small spike. Since then, demand has drifted up, slowing markedly after prices soared in 2004–06. In 2006 $, oil prices would need to hit ~$91 to match their 1981 high.

EIA data, RMI analysis

The last U.S. efficiency boom was derailed by a glut in 1984–86: could we see that bad movie again?

- In 1981, President Reagan launched, expedited, and subsidized a huge expansion of big, slow, costly supplies…but didn't notice the market was producing a gusher of efficiency
- The resulting glut crashed prices in 1984–86
- All the same forces were *again* set in motion 20 years later
  - Efficiency drivers are somewhat different now, but arguably stronger
  - Efficiency's pace is impressive despite different details: *e.g.*, 78% of the increase in 1996–2005 U.S. energy services was fueled and powered by reduced energy intensity, not by increased physical supply
  - The same underlying dynamic prevails—fast technologies get deployed and grab the revenue streams before slow ones can—but this time there are not one but *two* fast technology groups (efficiency plus micropower)
- This trainwreck would take a few years to play out; impossible to say yet whether it can offset upward price pressures
- Key difference: this time, not just energy *prices* but also *security, geopolitics, and climate* will keep our eye on the ball

Business-based oil *solution*

Independent, detailed, peer-reviewed, transparent

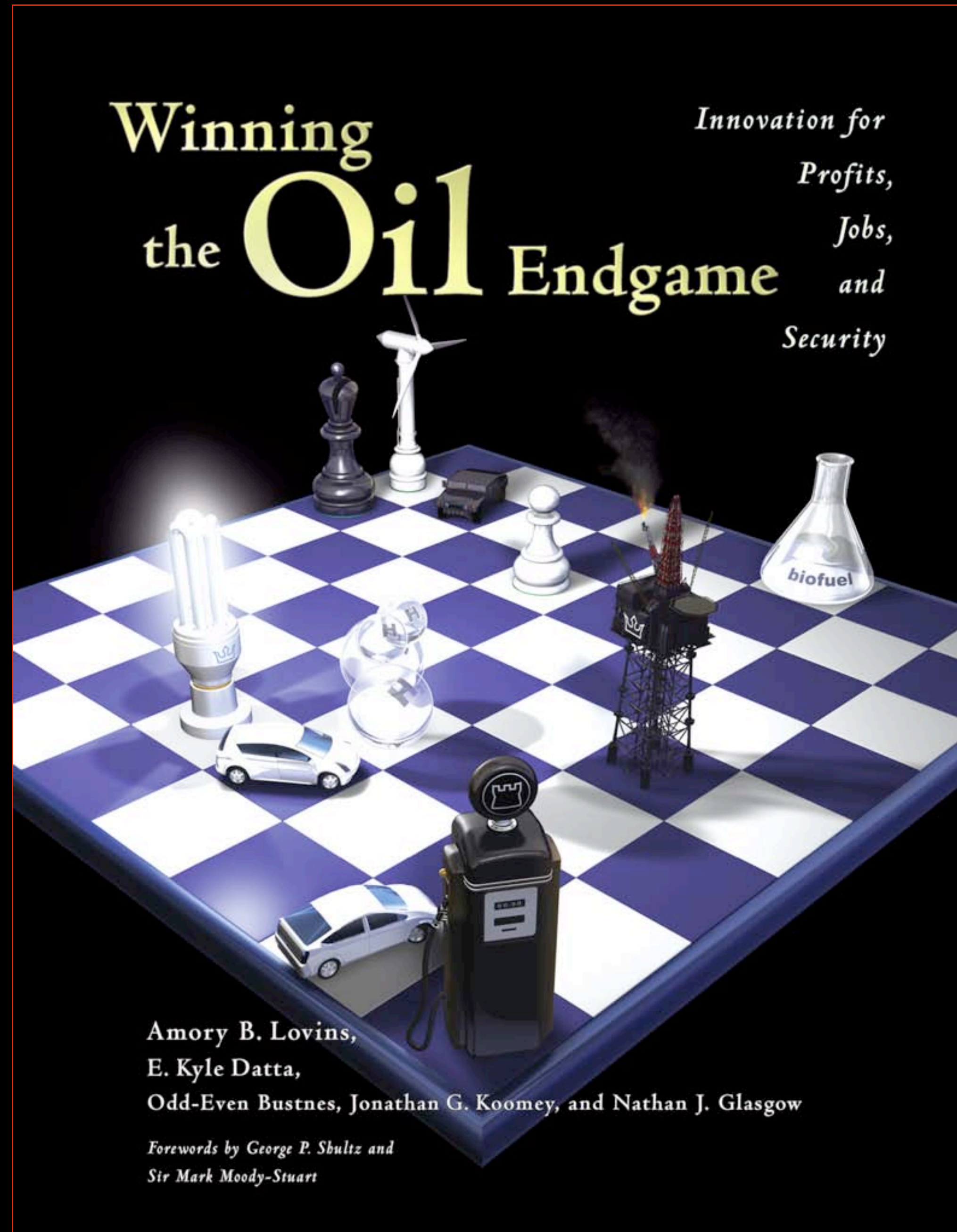
Cosponsored by USDoD

For business & mil. leaders, built on business cases

Book and technical backup are free at:

www.oilendgame.com

Over the next few decades, the U.S. can* eliminate *its use of oil and revitalize its economy, led by business for profit



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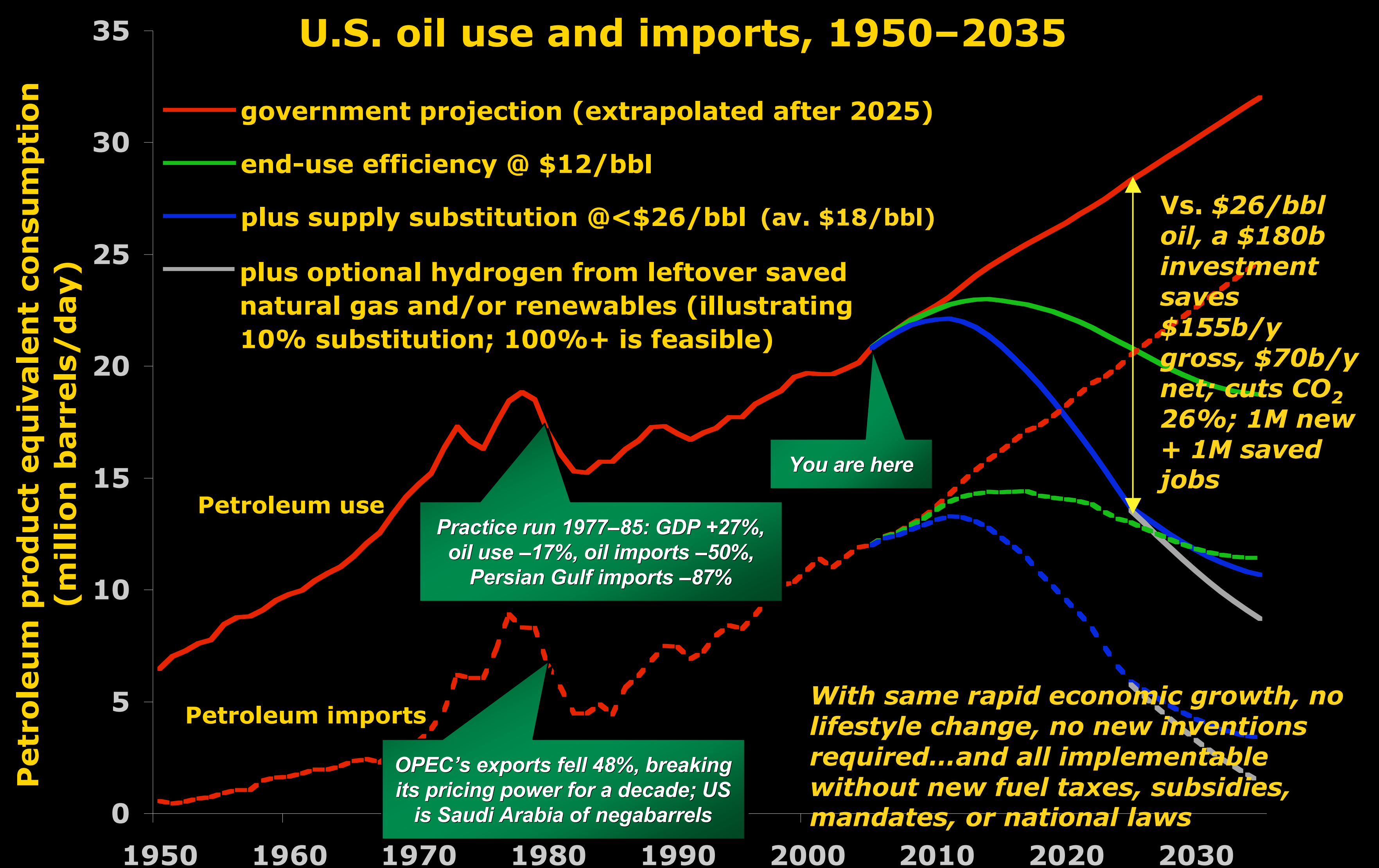
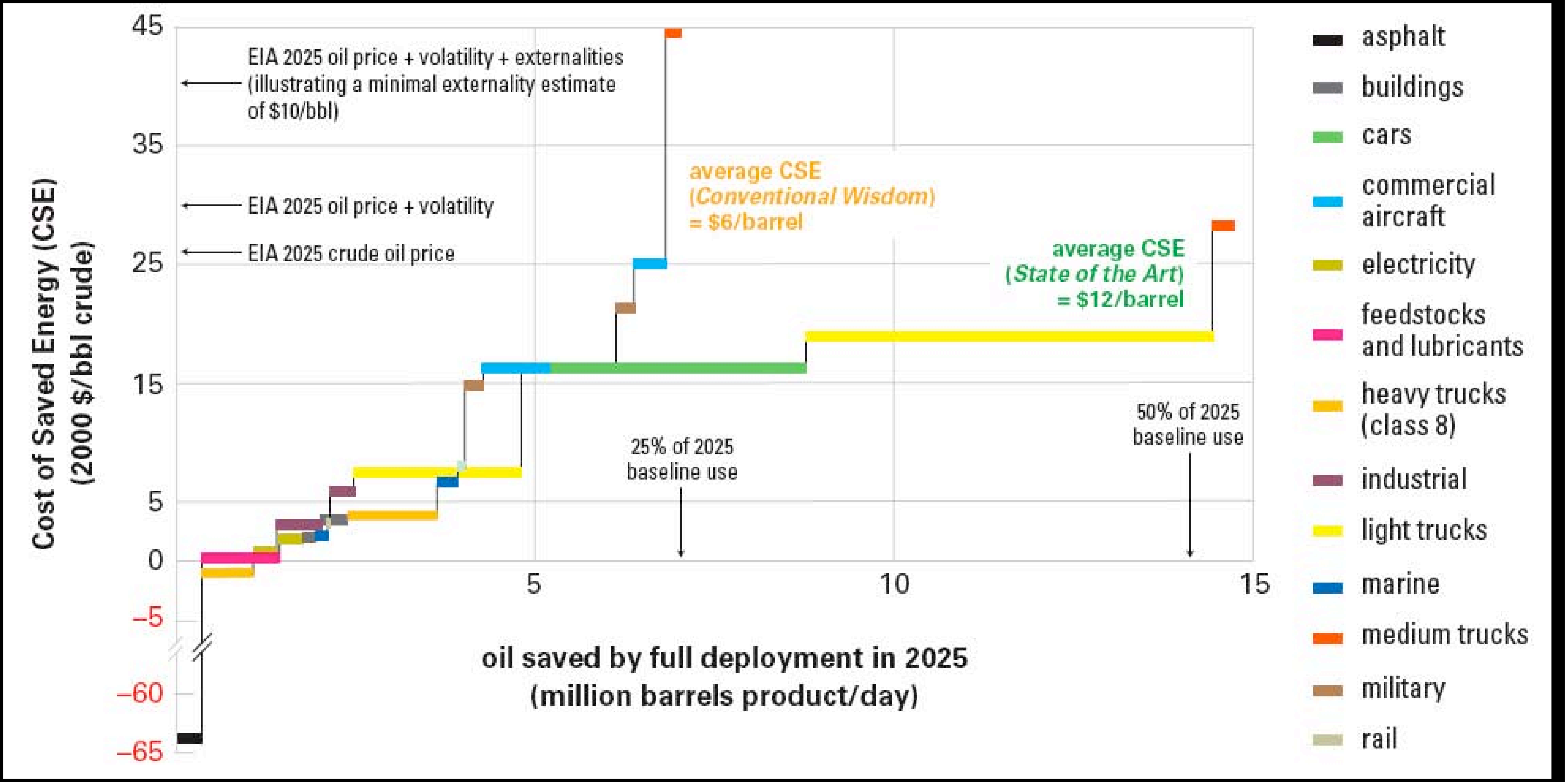
A profitable US transition beyond oil (with best 2004 technologies)



It pays to be bold: saving half the oil for $12/bbl is better than saving a fourth at $6/bbl — else alt. supplies cost too much



Hypothetically **assuming full deployment in 2025 (actually we realize half the savings by then); these curves assume *no further invention* in 2005–25**

Vehicles use 70% of US oil, but integrating low mass & drag with advanced propulsion saves ~2/3 very cheaply

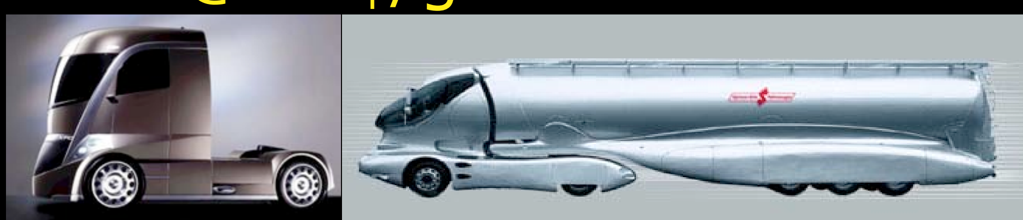
CARS: save 69% at 57¢/gal

Surprise: ultralighting is ***free —*** offset by simpler automaking and the 2× smaller powertrain

155 mph, 94 mpg

PLANES: save 20% free, 45–65% @ ≤46¢/gal

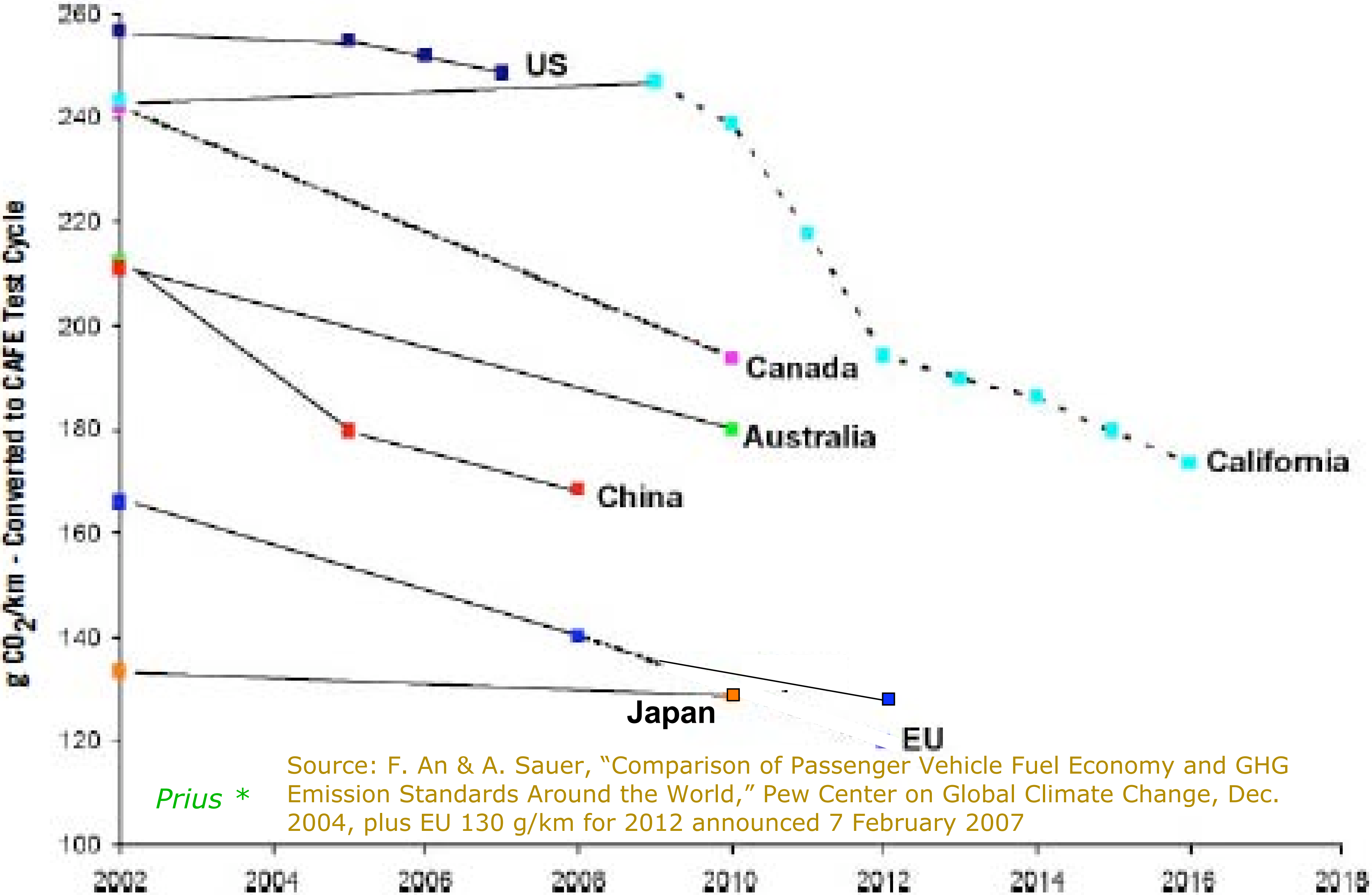
TRUCKS: save 25% free, 65% @ 25¢/gal



BLDGS/IND.: big, cheap savings; often *lower* capex

Technology is improving faster for efficient end-use than for energy supply

Current and projected new-car efficiency or CO_2 stds. (in US CAFE g CO_2/km-NEDC)



Source: F. An & A. Sauer, "Comparison of Passenger Vehicle Fuel Economy and GHG Emission Standards Around the World," Pew Center on Global Climate Change, Dec. 2004, plus EU 130 g/km for 2012 announced 7 February 2007

Challenging a basic assumption in Detroit and Washington

- Efficiency assumed to be a tradeoff—makes cars small, unsafe, sluggish, costly, ugly,…
- Hence policy intervention needed to induce cus-tomers to buy the compromised vehicles

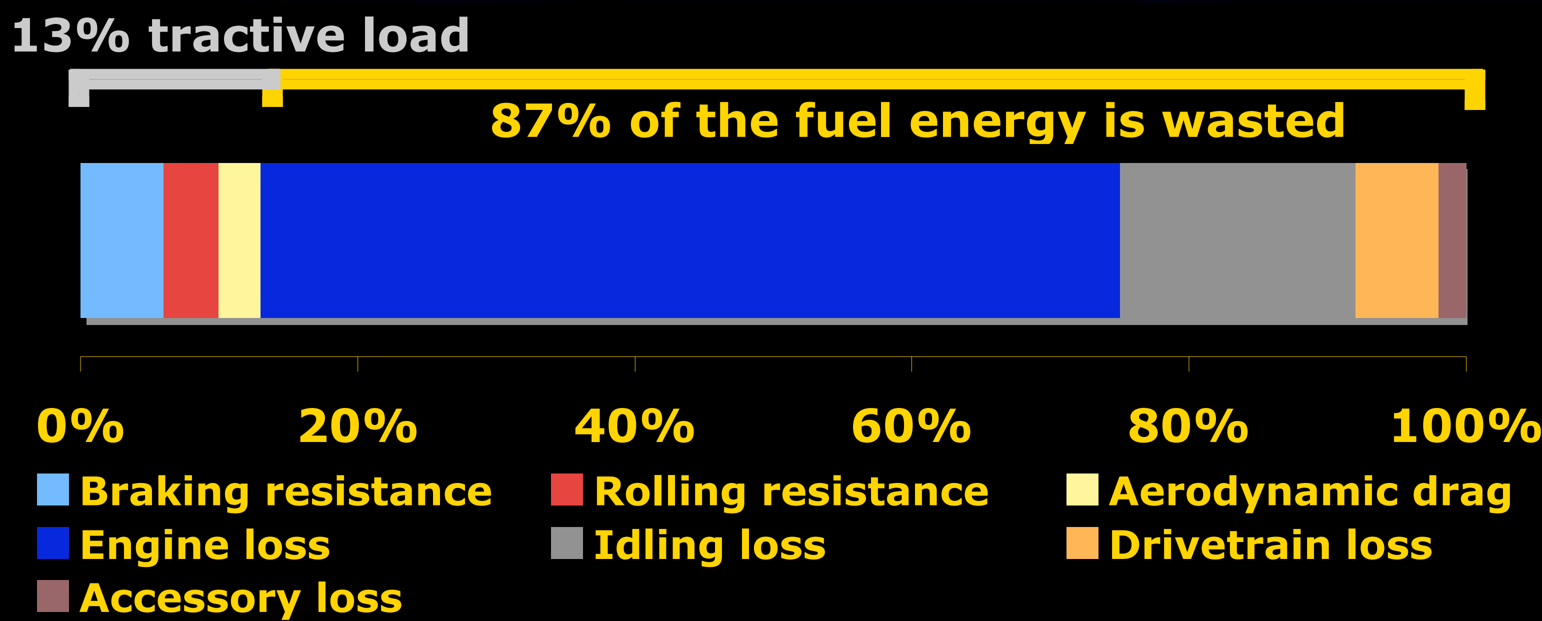
How many people still buy phonograph records…

…or cathode-ray-tube TVs instead of big flat-panel TVs?

◇ An engineering end-run around tax/CAFE gridlock

◇ A robust business model based solely on value to customer and competitive advantage to suppliers

Each day, your car uses ~100× its weight in ancient plants. Where does that fuel energy go?



- 6% accelerates the car, <1% moves the driver
- Three-fourths of the fuel use is weight-related
- Each unit of energy saved at the wheels saves ~7–8 units of gasoline in the tank (or ~3–4 with a hybrid)
- **So first make the car radically lighter-weight!**

Midsize 5-seat* Revolution concept *SUV (2000)
Ultralight (1,889 lb = steel – 53%) but ultrasafe
0–60 mph in 8.2 s: 114 mpg with fuel cell
0–60/7.1 s: 67 mpg with gasoline hybrid

ROCKY MOUNTAIN INSTITUTE

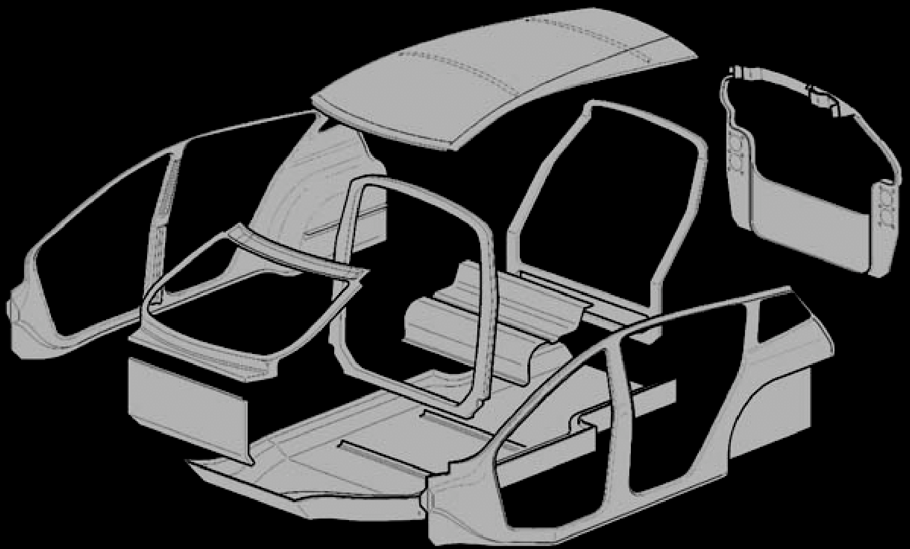
"We'll take two."
— *Automobile* magazine

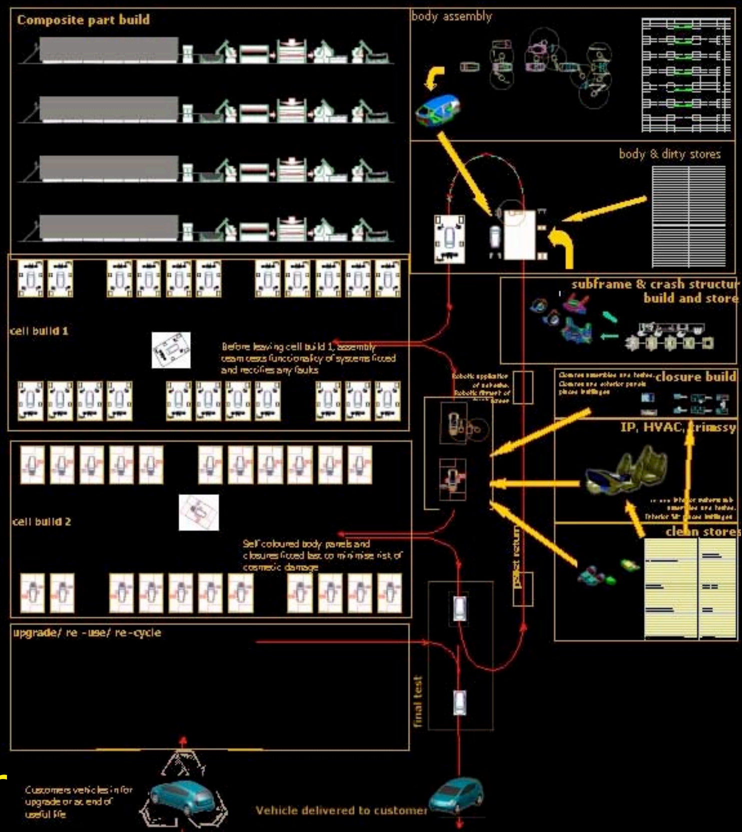
World Technology Award, 2003

Show car and a complete virtual design, uncom-promised, production-costed, manufacturable; hybrid's MSRP is $2,511 higher (<2-y payback)

Radically simplified manufacturing

- ◇ Mass customization
  - *Revolution* designed for 50k/year production volume
  - Integration, modular design, and low-cost assembly
  - Low tooling and equipment cost





- 14 major structural parts, no hoists
- 14 low-pressure diesets (not ~10^3)
- Self-fixturing, detoleranced in 2 dim.
- No body shop, optional paint shop
- Plant 2/5 less capital/car-y, 2/3 smaller

Saving oil: basic market failures

- Oil is priced well below its societal cost
  - Externalities include military/security (~\$10–25⁺/bbl), diplomatic/geopolitical/instability (\$?/bbl), climate (~\$2–5/bbl), other environmental (~\$1–15/bbl), net subsidies ~(\$1–3/bbl + ?\$16/bbl to oil-*using* systems), or price volatility (\$3.5/bbl in spring 2004)—though *Winning the Oil Endgame* assumes all externalities are worth *zero*
- Most customers, even sophisticated ones, lack good information on alternatives, especially in end-use efficiency
- Most customers have very high implicit discount rates (≥60%/y) when buying energy efficiency
- Many other market failures and cultural / institutional obstacles also slow implementation

Can Detroit use efficiency as a transformative strategy?

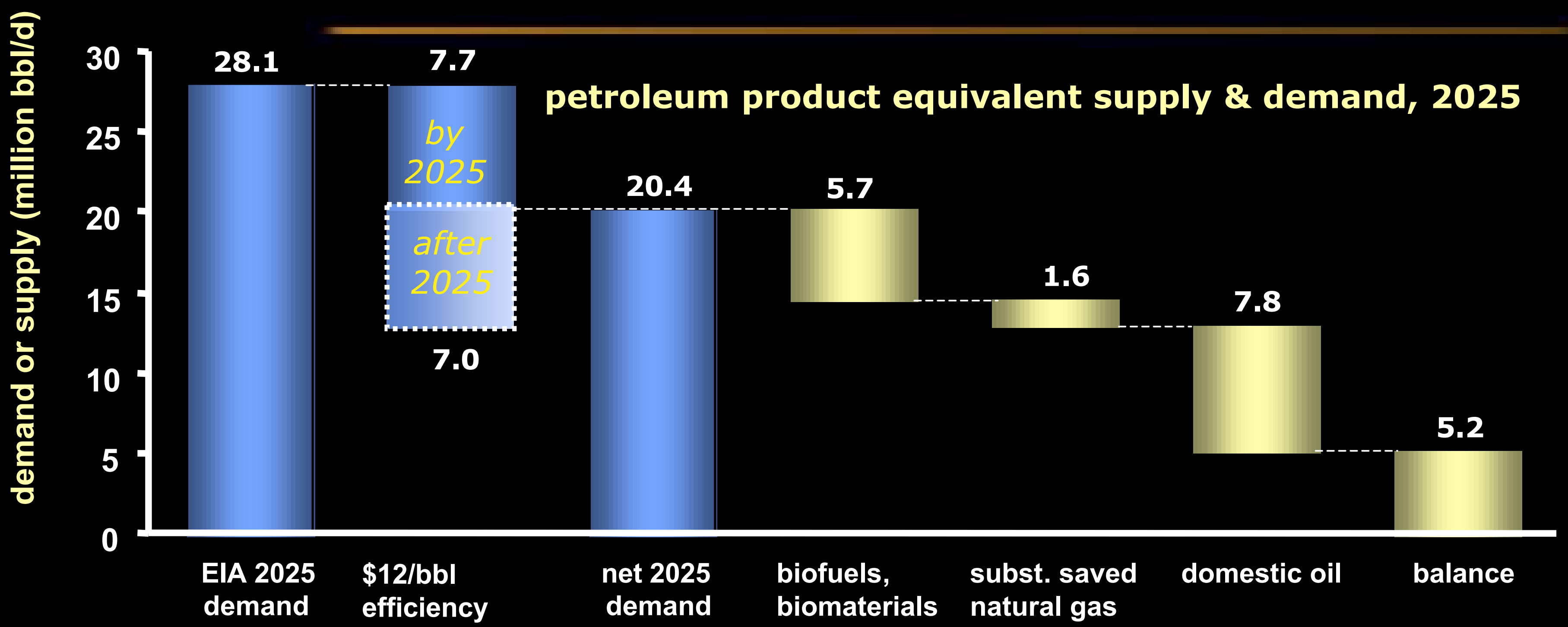
- Boeing's crisis in 1997 was like Detroit's today
  - Wrenching changes instituted at BCA, including TPS (*e.g.*, moving assembly); manufacturing and costs brought back under control
  - But what about growth? What was in the pipeline after *777*?
- In 2003, Airbus for the first time outproduced Boeing
  - "This is really a pivotal moment…could be the beginning of the end for Boeing's storied airplane business," said Richard L. Aboulafia, a Teal Group aerospace analyst, in 2003
- Boeing's bold, efficiency-led 2004 response: *787 Dreamliner*
  - ≥20% more efficient than comparable modern aircraft, *same price*
  - 80% advanced composite by volume, 50% by mass →
    - Bigger windows, higher-pressure cabin

  - 3-day final assembly (*737* takes 11 days)
  - 513 orders (490 firm + 23 pending), 314 additional options
  - Sold out until 2013—fastest order takeoff of any airliner in history
  - Now rolling out *787*'s radical advances to *all* models (Yellowstone)
- Airbus: Ultra-jumbo *A380*, 2 years late, ~€5b over budget
  - Response? Efficient, composite *A350*—probably too late

Implementation is underway via "institutional acupuncture"

- RMI's 3-year, $4-million effort is leading & consolidating shifts
- Need to shift strategy & investment in six sectors
  - Aviation: Boeing did it (*787 Dreamliner*)…and beat Airbus
  - Heavy trucks: Wal-Mart led it (with other buyers being added)
  - Military: emerging as the federal leader in getting U.S. off oil
  - Fuels: strong investor interest and industrial activity
  - Finance: rapidly growing interest/realignment will drive others
- Cars and light trucks: slowest, hardest, but now changing
  - Alan Mulally's move from Boeing to Ford with transformational intent
  - UAW and dealers not blocking but eager for fundamental innovation
  - Schumpeterian "creative destruction" is causing top executives to be far more open to previously unthinkable change
  - Emerging prospects of leapfrogs by China, India, ?new market entrants
  - Competition, at a fundamental level and at a pace last seen in the 1920s, will change automakers' managers or their minds, whichever comes first—watch this space!

2025 demand-supply integration



Great flexibility of ways and timing to *eliminate* oil in next few decades

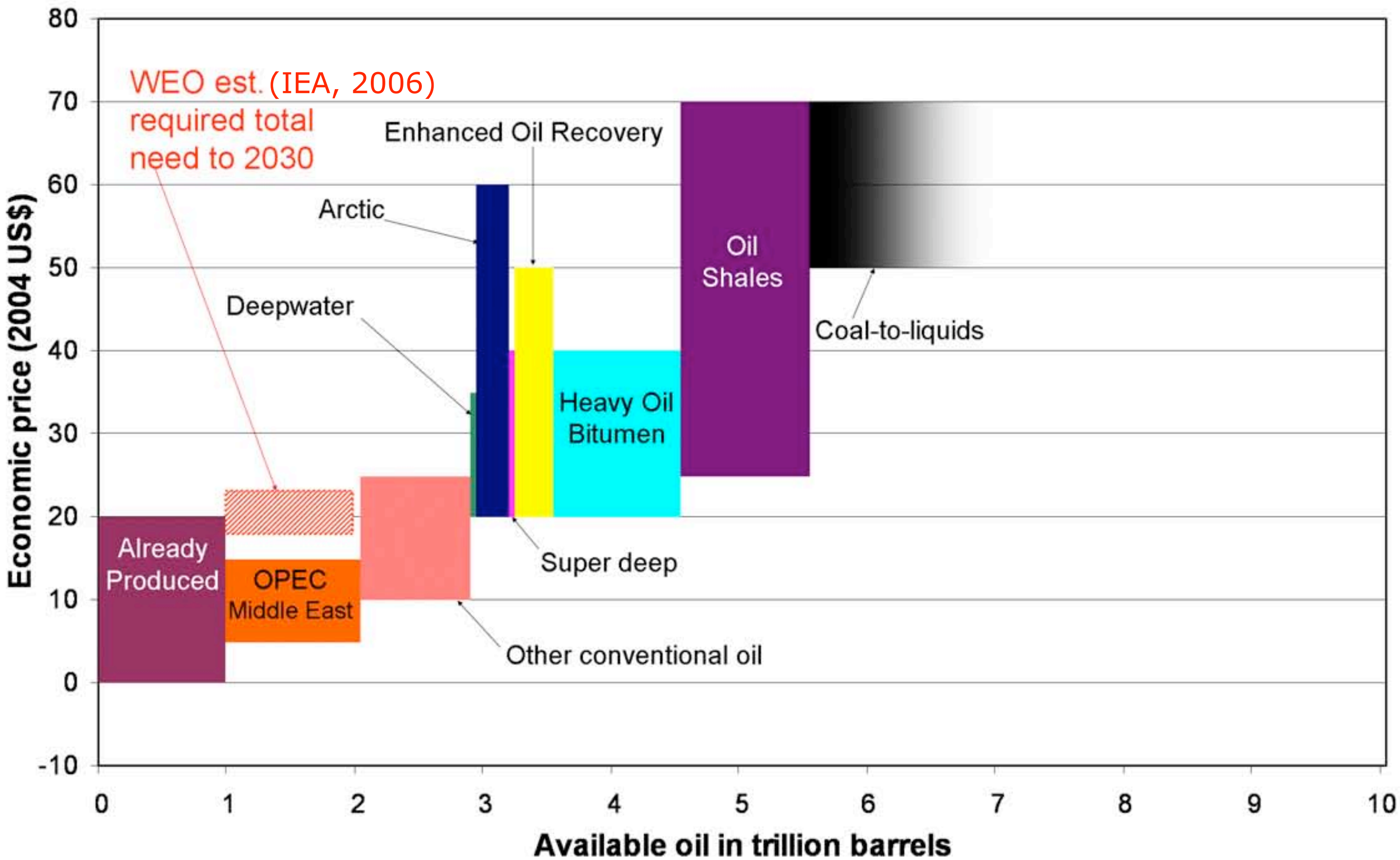
- **Buy more efficiency (it's so cheap)**
- **Wait to capture the 7 Mbbl/d of efficiency still in process in 2025**
- **"Balance" can import crude oil/product (can be all N. Amer.) or biofuels**
- **Or saved U.S. natural gas @ $0.9/million BTU can fill the "balance"…or**
- **H_2 from saved U.S. natural gas can displace "balance" *plus* domestic oil**
- **Not counting other options, *e.g*. Dakotas windpower—50 MT/y H_2 source**

Some recent U.S. wildcat discoveries

- 8.3 million bbl/d play in the Detroit Formation (light-vehicle efficiency—no PHEVs/EVs/H_2)
- 1.6 million bbl/d play in heavy trucks
- 1.2 million bbl/d play in industrial fuels/feeds
- 1.1 million bbl/d play in buildings
- 0.9 million bbl/d play in aircraft
- 1.6 million bbl/d play in other oil end-uses
- > 5 million bbl/d play in robustly competitive biofuels, chiefly cellulosic ethanol, and in biomaterials and biolubricants
- 12 TCF/y play in electricity and gas end-uses

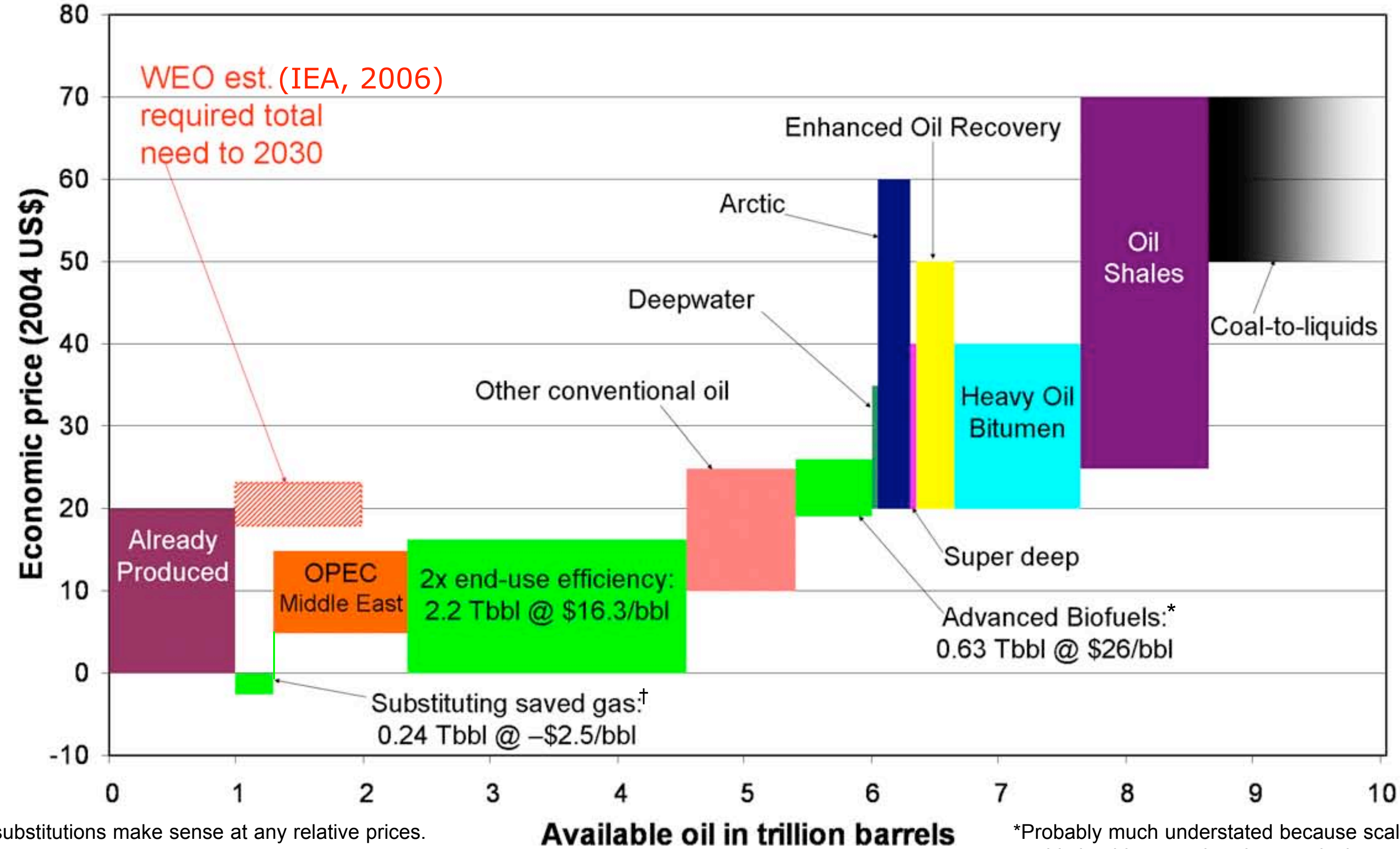
Shouldn’t we drill the most prospective plays first?

The oil industry’s conventional wisdom: approximate long-run supply curve for world crude oil and substitute fossil-fuel supplies



Source: BP data as graphed by USDoD JASON, “Reducing DoD Fossil-Fuel Dependence” (JSR-06-135, Nov. 2006, p. 6, www.fas.org/irp/agency/dod/jason/fossil.pdf), plus (red crosshatched box) IEA’s 2006 *World Energy Outlook* estimate of world demand and supply to 2030, plus (black/gray) RMI’s coal-to-liquids (Fischer-Tropsch) estimate derived from 2006–07 industry data and subject to reasonable water constraints. This and following graphic were redrawn by Imran Sheikh (RMI)

How that supply curve stretches ~3 Tbbl if the U.S. potential shown in *Winning the Oil End-game* scales, very approximately, to the world



†These substitutions make sense at any relative prices. Depending on future prices, additional such substitutions several- to manyfold larger than shown are also available

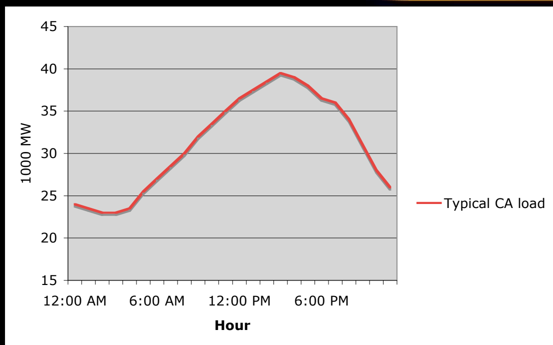
*Probably much understated because scaling from U.S. to world should count abundant tropical cane potential; also, the estimate does not include emerging major options like algal oils

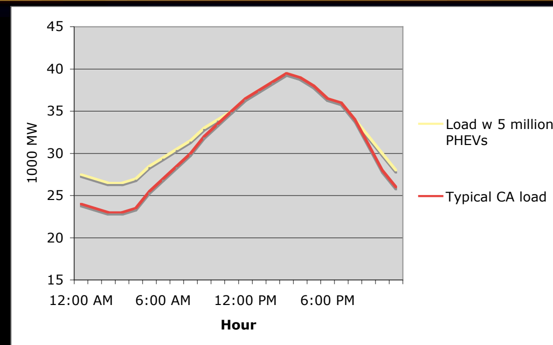
To scale from U.S. alternatives-to-oil potential in Mbbl/d achievable by the 2040s (at average cost $16/bbl in 2004 $: www.oilendgame.com) to world potential over 50 y, multiply the U.S. Mbbl/d × 146,000: 365 d/y × 50 y × 4 (for U.S.→world market size) × 2 (for growth in services provided). Obviously actual resource dynamics are more complex and these multipliers are very rough, so **this result is only illustrative and indicative.**

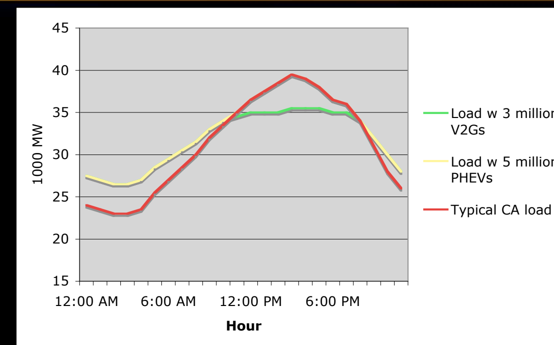
Further stages of the emerging automotive [r]evolution

- An excellent hybrid, properly driven, doubles efficiency
  - Considerably more if new diesels can meet ratcheting air regs
- Ultralighting (+ better aero and tires) redoubles eff’y.
- Cellulosic-ethanol E85 quadruples oil efficiency again
  - Biofuels can make driving a way to protect, not harm, the climate
- A good plug-in hybrid (such as Toyota is rumored to plan for initial release MY08) redoubles fuel efficiency again, and could be attractive if the power grid buys its electric storage function via a “smart garage”
  - Precursor of “vehicle-to-grid” fuel-cell play—power plant on wheels
  - So far, these stages can save 97% of the oil/mile used today
- Hydrogen fuel cells also compete via cheaper ¢/mile and 2–6× less CO_2/mile (or zero CO_2 if renewable)

Smart vehicle-to-grid (V2G) interface could be important







The grid could recharge PHEVs with previously spilled night windpower, then lop daytime peak

- Cars are parked ~96% of the time
- PHEV batteries or FCEV fuel cells in a superefficient U.S. light-vehicle fleet have ~6–12× total U.S. electric generating capacity, so even modest V2G displaces all coal/nuclear plants
- First ~2 million US drivers selling that capacity back to utility where/when most valuable could earn back entire car cost
- V2G Hypercar®-class vehicles and their hydrogen transition strategy could ultimately solve up to ~2/3 of global CO_2 problem
- Utilities love G2V: offpeak el. sales, ratebasing grid expansion, el.→transport GHG shift, battery finance, hi-tech customer bundle

Big, fast changes have happened

- U.S. automakers switched in **6 years** from 85% open wood bodies to 70% closed steel bodies—and in **6 months** from making four million light vehicles per year to making the tanks and planes that won World War II
- Boeing transformed its planes in **4 years**, 2004–08
- GM's small team took *EV1* from launch to street in **3 years**
- Major technological diffusions take **12–15 years** for 10%→90% stock adoption, but policy can speed takeoff by 3 years
- In 1977–85, U.S. cut oil intensity 5.2%/y—equivalent, at a given GDP, to a Gulf every 2.5 years
  - Biggest contribution: U.S.-made new cars gained 7.4 mpg in 6 y (47%, 4.9%/y)—96% from smarter design, only 4% from smaller size
- If every light vehicle on the road in 2025 were as efficient as the best 2004 cars & SUVs, they'd save twice as much oil as the U.S. now imports from the Persian Gulf

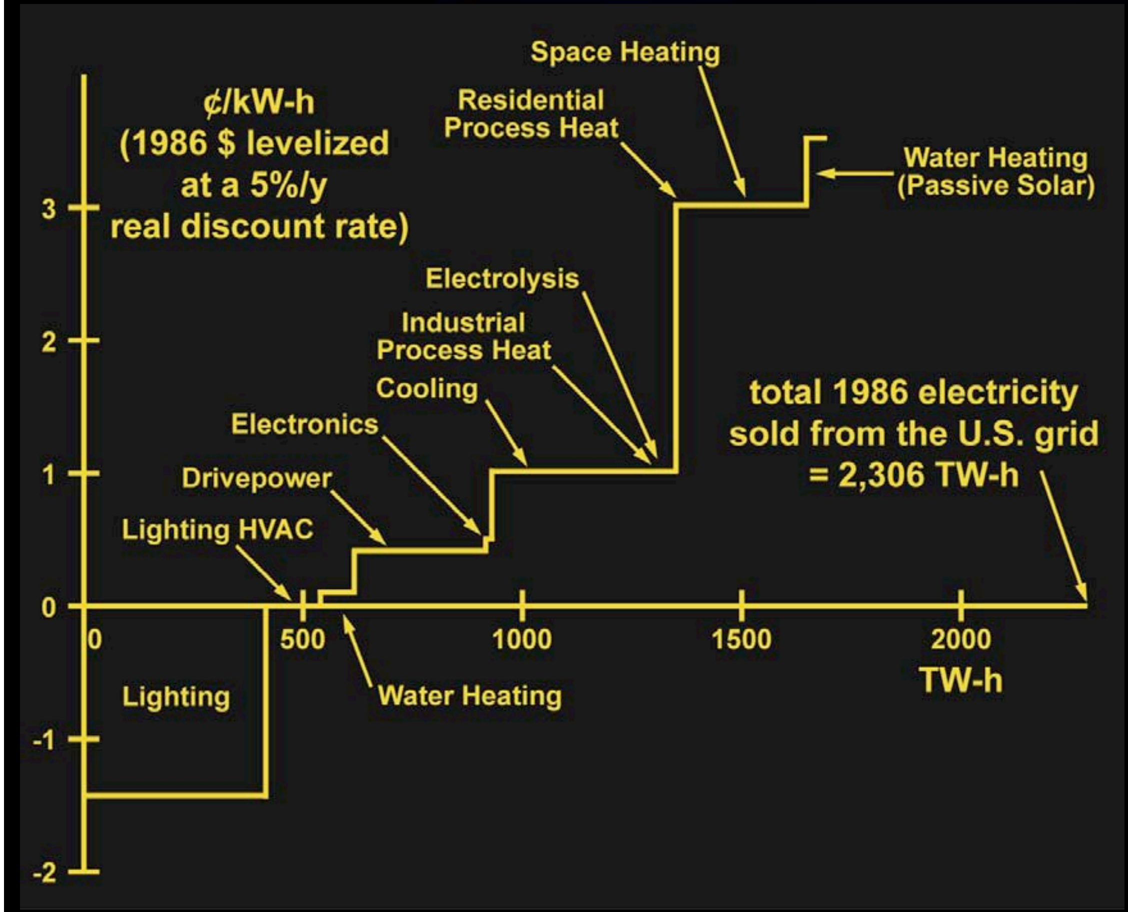
Electric end-use efficiency can work quickly even with old methods

- In ~1975–85, most new U.S. end-use devices—cars, buildings, refrigerators, lighting systs., etc.—doubled in efficiency (~7%/y)
- In 1983–85, 10 million people served by Southern California Edison Company (then the #3 US investor-owned utility) were cutting its 10-years-ahead forecast peak load by 8½% *per year*, at ~1% of marginal supply cost
- In 1990, New England Electric System got 90% of a small-business retrofit pilot program's market (1.5× target) in 2 months
- PG&E got 25% of its 1990 new-commercial-construction market in 3 months, raised its 1991 target, and got it all during 1–9 Jan.
- Even without helpful policy (in all but a few states), the U.S. has cut electric intensity >2%/y in 6 of the past 10 y (av. 1.7%/y)
- New delivery methods are even better—not just marketing negawatts but making markets *in* negawatts, thus maximizing competition in who saves and how—and marketing efficiency for its side-benefits, not only cutting energy costs

Efficiency's marketable side-benefits often worth $10^{1-2}\times$ more than lower bills

- Efficient buildings raise labor productivity ~6–16%
  - A typical 2005 office paid ~164× as much for people as for energy
- Efficient lighting systems improve visibility & beauty
  - 20–26% faster learning (per test scores) in well-daylit schools
  - 40% higher retail sales/ft^2-y in well-daylit stores
- Efficient motors are more reliable, quiet, controllable
- Efficient refrigerators keep food fresher, longer
- Efficient hospitals have faster healing, less pain, fewer infections, better financials
- Efficient supermarkets sell more and safer food
- Side-benefits more than double industrial efficiency's returns and savings

1989 supply curve for saveable US electricity (*vs.* 1986 frozen efficiency)



Best 1989 commercially available, retrofittable technologies

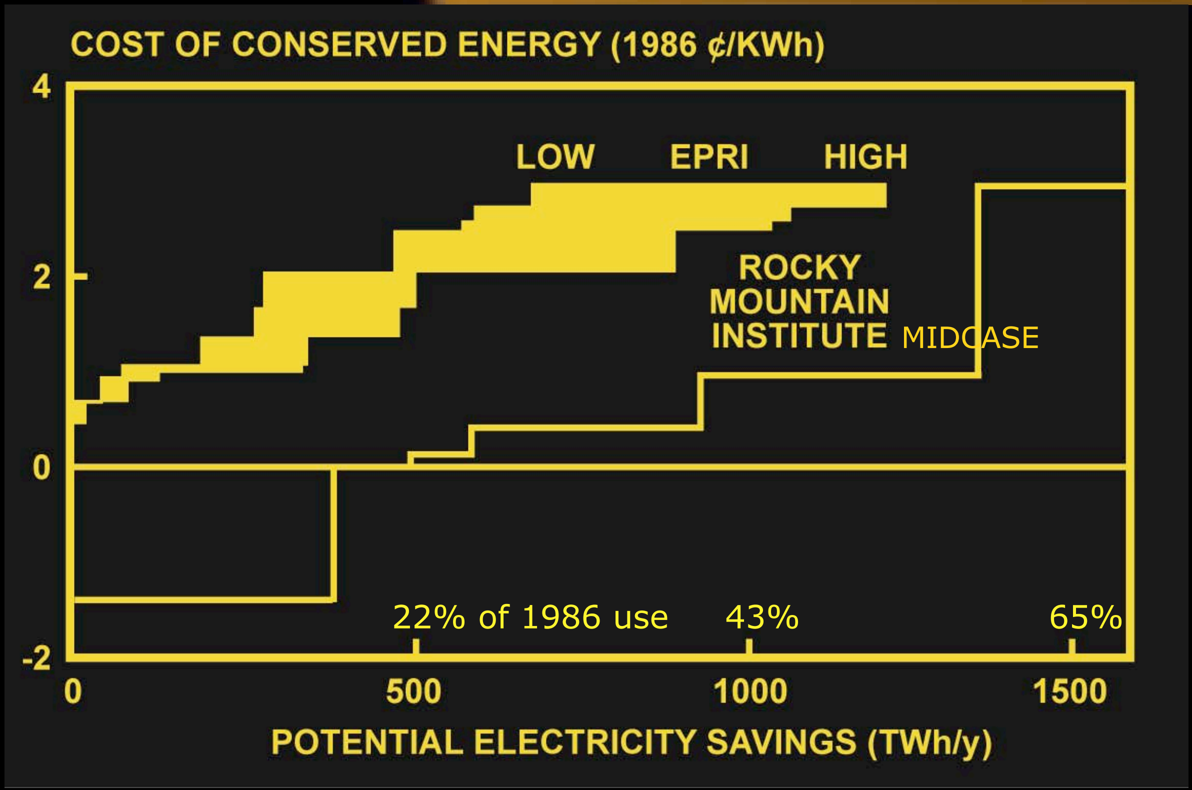
EPRI found 40–60% saving 2000 potential

Similar S, DK, D, UK…

Now conservative: savings keep getting bigger and cheaper faster than they're being depleted

Measured technical cost and performance data for ~1,000 technologies (RMI 1986–92, 6 vol, 2,509 pp, 5,135 notes)

Two 1990 supply curves for saved US electricity (ORNL/CON-312, 1991)



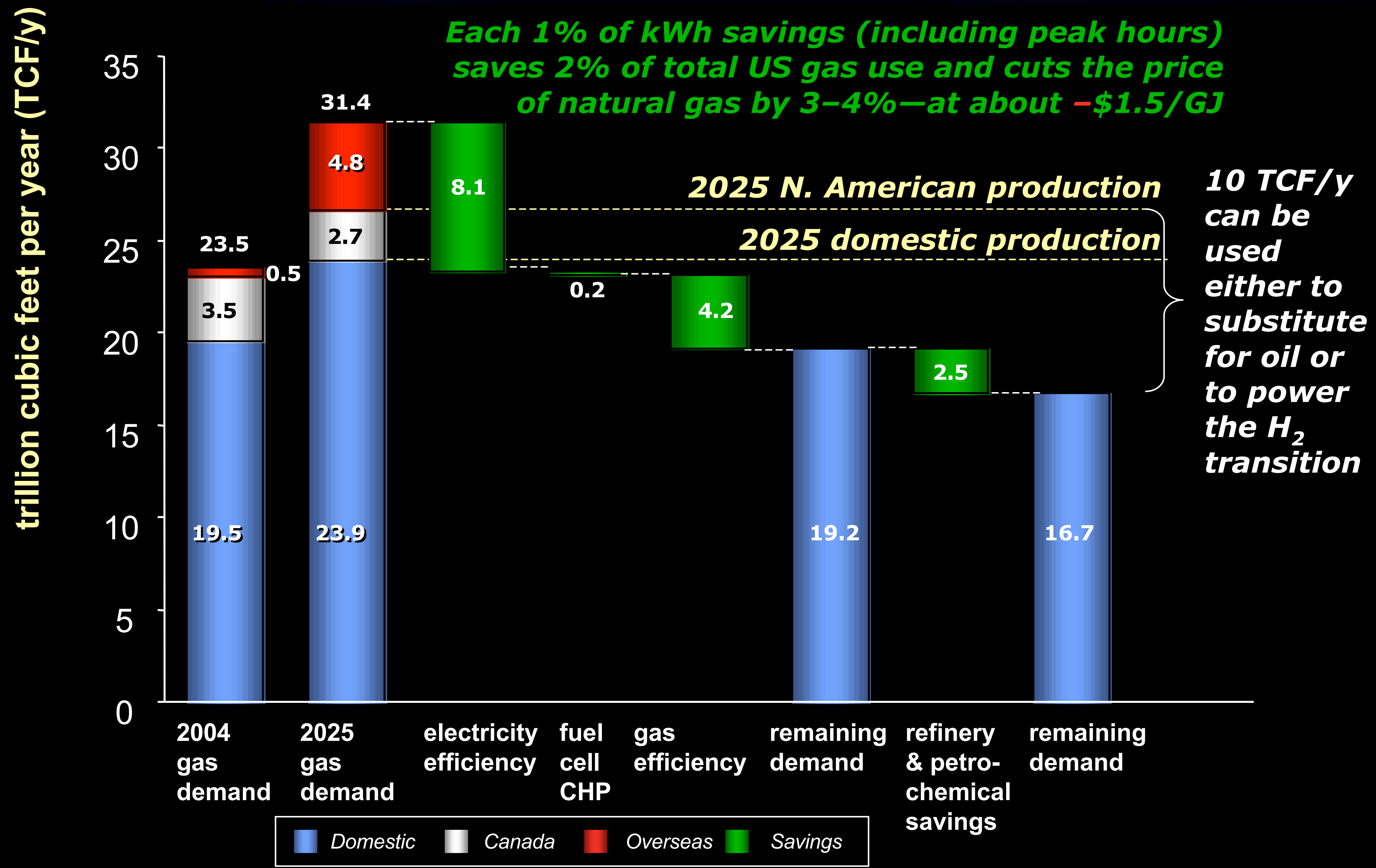
◇ EPRI: potential savings by 2000, *excluding* 9–15% add'l savings expected to occur spontanteously

◇ RMI: full long-term potential retrofit savings

◇ Difference is largely methodological, not substantive

- ○ EPRI excludes, RMI includes saved maint. cost, so commercial lighting retrofit costs +1.2 *vs* −1.4¢/kWh
- ○ EPRI assumes drivepower savings 3× smaller & 5× costlier than EPRI agrees *id*. (*Sci. Amer*. Sept 1990)

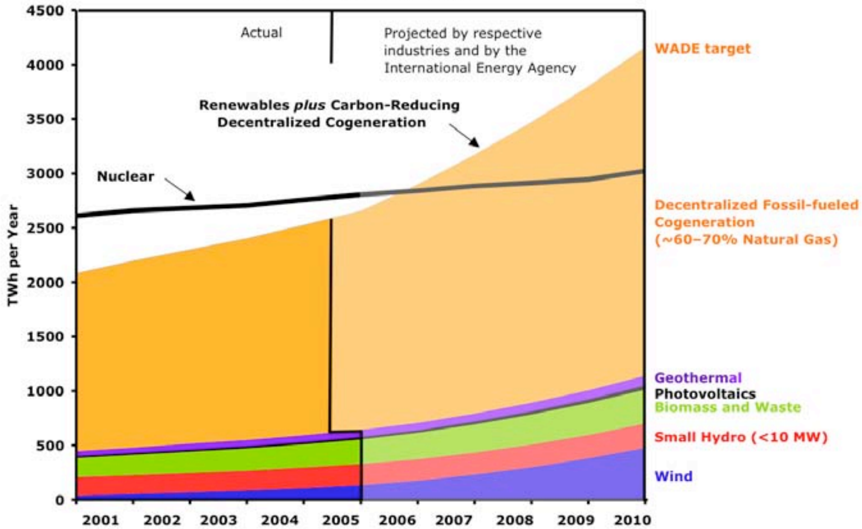
>12 TCF/y of US natural gas could be saved by efficiency, at an average cost ~$0.9/MCF (<1/10th recent price)



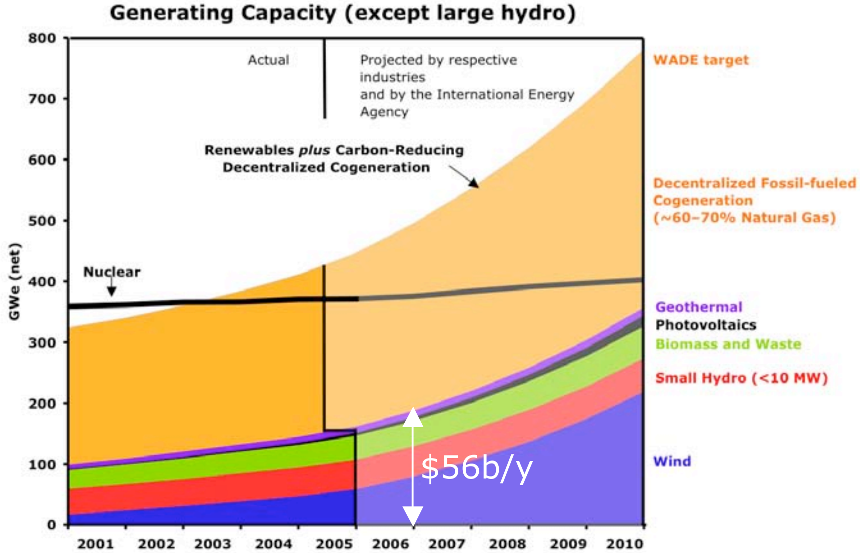
Electric shock: low-/no-carbon *decentral-ized* sources are eclipsing central stations

RMI analysis: www.rmi.org/sitepages/pid171.php#E05-04

Low- or No-Carbon Worldwide Electrical Output (except large hydro)



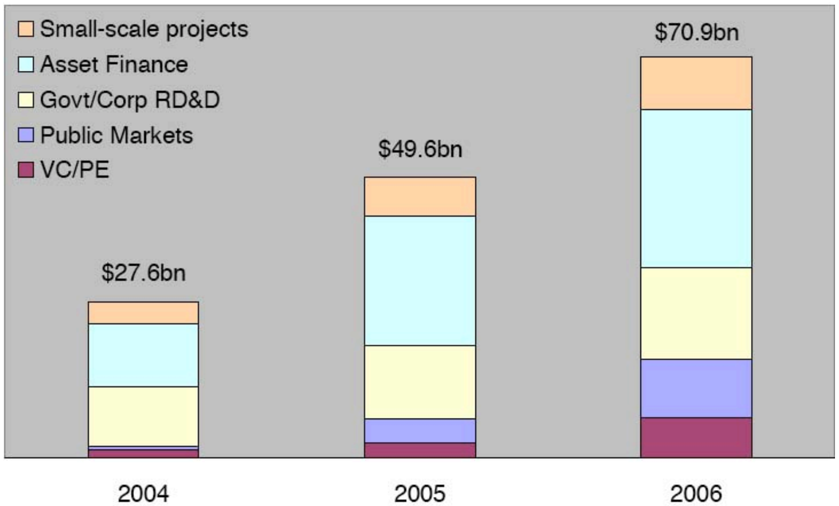
Low- or No-Carbon Worldwide Installed Electrical Generating Capacity (except large hydro)

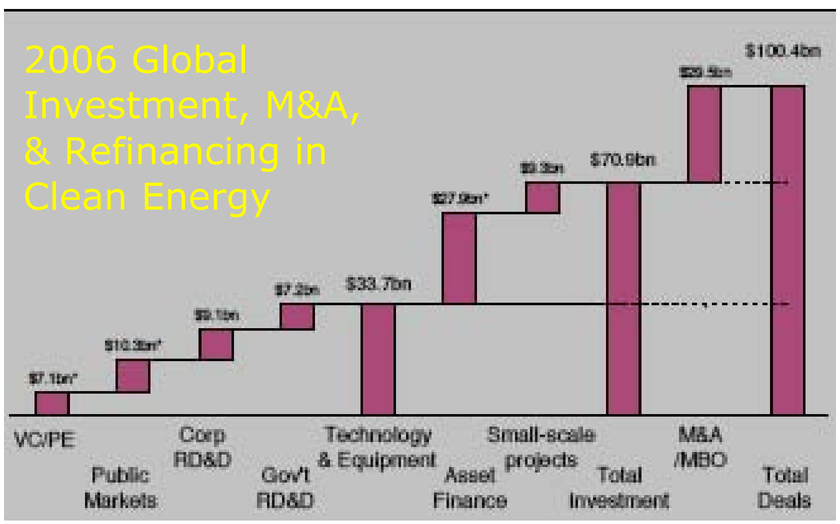


- Two-thirds combined-heat-and-power (cogeneration)*, ~60–70% gas-fired, ≥50% CO_2 reduction

  *Gas turbines ≤120 MWe, engines ≤30 MWe, steam turbines only in China
- One-third renewable (including hydropower only up to 10 MW_e)
- *1/6 of el, 1/3 of new el., & rising*
- 1/6 to >1/2 el. in 13 ind'l. nations
- In 2005, these low- or no-carbon electricity generators added 4× as much output and 11× (or excluding peaking & standby units, 8×) as much capacity as nuclear added
- *Negawatts probably even bigger*
- Why are micropower & negawatts winning? Less cost & financial risk!
- That's why they're financed mainly by private capital, while nuclear is bought only by central planners

Global investment in clean energy: $71b in 2006 ($100b transactions)





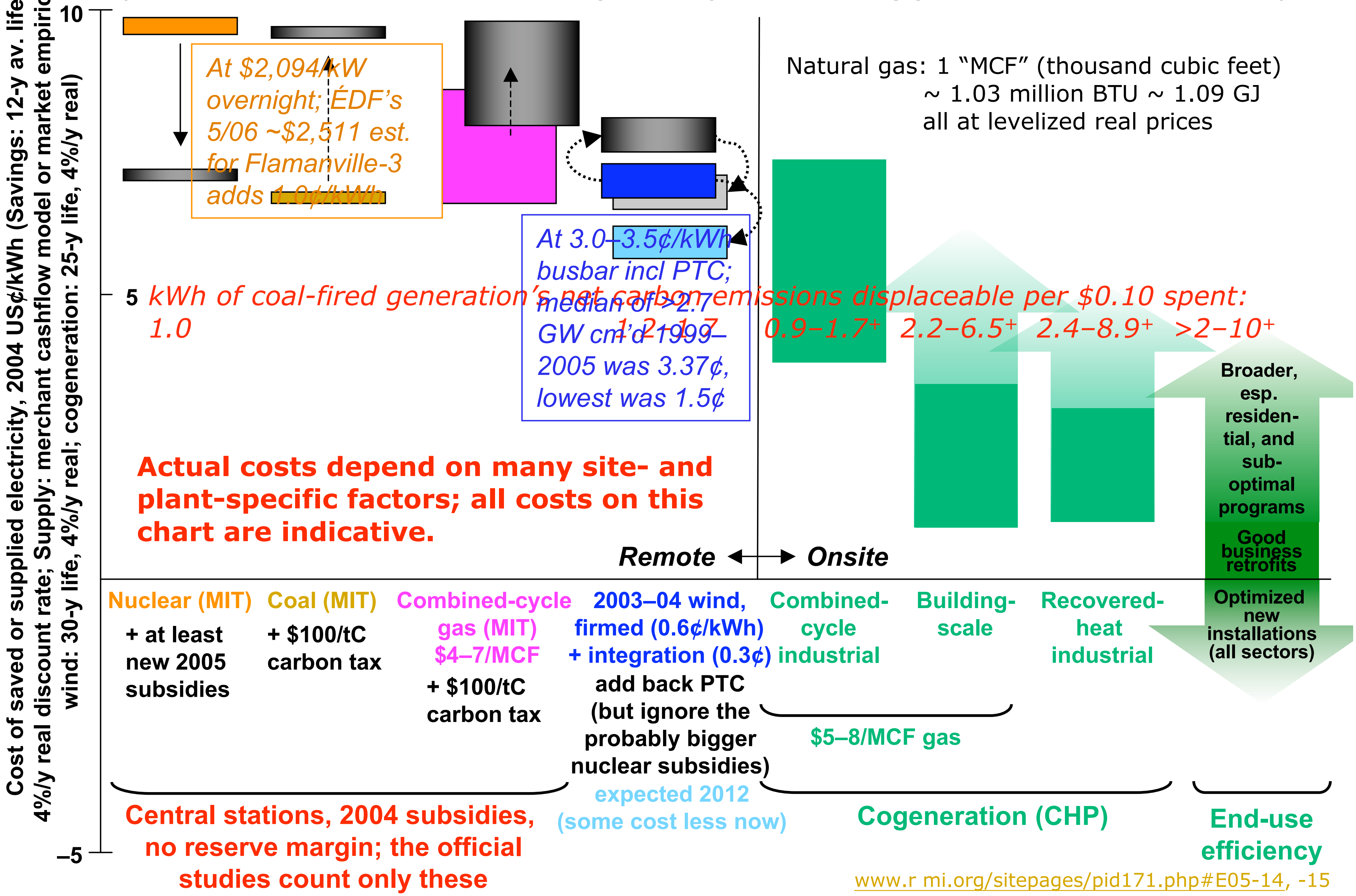
- ◇ Clean-energy investments grew 80% in 2005, 43% in 2006
- ◇ 2006 new investments included $31b wind, $12b solar, $8b biomass & waste [to el.], $3b other [el.] renewables, $6b other renewables, $15b biofuels; total for distributed renewable power equipment ~$56b (*vs.* ~$38b in 2005)
- ◇ 12/2006 quoted companies' market cap: $154b wind, $95b solar, $74b biomass/biofuels (much non-el.), $61b other renewables, $53b demand-side efficiency
- ◇ WilderHill New Energy Global Innovation Index (NEX) grew 29.3%/y compound in 2002–05, 33.3% in 2006, but 2006 performance weak to negative in non-Kyoto-ratifying countries, strong in others; outperformed AMEX Oil; >80% better than NASDAQ or S&P 500

Bottom-up, transaction-by-transaction 3/07 data: Michael Liebreich, New Energy Finance, London

Central power stations' fatal competitors

Levelized cost of *delivered* electricity or end-use efficiency (zero distributed benefits)

(at 2.75¢/kWh 1996 embedded IOU average delivery cost, including grid losses, for remote sources)

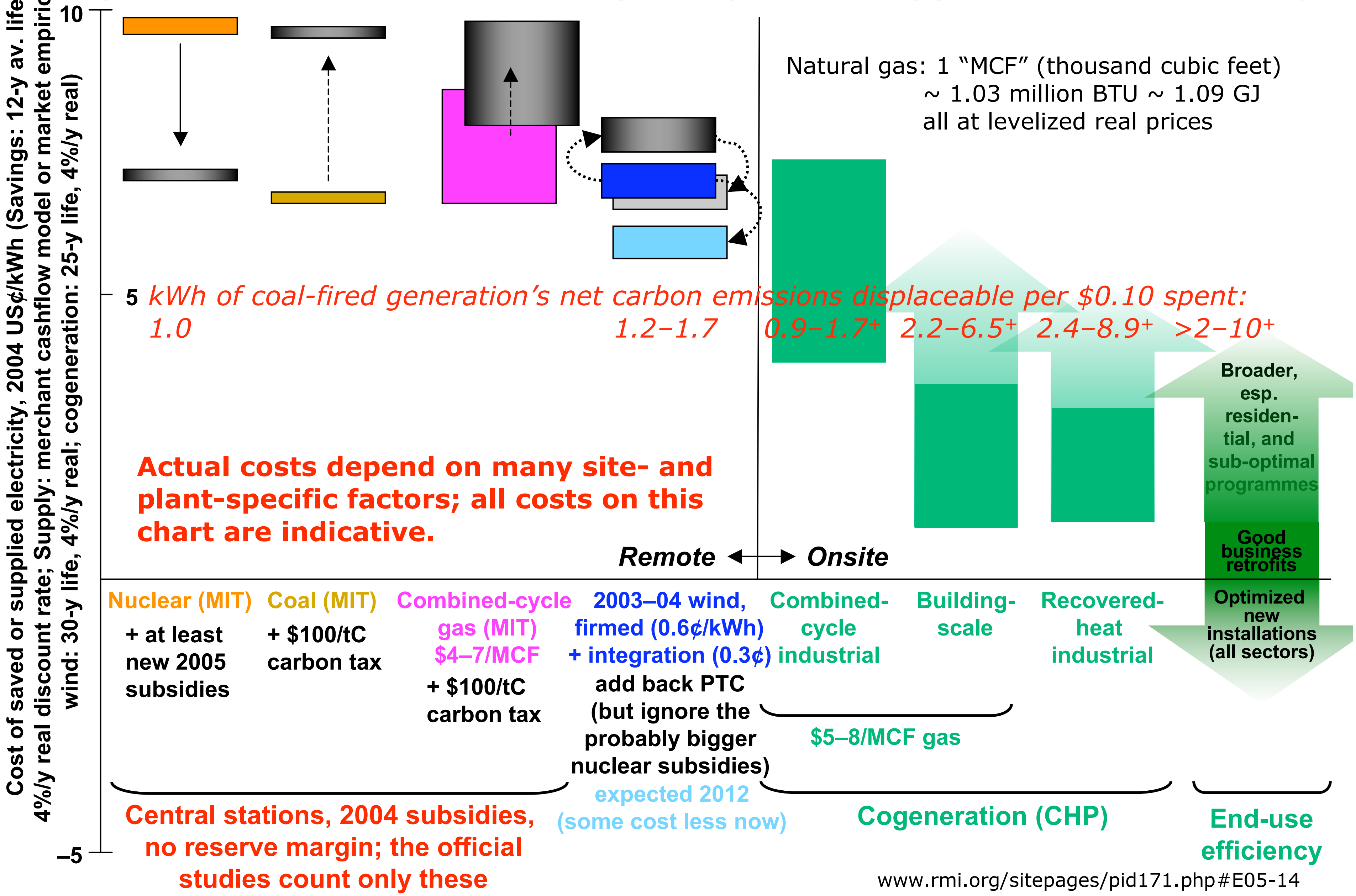


www.rmi.org/sitepages/pid171.php#E05-14, -15

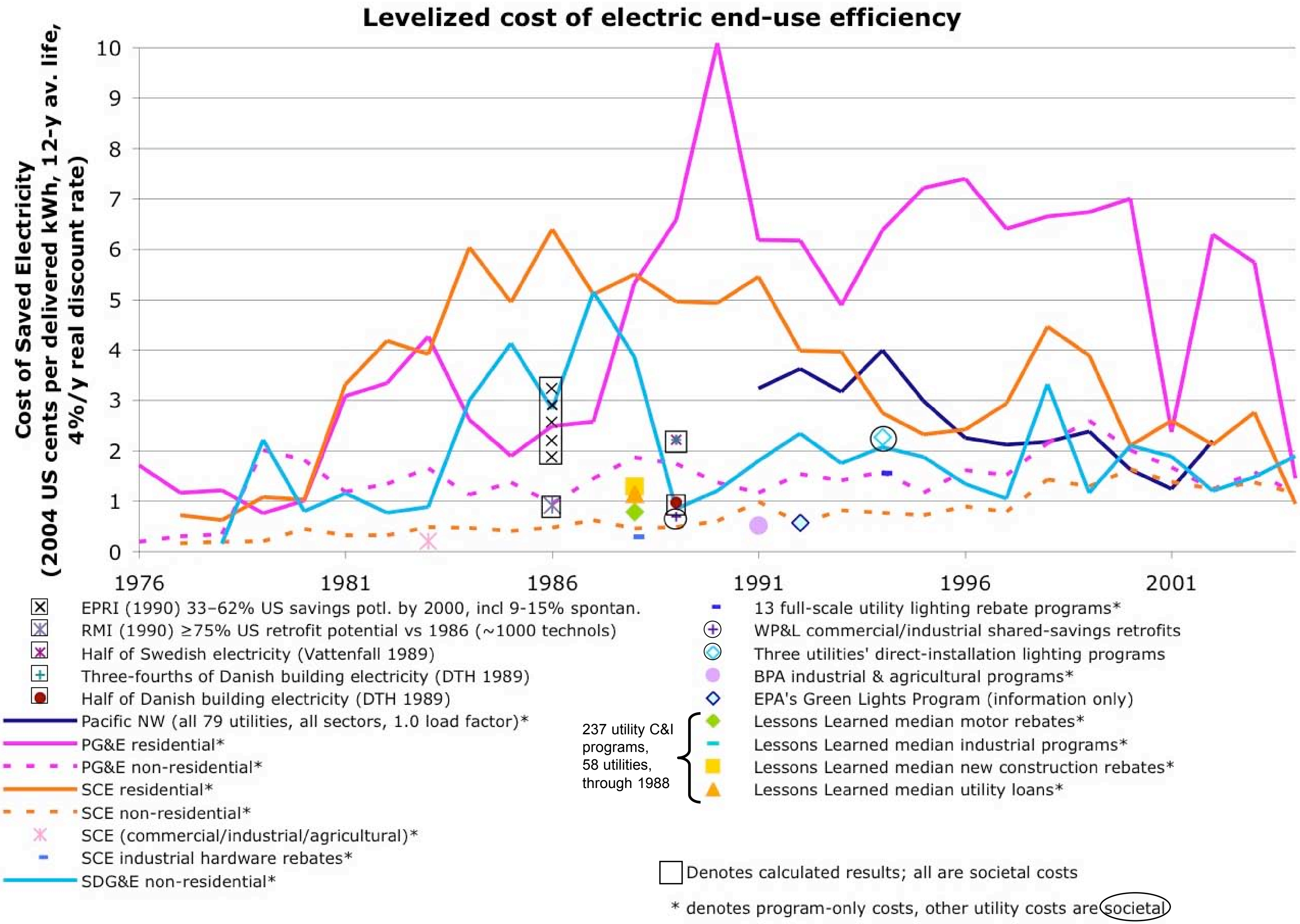
Central thermal plants' fatal competitors

Levelized cost of *delivered* electricity or end-use efficiency (zero distributed benefits)

(at 2.75¢/kWh 1996 embedded US IOU average delivery cost, including grid losses, for remote sources)

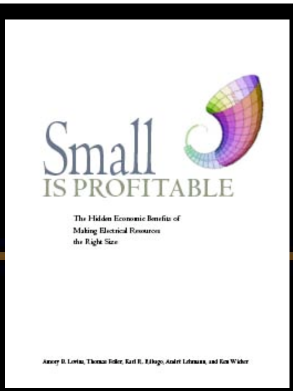


www.rmi.org/sitepages/pid171.php#E05-14



In general, these utility programs don’t dive nearly as deep as RMI’s assessment of potential

"Distributed benefits" change the game



- *Small Is Profitable: The Hidden Economic Benefits of Making Electrical Resources the Right Size* (RMI, 8/02)
  - www.smallisprofitable.org
  - One of *The Economist*'s top three business/economics books of 2002
- Codifies and quantifies 207 "distributed benefits" that collectively increase the economic value of decentral-ized generation by typically ~10× (but site-specific)
- Four kinds: financial economics, electrical engineering, miscellaneous, externalities
- "Cleaner Energy, Greener Profits" (www.rmi.org, 2001) shows how this approach can make fuel cells profitable even at handicraft prices ($3,000/kW$_e$)

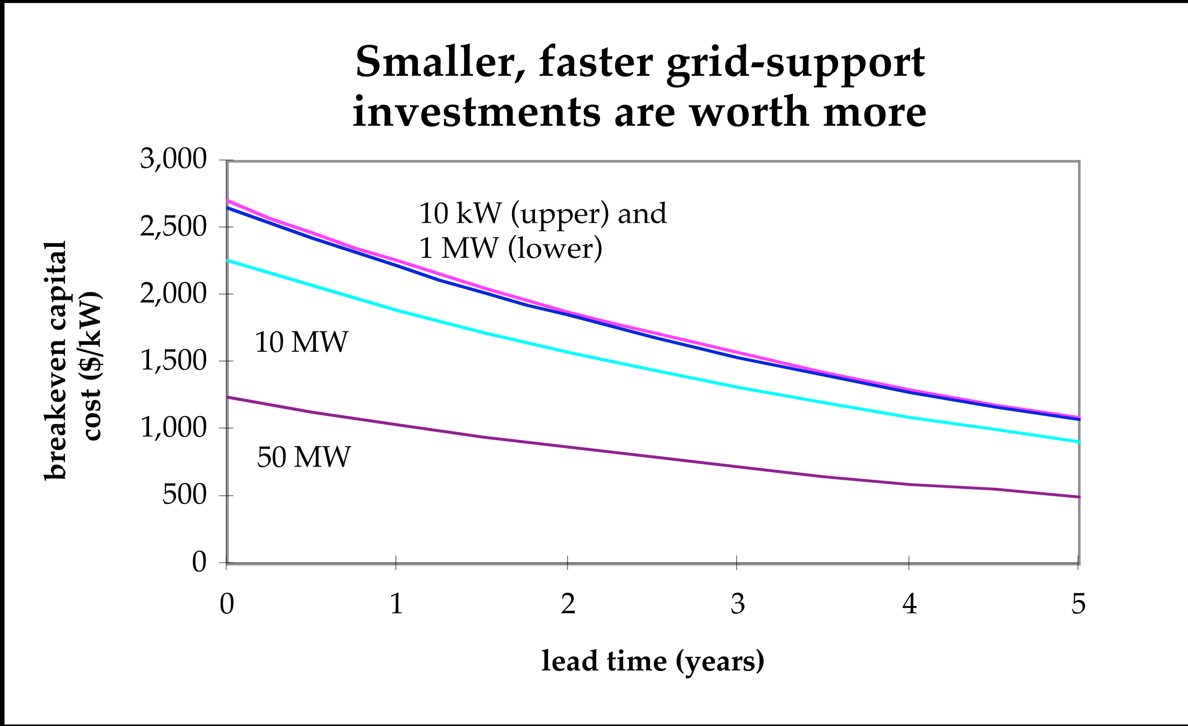
Whence the order-of-magnitude typical value increase?

- Financial-economics benefits: often nearing ~10× renewables, ~3–5× others
- Electrical-engineering benefits: normally ~2–3×, far more if the distribution grid is congested or if premium power reliability or quality is required
- Miscellaneous benefits: often around 2×, more with thermal integration
- Externalities: indeterminate but may be important; not quantified here
- *All these apply to end-use efficiency as well as to decentralized supply!*

207 Distributed benefits: ~10× value

(Actual value is very technology- & site-specific)

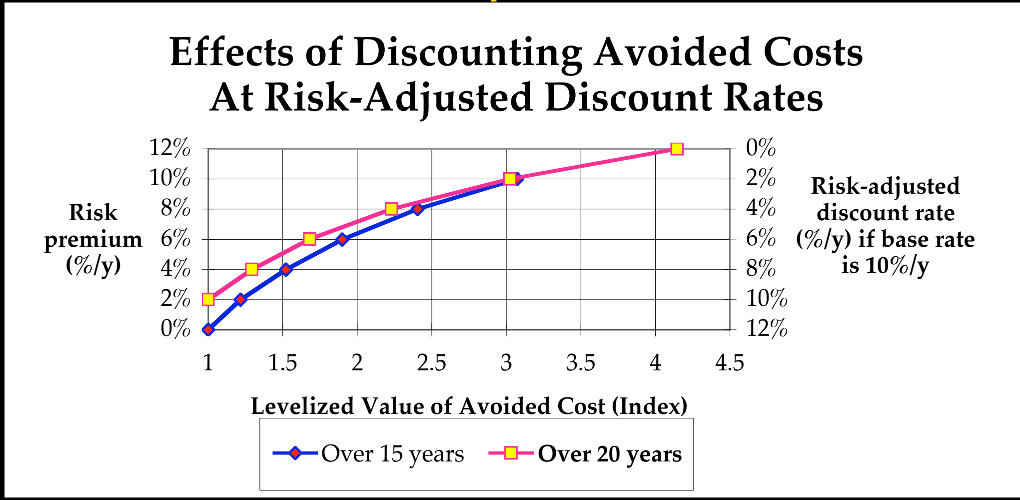
- ~10¹×: Minimizing regret (financial economics)
  - Short lead times and small modules cut risk
    - Financial, forecasting, obsolescence
    - Overshoot and "lumpiness"



Tom Hoff's analytic solution shows that it's worth paying ~2.7× more per kW for a 10-kW overnight resource than for a 50-MW 2-y resource

Financial-economics benefits (cont'd)

- Portable resources are redeployable
  - Benefits' expected value rises, risk falls
- Rapid learning, mass-production economies
- Constant-price resources *vs.* volatile prices
  - Risk-adjusted discounting can nearly double the present value of a gas cost stream for fair comparison with windpower



- Genuinely diversified supply portfolios
- "Load-growth insurance" of CHP and efficiency

The US gas price's risk premium was ~500–600 basis points in 2002 but is probably higher now, as the market has become far more volatile

Bundling PVs with end-use efficiency: a recent example

- Santa Rita Jail, Alameda County, California
- PowerLight 1.18 MW_p project, 1.46 GWh/y, ~1.25 ha of PVs
- Integrated with Cool Roof and ESCO efficiency retrofit (lighting, HVAC, controls, 1 GWh/y)
- Energy management optimizes use of PV output
- Dramatic (~0.7 MW_p) load cut
- Gross project cost $9 million
- State incentives $5 million
- Gross savings $15 million/25 y
- IRR >10%/y (Cty. hurdle rate)
- Works for PVs, so should work better for anything cheaper

All options face implementation risks; what does market behavior reveal?

- California's 1982–85 fair bidding with roughly equal subsidies elicited, *vs.* 37-GW 1984 load:
  - 23 GW of contracted electric savings acquisitions over the next decade (62% of 1984 peak load)
  - 13 GW of contracted new generating capacity (35% of 1984 load), most of it renewable
  - 8 GW (22%) of additional new generating capacity on firm offer
  - 9 GW of new generating offers arriving *per year* (25%)
  - Result: glut (143%) forced bidding suspension in April 1985
- Ultimate size of alternatives also dwarfs demand
  - El. end-use efficiency: ~40–60% (EPRI) or ~75–80% (RMI) of US el. use at below *short*-run marginal delivered supply cost
  - CHP: US industry alone has ~100 GW_e potential—plus buildings
  - Wind: ≥2× US & China electricity use, >6× UK, >9× global el. use
  - Other renewables: collectively even larger, PVs almost unlimited
  - Diverse, dispersed, forecast, and integrated deployment makes variability & land-use concerns unimportant (*all* sources are var-iable/intermittent, differing in why, how big/long, predictability)

Basic verities of today's electricity business

- Negawatt-hours cost far less than megawatt-hours, usually even on the *short*-run margin
- This cost gap is widening in both price and externalities
- As customers figure this out, they'll want to buy less electricity and more efficiency: nobody *wants* raw kWh!
- The only question is who will sell them the efficiency
- It is a sound business strategy to sell customers what they want before someone else does
- Whether markets buy/sell negawatts or not, customers can and often do; markets will clear accordingly
- Every customer hassle in buying negawatts is a business opportunity for utilities, with their skills, cash, billing relationship, customer knowledge, & market power
  - These advantages must not be abused
  - Utilities always have a make-or-buy choice—& partners

The inside-out utility: build from the customer's end-use needs

- **Traditional:** project demand, build generation, size & build grid to deliver output to customers
- **Customer-focused:** start with end-uses
  - In each distribution area that's about to invest…
  - Target efficiency and demand response on the key end-uses found to be causing that neighborhood's load growth
  - Augment as necessary with distributed generation, reactance control, other minor grid improvements
  - Thus work from end-use back upstream, and target negawatts like a rifle, not a shotgun
- When tried at PG&E and Ontario Hydro…
  - Generation and (usually) transmission expansion proved needless
  - All customer needs were met more reliably and quickly
  - *Required capital investment decreased by up to ~90%*
  - Ontario Hydro alone saved US$0.5b in two experiments (two out of ~200 distribution planning areas)

Higher energy prices are helpful and theoretically correct, but…

- Politically the most *difficult* policy instrument; worse:
- Not *necessary* (efficiency is profitable at low prices)
  - 1996–2001 US E/GDP fell 3%/y despite record-low & falling prices
  - Seattle residents in 1990–96, paying half the price/kWh of Chicagoans, saved 12× %kW_p and 3640× %kWh/y of Chicago: it's faster to respond well to weak price signal than badly to strong one
- Not *sufficient* (no "barrier-busting" → little effect)
  - DuPont's EU chemical plants were as inefficient as U.S. ones
  - Dow/Louisiana saved $110M/y @ >200%/y ROI; Dow/Texas didn't
- Often not the most *effective* policy instrument
  - *E.g.,* new-car feebates would work far better than fuel taxes
  - People are complex, influenced by many factors besides price
- *Weaker* than improving *ability to respond* to price
  - 60–80 market failures dominate use and require close attention
  - Each barrier is a business opportunity, as we'll see in a moment

By the way, we've just been trying the high-price approach

- Energy market prices have been testing historic highs
  - Most U.S. policymakers fear costly energy even though our strongest competitors have long had it, and thus became more efficient than us
  - Congress wouldn't raise oil taxes, so OPEC captured the rent instead
  - White House rejected Kyoto from claimed fear of $50/TC carbon taxes
  - Other White House policies soon helped raise world market prices by the equivalent of $80–160/TC*, to levels predicted to wreck the economy

    I.e., increases by ~$0.65–1.30/gal for wholesale gasoline and by ~$4–8/million BTU for natural gas
  - So we paid the "carbon tax" to others, but missed the carbon reduction
- Markets now preparing for carbon trading (the right price isn't zero—it's better to be roughly right than precisely wrong)
  - Vital not to indulge in ancestor worship—no grandfather clauses!
- Wider context: some EU nations' shifts of taxation from jobs and income to consumption and depletion correctly signal new relative scarcities and increase total factor productivity
- Ideally, get correct prices *and* trimtabs to evade the barriers
- What are the market failures whose repair lets prices work?

The two biggest public-policy levers to support the business logic

1. *Reward electricity and gas distribution companies for reducing customers' bills, not for selling more electricity*
   - Decouple profits from sales volumes using a balancing account
   - Let distributor keep a small part of the savings it achieves for its customers
   - Unanimously endorsed by U.S. state utility utility regulators 7/88, adopted in ~7–9 states, derailed by restructuring, now coming back: in place for electricity in CA and ID, for gas in ~8–10 states; many more on the way; NRDC and Energy Foundation lead these reforms, www.raponline.org supports Commissions
2. *Use size- and revenue-neutral "feebates" to widen the price spread between less and more efficient light-duty vehicles (of a given size)*
   - Arbitrages the discount-rate spread between private car-buyers and society, so buyers will consider the full 14-year lifecycle savings, not just the first year or two
   - Encourages choice of efficient vehicles of the desired size, not of a different size
   - ~90% of feebates' effect comes from automakers' shifting their offerings to try to move from fee zone to rebate zone; this *increases* their profit margins

- These and other innovative policies are more effective, and far more politically attractive, than traditional ones (like CAFE and fuel taxes)
- A ripe opportunity for state-level leadership and experimentation

Between the idea / And the reality / Between the motion / And the act / Falls the Shadow

—T.S. Eliot

- There are ~60–80 specific market failures* of 8 types
  1. Capital misallocation
  2. Value-chain risks
  3. Organizational failures
  4. Informational failures
  5. Regulatory failures
  6. Perverse incentives
  7. False or absent price signals
  8. Absent markets
- **Proven methods can turn each of these obstacles into lucrative business opportunities**
- ***Barrier-busting*** **should top the policy agenda**

*"Climate: Making Sense *and* Making Money," RMI, 1977, www.rmi.org/images/other/Climate/C97-13_ClimateMSMM.pdf, pp. 11–20

What are we waiting for?
***We* are the people we have been waiting for!**

"Only puny secrets need protection. Great discoveries are protected by public incredulity."

—Marshall McLuhan

Your move…

www.oilendgame.com,

www.fiberforge.com,
www.rmi.org (Library),
www.natcap.org

Project Finance Roundtable:
Financing Energy Efficiency Projects

Moderator:
Dan Reicher, *Director of Climate Change and Energy Initiatives*
GOOGLE

Panelists:
Kevin Walsh, *Managing Director*
GE ENERGY FINANCIAL SERVICES

John G. Ravis, *Vice President*
TD BANKNORTH PROJECT FINANCE

Peter Liu, *Initial Founder and Vice Chairman*
NEW RESOURCE BANK

Kimberly Albertson, *Finance Manager*
AMERESCO
President, ASSOCIATION FOR GOVERNMENTAL LEASING AND FINANCE

Chuck Goldman, *Group Leader, Markets and Policy Group*
LAWRENCE BERKELEY NATIONAL LABORATORY

Dan W. Reicher has over 20 years of experience in business, government and non-governmental organizations focused on energy and environmental technology, policy, finance and law. He recently joined Google where he serves as Director of Climate Change and Energy Initiatives for the company's new venture called Google.org. Google.org has been capitalized with more than $1 billion of Google stock to make investments and advance policy in the areas of climate change and energy, global poverty, and global health.

Prior to his recent position at Google, Mr. Reicher served as President and Co-Founder of New Energy Capital Corp., a New England-based company that develops, invests in, owns and operates renewable energy and distributed generation projects. Mr. Reicher is also a member of General Electric's Ecomagination Advisory Board.

From 1997-2001, Mr. Reicher was Assistant Secretary of Energy for Energy Efficiency and Renewable Energy at the U.S. Department of Energy (DOE). As Assistant Secretary, he directed annually more than $1 billion in investments in energy research, development and deployment related to renewable energy, distributed generation and energy efficiency. Prior to that position, Mr. Reicher was DOE Chief of Staff (1996-97), Assistant Secretary of Energy for Policy (Acting) (1995-1996), and Deputy Chief of Staff and Counselor to the Secretary (1993-1995). He was also a member of the U.S. Delegation to the Climate Change Negotiations, Co-Chair of the U.S. Biomass Research and Development Board, and a member of the board of the government-industry Partnership for a New Generation of Vehicles. After leaving the Clinton Administration in 2001 he was a consultant to the Senate Environment and Public Works Committee and a Visiting Fellow at the World Resources Institute.

In 2002, Mr. Reicher became Executive Vice President of Northern Power Systems, a venture capital-backed renewable energy and distributed generation engineering, services and technology company with installations in more than forty-five countries. Mr. Reicher led the renewable energy sales group at Northern and also was actively involved with the company's project finance, government relations and public affairs initiatives. He also played a significant role in the successful sale of the company to Proton Energy Systems, a leading hydrogen company, and the simultaneous creation of Distributed Energy Systems, a new NASDAQ-listed holding company that now owns both Northern Power and Proton Energy.

Prior to his roles at the Department of Energy and in the business community, Mr. Reicher was a senior attorney with the Natural Resources Defense Council where he focused on the federal government's energy and nuclear programs as well as environmental law and policy issues in the former Soviet Union. He was also previously Assistant Attorney General for Environmental Protection in Massachusetts, a law clerk to a federal district court judge in Boston, a legal assistant in the Hazardous Waste Section of the U.S. Department of Justice, and a staff member of President Carter's Commission on the Accident at Three Mile Island.

Mr. Reicher currently is co-chairman of the advisory board of the American Council on Renewable Energy and a member of the boards of the American Council for an Energy Efficient Economy, the Vermont Energy Investment Corporation, the Keystone Center's Energy Program, and Circus Smirkus. He was also recently a member of the National Academy of Sciences Committee on Alternatives to Indian Point for Meeting Energy Needs.

Mr. Reicher also recently served as an adjunct professor at the Yale University School of Forestry and Environmental Studies and Vermont Law School. He holds a B.A. in Biology from Dartmouth College and a J.D. from Stanford Law School. He also studied at Harvard's Kennedy School of Government.

Mr. Reicher was a member of a National Geographic-sponsored expedition that was the first on record to navigate the entire 1888 mile Rio Grande and was also a member of the first group on record to kayak the Yangtze River in China.

Mr. Reicher is married to Carole Parker, who headed the Office of Pollution Prevention at the U.S. Department of Defense from 1994 to 1999. Carole and Dan have three children and live in Norwich Vermont. The family will be relocating to California in August 2007.

GE
Energy Financial Services

Profile

Kevin P. Walsh
Managing Director, Renewable Energy

Kevin Walsh leads the Renewable Energy group at GE Energy Financial Services. Renewable Energy is a strategic growth initiative at Energy Financial Services, which has a strong record of investing in wind, solar, hydro, geothermal and biomass energy projects globally, having more than doubled its renewable energy portfolio since 2004 to more than $1.75 billion. Mr. Walsh expects to grow EFS' investments in the fast-growing global renewable energy sector to more than $3 billion by the end of 2008.

Prior to this assignment, since January 2002, Mr. Walsh was responsible for the management of Energy Financial Services' more than $13 billion global portfolio of energy investments, as well as related portfolio sales and reinvestment.

Since joining GE Structured Finance (SFG) in 1990, Mr. Walsh has held positions of increasing responsibility in Energy, Capital Markets, Industrial and eBusiness. In 1993 he was a Director in SFG's London office with responsibility for energy investments in assigned countries in the European and Southeast Asia Region. In 1995, he returned to the U.S. as Senior Vice President, Capital Markets, where he was responsible for debt arrangement and syndication activities in the Americas Region for various GE industrial businesses including GE Energy. Beginning in 1997, he was named Managing Director, Paper and Forest Products Group. In 1999 he served as Managing Director, eBusiness for SFG, leading the business' efforts to web-enable its processes, build partnerships and alliances and make strategic e-commerce investments.

Mr. Walsh graduated cum laude from Fairfield University, where he received a B.S. in Business Management. He is a graduate of General Electric's Financial Management Program.

About GE Energy Financial Services
GE Energy Financial Services' 300 experts invest globally with a long-term view, across the capital spectrum and the energy and water industries, to help their customers and GE grow. With $13 billion in assets, GE Energy Financial Services, based in Stamford, Connecticut, invests more than $5 billion annually in two of the world's most capital-intensive industries, energy and water. More information: www.geenergyfinancialservices.com.

About GE
GE (NYSE: GE) is Imagination at Work - a diversified technology, media and financial services company focused on solving some of the world's toughest problems. With products and services ranging from aircraft engines, power generation, water processing and security technology to medical imaging, business and consumer financing, media content and advanced materials, GE serves customers in more than 100 countries and employs more than 300,000 people worldwide. For more information, visit the company's Web site at www.ge.com.

CONTACT:
Ken Koprowski
GE Energy Financial Services
(203) 961-5743

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GE
Energy Financial Services

Investing in Energy Efficiency

Energy Efficiency Finance Forum
April 12, 2007

Kevin Walsh, Managing Director

Agenda

- GE Overview
- Ecomagination
- Energy Financial Services Overview
- Market Opportunity
- Attracting Investors to Energy Efficiency

GE- The Right Mix for Growth

GE Key Facts/Honors:

- Founded by Thomas Edison in 1878 as the Edison Electric Co.
- Only company still listed in Dow Jones Industrial Index since 1896
- 6 global businesses operating in more than 100 countries
- 315,000 employees worldwide
- 2006 revenues $163.4 billion
- AAA Rated
- World's Most Respected Company (1999-2005) Financial Times
- 2007 America's and World's

GE Infrastructure

GE Industrial

GE Commercial Finance

GE Consumer Finance

GE Healthcare

NBC Universal

Energy Financial Services

Energy

Water

Oil & Gas

Rail

Aircraft Engines

Commercial Aviation Services

2JH

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e•co•mag•i•na•tion (ē'kō-măj'ə-nā'shən)

(n.) GE's commitment to imagine and build innovative solutions that benefit our customers and society at large

Our ecomagination Commitment:

4 Doubling our research investment

5 Introducing more ecomagination products

6 Reducing greenhouse gas emissions

7 Making customers true partners

8 Informing the public about our progress

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GE Energy Financial Services

A'47E Dvvhwv

Deal Size
$25MM – $1B

Double-digit
Growth

Investing globally, with a long-term view, across the capital spectrum and the energy and water industries, to help our customers and GE grow.

25+ Year Track Record in Energy Finance + GEš 100+ Years in Energy

GEš AAA Rating – Funding Cost Advantage

300 Energy & Water Experts ð
6 Commercial Teams

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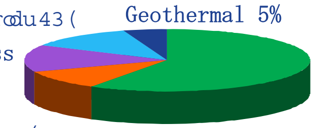
EFS Renewable Energy Portfolio

$1.75 Billion
Renewable Energy
Portfolio



71; JZ Sruwirolr

Percentages Represent Investment $'s closed as of January 1, 2007

- 25-Person dedicated team
- Broad range of financial products
- Equity in 25 wind farms
- Recently closed photovoltaic projects and large run-of-river hydro mandate
- Diverse portfolio of technology providers, wind regimes, financial structures

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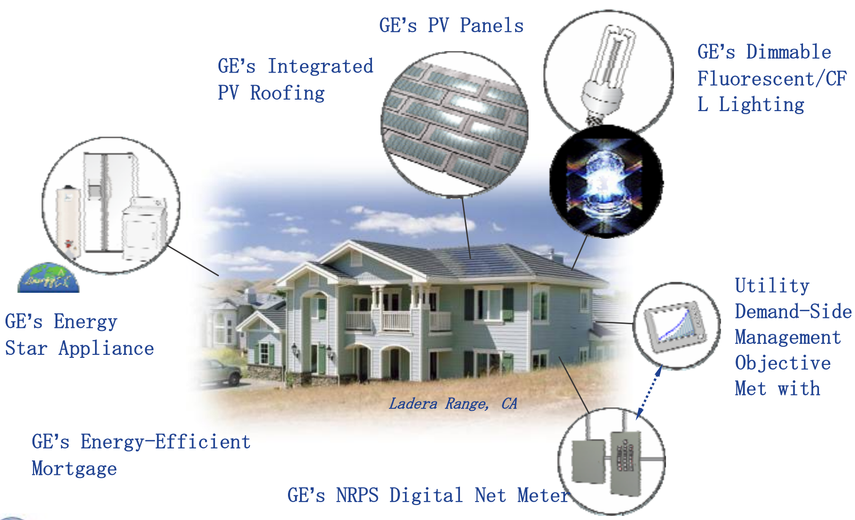
GE's Energy Efficient Homes



: 2JH

Financing Energy Efficiency Installations

What Are The Models?

- Performance contract finance… individual contracts or portfolios
- ESCO corporate finance
- Equipment finance…leases, loans
- Real estate finance…mortgages, equity lines

GE’s View of Energy Efficiency Finance

Opportunities
- Large potential market
- Good econaomics
- Proven technology
- Creditworthy counterparties
- Pull-through of GE products

Challenges
- aaaaaaaUnderwriting small deals
- Complex transactions
- Ability to measure
- High soft costs
- Returns on shared savings contracts

GE EFS' Energy Efficiency Investments
Case Study: NORESCO

- NORESCO specializes in the development, design, construction and operation of energy and environmental efficiency projects
- Helps customers, such as the federal government, achieve energy efficiency, environmental and cost management goals
- GE Energy Financial ServicesŠrole: provided senior debt financing to assist GFI Energy Ventures in its acquisition of NORESCO

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Financing Energy Efficiency Companies

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GE Businesses Involved in Cleantech Investing

GE Energy Financial Services
Invests globally across the capital spectrum and the energy and water industries

GE Commercial Finance
$190B in assets

GE Global Research
Niskayuna, NY, Munich, Bangalore and Shanghai

GE Industrial & Infrastructure
GE Energy
GE Commercial & Industrial

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GE EFS' Energy Efficiency Investments
Case Study: Comverge

- ComvergeŠs Virtual Peaking CapacityØ programs provide electric utilities with fully outsourced electricity demand response
- Programs provide automated capacity reduction during periods of peak demand -- no need to build peaking plants, relieves grid congestion
- GE Energy Financial ServicesŠrole: $40 million senior credit facility to finance the purchase and installation of equipment

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Unique Issues for VCs in Energy

- Regulatory driven
- Technology adoption can be very slow
- Capex intensive
- Technology looking for markets vs market needs pulling the technology

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www.geenergyfinancialservices.com

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John G. Ravis
Vice President
TD Banknorth Project Finance

John Ravis is Vice President of Project Finance at TD Banknorth. For the past 12 years, TD Banknorth has been a leader in financing projects in the renewable energy and renewable fuels sectors as well as in related industries. Currently, TD Banknorth's portfolio includes investments in wind, geothermal, hydro, landfill gas, biomass, solar PV electric production, combined cycle natural gas, coal, and ethanol projects.

Mr. Ravis has over 16 years of experience in energy project financing. He joined TD Banknorth in November 2005. Prior to joining TD Banknorth, he was a Vice President at EnCapital, a Boston-based investment bank advising clients in developing and financing renewable energy projects. Previously, Mr. Ravis was the Senior Vice President and Chief Underwriter for ABB Energy Capital, where he managed a group structuring financings for projects in the renewable energy, power generation, and energy infrastructure sectors. Mr. Ravis has also worked in Project Finance at Raytheon Engineers and Constructors, Constellation Energy and ABB/Combustion Engineering.

Mr. Ravis received a BS in Engineering and an MBA, both from the University of Michigan.

Implementing Energy Efficiency Projects: A Transactional Perspective

John Ravis

TD Banknorth Project Finance

TD Banknorth

Energy Efficiency Finance Forum

Starting Point:

Inked an Energy Services Agreement with XYZ Inc.'s local manufacturing plant to install energy efficient lighting.

Now what?

TD Banknorth

Energy Efficiency Finance Forum

- Seriously, who is the credit?
- Will the Host provide financials?
    - What quality can you expect?

Energy Efficiency Finance Forum

- Need Corporate Approvals (board resolutions, duly authorized docs, etc)
    - Involve staff resources (accounting, finance and legal)
- How will the Host treat the ESA for accounting purposes?
- Will the parent company guaranty subsidiaries obligations?

Energy Efficiency Finance Forum

Third Party Issues

Does the Host own the building?

Who owns the building?

Is there a mortgage on the property?

What happens if the Landlord defaults?

TD Banknorth

Energy Efficiency Finance Forum

Third Party Issues

- Consents, Subordination and Nondisturbance Agreements, and other documents
- Similar to a RE financing
- Add to the transaction costs

TD Banknorth

Energy Efficiency Finance Forum

Other Issues

How are you getting paid?

How do you evidence completion?

Do you have enough flexibility?

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Checklist

Host Financials

Parent Company guarantee

Accounting treatment

Building Ownership/Mortgagee

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If you have any questions or comments:

John G. Ravis

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john.ravis@TDbanknorth.com

TD Banknorth

Peter Liu's Conference Bio

Peter Liu is the initial founder and vice chairman of New Resource Bank, an innovative community bank in San Francisco started by leading entrepreneurs that focuses on financing sustainable and efficient resources. Peter currently serves on the Clean Technology Investment Advisory Boards of the California Public Employees Retirement System and the California Teachers' Retirement System. He previously was an energy sector banker at Credit Suisse First Boston and the Chase Manhattan Bank, where he completed over $8 billion in energy project financings. He has also been an engineer for the Chevron Corporation and the California Air Resources Board. Peter did his undergraduate studies in Chemical Engineering & Materials Science at UC Berkeley and graduate studies in Public Affairs at Princeton.

New Ideas for EE Financing

newresourcebank

Energy Efficiency Financing Forum

NY, April 2007

Presented by Peter Liu
peter.liu@newresourcebank.com

newresourcebank

New Resource Bank Overview

- Innovative community bank in the SF Bay Area
  - A **NEW** standard in customer service
  - Financing sustainable **RESOURCE**s in our community
  - A **BANK** that does more with your money
- Formed by the New Resource Community with a strong capital base
  - One of the largest initial capitalizations in Northern California
  - 240 founding shareholders comprising top entrepreneurs and bankers
- Managed by a highly experienced team with proven results
  - Customized banking with world class expertise and technology
  - 200 years of combined banking experience in senior team
  - Managed combined asset growth of $50 billion

newresourcebank

Entrepreneurial to the Core

Our founding investors have founded and built leading companies, including…

SYBASE
ofoto
Lotus
Interface
E2 Environmental Entrepreneurs
Driscoll's
WR HAMBRECHT + CO
Triodos Bank
Veritable Vegetable
CTG Energetics, Inc.
GreenBiz.com
Silicon Valley Bank
Mendocino Wine Co.
rosecompanies
Menlo Equities
Greenopia
SUNPOWER
dfj | ELEMENT
macromedia
University Games
Handango
BRIGHTMAIL

newresourcebank

NRB – Our Own Operations

Building & Operations
- Office tracking LEED Gold
- Paper & trip reduction
- Renewable Green-E

People
- Diverse staff and board
- Green incentives

Training
- Sector and topical

Community
- Engagement and education
- Growing in leadership

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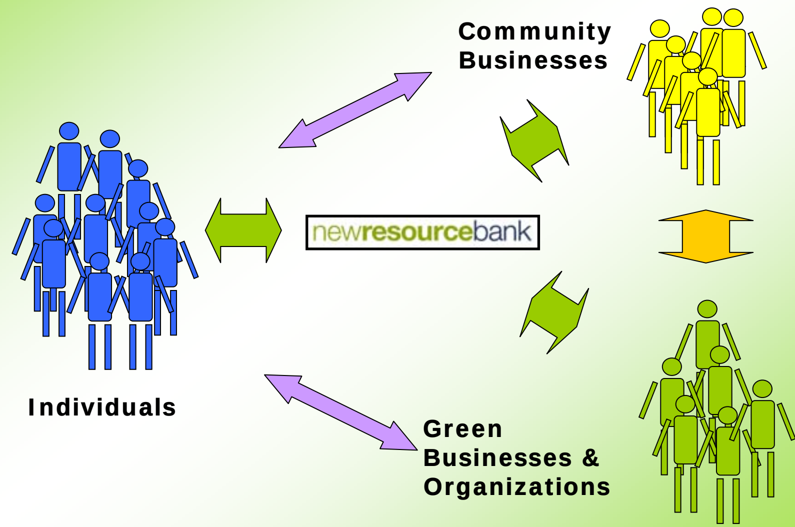
Community Bank - Redefined



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Supporting Great Entrepreneurs

newresourcebank

NRB – Sector Value Added

Green Buildings	◻ More $ at a lower cost to build green ◻ Green building resource & information
Cleantech/ Renewable	◻ Customized loan & cash mgmt for growth and projects ◻ Customer financing for capital intensive products
Organic & LOHAS	◻ Credit for early stage and high growth companies ◻ Member of wide capital chain – advice and referrals
Recycling/ Efficiency	◻ Internal expertise and open-mind ◻ Value-added upstream partnerships
NGO & Govt.	◻ Efficient banking and revenue partnerships ◻ Partnership on education and training resources

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NRB's More "Green" for Green Buildings

Focus on value for developers
- Green has marketing advantages and lower operating costs
- NRB financing to enhance returns

- Lower cost and more loan-to-value for green Projects
  - 0.125% lower in rates for green leadership
  - Conventional construction LTV ≤75% - green leadership ≤80%
- Core competency built from the New Resource Community
  - National green building leaders
  - Proven green developers
  - Innovative designers and entrepreneurs

newresourcebank

Building Efficiency From the Beginning

NRB Case Study: Berkeley Southside Lofts

BEFORE

AFTER

Other NRB examples

- Martinez, CA LEED-for-Homes infill construction
- Oakland, CA smart growth construction
- Healdsburg, CA town center remediation and infill development

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NRB Residential Solar Financing Program with SunPower

SUNPOWER

+

newresourcebank

Smart Financing for a Smart Energy Decision

Program Features

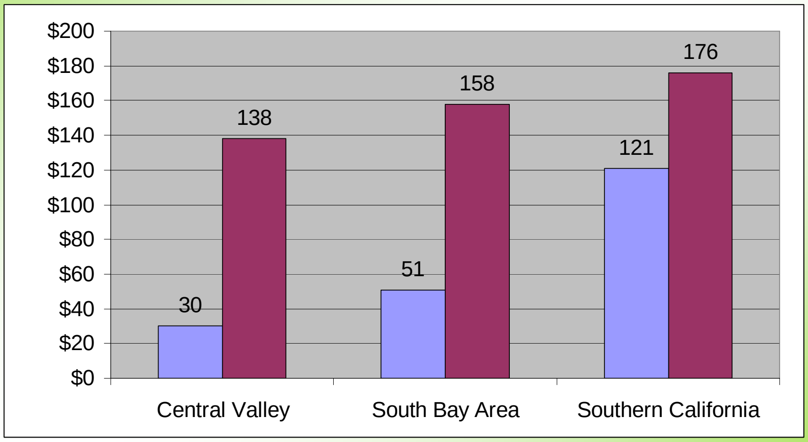
- One step process
- Quick approval & No Fees
- Long term financing options
- Tailored to customer preferences
- Leverage broad sales channels

Get more value for your home by paying a bill similar to your utility bill

newresourcebank

Cost Neutral Targets for Solar

Solar Home Electric Bill vs. Non-solar Home Electric Bill (2.5 kW avg. system)



Source: Environment California, Survey of Home Owners in California

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Financing Energy Efficiency – Our Focus

- Where 3rd party financing makes a difference to adoption
- Operating vs. non-core capital costs

NRB Initial Focus

newresourcebank

Approach to Potential Clients

Evaluate and take advantage of existing programs & partnerships

Utility financing/rebate programs?

3rd party financing?

- Project or energy service partner
- Appropriate client – credit and fundamentals
- Contract, product and credit structure fit

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Project in development/financing

- Energy service company guaranteed performance contract
  - Initial audit free to client
- Financing provides immediate savings with no investment
- Credit considerations
  - Investment grade client
  - ESCo recourse to performance shortfall
  - ESCo services equipment and monitors during financing term
  - Client provide energy usage info
- Challenges
  - Guaranteed performance period = financing period
  - Strong credibility of audit results and projected savings
  - Client equipment service and data monitoring requirements
  - Leased vs. owned buildings

newresourcebank

Looking to the Future

- Simplify financing structure for scalability
- “Community” programs for residential
- Great partners
- Continued policy innovation

Shameless Plug

China|U.S.
Energy Efficiency Alliance | 中美能效 盟
chinauseealliance.org

Charles Goldman is a staff scientist and Group Leader in the scientist in the Environmental Energy Technologies Division of the Lawrence Berkeley National Laboratory, a Department of Energy national laboratory. He leads a group of ~10-15 professionals working on electricity markets and policy issues for the Department of Energy's Office of Electricity Delivery and Energy Reliability. Mr. Goldman has published over 80 articles and reports on energy efficiency and demand response policy, programs, and technology analysis, utility integrated resource planning, retail energy services, energy service company industry and market trends, and electric industry restructuring and holds an M.S. degree from the Energy and Resources Group at the University of California Berkeley. He has been a member of NAESCO's Accreditation Committee since 1996. In 1997, Mr. Goldman was appointed by the California Public Utilities Commission as one of eight members of the California Board for Energy Efficiency (CBEE). He served as the Vice-Chairman of the CBEE from 1997 through March 2000 and oversaw $275 million/year in funds for energy efficiency programs.

Private Sector Energy Efficiency Financing: ESCO Industry Market Growth and Development

Charles Goldman
E. O. Lawrence Berkeley National Laboratory
CAGoldman@lbl.gov

Presentation to

ACEEE Energy Efficiency Finance Forum

April 12, 2007

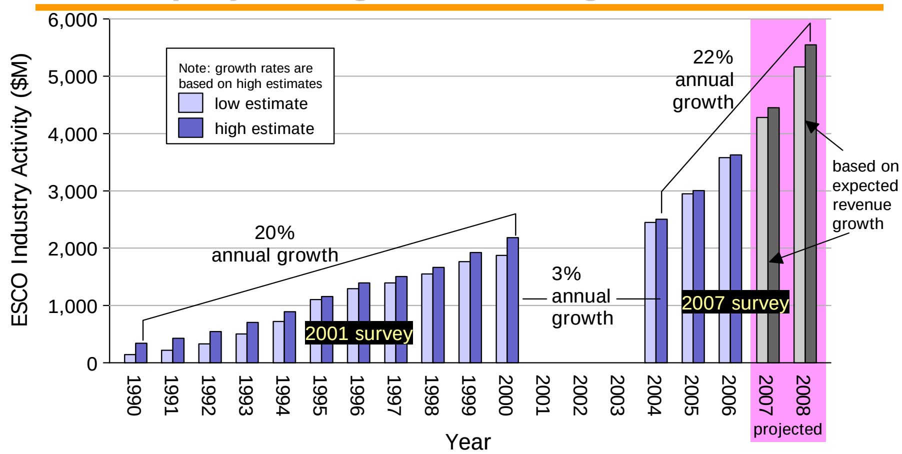
Overview of Presentation

- Sneak preview of recent LBNL/NAESCO survey of U.S. ESCO Industry
- Preliminary Results:
  - Industry Size Estimates
  - Industry Structure
  - Economic Activity by State
  - Procurement Strategies
  - Project/Technology Types

Approach

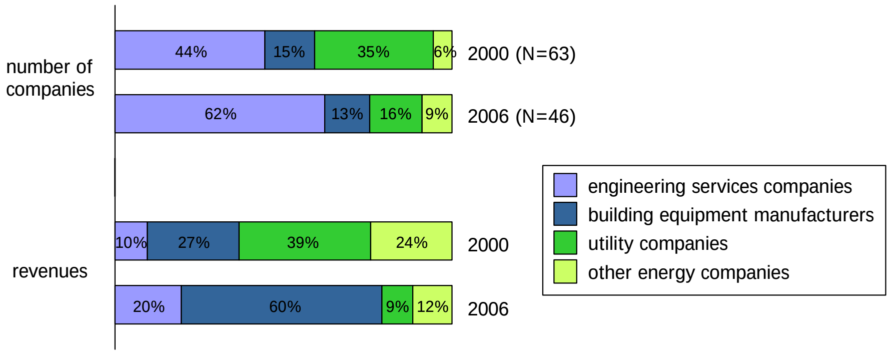
- **Identified 46 ESCO companies**
  - Defined by performance contracting as a core (though not exclusive) part of the company's business
- **Survey administered to company executives Feb/March 2007**
  - 72% of companies responded, including all the large ESCOs (respondents represent ~97% of industry revenues)
  - Delphi approach for ESCOs that didn't respond
- **Limitation of approach: Self-reported data**
- **Quality assurance**
  - Delphi process to review company responses
  - Historic financial info used as reality check

ESCO Industry Activity: 1990–2006 plus projected growth through 2008



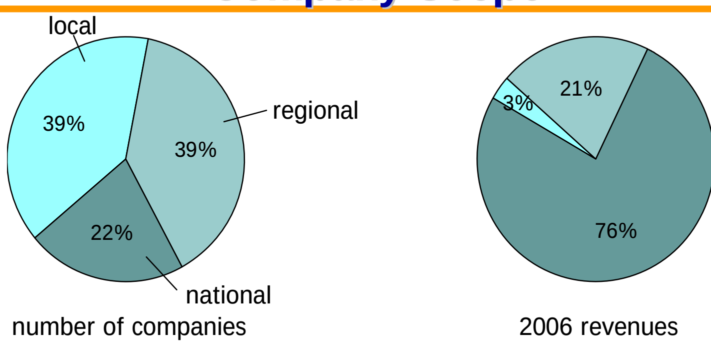
- **ESCO Industry revenues in 2006: ~$3.6B**
- **Flat growth in early 2000's—fallout from CA electricity crisis; retail competition stalled; the "Enron effect"; federal ESPC sunset**
- **Recovery in last two years (20% annual growth between 2004 and 2006)**

ESCO Industry Structure: Ownership Parent



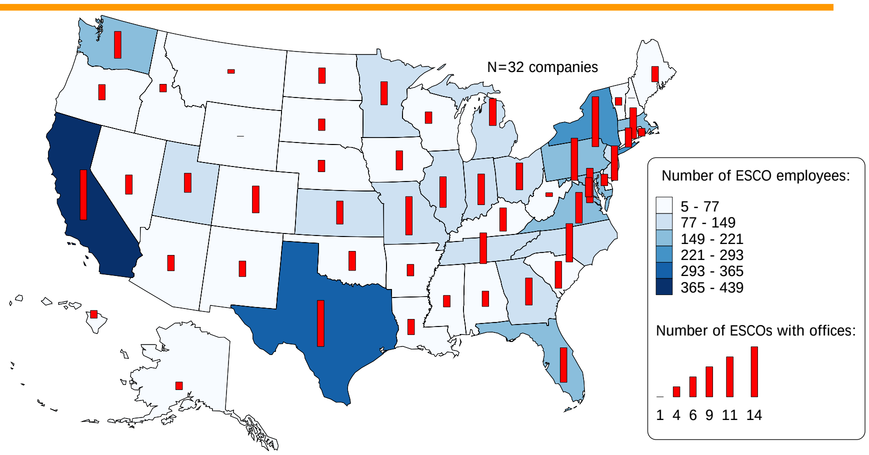
- A large share of ESCOs are engineering services companies, but they are relatively small: 62% of companies but only 20% of revenues
- A few, very large building equipment and controls manufacturers make up a large, and growing, share of industry revenues (60% in 2006)
- Utility-owned ESCOs have become less prevalent, and smaller, than in 2000
- ESCOs owned by other energy companies (e.g., oil companies, non-regulated or non-U.S. energy suppliers) account for ~10% of the industry

ESCO Industry Structure: Company Scope



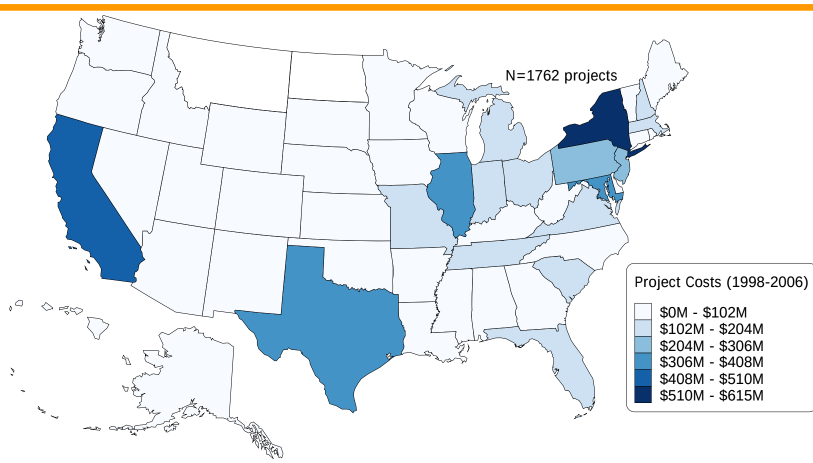
- **About 22% of ESCOs are national players; but these companies account for ~76% of industry revenues**
- **39% of ESCOs are regional players: account for ~20% of industry revenues**
- Despite industry consolidation, there are still lots of small local players, particularly in states with strong enabling policies or incentive programs

ESCO Economic Activity by State



- Estimates of number of FT employees based on survey responses for 32 companies (represents 97% of 2006 industry revenues)
- Provides a benchmark of current capability for state policymakers/utilities interested in starting or ramping up programs

ESCO Project Investment: 1998-2006

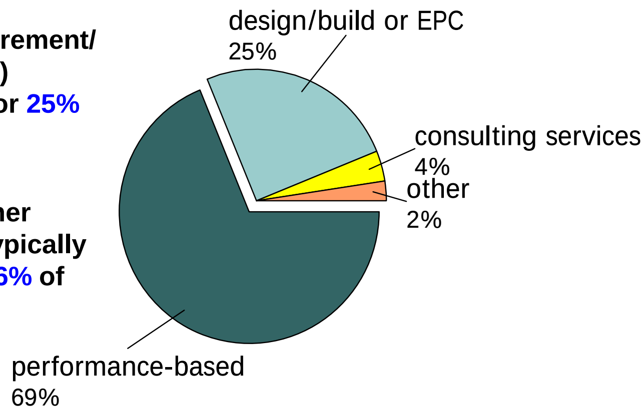


- **Project costs are from LBNL/NAESCO database, which represents ~20% of total ESCO industry activity**
  - May not be representative on a state-level basis

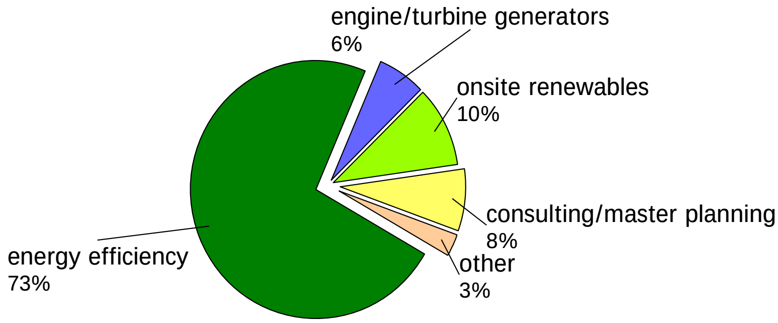
ESCO/Customer Contracting Arrangements

- **Performance-based contracts made up 69% of industry activity in 2006, compared to only 60% in 2000**

- **Design/build and Engineering/Procurement/ Construction (EPC) projects account for 25% of ESCO industry revenues**
- **Consulting and other energy services (typically O&M) account for 6% of ESCO revenues**



Technology/Project Types



- "Conventional Wisdom": trend toward larger projects, more onsite generation and renewables

- **Energy efficiency still a major share of industry activity (73%)**
- **Engine/turbine generators are a growing, but still relatively small share (6%)**
- **Renewables account for 10%**
- **Consulting/master planning and other services account for ~11% of ESCO revenues**

LBNL Reports on the U.S. ESCO Industry

- **A Survey of the U.S. ESCO Industry: Market Growth and Development from 2000-2006**

  Forthcoming

- **Public and Institutional Markets for ESCO Services: Comparing Programs, Practices and Performance**
  N. Hopper, C. Goldman, J. McWilliams, D. Birr, K. McMordie Stoughton. LBNL-55002. March 2005

- **Market Trends in the U.S. ESCO Industry: Results from the NAESCO Database Project**
  C. Goldman, J. Osborn, N. Hopper, and T. Singer. LBNL-49601. May 2002

  Available at: http://eetd.lbl.gov/ea/EMS/ee-pubs.html

Technology Showcase:
New Developments in Energy Efficiency Technologies

Moderator:
R. Neal Elliott, *Industrial Program Director*
AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY

Panelists:
Combined Heat & Power
Sean Casten, *President & CEO*
RECYCLED ENERGY DEVELOPMENT LLC (RED)

HVAC Innovations
Mike Thompson, *Environmental Affairs Director*
TRANE

Solid-State Lighting
Jim Brodrick, *Solid State Lighting Portfolio Manager*
U.S. Department of Energy

Building Technologies
Stephen Selkowitz, *Head, Building Technologies Department*
LAWRENCE BERKELEY NATIONAL LABORATORY

Monitoring and Communication Technologies
Dan Delurey, *Executive Director*
DEMAND RESPONSE AND ADVANCED METERING COALITION (DRAM).

R. Neal Elliott, Ph.D., P.E.

Neal Elliott has been Industrial and Agricultural Program Director with the American Council for an Energy-Efficient Economy (ACEEE), a nonprofit organization dedicated to advancing energy efficient technologies and policies since 1993. Elliott is an internationally recognized expert and author on energy efficiency in manufacturing and agriculture, industrial energy efficiency programs, motor systems, combined heat and power, analysis of energy efficiency and energy markets, and a frequent speaker at domestic and international conferences. Prior to joining ACEEE, Elliott was a leader of the industrial and agriculture energy efficiency programs at the N.C. Alternative Energy Corporation (now Advanced Energy), focusing particularly on chemicals, wood products, textiles, livestock and produce industries. Prior to joining NCAEC he was state wood energy coordinator with the Extension Service at North Carolina State University. Elliott received B.S. and M.S. degrees in Mechanical Engineering from North Carolina State University, a Ph.D. from Duke University, and is a registered professional engineer in North Carolina.

Sean Casten

Sean Casten is the President and CEO of Recycled Energy Development LLC (RED), a company specializing in the development, ownership and operation of power plants that convert waste energy into electric power at industrial facilities in the United States and Canada. The company's mission is to profitably reduce greenhouse gas emissions, which it accomplishes through a unique contract and financial structure, coupled with over 50 years of combined experience among the company's senior management in industrial energy outsourcing.

From 2000 - 2006, Sean was the President and CEO of Turbosteam Corporation, a company specializing in the design and sale of capital equipment to recover waste energy into electric power in industrial facilities. Turbosteam is now a subsidiary of RED.

Prior to joining Turbosteam, Sean as a Manager in Arthur D. Little's Energy practice where he specialized on technology and strategic issues surrounding alternative fuels and emerging power generation technologies.

In 2005, he was recognized by the US Combined Heat and Power Association along with Chairman Bill Flynn of the NY Public Service Commission as a "CHP Champion" in recognition of leadership towards greater national use of clean, efficient and reliable combined heat and power.

He is the 2007 Chairman of the United States Combined Heat and Power Association and the founding (2005) Chairman of the Northeast Combined Heat and Power Initiative. He has authored numerous papers and given numerous speeches on the technological, regulatory and business-practice barriers to and opportunities from on-site power generation.

Sean holds a B.A. from Middlebury College, a M.S. in Biochemical Engineering from Dartmouth College and a Master's of Engineering Management from Dartmouth College.

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COMBINED HEAT AND POWER, RECYCLED ENERGY AND THE GOLDILOCKS OPPORTUNITY

Presentation to the Energy Efficiency Finance Forum
April 12, 2007

Sean Casten
President & CEO
Recycled Energy Development, LLC

March 14, 2007

RED RecycledEnergy Development

the new green

How to deploy more CHP is not a productive question independent of consequences. But CHP is the answer to deep societal questions.

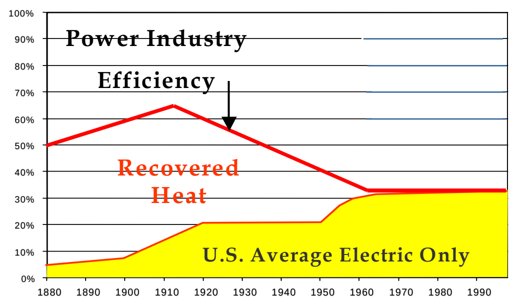
- The wisdom of David Lee Roth, as applied to 2007 energy policy.
- More meaningful questions:
  - Can we lower GHG emissions without driving up the cost of energy?
  - Can we serve new load growth without facing NIMBY fights and driving up cost?
  - Can competition work in the electric sector?

RED RecycledEnergy Development

the new green

www.recycled-energy.com 740 Quail Ridge Drive Westmont, IL 60559 phone 630.590.6030 fax 630.590.6037

Back to the future? Cost-effective GHG control is neither an oxymoron nor dependent on R&D.



Challenge & Opportunity (U.S. only)

- ~$100 billion potential energy savings/revenue from if we return to 1920s model (~37% rate reduction)
- Would reduce GHG emissions by 1 billion tons/yr
- No other GHG reduction approach comes close in terms of economics or market potential.

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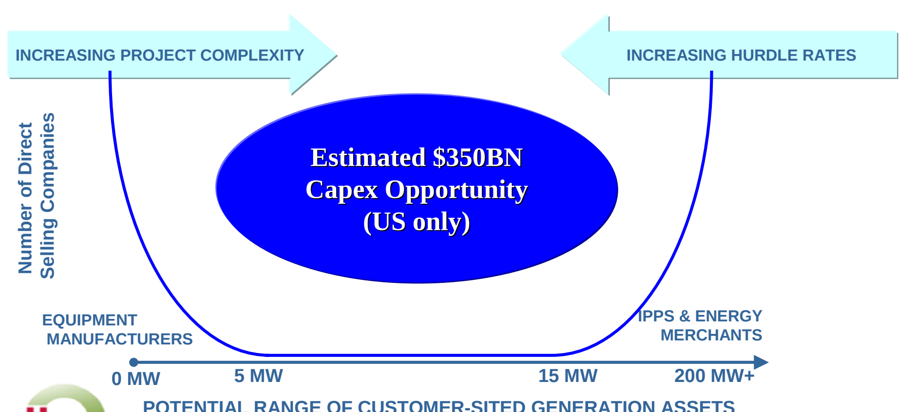
BUT – current business models are not structured to capitalize on this opportunity.



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“Extraordinary claims require extraordinary proof” – Carl Sagan

- Potential for such massive potential conflicts with conventional wisdom – how is this possible in a market economy?
  - Biggest industry in country is not subject to competitive pressure. Markets give you what you reward – and cost-plus rewards cost.
  - “Stick to your core” drive industrials away from >2 year paybacks on energy, and outsourcers have not filled gap.

RED RecycledEnergy Development

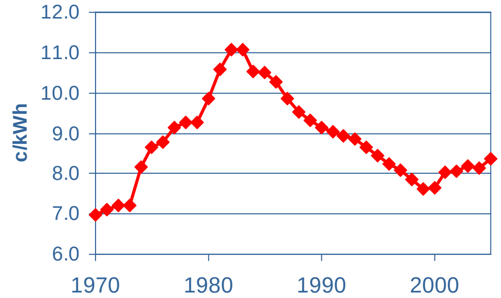
Why haven’t outsourcers emerged to date?

- Regulatory obstacles
  - Utilities have neither the incentive, thermal expertise nor entrepreneurial culture to pursue.
  - Rate structures, interconnect rules and bans on third party electric sales all erect barriers to entry.
  - Subsidies and demographic trends caused real, delivered energy prices to fall every year until 2000*; lowered incentive for EE.
- These barriers are falling.

RED RecycledEnergy Development

* With the exception of brief disruption in late 1970s after OPEC price shocks

Electricity price history – end of an era?



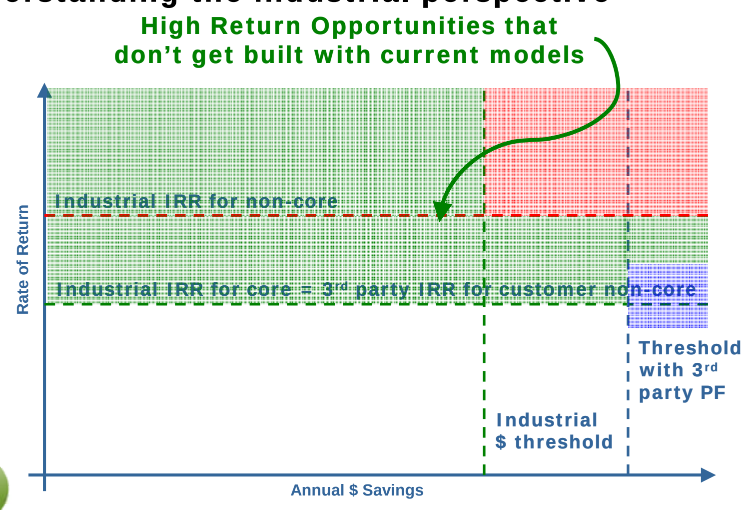
Why haven't outsourcers emerged to date?

- Financial & Business obstacles
  - Bulk of space is ~$2 – 20 MM projects
  - Too big for "spiderweb" contracting inherent to OEM model
  - Too small for high transaction costs inherent to merchant/PF model
  - Too much $ for industrials or 3rd parties to self-finance (esp. without losing control)
  - But $350 billion is a lot of porridge…
- Significant returns will accrue to the enterprise that can overcome these obstacles

Understanding the industrial perspective

- Rule of thumb: non-core investments must deliver < 2 year paybacks to gain capital approval (and only then if $ is available)
- BUT: purchasing processes reluctant to enter long-term agreements that have a higher WACC than industrial.
- Creates the gap and opportunity (see next)

Understanding the industrial perspective



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Conventional finance doesn't work for CHP/RE projects.

- Asset-backed debt not well structured for large, custom-engineered facilities
- Cash-flow secured project finance too transaction-intensive for <$50MM projects
- Time-to-cash is too long for private equity without liquidation of business, in spite of rapid capital paybacks (once built)
  - ~1 year project development time
  - ~1 – 2 year project construction time
  - ~3 – 5 years to pay off (required) debt
- Family history – PE-level returns incompatible with new construction?

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"Energy Investment Trust" - The ideal financial structure?

- CHP/RE project development has more in common with REITs than conventional PE
  - Value creation is in acquisition and earnings enhancement during first few years
  - Projects generate high-return annuities
  - Once developed, assets have value based on long-term earnings.
  - Projects can be sold independent of parent enterprise at attractive multiples
- Structure so that projects can be funded with 100% equity, then leveraged post-acquisition to minimize transaction costs and deal-fatigue.

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Mike Thompson
Director of Environmental Affairs – Trane Commercial Systems

Mike Thompson is director of environmental affairs for Trane Commercial Systems (TCS) and has worked for Trane in the heating, ventilation and air conditioning (HVAC) industry for 15 years.

In this role, Mike is responsible for developing and communicating Trane's environmental message to the industry, and working with Trane's sales distribution organization globally to educate customers on the importance of environmental issues when selecting an HVAC system. He's held numerous positions with Trane including Field Sales and Global Marketing manager for Trane's large tonnage chillers.

Mike is an active member in a wide range of HVAC industry organizations. Mike's efforts include participation in ASHRAE's 90.1 committee on building efficiency, ASHRAE 34 committee on refrigerant safety, and ASHRAE 15 committee on equipment room design. He is also a an active member of the International District Energy Association (IDEA), and is a member of the technical committee for Green Globes (GBI).

Mike earned a bachelor's degree from Texas A&M University in mechanical engineering.

\# # #

HVAC Impacts of Environmental Legislation

Mike Thompson

Director of Environmental Affairs

Trane- LaCrosse, WI

TRANE

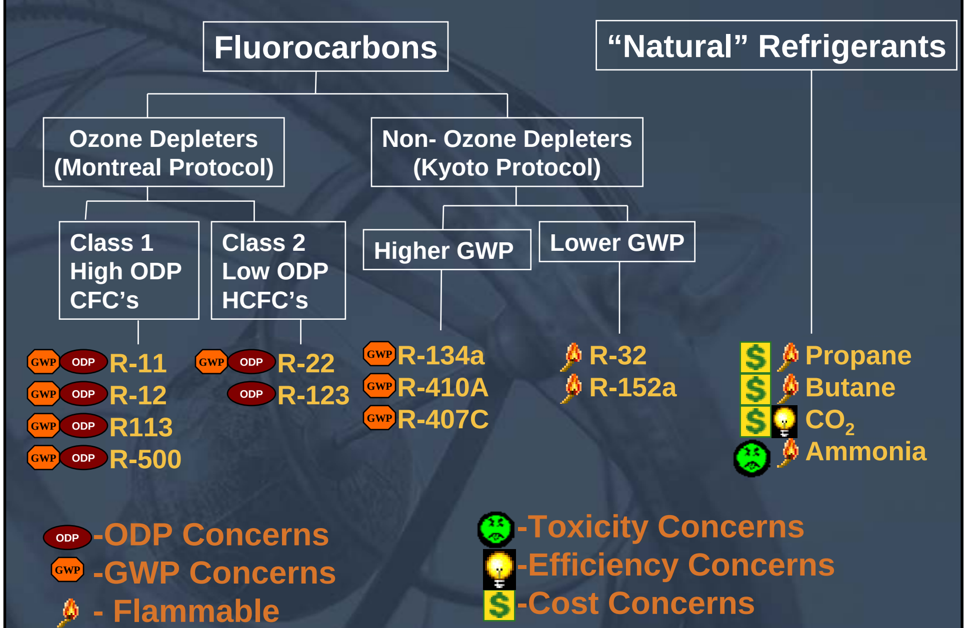
Topics

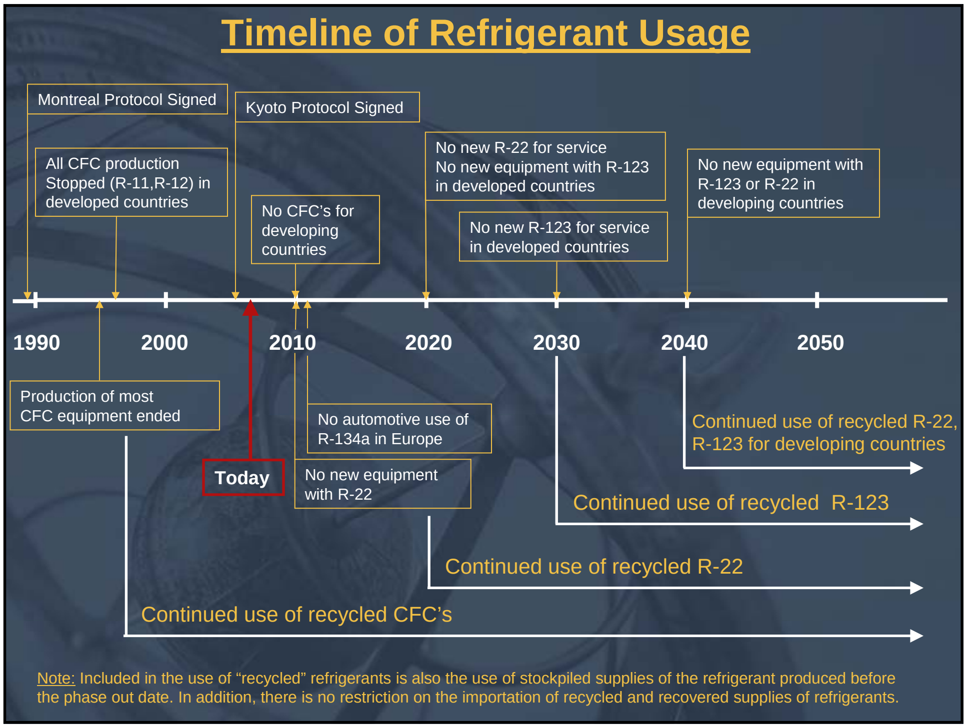
- What impacts do refrigerants really have on the environment?
- What is the best overall environmental solution?
- What do the people outside the HVAC community say about refrigerants?

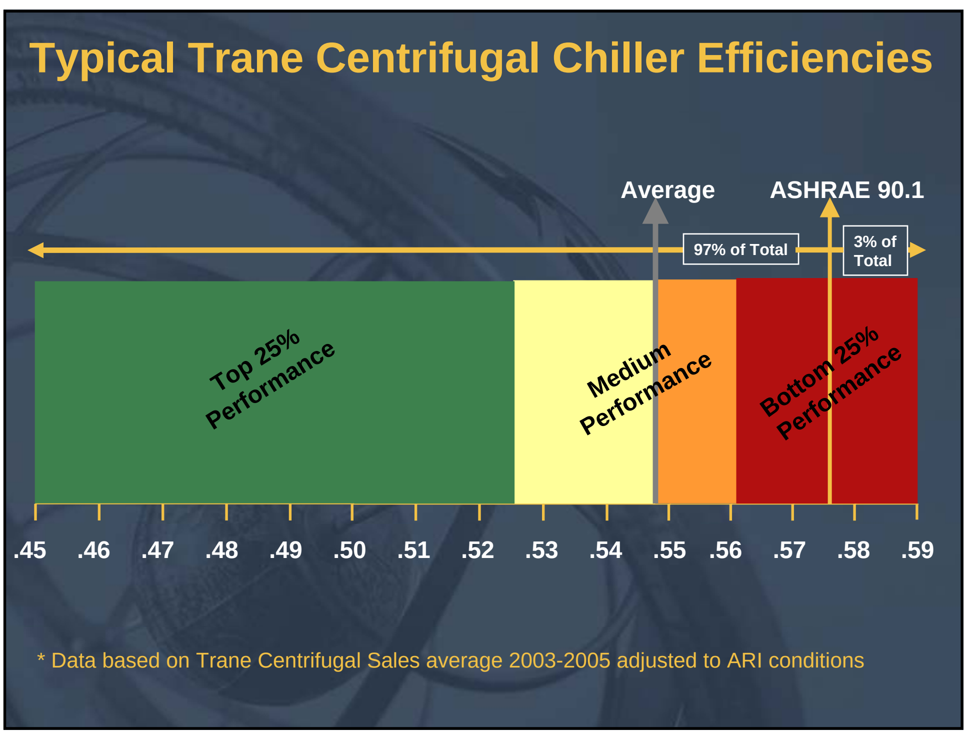
Trane's Environmental Organization

- **Jim Wolf-** VP- Global Environmental Policy, Chairman of Environmental Council
- **Mike Thompson-** Director of Environmental Affairs- TCS- Global
- **Jeff Moe-** Program Director, Environmental Policy
- **Philip Yu-** Director of Environmental Affairs- Asia
- **Laurent Legin-** Environmental Affairs- Europe

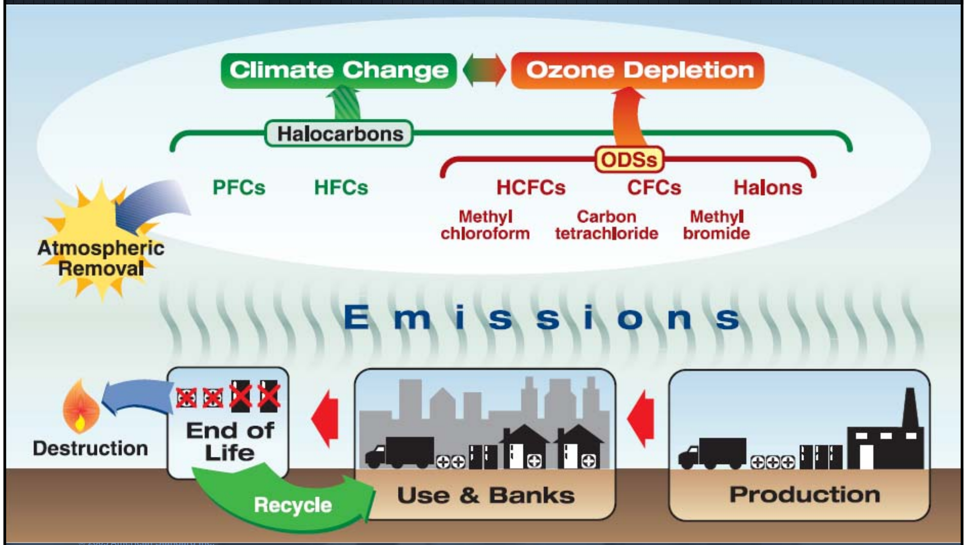
Options For HVAC Refrigerants




Timeline of Refrigerant Usage
Montreal Protocol Signed
Kyoto Protocol Signed
No new R-22 for service
No new equipment with R-123
in developed countries
No new equipment with
R-123 or R-22 in
developing countries
All CFC production
Stopped (R-11,R-12) in
developed countries
No CFC's for
developing
countries
No new R-123 for service
in developed countries
1990
2000
2010
2020
2030
2040
2050
Production of most
CFC equipment ended
No automotive use of
R-134a in Europe
Continued use of recycled R-22,
R-123 for developing countries
Today
No new equipment
with R-22
Continued use of recycled R-123
Continued use of recycled R-22
Continued use of recycled CFC's
Note: Included in the use of "recycled" refrigerants is also the use of stockpiled supplies of the refrigerant produced before the phase out date. In addition, there is no restriction on the importation of recycled and recovered supplies of refrigerants.


Typical Trane Centrifugal Chiller Efficiencies
Average
ASHRAE 90.1
97% of Total
3% of
Total
Top 25%
Performance
Medium
Performance
Bottom 25%
Performance
.45
.46
.47
.48
.49
.50
.51
.52
.53
.54
.55
.56
.57
.58
.59
* Data based on Trane Centrifugal Sales average 2003-2005 adjusted to ARI conditions

Direct Environmental Impact

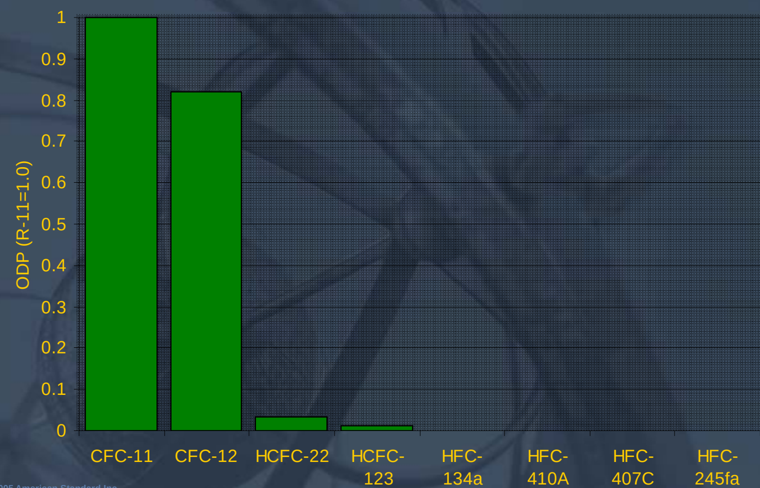


Source: IPCC/TEAP Special Report on Safeguarding the Ozone Layer and the Global Climate System

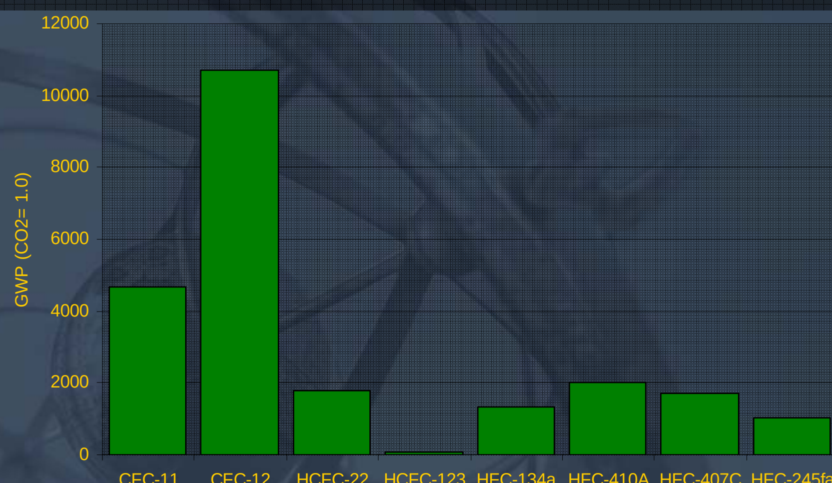
The Best Environmental Solution

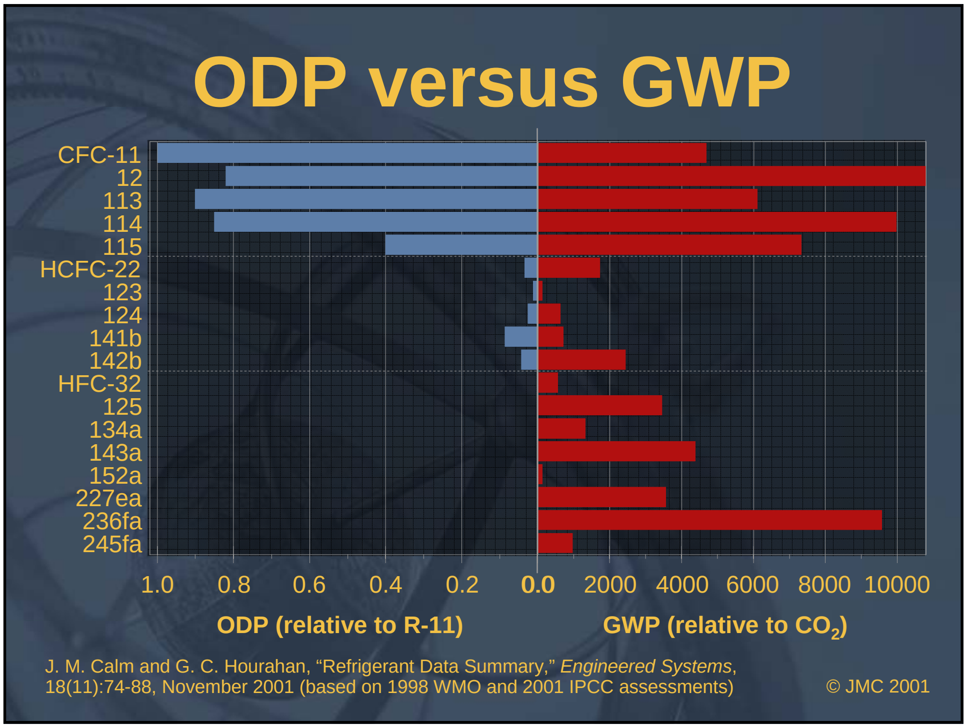
1. Low ODP (Ozone Depletion Potential)
2. Low GWP (Global Warming Potential)
3. High operating efficiency
4. Short atmospheric life
5. Low leakage rates (low operating pressure)

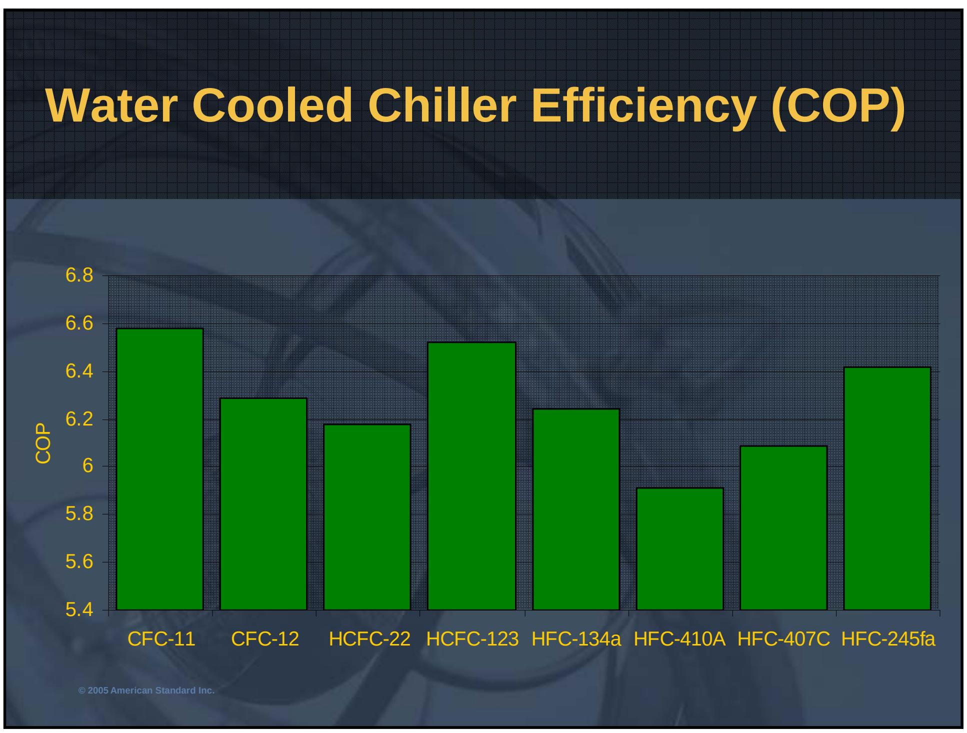
Ozone Depletion Potential (ODP)



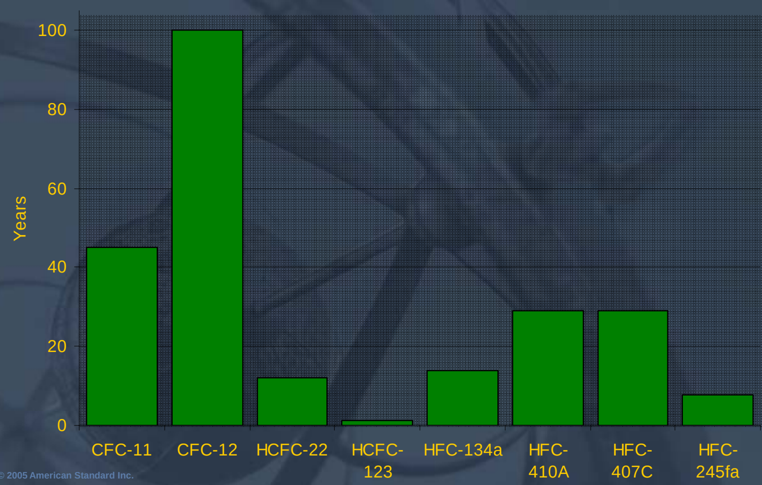
Global Warming Potential (GWP)



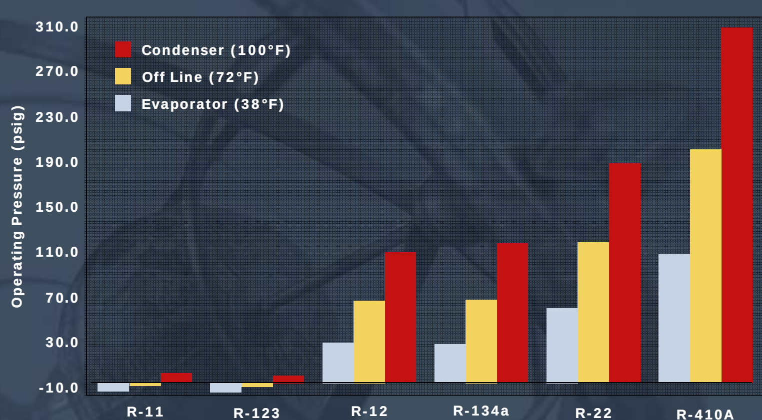

ODP versus GWP
CFC-11
12
113
114
115
HCFC-22
123
124
141b
142b
HFC-32
125
134a
143a
152a
227ea
236fa
245fa
1.0 0.8 0.6 0.4 0.2 0.0 2000 4000 6000 8000 10000
ODP (relative to R-11)
GWP (relative to CO_2)
J. M. Calm and G. C. Hourahan, "Refrigerant Data Summary," *Engineered Systems*, 18(11):74-88, November 2001 (based on 1998 WMO and 2001 IPCC assessments)
© JMC 2001

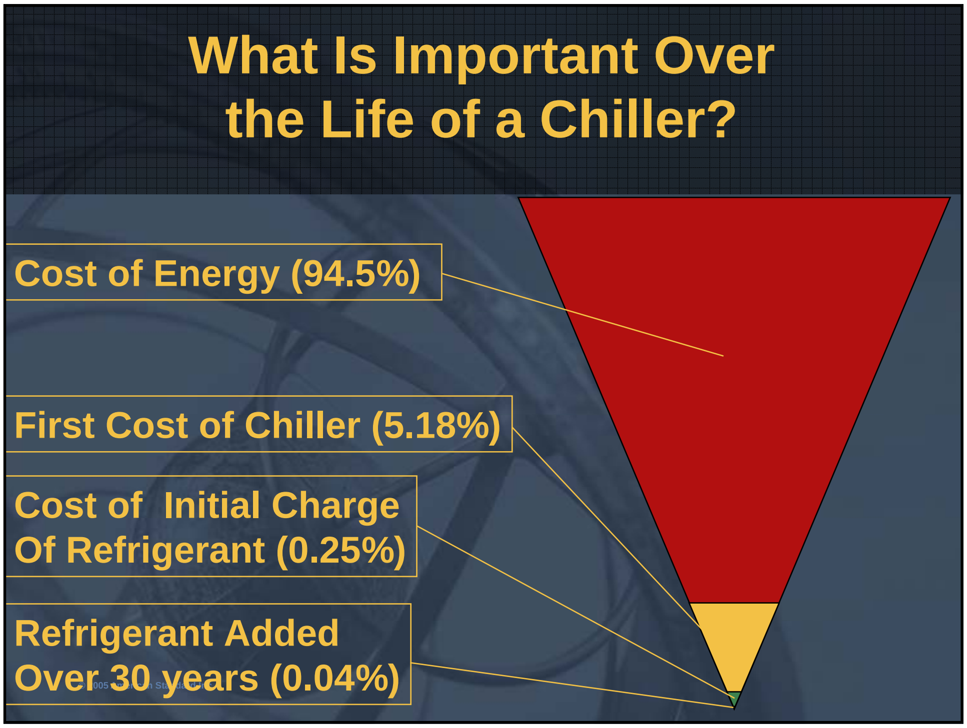

Water Cooled Chiller Efficiency (COP)
COP
6.8
6.6
6.4
6.2
6
5.8
5.6
5.4
CFC-11
CFC-12
HCFC-22
HCFC-123
HFC-134a
HFC-410A
HFC-407C
HFC-245fa
© 2005 American Standard Inc.

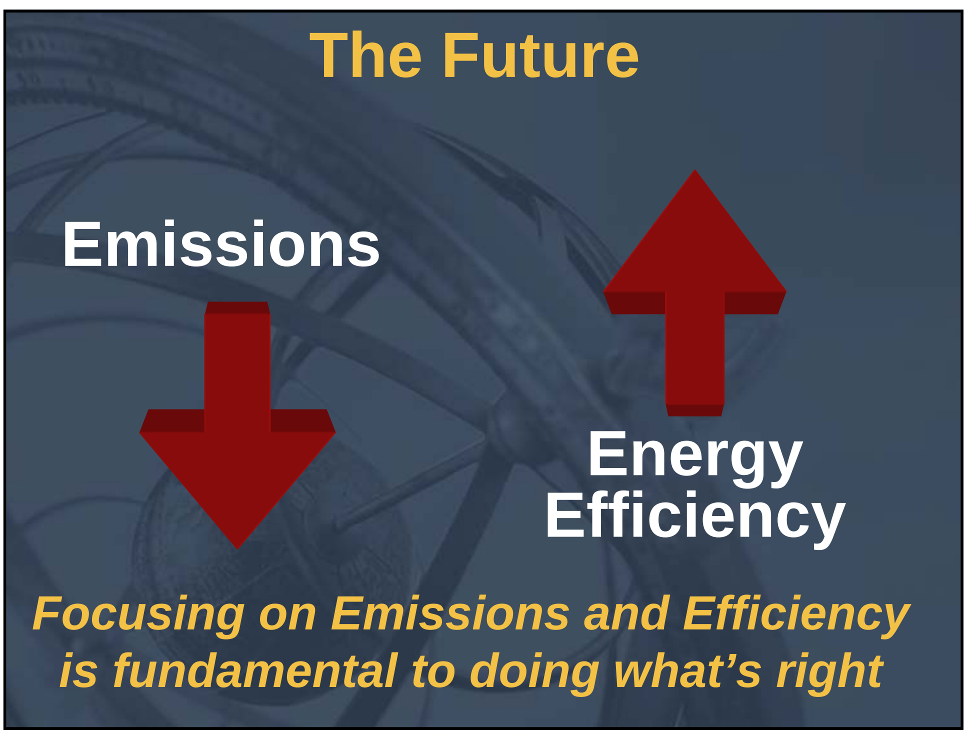
Atmospheric Half-Life (Years)



Chiller Operating Pressure




What Is Important Over the Life of a Chiller?
Cost of Energy (94.5%)
First Cost of Chiller (5.18%)
Cost of Initial Charge Of Refrigerant (0.25%)
Refrigerant Added Over 30 years (0.04%)


The Future
Emissions
Energy Efficiency
Focusing on Emissions and Efficiency is fundamental to doing what's right

Summary

- There are global pressures on the use of all fluorocarbons
- The balanced approach to refrigerant selection is the best way to protect the environment
  - Ozone Depletion
  - Global Warming
  - Energy Efficiency
  - Short atmospheric life
  - Low pressure (low tendency for leakage)
- For both environmental and economic benefit, focus on the highest possible energy efficiency and the lowest possible refrigerant emissions

Important Technical Resources

- Trane: http://www.trane.com/commercial/issues/environmental/
- US EPA: http://www.epa.gov/Ozone/
- US Green Buildings Council: http://www.usgbc.org/
- Energy Star: http://www.energystar.gov/
- James M. Calm: http://www.jamesmcalm.com/
- PAFT (Programme for Alternative Fluorocarbon Toxicity Testing): http://www.afeas.org/paft/
- Refrigerant Pricing: http://www.r22.org/

James Brodrick is the Manger of the Solid State Lighting Portfolio at the U. S. Department of Energy. Dr. Brodrick directs solicitations, portfolio management, strategic planning, quality performance, and industry liaison for research & development and market introduction by the Federal Government of the semiconductor technology to create energy savings in general illumination.

James R. Brodrick
Solid State Lighting R&D Portfolio
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U.S. Department of Energy
Energy Efficiency and Renewable Energy

Solid-State Lighting: Technology & Market

James R. Brodrick, Ph.D.
U.S. Department of Energy

April 12, 2007
The Energy Efficiency Finance Forum
New York, NY

U.S. Department of Energy
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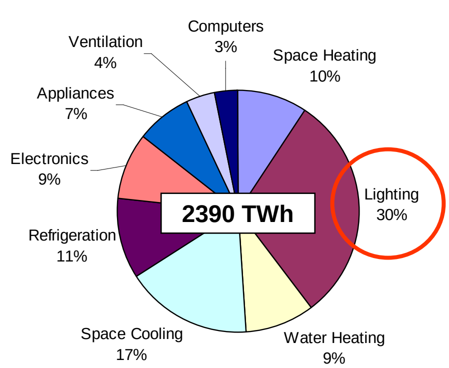
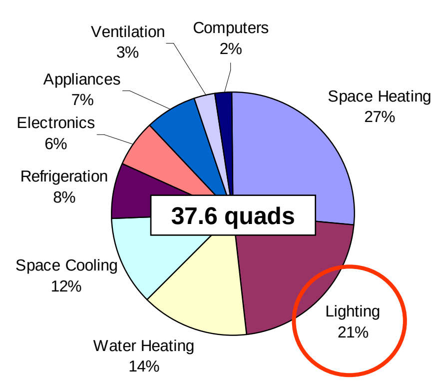
U.S. Buildings Energy End-Use Breakdown, 2001

Site Electricity Consumption



Total Primary Energy (all fuels)



Source: Building Technology Program Core Databook, August 2003. http://buildingsdatabook.eren.doe.gov/frame.asp?p=tableview.asp&TableID=509&t=xls

U.S. Lighting Market

General Illumination – Today

• Lamps	$5-7B (USA)	~20B (World)
• Fixtures	$~20B (USA)	~80B (World)
Total	$25-27B (USA)	~100B (World)

LED – Today

• High Brightness	$~4.0B
• Illumination	$~0.2B

Future

- 2011: $1.0B in High Brightness LED for Illumination
- 2025: $15-20B in annual economic activity
- $280B in cumulative consumer energy savings

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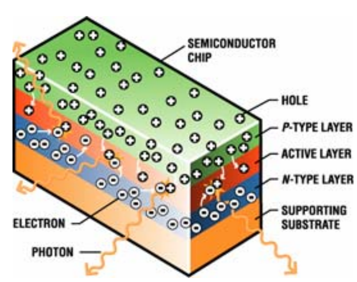
What Is Solid-State Lighting?

- A semi-conducting device composed of layers
  - N-type layer (negative) releases electrons
  - Combine with "holes" from the P-type layer (positive)
  - Electron-hole pair recombinations produce photons, emitted from the active layer
  - Photon color depends on the chemical make-up of the active layers
- Two common types: Light Emitting Diodes (LEDs) and Organic Light Emitting Diodes (OLEDs)



Efficiency and Cost of White Light Sources

Source efficacy – mean lumens (2007)

- Incandescent (60W) ~14 lpw
- Fluorescent (F32T8) ~83 lpw
- HID (400W Metal Halide) ~80 lpw
- SSL (White LED) ~85 lpw

Normalized retail lamp price (2007)

- Incandescent (60W) ~0.30 $/klm
- Fluorescent (T8) ~0.60 $/klm
- HID (Metal Halide) ~2.00 $/klm
- SSL (White LED) ~35.00 $/klm

Research is improving SSL efficacy while decreasing price

Source: Solid-State Lighting Research and Development Portfolio, Multi-Year Program Plan FY'07-FY'12, March 2007

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Lighting Paradigm Shift

Analog	**Digital**
Vacuum tube	Transistor, IC
LP record	CD, MP3
Television CRT	LCD, OLED
VCR tape	DVD, MPEG
Photographic film	CCD

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Unique and Potentially Better Technology

- More efficient
- Low voltage DC
- Directional/surface
- Shades of white light
- Integrated micro-controls
- Long life

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SSL on the Move

- Significant breakthroughs, more to come
- More R&D is needed
- Products on market

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New Product Announcements

- "*Philips Lumileds shatters 350 mA performance records with 115 lm/W LED*"
  January 2007
- *"Seoul Semiconductor introduces world's brightest LED, a 240 lumens single die light source" [100 lm/W]*
  December 2006
- *"Cree delivers the first 160-lumen white power LED" [85 lm/W]*
  October 2006
- *"Nichia releases 80 lm/W power LED"*
  October 2006

Seoul Semiconductor

Cree Inc.

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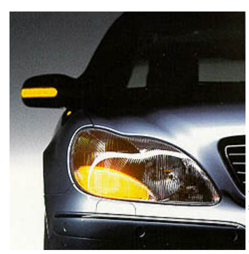
Examples of SSL Applications Today

©Dialight



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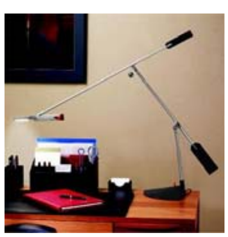

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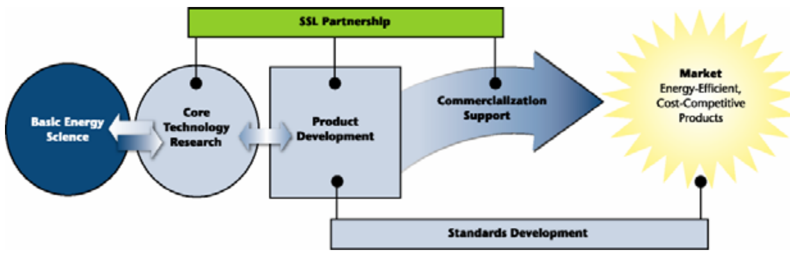
DOE Solid-State Lighting
5 Thrust – Total Program



Guiding technology advances from laboratory to marketplace

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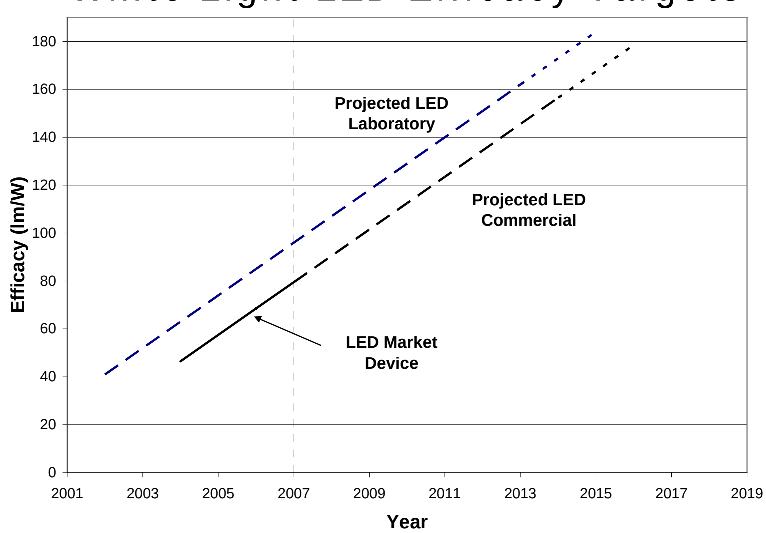
White-Light LED Efficacy Targets



SSL Multi-Year Program Plan, January 2007. Cool White LED Efficacy Projection

U.S. Department of Energy
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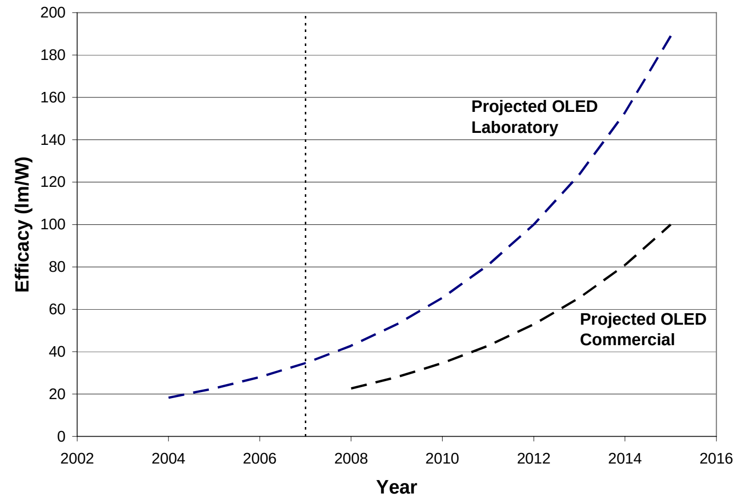
White-Light OLED Efficacy Targets



SSL Multi-Year Program Plan, January 2007.

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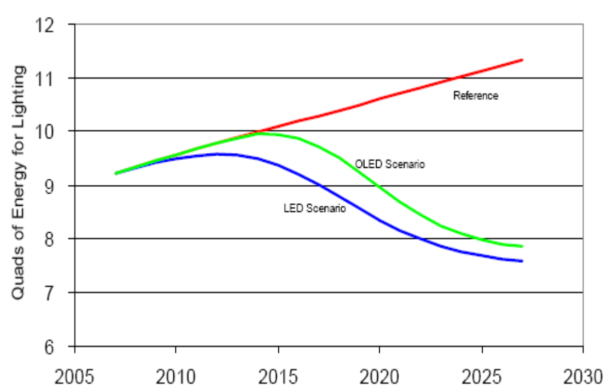
National Energy Consumption for Lighting



Source: Energy Savings Potential for SSL in General Illumination Applications—December 2006.

U.S. Department of Energy
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Technical Challenges for R&D

- LEDs
  - High-efficiency green light
  - Performance at higher current levels
  - Thermal issues
- OLEDs
  - Higher-efficiency blue light
  - Extracting light from a planar structure
  - Lifetime issues:
    - High current density
    - Environmental degradation
  - Cost, cost, cost

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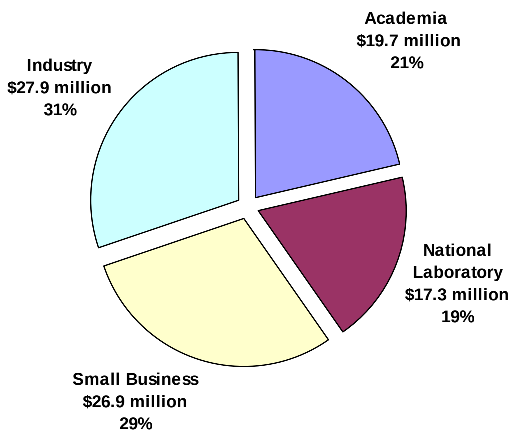
Recipients of DOE Funding



The Department funds solid-state lighting research in partnership with industry, universities, and national labs.

November 2006

DOE Market Introduction

- Lighting for Tomorrow: SSL design competition for fixture manufacturers
- Commercial Product Testing Program: Hard data on available products
- SSL Fact Sheets: "Learn the trade"
- Standards and Test Procedure Development: Laying foundation for organized market
- DOE ENERGY STAR® for SSL: Designates the better performing products
- Demonstrations and Procurement: Downlights in Summer 2007

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Learn More

Voices for SSL Efficiency:
Opportunities to Partner and Participate

Workshop on Market Introduction

Sponsored by DOE and SCE
April 23-24, 2007
Pasadena, California

For more information:
www.netl.doe.gov/ssl

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Stephen Selkowitz is Department Head of the Building Technologies Department, Lawrence Berkeley National Laboratory, LBNL, where he manages 70 technical staff in a building science R&D program encompassing Windows and Daylighting Systems, Lighting Systems Research, Computer Simulation Tools, Commercial Building Performance, Demand Response Research and an Applications Team that helps deploy energy efficiency solutions.

Selkowitz has over 30 years of experience in the field of building energy performance, with an emphasis on research, development and deployment of energy efficient technologies and design practices. Projects range from near term demonstrations of emerging technologies to research that will enable the design and construction of a new generation of “zero energy” or “carbon-neutral” buildings. The projects include basic materials research intended to influence the next generation of building façade and daylighting products, as well as development of new energy simulation tools and information technologies needed to change the practice of building design and operations. The program balances a state-of-the-art research effort with an aggressive technology transfer and implementation effort so that results of the R&D program are effectively adopted by industry and utilized by the building community. Selkowitz participates in a wide range of building industry, government, and professional activities in the U.S. and internationally. He is a frequent invited speaker on the topic of building energy efficiency, and is the author of over 170 publications and holds 2 patents. He was the recipient of the 2002 ACEEE Champion of Energy Efficiency Award. Before joining LBNL he was a principal in a consulting engineering firm and taught courses in Environmental Controls and Alternative Energy Systems.

Energy Efficiency Finance Forum
April 12, 2007

Advanced Building Technologies

Toward a New Generation of Net-Zero Energy, Carbon-Neutral Buildings

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Reducing Energy/Carbon Impacts of Buildings

- **Buildings are a big part of the problem, and thus the solution**
  - 40% of energy use
  - 70% of electricity use; (driving carbon emissions due to coal)
- **We are not going to dig or drill our way out of this**
- **Existing market forces are largely ineffective**
- **It is critically important to *rapidly and drastically* reduce energy/carbon impacts of buildings**
- **Can We Make a Difference?**
- **How Do We Reinvent Our Future?**

Defining a Pathway to the Future

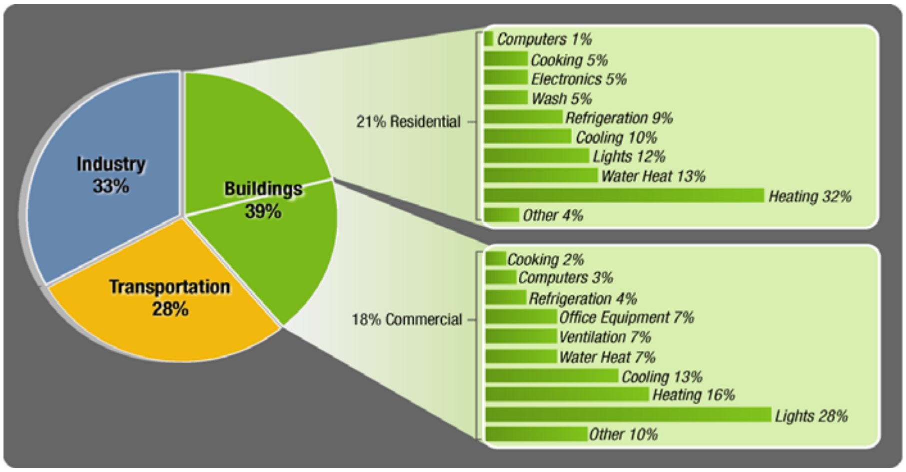
"If I had asked people what they wanted, they would have said faster horses."

Henry Ford

Building Energy Demand Challenge: End Use Energy Consumption

Buildings consume 39% of total U.S. energy

- ***71% of electricity and 54% of natural gas***



Business Perspectives and Opportunities

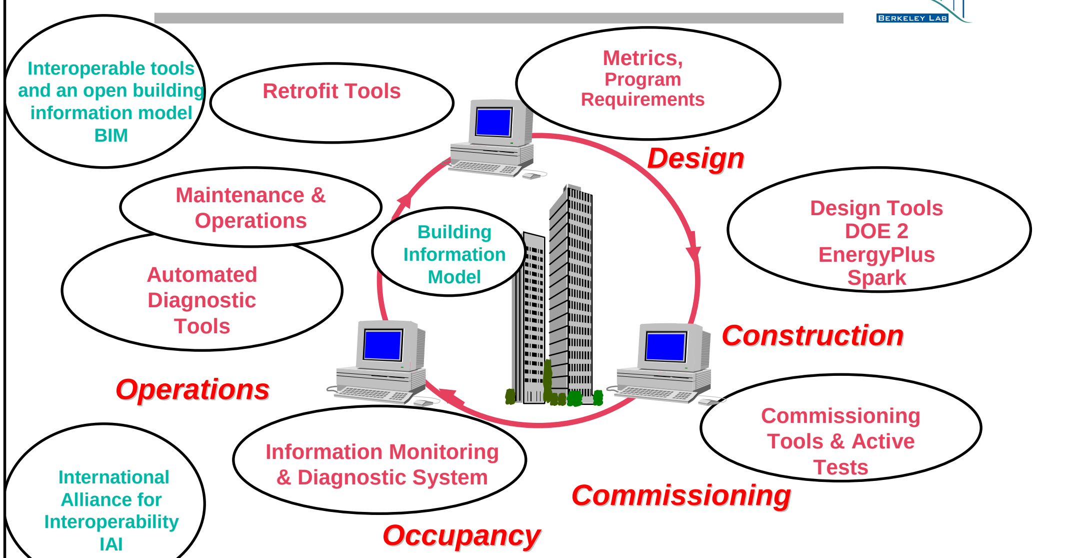
“Widget” - Hardware Perspective:

Device <--> Building System <--> Building <--> Power system

Building Lifecycle Services Perspective:

Planning -- Design -- Construction -- Operations -- Maintenance -- Renovation

Information Technology-based Building Life-Cycle Performance View

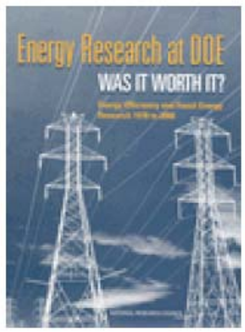


Technology: Low-E Windows

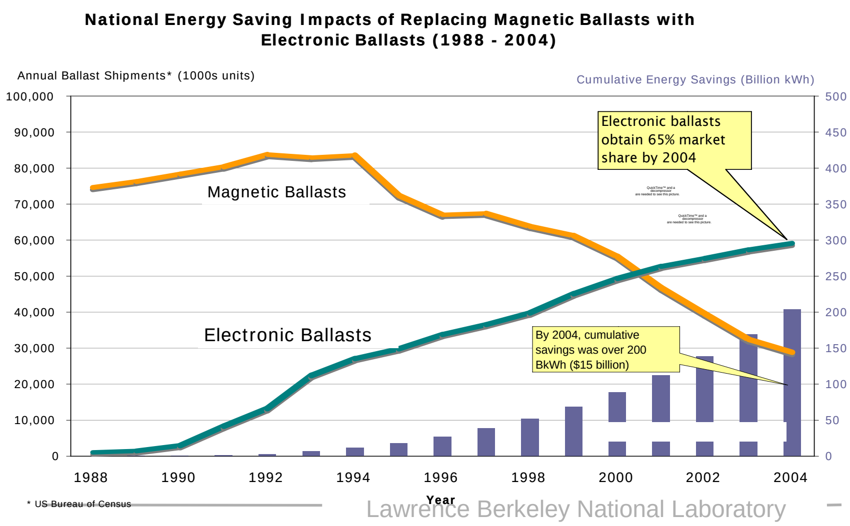
- Challenge: Double glazed windows cost U.S. consumers $20+Billion per year in unneeded energy costs
- Triple glazed windows, too heavy, costly
- **Solution: Low-Emissivity Coating and gas fill**
- **R&D and Market Issues:**
  - Coating design
  - Window Thermal Performance optimization
  - Manufacturing technology
  - Durability
  - Cost
  - Integration into a complete window
  - Rating and labeling performance
  - Field test to verify performance vs Climate, application

Low-E Windows: Impacts

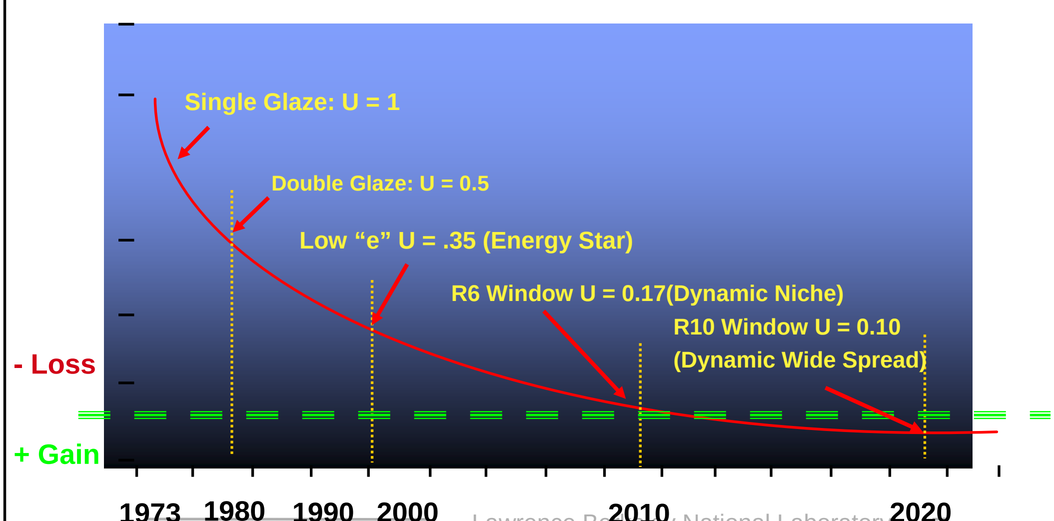
- R&D Action
  - DOE R&D program
  - Industry R&D investments --> investments in production
- Impacts:
  - Low-E Glazing Market growth
    - 1980: 0
    - 1990: 120M sf
    - 2003: 800M sf
- **National Academy study**
  - R&D investment vs Energy Saved and Net Economic Return
  - Effective R&D has huge ROI:
    - $ millions invested; $billions returned
- **Lessons learned**
  - Long lead time from Lab R&D to widespread market application
  - Widgets vs industry infrastructure- e.g. coating --> window
  - Public - private partnerships can be effective

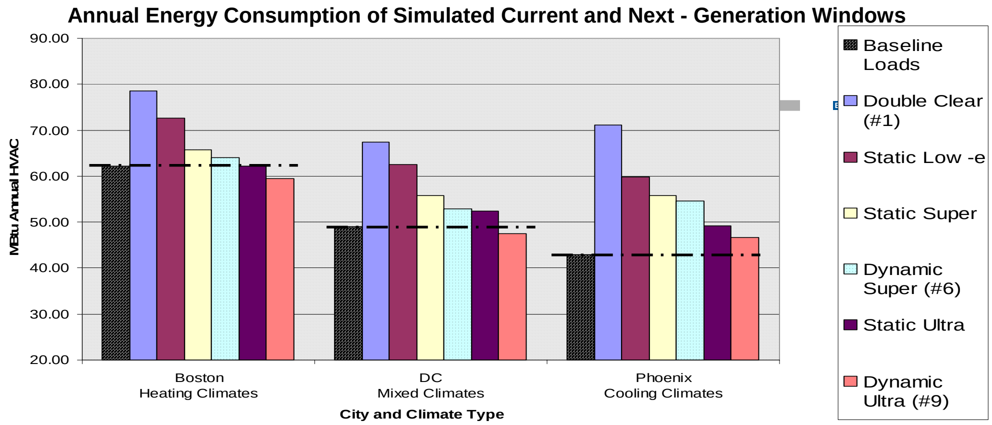


Electronic Ballast Success Story



Advanced Windows Can Become Energy Producers





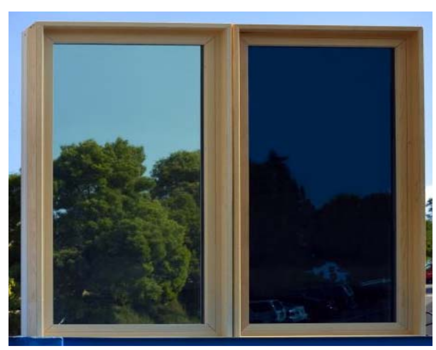
- **Static** windows have constant U and SHGC
- **Dynamic** windows have constant U-factors but have seasonally variable SHGCs

- Static windows are selected to minimize annual energy consumption:
  - In heating and mixed climates, static windows are high solar gain
  - In cooling climates, static windows are low solar gain.

	Window	U-factor (Btu / ft^2 – hr – F)	SHGC
1	Double clear	0.49	0.56
2	Double (low-e) high solar	0.36	0.53
3	Double (low-e) low solar	0.34	0.30
4	Triple (“super”) high solar	0.18	0.40
5	Triple (“super”) low solar	0.18	0.26
6	Dynamic super	0.18	0.26 or 0.40
7	Ultra high solar	0.10	0.35
8	Ultra - low solar	0.10	0.10
9	Dynamic Ultra	0.10	0.10 or 0.35

Next Generation Prototype “Zero Energy” Window

- Current Prototype
  - Dynamic Glazing; SHGC (0.04 – 0.34)
    - Electrochromic glazing
  - Highly Insulating; U Value 0.18, R 5.6



- Ongoing R&D
  - Increased dynamic range
  - Cost-effective production
  - Frame heat transfer R&D (50% of heat lost through 20% of area)
  - Systems benefits:
    - Better comfort
    - No perimeter ducts
    - No central heating system??

LBNL Façade Test Facility

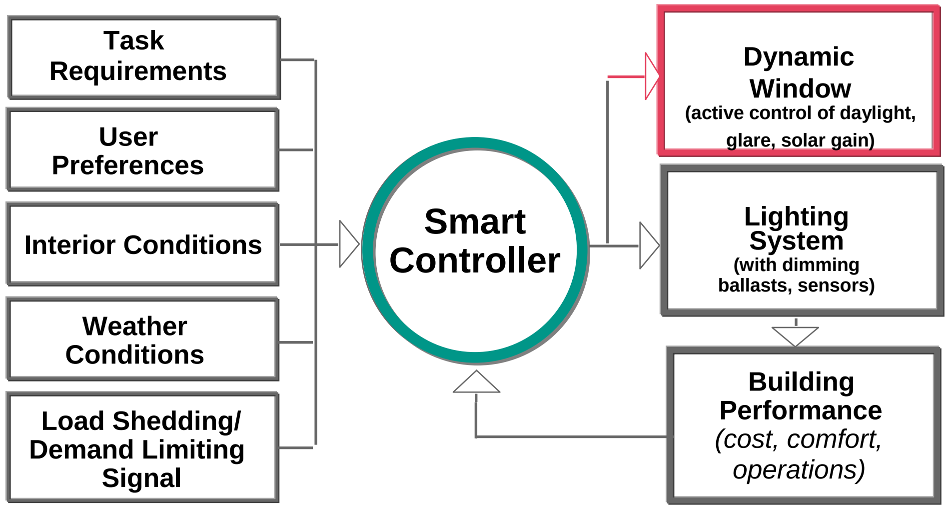
EC windows	EC windows	Spectrally selective low-E
Blinds*, no blinds	Blinds*, no blinds	Blinds*, no blinds
Daylight or glare	Daylight or glare	
Control mode	Tv=0.56-0.02	Tv=0.41
	SHGC=0.42-0.09	SHGC=0.23

*Venetian blinds fully down, 45 deg angle
Glare control: When direct sun, Tv of EC=0.05.

Switchable Electrochromic Windows:

- LBNL full-scale windows field test facility

Intelligent Control of Dynamic Systems



New Approaches to Efficient Lighting

1. **Use more efficient lamps and fixtures**, best suited to specific tasks

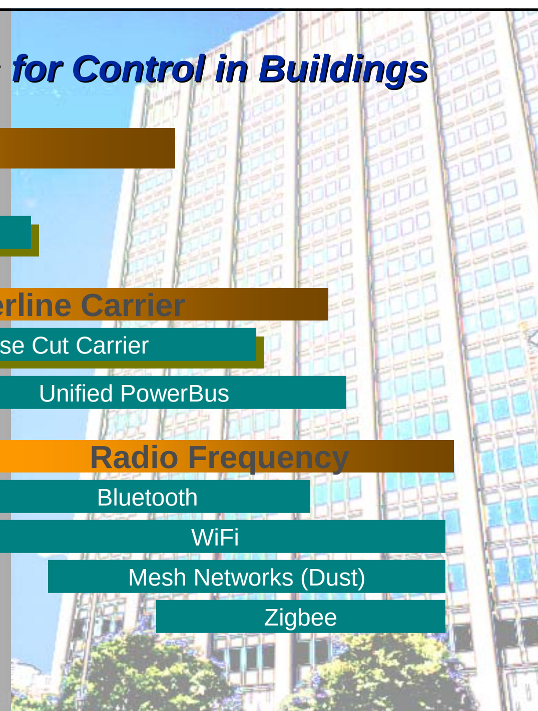
2. But, **Lighting design, operation and energy use** (**should also**)
   - **Vary with task**
     - Task lighting needs- e.g. talking on phone vs brain surgery
     - Task vs Ambient lighting needs
   - **Vary with location in building**
   - **Vary with user**
     - Age, use of glasses, medical conditions,….
   - **Vary with time**
     - e.g. available daylight, load management need,….
     - Contrast: night vs day
   - **Address perception in the space** as well as more easily measurable engineering units, e.g. lux or footcandles

3. **Largest NEW savings in the next 10-15 years will come from CONTROLS**

Lighting Controls

- **Occupancy controls well accepted**
- **Conventional Lighting Controls Need Further Improvement**
  - Improved photocell sensors
  - Controls capable of exploiting many control strategies
  - Modular integration of occupant and photo-sensing controls
  - Lighting control integrated with variable transmittance windows (automated blinds, electrochromic glazing)
- **Make lighting components "smart"**
  - Embedded intelligence in ballasts, fixtures, switches
- **Link them in Networks**
  - Mesh Networks with Wireless Controls
  - Distributed building control networks

Networking Protocols for Control in Buildings



Wired fieldbus

DALI

IBECS

Powerline Carrier

Phase Cut Carrier

Unified PowerBus

Radio Frequency

Bluetooth

WiFi

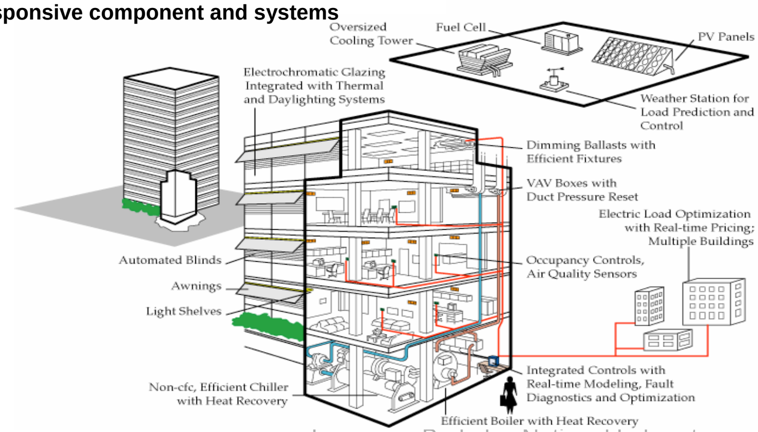
Mesh Networks (Dust)

Zigbee

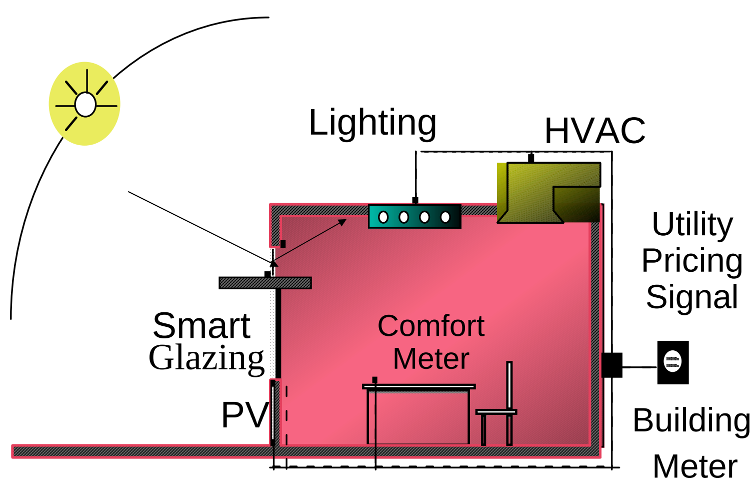
- **Wired systems for new construction and major rehab**
- **Powerline carrier or wireless RF for existing buildings**

Building Systems Integration Opportunities

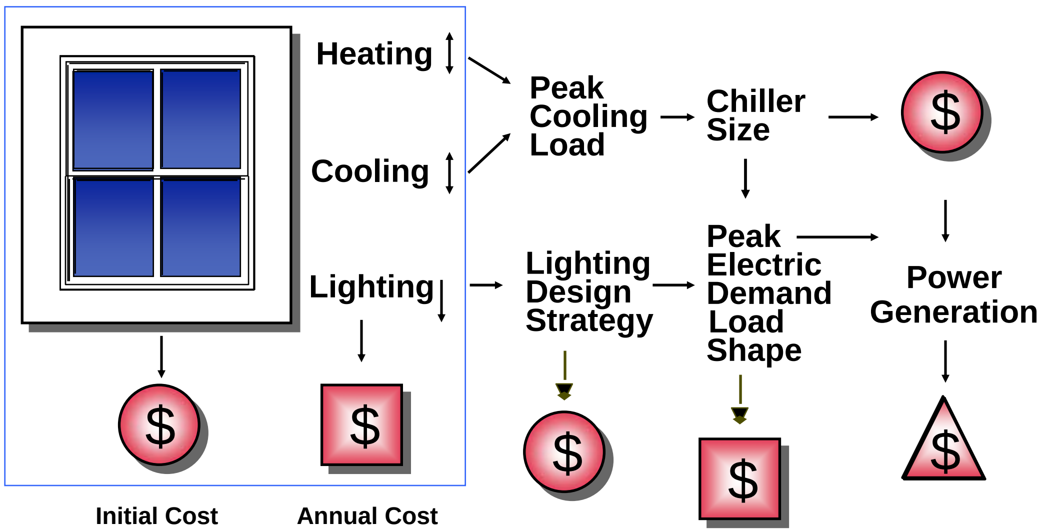
- Underlying Building Information Model
- Smart Integrated Design
- Intelligent, Adaptive Controls for Occupant <-> Facility Manager
- Efficient technologies
- Smart, responsive component and systems



Conceptual Design for a Carbon-Neutral Office using an Integrated Building Facade Systems



System integration Cost tradeoffs



Energy Costs in Perspective

Cost / Sq. Ft. Floor -Year

- **Energy Cost: $2.00**
- **Maintenance: $3.00**
- **Taxes: $3.00**
- **Rent: $30.00**
- **“Productivity” $300.00**

The New York Times HQ Building

Owners program:
- Highly glazed façade gives workers views and allows the city to see “news” at work
- But glare, cooling, visibility etc

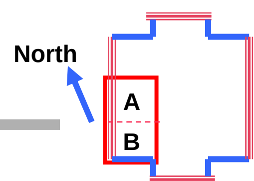
Need/Goal:
- Develop integrated , automated shading and dimmable lighting system
  - Affordable, reliable and robust
- Transform the market- push these solutions toward widespread use

Challenge:
- **How to develop a workable integrated hardware/software solution**
- **How to “guarantee” that such a solution will work in practice**

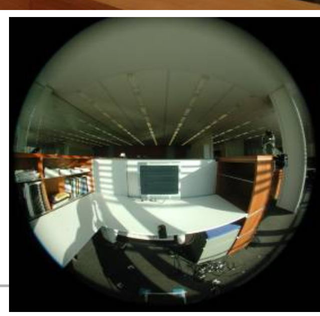
- 1,600,000 sq.ft.
- Full glass facade
- Occupancy in 2007

- Public/Private Partnership:
  - NYSERDA, DOE, CEC

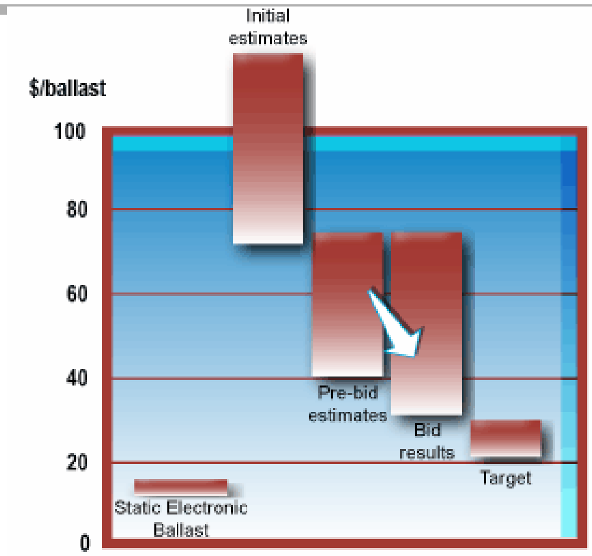
Approach: Test Performance in a Full-Scale Mockup



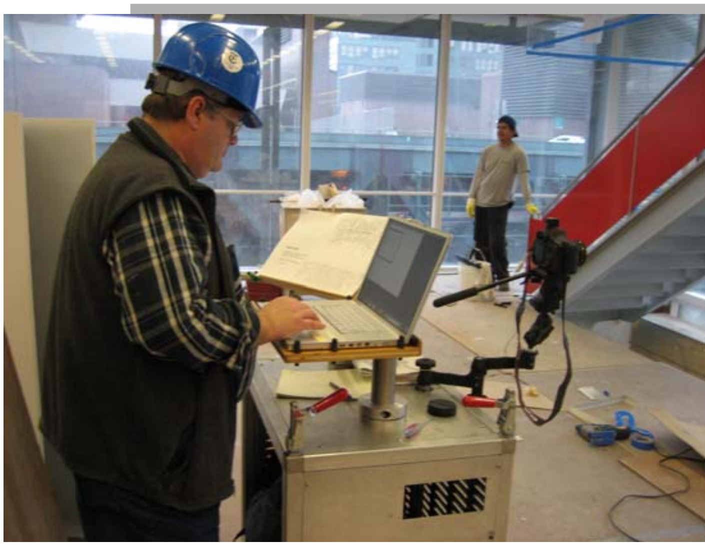
- Shading, daylighting, employee feedback and constructability: ~4500 sq ft mockup
- Concerns with glass facade:
  - —Window glare (Tv=0.75)
  - —Control of solar gain/cooling
  - —Daylight harvesting potential
- Real sun and sky conditions near construction site, 12-month monitored period

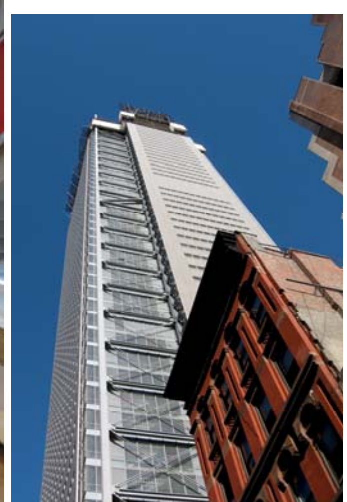


Progress Toward Cost Effective Dimming Electroni Ballast



The New York Times Headquarters: Shade Commissioning Tool being Tested





New York Times HQ
Occupancy 2007

Major construction complete
Commissioning underway
Occupancy 2007
Extensive monitoring planned



More Info

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Delurey is President of the Wedgemere Group, a firm that specializes in marketing, communications and public policy services in the area of Demand Response.

Wedgemere manages the Demand Response and Advanced Metering Coalition (DRAM), an association of technology and service providers that focuses on education and outreach activities. Wedgemere also manages the U.S. Demand Response Coordinating Committee (DRCC), an organization of ISOs, utilities and other parties that work to develop and exchange information among regions, states, and practitioners. In addition to its research activities, the DRCC is well known for its Webinar series on Demand Response and for its National Town Meeting on Demand Response.

Delurey has over 20 years of experience in the energy industry, with the majority of it in the electric industry and much of that working on demand side issues and programs. Prior to founding Wedgemere Group, he was Chief Marketing Officer for Nexus Energy Software. Previous to that, he was Vice President of External Relations for New England Electric System, where he had responsibility for state and federal affairs and corporate communications. Earlier in his career, he held marketing-related positions with both Boston Edison and Southern California Edison. Prior to those positions, he worked on demand side programs and products at Xenergy and at the New York State Energy Office.

Presentation to Energy Efficiency Finance Forum

April 12, 2007

Dan Delurey
Demand Response & Advanced Metering Coalition (DRAM)
www.dramcoalition.org

Demand Response and Advanced Metering Coalition (DRAM)

- Founded in 2001
- 501 c (6) trade association for the demand response industry
- Focused on providing information on demand response technologies and services to policy makers, utilities, media and stakeholder parties.

DRAM Members

- Cellnet
- Comverge
- Echelon
- Elster Electricity
- eMeter
- EnergySolve
- EnerNOC
- ESCO Technologies
- Itron
- Landis + Gyr
- Sensus Metering
- Silver Spring Networks
- SmartSynch
- Trilliant Networks

U.S. Demand Response Coordinating Committee (DRCC)

- Founded in 2004 as charitable non-profit 501 c 3 organization
- Mission is to develop and facilitate the exchange of information and expertise on demand response among regions, states, and individual parties
- Served as the official U.S. stakeholder and funding group for the Demand Response Project of the International Energy Agency
- Responsible for the National Town Meeting on Demand Response Series of events and the DRCC Webinar Series

DRCC Members

- Ameren
- American Electric Power
- Hess
- Hunt Power
- IBM
- ISO-New England
- Mid-American Energy
- Midwest ISO
- National Grid
- NYSERDA
- PJM
- Progress Energy
- Pacific Gas & Electric
- Salt River Project
- San Diego Gas & Electric
- Southern California Edison
- Southern Company
- TVA
- Wal-Mart
- Xcel

Demand – An Evolutionary Perspective

- Conservation
  - Running out of oil
- Load Management
  - Curtailment and Control
- Efficiency – Phase 1
  - Get the same benefit with less energy
- Demand Side Management
  - Utility-oriented; IRP
- Efficiency – Phase 2
  - Beyond the end use
- Demand Response
  - Dynamic, communication and price-based
- Optimization (Smart Age)
  - Systems approach: Smart Grid, Smart Homes, Smart appliances

Load Management – then and now

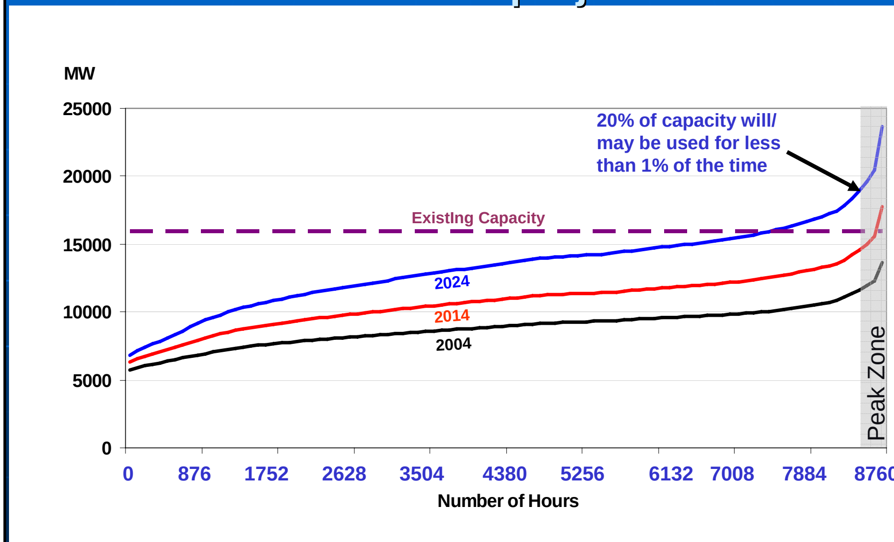
- Emergency-driven
- Blackout-avoidance
- Reliability-focused
- Old Technology
- Blunt Instrument
- One size fits all
- Opt-in

- Customer choice
- Optimize Efficiency
- Mass Mkt Capability
- New Tech; Internet
- Tie to Mkt Dynamics
- Risk/Reliability tool
- Smart Bldgs & Appl.
- Opt-out

Demand Response Compared to Traditional Efficiency

- Dynamic in implementation
- Based on change in pricing
- More benefits but in more and different places
- Utility or other load serving entity is more involved
- More precisely measured and verifiable

NSW Annual Load Curve current and projected



Out-year projections assume extreme weather and no new DSM

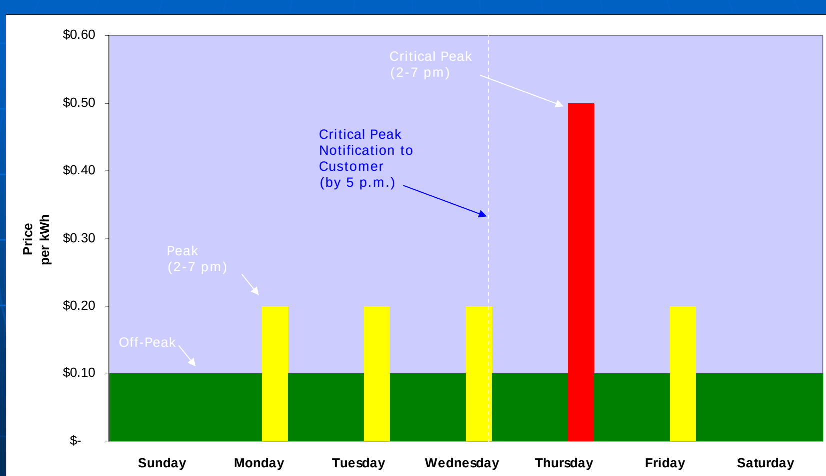
DRCC Definition of DR

Providing electricity customers in both retail and wholesale electricity markets with a choice whereby they can respond to dynamic or time-based prices or other types of incentives by reducing and/or shifting usage, particularly during peak periods, such that these demand modifications can address issues such as pricing, reliability, emergency response, and infrastructure planning, operation, and deferral.

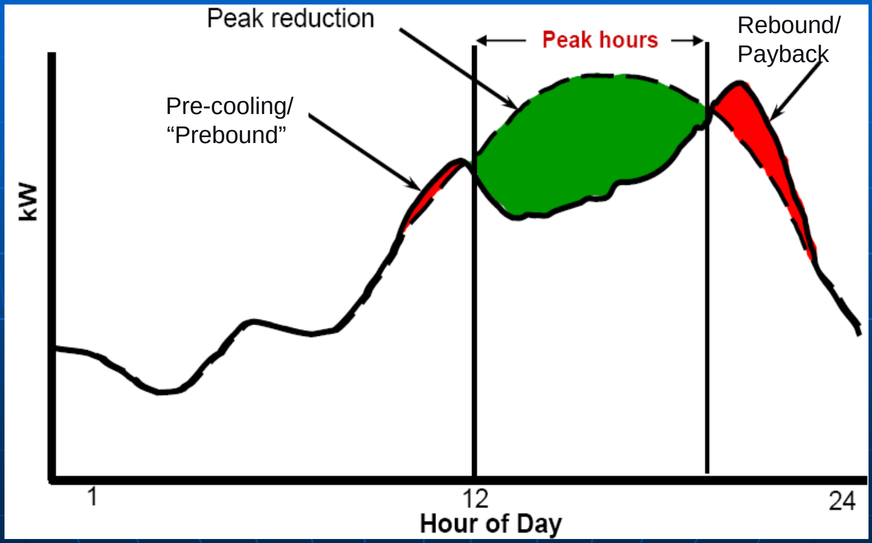
Different Views of the Elephant

- DR is all about reliability
- DR is all about efficient markets
- DR is all about mitigating market power
- DR is all about energy efficiency
- DR is all about peak management
- DR is all about making a smart grid
- DR is all about reducing utility costs

Critical Peak Pricing Structure

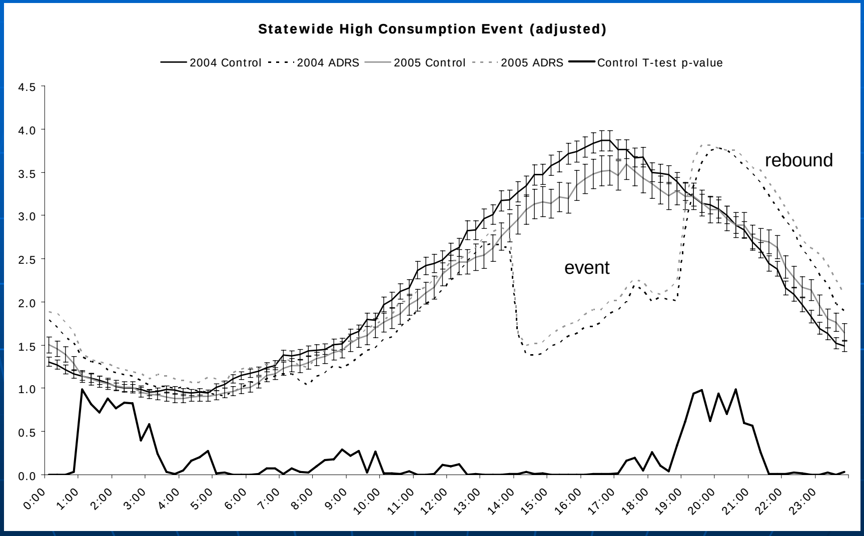


Schematic of Typical DR



Source: Chris King, eMeter Corporation

Experience Resembles Theory
California ADRS Data



"Are Smart Homes More Efficient? Energy Impact of California's Residential Automated Demand Response Program" *Katherine Wang, Joel Swisher, Rocky Mountain Institute*

Basic DR Approaches

Alter cycling regime

Examples:

- HVAC, especially air conditioning
- Metal melting
- Other thermal (e.g. hot water, refrigeration)

Shift to off-peak hours

Examples:

- Appliances, equipment
- Water pumping (swimming pools, agricultural, municipal)

Shut off completely or dim

Examples:

- Lighting
- Fans

Types of DR Programs

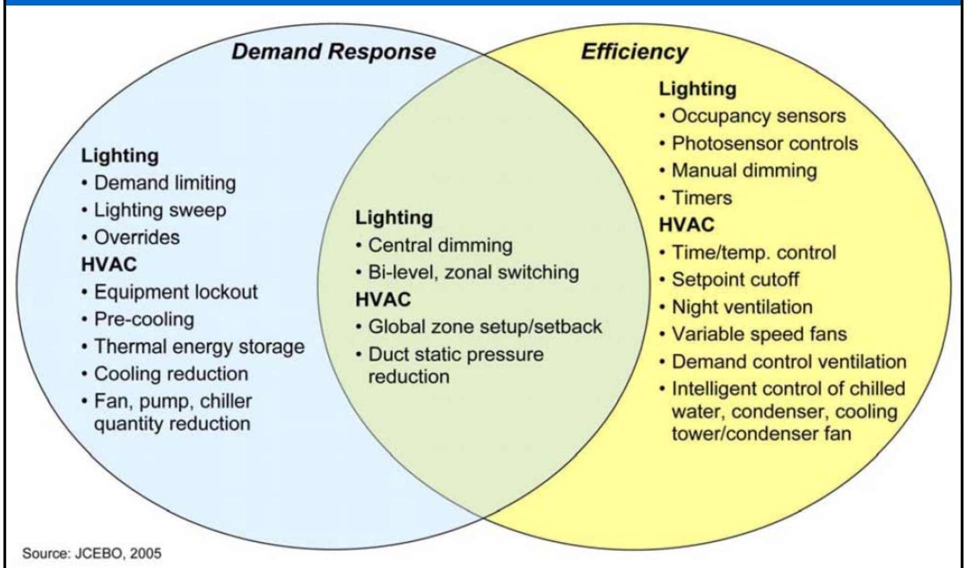
- Time-based pricing
  - Time-of-use
  - Critical peak pricing
  - Real-time pricing
- Interruptible/Curtailable
  - Direct load control
  - Large customer interruptible
  - Home and building automation

Types of DR Technologies

- Measurement
- Information
- Communications
- Controls
- Data Management
- End-Use Specific Controls
- Smart Appliances and Devices

Examples of DR Technologies

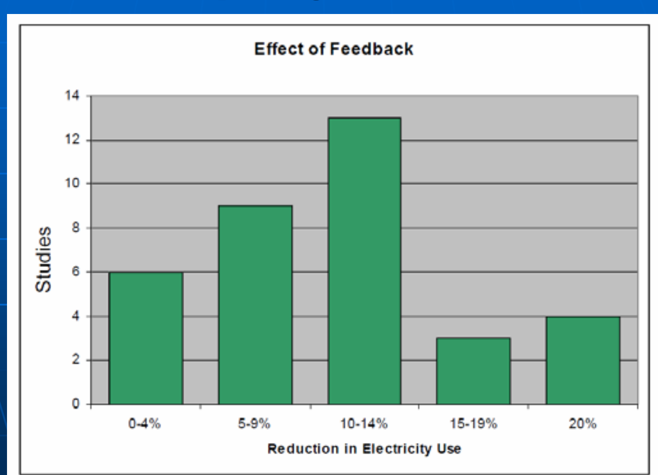
- Advanced Metering (aka smart meter)
- Smart Thermostat, etc
- Energy Management System
- In-Premise Display
- Communications Network
  - LAN, WAN and Zigbee/Home Plug
- Dynamic Storage
  - Plug-In Hybrid Electric Vehicles
  - Thermal and Advanced Battery
- Smart Appliances



Overlap of Efficiency and Demand Response

From Sila Kiliccote and Mary Ann Piette, Lawrence Berkeley National Laboratory

Conservation Effect of Feedback programs



Source: King and Delurey, *Public Utilities Fortnightly*, March 2005

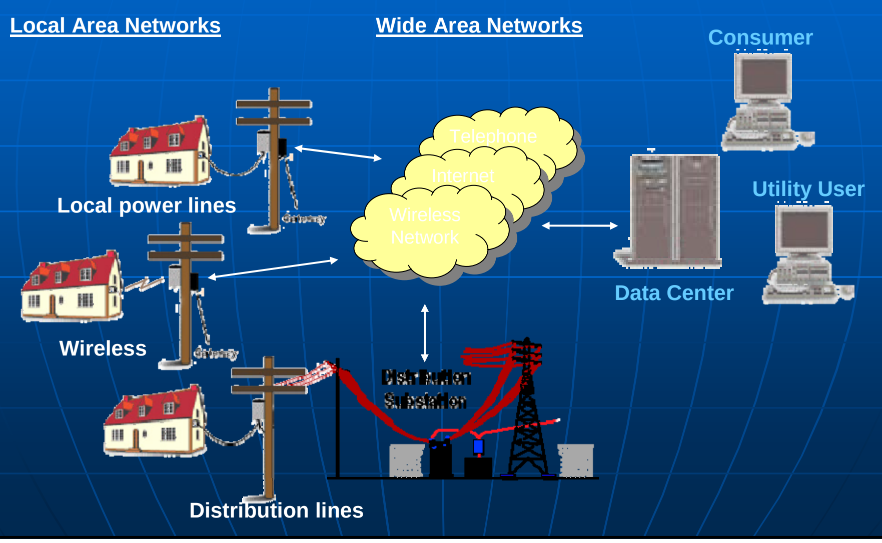
DR impact on the Environment

1. Conservation effect lessens environmental impacts
2. Load flattening defers and/or avoids need for some transmission lines, powerplants
3. DR fits well with intermittent renewables and with PHEVs
4. DR alters generation/resource/unit mix

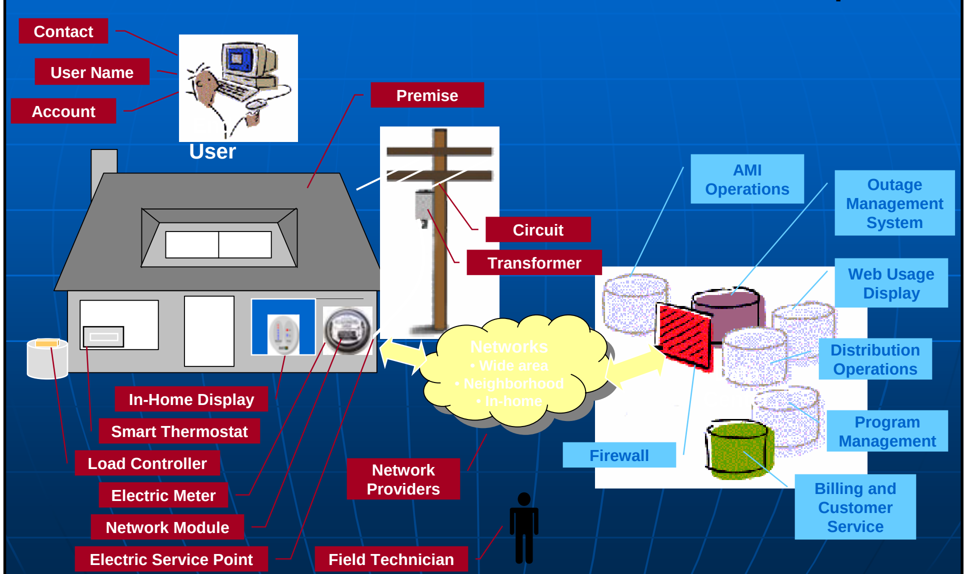
DR & Environment (2)

4. Alters generation mix, by fuel and by unit, as
   - On-peak units down; off-peak units up or flat
   - Fuel types (often oil and gas decrease; coal increases)
   - Older, marginal units
   - Emissions footprint
     - CO_2
     - Ambient: SO_x, NO_2, particulates, toxics
   - Time of pollution and smog/ozone formation
     - Ozone Transport Commission activity
   - Localized impacts

AMI Communication Networks

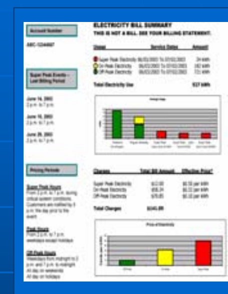


AMI Data and Software Relationships



New Customer Options Enabled by AMI (Basic)

Service	New Options Supported
Billing	Choice of billing date No estimated bills Month-to-date bill Projected month-end bill
Pricing	Flat rates Time-of-use Critical peak pricing Real-time pricing
Outage Response	Automatic outage detection Restoration verification
Usage Information	Real-time meter read First call problem resolution Web data access Monthly detailed usage reports Baseline threshold alarms Month-to-date usage Daily or hourly data to walk customer through usage patterns



Advanced Metering Applications

Technical Capability	Applications Supported
Hourly Data Recording	Dynamic pricing (real-time, critical peak, time-of-use) Load research Distribution system planning and asset use Unaccounted for energy (energy theft, line loss, etc.)
Remote Communications	Remote meter reading Move-in / move-out meter reading Outage and restoration management
Interface to Utility Systems	Billing Customer service Distribution operations
Interface to Load Control	Demand reductions during emergencies Automated response to dynamic pricing
Customer Data Access	Customer energy information and management

Drivers for Demand Response

- Customer desire for information, choice and control
- Modernization of infrastructure
- Modernization of the utility industry
- Utilities like demand response
- Optimization of planning and operations
- Policy makers desire to lower prices
- Desire for increased reliability and security
- Dynamic emissions management (Nox and Sox)
- New improved platform for energy efficiency
- Monetization of reductions and offsets in a carbonized economy

Challenges for Demand Response

- Questions about Environmental Profile
- Foot in many camps – the challenge of many faces
- Not included in most discussions of energy efficiency
- Lack of trust by some parties in customers and utilities to do the right thing

A New Era

- Information to customers about usage, including near-term feedback on efficiency actions
- New control – automated and/or discretionary - over end-uses and electricity bills
- New abilities for measurement and verification – as kWh reductions gain additional currency in climate change regime
- New pricing options for customers – in restructured and traditional regulatory situations
- Support for intermittent renewable energy

A New Era

- Support for clean, economically competitive electricity DG
- Dynamic emissions control for SOx and NOx
- Smart connected and controllable appliances (prices to devices)
- Support for Cash-Back Hybrids and "green fill"
- Creation of a dynamic "electanet"
- Greater overall energy efficiency
- Greater overall kwh reductions


For More Information
Dan Delurey
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Web Sites
www.dramcoalition.org
www.demandresponseinfo.org
Webinars
www.demandresponseinfo.org
National Town Meeting on Demand Response
www.demandresponsetownmeeting.com

Refreshment Break

Panel Discussion
Innovative Financing Structures and Business Models

Moderator:
Ed Feo, *Partner*
MILBANK, TWEED, HADLEY & MCCLOY, LLP

Panelists:
Jeff Eckel, *President & CEO*
HANNON-ARMSTRONG

Stephen Cowell, *Chairman and CEO*
CONSERVATION SERVICES GROUP

Robert Pratt, *Sr. Vice President, Climate Change/Energy*
KENDALL FOUNDATION

Richard Cowart, *Director*
REGULATORY ASSISTANCE PROJECT

Edwin F. Feo
Los Angeles
213-892-4417
efeo@milbank.com

Mr. Feo represents companies in corporate and financial transactions in the energy and infrastructure industries. In over twenty-five years of practice, he has led numerous transactions in the United States, Latin America and Asia. These transactions have included the development, acquisition and financing of generation assets, transmission lines, gas pipelines, petrochemical plants, offshore oil rigs, telecommunications infrastructure, water and waste facilities and toll roads. Recently, he has represented:

- The sponsors in the $1.8 billion privatization of the Chicago Skyway.
- The sponsors in the $533 million acquisition of the equity interests in the Dulles Greenway, a 14 mile private toll road in Virginia.
- An international consortium in their bid for the privatization of the Indiana Toll Road, a 157 mile toll road crossing Indiana.
- The lenders in the financing of the Cross Sound Cable Project, an undersea transmission cable linking Connecticut to Long Island.
- The lenders in the financing of the Pocahontas Parkway, an 8.8 mile privately operated toll road in Virginia.
- The lenders in the $822 million financing of the Sabine Pass LNG facility.
- The lenders in the Three Winds portfolio financing (the *Project Finance* magazine 2004 North American Renewable Energy Deal of the Year).
- The sponsors in the acquisition and financing of the 5,300 MW Duke Southeast Portfolio by Matlin Patterson affiliate KGen Power.
- The lenders in the $71 million financing of the Top Deer Wind Energy project.

In March 2005 he was named in the *California Lawyer* magazine "Attorneys of the Year" in the Energy category for spearheading the largest energy deals of 2004. The following month, *The American Lawyer* named Mr. Feo "Deal Maker of the Year" for spearheading the innovative $1.82 billion Chicago Skyway privatization, also named North American Transport and Overall Deal of the Year by *Project Finance* magazine. He was also listed in the *International Who's Who of Project Finance Lawyers* for 2007.

Mr. Feo graduated with a BA and JD from UCLA, and was elected to *Phi Beta Kappa*, the Board of Editors of the *UCLA Law Review* and Order of the Coif. Mr. Feo is a member of the Board of Trustees of the California Science Center Foundation and a member of the Board of Governors of the Aquarium of the Pacific.

*Jeffrey Ecke*l is the President and CEO of Hannon Armstrong and brings 25 years of experience in financing infrastructure assets, in both financial services and industry capacities. He founded Hannon Armstrong's federal energy practice in 1986 and later Wartsila Power Development in 1991, a leading international IPP developer for much of the 90's, as well as EnergyWorks in 1995, a Bechtel joint venture. He returned to Hannon Armstrong in 1999. He received a BA in political science at Miami University and an MPA from the Maxwell School at Syracuse University.

Mr. Eckel drives a Prius and has averaged 48.5 mpg since its purchase in 2004, saving approximately 34 barrels of crude oil and almost 7 tons of CO_2. And since that is just a drop in the bucket in the global climate change battle, he has continued to push renewables and energy efficiency at work as well as play.

Innovative Financing Structures and Business Models

Observations on Energy Efficiency Financing

March 9, 2007

HANNON ARMSTRONG

- Hannon Armstrong has financed over $1.5 billion in energy efficiency assets since 2001.
- We fund through several Hannon Armstrong Multi-Asset Trusts ("Hannie Mae")
  - 275 separate transactions at $5.5m per transaction
  - 1,200 separate Energy Conservation Measures ("ECM") at $1m per ECM
  - 440 Legal opinions.
- We are proud of the effort to date but recognize this is only the beginning of the energy efficiency finance market.

Proprietary and Confidential

• Aggregation is the key to energy efficiency finance and aggregation has to occur at three distinct levels:

- •At the end user level – common contracts are key
  - •At the ESCO level – credit worthiness and common contracts
    - •At the finance level – securitization is one such tool

•From a finance standpoint, we can only control the third tier financial aggregation requirement. It is up to others in government and industry to supply the necessary aggregation to make energy efficiency finance profitable.

• From an investor standpoint, energy efficiency poses challenges relative to conventional infrastructure finance or even renewable finance.

•In order to invest $1 billion dollars in energy assets, investors will have to do:

- •1 IGCC plant;
- •5 Geothermal projects;
- •13 Wind projects; or
- •**200 Energy Efficiency projects.**

•It is the nature of the asset that it comes in small packages and the finance problem is much tougher to solve than large, project financings.

The great promise in energy efficiency is if the CO2 benefits soon gets factored into the economic and financial analysis.

How Much CO2 for a Billion Dollars?

Technology	CO2 Reductions Annually (Billions of lbs)	Cents/kWh
Energy Efficiency	2.15	6.0*
Geothermal	2.10	7.0
Wind	1.76	9.0
Solar	.47	30+

** ESCO Provided Energy Efficiency as estimate by ORNL and Hannon Armstrong*

From a strict finance standpoint Energy Efficiency does not compete well with Renewable Energy assets.

Technology	Ability to Turn-off for Lack of Payment	Equity/ Coverage	Collateral
Energy Efficiency	4	4	4
Geothermal	3	1	1
Wind	2	2	2
Solar	1	3	3

1 = Best, 4 = Worst

HANNON ARMSTRONG

•While Hannon Armstrong has investments in geothermal, wind and solar assets, we believe the greatest opportunities are in energy efficiency.

•We agree all renewable technologies are critical to achieving CO2 emission stability, however efficiency is approximately a 50% contribution.

•Even though our $1.5 billion investment in efficiency is merely a rounding error in the required CO2 reductions, it has provided us important lessons [*READ: WE MADE LOTS OF MISTAKES ALONG THE WAY*] in aggregation of transactions that we look forward to applying in the years to come.

•We are interested in meeting with anyone focused on AGGREGATION.

Stephen L. Cowell
Chairman and CEO

Stephen L. Cowell founded Conservation Services Group (CSG) in 1984 and is the organization’s chairman and chief executive officer. Mr. Cowell has been the founder and director of numerous energy efficiency and renewable energy organizations during his career.

For the past 30 years, Mr. Cowell has been involved in conservation programs around the country and has successfully advocated for energy efficiency as an electric power supply option. He has helped create and build the industry through sound public policy, legislation, development of utility company programs, and establishment of trade ally networks and delivery of cost-effective residential and commercial and industrial energy efficiency programs. Under Mr. Cowell’s leadership, CSG has designed and implemented conservation and renewable energy programs for utilities, state agencies, and other groups throughout the U.S. and has provided water and power conservation services to over one million businesses and households.

Advanced Environmental Attributes

From White Tags to RGGI:

Selling environmental benefits and capacity to finance efficiency projects

Energy Finance Forum

Stephen Cowell, CSG

April 12, 2007

CSG
Conservation Services Group

About CSG

- Founded in 1984; nonprofit corporation
- Nearly 300 staff, 12 offices nationwide
- More than 100 clients
- Design, develop, and deliver energy efficiency and clean energy programs and projects
- Over 1 million homes and facilities served
- Net Zero Greenhouse Gas and Climate Leader

CSG
Conservation Services Group

Introduction

- New opportunities for financing energy efficiency programs and projects from capturing the full value of efficiency
- Monetization of environmental and regional power market value of efficiency
  - What are these finance mechanisms?
  - How do they work?

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Market #1

Greenhouse Gas (GHG) offset markets

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Site reduction vs. offsets

- Factory A - 10 tons emissions with a 9 ton allowance cap

- Options:
  - 1. Reduce emissions to 9 tons (may not be possible)
  - 2. Buy 1 ton of reduced emissions from another location (this 1 ton is an offset)

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Conservation Services Group

Carbon Cap and Trade

- Regulated entities (generally large sources) must have an allowance for each ton of GHG emitted during a compliance period
- Entities can trade among themselves to achieve mandated result or use offsets

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Example of 1 ENERGY STAR Home

- “Laurelwood” - North Smithfield, Rhode Island
  - Increased insulation, advanced air sealing, ENERGY STAR appliances and lighting, efficient furnace
- Electricity annual savings*
  - 1559 kWh = 1247 lbs CO_2
- Natural gas annual savings
  - 236 therms = 2714 lbs CO_2
  - **= Two tons of carbon reduction (20 year value of $50 at $2 per ton and $500 at $20 per ton)**

**average per unit, first 31 units*

CSG
Conservation Services Group

Example: Program funding from offsets

Property owners transfer legal title to resulting CO_2 offsets to The Climate Trust

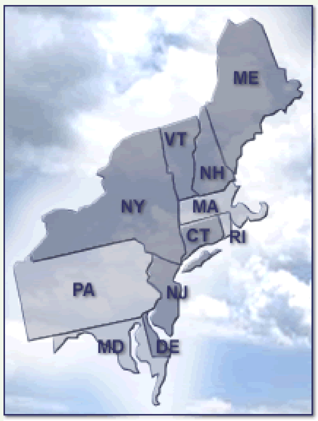
City of Portland assists property owners in improving energy efficiency

The Climate Trust

Climate Trust funds City of Portland program

CITY OF PORTLAND
OFFICE OF SUSTAINABLE DEVELOPMENT

Regional Greenhouse Gas Initiative



- First mandatory Cap and Trade in U.S.
  - MA, RI, & MD have joined 7 original states
  - Minimum of 25% of allowances auctioned for Public Benefit (EE)
  - NY, VT, & MA have committed to 100% auction

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Carbon Cap and Trade: Creates a market for your offsets

- Regional CO_2 cap-and-trade programs
  - RGGI (rules do not allow non-regulated offsets)
  - Southwest Climate Initiative
  - Powering the Plains
  - Western Regional Climate Action Initiative
  - Oregon Climate Trust
  - Climate Action Plans

National CO_2 cap-and-trade programs: coming to a country near you!

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Market #2

- NO_x Allowance markets

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Environmental/Emissions Markets

- NO_x emissions reductions (nitrogen oxides)
- EPA mandated cap on emissions to eliminate smog
- State Implementation Plans required when emissions exceed the cap: “non-attainment”

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NO_x – Public Benefit Set Aside

- Ability to claim allowances that a state has “set aside” for Public Benefit
- Administered state-by-state
  - MA is example of early action
- Denominated in Tons (royal)

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Example: Massachusetts

- 2004 – first year for NO_x set asides
- 687 tons of allowances available
- DOER could claim on behalf of efficiency programs
- ESCOs and customers could claim

Value example:

NO_x: 1 MWh during 5 month season = 1.5 lbs emissions or .00075 tons

1 allowance = 1 ton = $2,000

1 MWh = $1.50 per year ($.0015 per kWh)

CSG Conservation Services Group

Example of 1 ENERGY STAR Home

- "Laurelwood" - North Smithfield, Rhode Island
  - Increased insulation, advanced air sealing, ENERGY STAR appliances and lighting, efficient furnace
- Electricity annual savings*
  - 1559 kWh = 2.34 lbs NO_x
- Natural gas annual savings
  - 236 therms = 3.5 lbs NO_x

= .003 tons NO_x reduction = $6/yr

**average per unit, first 31 units*

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Market #3

- Capacity Markets

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Capacity Supply

- Capacity = amount of electricity available from a generating unit or needed by users at any moment in time
  - Measured in kilowatts (energy = that amount over time or kilowatt-hours)
- Power Markets and System Operators need both kW and kWh

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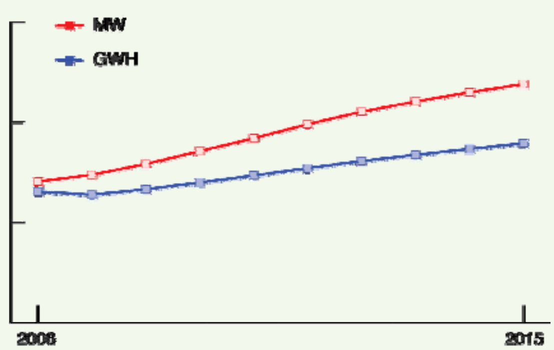
Peak vs Average energy growth



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Approaches to power market needs

- Traditional:
  - Build new power plants by regulated utilities
  - Establish a new market to buy additional power plant capacity in competitive markets
- New Capacity Market:
  - New England ISO and Power Pool proposed new capacity market based on traditional model
  - CSG intervened in settlement negotiations, citing advantages of demand resources

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Settlement Agreement

- Agreement to incorporate Demand Resources into market
- Forward Capacity Auction
  - Three years forward
  - Existing capacity gets one year commitment
  - New capacity to select 1 to 5 year commitment
  - Opportunities to de-list or retire by bids
- Demand resources fully participate and have special treatment
- Measurement and Verification required

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Value potential

- 1 year-round kW of load reduction in an ENERGY STAR Home through reduced AC, appliances, lighting etc. =

  $36 (transition) to $100 ($8 clearing price) per year for 20 years or a NPV of about $1,000.

Market #4

- White Tags

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White Tags

- A term of art for verification that one MWh of electricity was not used during a specified time period as the result of an approved energy efficiency measure
- Administered:
  - -- CT first state with an official program
  - -- Sterling Planet launched initiative to create a voluntary market
- Trading deadlines vary by market similar to RECs

Challenges to all these markets

- Complex participation requirements
- Minimum size to participate
- Measurement and Verification Standards are required for market confidence
- Accounting systems are needed for transparency
- Aggregation and balancing needed
- Trading and sales needs specialists

Thank you!

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www.csgrp.com

CSG
Conservation Services Group

Robert L. Pratt

Rob Pratt is Senior Vice President of the Henry P. Kendall Foundation, heading up the Foundation's climate change program. By catalyzing major climate programs in New England through the implementation of "massive energy efficiency," distributed generation (renewable and combined heat and power facilities), and demand response, along with transportation initiatives, the Foundation hopes to demonstrate that significant greenhouse gas emissions can be reduced in the short to mid-term. Rob formerly served as Director of the Massachusetts Technology Collaborative's Renewable Energy Trust (RET), the $250 million fund through which he developed a series of innovative programs designed to promote the use of clean energy technologies and build investment in the state's renewable energy industry.

Mr. Pratt is Chairman of the Board of the International Institute for Energy Conservation (IIEC), promoting energy efficiency policies and their implementation in developing countries, a non-profit organization which he founded in 1984. He serves as Treasurer and is on the board of the Alliance to Save Energy (ASE), the largest non-profit organization in the U.S. solely dedicated to the promotion and acceleration of energy efficiency. Rob is on the Board of the Clean Energy States Alliance (CESA), the organization of 17 renewable energy state funds; and is Chairman Emeritus and a member of the Advisory Board of the American Council On Renewable Energy (ACORE), a non-profit organization based in Washington, D.C. focused on bringing renewable energy into the economic mainstream in the U.S.

Prior to directing the Renewable Energy Trust, Mr. Pratt was the founder, Chairman and Chief Executive Officer of Energia Global International, Ltd. (EGI), one of the leading renewable energy companies in Latin America. Founded in 1991 as a startup, EGI (now Enel Latin America) became a major development company in the region, with hydroelectric, wind and distribution assets in Costa Rica, Guatemala, El Salvador and Chile Mr. Pratt received an MPA degree from the John F. Kennedy School of Government at Harvard University, a JD degree from Georgetown University Law Center, and a BA degree in government with high honors from Wesleyan University.

Financing Massive Energy Efficiency Implementation

Rob Pratt
Senior Vice-President
Henry P. Kendall Foundation

The Energy Efficiency Finance Forum
April 12, 2007

Kendall Foundation & Climate Change

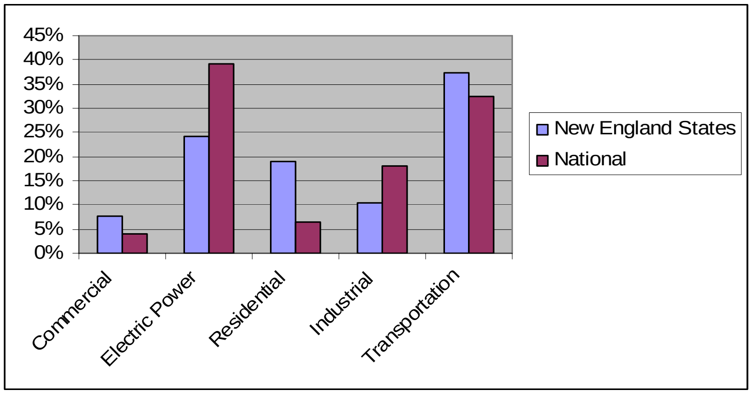
- Trustees transformed mission to Climate Change in 1999
- In view of climate imperative, passive philanthropy is not sufficient
- We use the Advocacy, Entrepreneurial and Collaborative Approaches throughout our programs and grant decision-making

Kendall Foundation Strategies

- ***Advocacy Approach*** – pursue big ideas that have impact, are cost-effective and create change.
- ***Entrepreneurial Approach*** – bring in the private sector and encourage them to make money doing the right thing.
- ***Collaborative Approach*** – engage partners – nonprofits and foundations – to promote climate change solution agendas

It's All About Emissions

	Commercial	Electric Power	Residential	Industrial	Transportation
New England States	7.79%	24.20%	18.90%	10.50%	37.47%
National	3.90%	39.10%	6.40%	18.10%	32.30%



Kendall Climate and Energy Team

- Energy & Advocacy Team with more than 100 years of entrepreneurialism, private sector experience and policy leadership
- Over $1.5 Billion in EE & RE Project Financings in U.S. and Latin America
- Team members include:
  - Rob Pratt – Energy entrepreneur, RE Trust Director
  - Doug Foy – Environmental and Government leader
  - Dave Dayton - Efficiency pioneer and entrepreneur
  - Other team members: Steve Morgan, Deborah Donovan, Amy Panek

Central Climate & Energy Themes

Massive Energy Efficiency Implementation

- Energy Efficiency offers most cost effective and impactful energy and climate solution
- Quintupling Efficiency beyond what has been done previously
- Emphasis on reduction of greenhouse gas emissions as the foremost criterion for actions taken

Innovative Financing

- Leverage as the central tenet
- Goal of $4–8 of implementation from each public dollar committed

What is Massive Energy Efficiency Implementation?

- High Penetration rates in Commercial, Industrial, Government & Residential Sectors
- Critical mass for financing; reducing marketing and transaction costs
- Emphasis on Retrofitting existing buildings; engage new construction as well
- Use all measures: lighting, HVAC and control systems, appliance standards and building practices
- Install Distributed Generation (Renewable Energy and Combined Heat & Power Facilities) wherever possible; emphasize demand response to reduce peak electricity use
- High profile campaigns involving government, private sector and citizen leadership

Innovative Finance & Leveraging

- Maximize new or existing public funding to leverage by a factor of 4–8x energy efficiency implementation
- Public funding may serve as the equity, allowing the bulk of the financing to come in as private debt
- Revolving lines of finance can be utilized, which continue to replenish themselves as energy savings are paid back
- Through government approved innovative financing programs, clean energy implementation -- ***per year*** -- could rise to:
  - Small states: $500+ million
  - Medium states: $1+ billion
  - Large states: $2+ billion

Massachusetts Leveraging Example

- Potential ***annual*** funding sources in 2008–2012
  - Regional Greenhouse Gas Initiative Auctions $80-150M
  - ISO – NE Forward Capacity Market 75-100M
  - EE & RE System Benefit Charges 140-160M
  - Carbon Offsets, RECs, pollution charges 10-25M
- Total of $305-435M could be leveraged into $1-1.5 billion in clean energy implementation per year
- With policies promoting RE and CHP, could generate up to ***$2+ billion in clean energy implementation per year***

$100 Million City Project
"Cambridge Energy Alliance"

- $100 million, 5 year, massive energy efficiency project in Cambridge, Massachusetts
- High profile campaign led by the city, with peer pressure among companies, organizations and residents to participate
- All sectors – commercial, industrial, government, universities, hospitals and non-profits, housing and residents
- Goal of reducing peak demand by 50 MW and fossil fuel use by 5% over 5 years
- Best way for city, companies and consumers to stabilize energy costs and reduce pressure on the grid
- Significant number of new jobs and economic development
- Major reductions in GHG emissions

City as Champion

Cambridge rallies its businesses, universities, organizations and citizens to reduce energy use and costs while making its infrastructure more efficient

- ***Reduce Cambridge's energy costs***
- ***Reduce America's dependence on foreign oil***
- ***Reduce Carbon and GHG emissions***

- City Levers:
  - "Brand" - credibility in Marketing and Investments
  - Authority to deal with all parties
  - Trusted relationship with large and small companies, university and nonprofit sector and residents
- City as a Natural Aggregator of:
  - Energy Demand
  - Public Incentives
  - Private Investment

Public Funding Available

- ISO-New England Forward Capacity Market (FCM) program to insure adequate electricity supply
  - $1 billion in 2007, escalating to $2+ billion
- "Efficiency" Resources now qualify on an equal footing with generation, including:
  - Conservation of electric energy
  - Peak load reductions
  - Renewable energy
  - Combined Heat & Power (Cogeneration)
- FCM provides substantial new influx of funding to anchor large-scale Energy Efficiency
- ISO-New England enthusiastic about "City as Aggregator" approach

Cambridge Energy Alliance
Financial Model - Overview

- Assembling $70 million revolving line of finance
  - $15 million in public funding (ISO-NE, other)
  - $5 million in private equity or subordinated debt financing
  - $50 million in private project financing debt
- $50 million in private debt raised from pension and annuity providers, life insurance companies
- Low risk debt, attractive interest rates
- Because savings are paid into revolving line, approximately $100+ million in energy efficiency implementation will result over 5 years

Cambridge Energy Alliance
Financial Model – Step by Step

- CEA finances energy-efficient improvements to facilities; customers repay financing under variable terms
- Guarantee customer savings exceed debt service
- Customer payments go to Lock Box of Bank Trustee
- Project Finance debt is non-recourse, secured by cash flow from customers + lien on equipment installed.
- Institutional investors familiar with this “performance contract” paper buy Certificates of Participation ($50M)
- Additional revenues from ISO-NE, carbon credits, RECs, etc. accumulate residual cash flow ($15M)
- This residual cash flow securitizes issue of subordinated debt or equity ($5M); provides working capital, credit enhancement, inclusion of underserved markets, etc.

Cambridge Energy Alliance
Governance Approach

- Cambridge is closely partnering with a 501(c)(3) – Cambridge Energy Alliance
- The nonprofit will serve as a City-sponsored ESCO (Energy Service Company), reaching out to aggregate demand from all sectors
- The nonprofit will:
  - lead public outreach and marketing campaign
  - raise debt financing through efficiency finance specialists
  - combine all available public revenue sources (FCM, efficiency incentives, RGGI funding, carbon offsets, etc.)
  - issue efficiency solicitations, i.e. for C&I, schools, hospitals, housing, residents
- All efficiency services will be delivered by ***private*** energy service companies, contractors and engineering firms

Cambridge Energy Alliance
High Profile Campaign

- Massachusetts Governor and Cambridge Officials Announced on March 29, 2007
- Cambridge, Harvard, MIT, Chamber of Commerce, and other key representatives on Organizing Committee
- Will involve all large Cambridge employers, hospitals, universities, schools, housing providers, small and medium size businesses, and residents
- Peer Pressure -- Decals and graphics to denote participants
- SmartPower organizing messaging, graphics, radio spots and public advertising
- Religious leaders will be involved; Additional community partners engaged in outreach

Jobs & Economic Development

- $100+ million investment over 5 years creates good jobs at all levels
- Partnership with MIT and Harvard, as well as entrepreneurial sector, will create new companies and approaches
- Efficiency reverses flow of money out of city and state
- Projection of Economic Multipliers

Conclusion

- Financing massive energy efficiency can often be done with existing public funding
- Given imperative of climate change solutions, must find ways to implement now
- Innovative Finance can lead the way.

"Make no small plans."

- Philosophy of Henry P. Kendall

Thank You

Rob Pratt

Henry P. Kendall Foundation

www.kendall.org

Richard Cowart -- Director, Regulatory Assistance Project

Richard Cowart is a Director of The Regulatory Assistance Project, a nonprofit institute that has advised governments in more than 40 US states and 16 other nations on energy and environmental policy issues.

One of the nation's most experienced regulatory commissioners, Richard served as Commissioner and Chair of the Vermont Public Service Board (PSB) for thirteen years under three Governors (1986-1999). He was elected President of the New England Conference of Public Utility Commissioners, and Chair of the National Association of Regulatory Utility Commissioners (NARUC) Committee on Energy Resources and the Environment.

Widely known for his work on power markets, energy efficiency and renewable power, his current work focuses on three areas:

- Assisting state and regional efforts in the US to cap greenhouse gas emissions from the power sector;
- Advising governmental and power agencies in China on regulations and market rules for the electricity sector; and
- Creating policies for demand response, efficiency, and renewable resources in US power markets and utility portfolios.

Before his appointment to the Vermont PSB, Mr. Cowart was Assistant Professor and Director of the program in Planning and Law at the University of California, Berkeley (1980-85), and Executive Officer and General Counsel of the Vermont Environmental Board (1978-80). He received his B.A. from Davidson College, and the J.D. and Master of City Planning degrees with honors from the University of California, Berkeley.

He received the Walton Award for outstanding public service to the State of Vermont (1996), the State Leadership Award, for "National Leadership in Renewable Energy," American Wind Energy Association (1997), NARUC's Kilmarx Award for sustained, national contributions on energy efficiency (2004), and the Conservation Law Foundation's highest award, the John H. Chafee Award for Environmental Leadership (2006).

Richard and his family live in Calais, Vermont, where they manage one of central Vermont's oldest Christmas tree farms.

<RHC bio 3-07>

Carbon Caps and Energy Efficiency:

The Marriage of Need and Potential

The Energy Efficiency Finance Forum
April 12, 2007
Richard Cowart

The Regulatory Assistance Project

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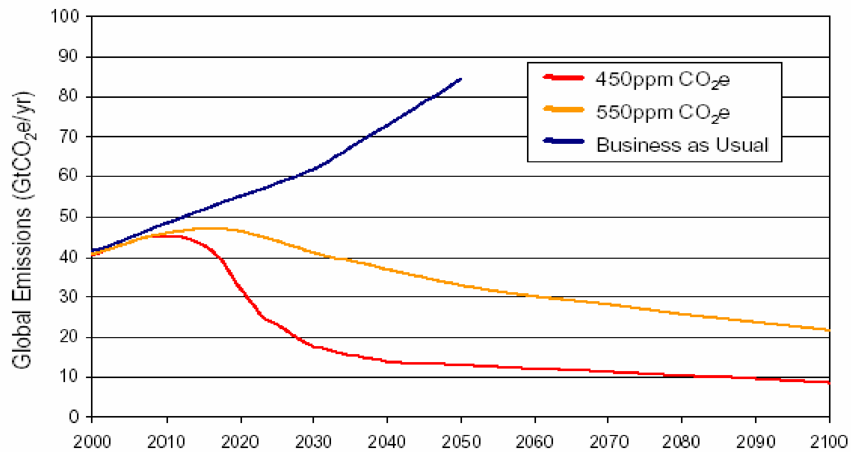
2 billion villagers want a better life

Emission paths to stabilization



Source: Stern Review (UK) October 2006

Theme: Design Cap &Trade for Efficiency

Goal: Design a GHG Cap and Trade program that inherently promotes ***end-use*** efficiency

Why?

- The whole point of cap-and-trade is to lower the cost of attainment
- End-use efficiency is the lowest-cost way to reduce power sector GHGs
- Carbon markets will have huge dollar flows (tremendous opportunity for EE)

State and regional power sector carbon caps

California & Oregon

RGGI - 8 to 10 states

Together, their carbon profiles exceed most nations.

Today's main points: Four lessons for cap-and-trade architects

- 1.The Acid Rain program design – smokestack-based, free allocations based on historic emissions – is not the best design for a carbon cap/trade system for the power sector.
- 2. **Energy efficiency** is not a "collateral energy policy," it is **the key to success** of power-sector carbon programs.
- 3. Cap-and-trade CAN be designed to promote and pay for much more efficiency.
- 4. RGGI and CA are creating powerful options to improve cap-and trade architecture; federal efforts should build on this experience.

Acid Rain cap-and-trade– What's different now?

- US Acid Rain program – universally recognized success. NOx and CAIR build on this model.
- GHG situation is different:
  - The best low cost solutions are not at the smokestack
  - Nor in the fuel supply -- we don't have low-carbon coal
  - Power markets, utility structures have changed
- Ask: what did the Acid Rain program do for energy efficiency?
- **Message for ESCOs, EE providers, consumer advocates – don't cede the cap & trade design space to conventional generation**

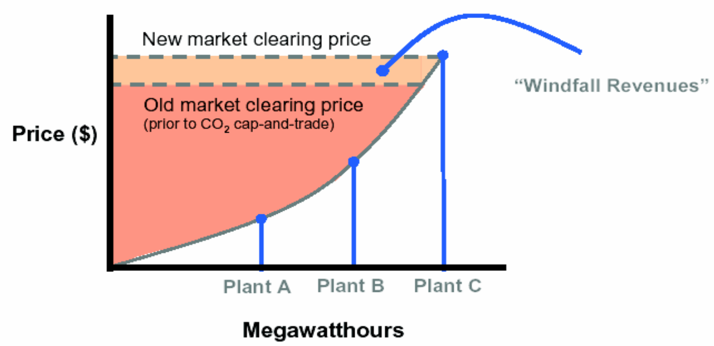
Architectural mistakes: Three wrong assumptions

- 1. Generators lose money under carbon cap and trade, so designers must give them allowances for free
- 2. Just manage pollution, price increases and demand elasticity will deliver needed efficiency
- 3. "Allocation is just distributional" -- Initial allocation won't affect program cost to consumers

Reality #1 Most generators make money with free historic allocation

Theoretical representation of "windfall revenues"

A fossil unit on the margin increases the market clearing price (i.e., the price paid to all generating units dispatched) to reflect the cost of CO_2 compliance



Reality #2: EE programs are more powerful than rate increases

- Economic theory: just raise the price of power
- DSM reality: ***Programs*** are needed to surmount market barriers to efficiency
- **$ spent through smart programs will deliver at least 5x the efficiency savings of $ spent through higher prices**
- Key conclusion: Build efficiency support into program architecture.
- BUT: Generators don't deliver efficiency
- Hmmm…who has relationships with customers?

What does it cost to avoid a ton of electric CO_2 ?*

Resource option	CO_2 intensity (tons/MWh)	Cost per MWh	Cost per ton avoided
Coal	.92/MWh	$40	NA
Gas	.45/MWh	$55+	$30+
New Nuclear	big debate	$70+ to ??	$30 to +??
Wind	low	$75	$38
PV	low	$180+	$152+
Efficiency	low	$30	**(-$11)**

**Generation cost data (except nuclear) from EPRI ("Generation Technologies in a Carbon-constrained World," 2005, assuming gas at $6MMbtu); EE data from Efficiency Vermont. For the point made here the precise numbers are not critical.*

The carbon power of electric efficiency: a simple comparison*

- Change 1 lightbulb to CFL:
  - 100 watts to 23 watts x 10,000 hours
  - Saves 770 kwh x 1.8 pounds CO_2/kwh = ~1400 pounds CO_2 <when displacing coal>
  - SAVES the economy $30 in power costs
- OR Make 700 gallons of corn-based ethanol:
  - 700 gallons x 2 pounds CO_2 saved per gallon = ~1400 pounds CO_2 < when displacing gasoline>
  - COSTS taxpayers $420 (700 gal x .60/gal tax benefits)
- Total utility EE spending nationwide is about $1.6 Billion
- Government support for ethanol is $5.1 – $6.8 Billion

**R Cowart comparison, based on EPA fuel & carbon data; IISD, "Biofuels –at What Cost?" (2006), standard CFL savings data,, and federal + state tax benefits for ethanol. Corrections invited.*

Reality #3: Carbon credit allocation can mobilize efficiency

- Key point: A carbon program that directly mobilizes end use efficiency **will cost less and achieve more** than one that focuses only on smokestacks.
- Two new techniques can tap the carbon value of efficiency and renewables:
  - **Consumer allocation (RGGI region)**
  - **Load-side cap and trade (California and Oregon)**

The Northeast Regional Greenhouse Gas Initiative (RGGI)

- **8 states now in**
- **2 other states likely to join (RI, MD)**
- **MOU signed by 8 Governors 12/06 &1/07**
- **Model Rule now approved**
- **State-by-state adoption 2007+**
- **Launch 2009**
- **Cap, reduce 10% by 2019**

RGGI answer: The Consumer Allocation

- Allocate up to100% of initial credits to consumer representatives (eg, distribution utilities, Efficiency Utility)
  - RGGI MOU - state minimum commitment is 25%
  - Most states will be higher – Vermont law is 100%; NY & MA draft rules now at 100%; CT, NJ may follow
- Generators need to purchase allowances, recycling the windfall revenue BACK to consumers
- PUCs supervise use of the $$ for benefit of consumers
- **Best result: focus these $ on investments that lower carbon (EE &RE)**
- Results: lower cost per ton avoided, lighter macro-economic impact >> quicker progress in reducing GHG emissions

Consumer allocation – Vermont goes first

*"In order to provide the **maximum long-term benefit** to Vermont electric consumers, particularly benefits that will result from **accelerated and sustained investments in energy efficiency** and other low-cost, low-carbon [resources],*

*the public service board …shall allocate **100 percent** of [Vermont's] tradable power sector carbon credits **and the proceeds from the sale of those credits***

*through **allocation to one or more trustees** acting on behalf of consumers"*

--H.860 (enacted 2006)

What happens if we double efficiency spending in RGGI?

Extensive modeling* for RGGI found:

- Carbon credit prices drop 25%
- Need for new fossil capacity drops 33%
- Customer bills drop 5% to 12%
- And – even greater EE investments (quite attainable) would yield greater savings

**IPM model runs by ICF Consulting using EE portfolios developed by ACEEE*

West Coast approach: Load-Side Cap & Trade

Basic rule: LSEs must have credits to cover the emissions associated with their sales to retail customers.

>> A **"carbon budget"** for the utility portfolio manager.

1. Measure historic emissions associated with electricity *serving the state* (or region) –
   - All sources, wherever located -- both in-state and imports
2. Set "hard" emissions caps to lower impact in stages
3. Distribute allowances ("carbon credits") to LSEs
4. LSEs spend credits as needed to match their portfolio of sources
   - **can sell excess credits from RE & EE choices**

Benefits of Load-Side Caps a/k/a Utility Carbon Budgets

1. Covers all power, including imports (like RPS)
   - 56% of CA's electric carbon is from other states
2. Power markets: lower cost to consumers
   - Means >> **lower cost per ton avoided**
3. No generator windfall – ratepayers pay for a cleaner portfolio but not more than that
4. **Promotes EE by those in position to deliver it**
   - **Avoided MWH saves allowances, $$ to LSEs**
   - Shared savings option -- Should LSEs pass those credits on the ESCOs and "white tag" providers?

Conclusions

- Efficiency is the key to low-cost power sector carbon reduction,
- Consumer allocation avoids generator windfall and provides a revenue source for efficiency
- Load-side cap reveals carbon value of EE to LSEs who can deliver it
- Congress will be acting too – will national legislation support efficiency?

For more information…

"Another Option for Power Sector Carbon Cap and Trade Systems – Allocating to Load"
(May 2004)

"Why Carbon Allocation Matters – Issues for Energy Regulators" *(March 2005)*

"Addressing Leakage in a Cap-and-Trade System: Treating Imports as Sources"
(November 2006)

"Why A Load-Based Cap?"
(March 2007, with Julie Fitch)

Richard Cowart, Regulatory Assistance Project
Posted at www.raponline.org

Email questions to *RAPCowart@aol.com*

DAY TWO: April 13, 2007

Continental Breakfast

Chair's Recap of Day One

Dan Reicher, *Director of Climate Change and Energy Initiatives*
GOOGLE

Bill Prindle, *Deputy Director*
AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY

Dan W. Reicher has over 20 years of experience in business, government and non-governmental organizations focused on energy and environmental technology, policy, finance and law. He recently joined Google where he serves as Director of Climate Change and Energy Initiatives for the company's new venture called Google.org. Google.org has been capitalized with more than $1 billion of Google stock to make investments and advance policy in the areas of climate change and energy, global poverty, and global health.

Prior to his recent position at Google, Mr. Reicher served as President and Co-Founder of New Energy Capital Corp., a New England-based company that develops, invests in, owns and operates renewable energy and distributed generation projects. Mr. Reicher is also a member of General Electric's Ecomagination Advisory Board.

From 1997-2001, Mr. Reicher was Assistant Secretary of Energy for Energy Efficiency and Renewable Energy at the U.S. Department of Energy (DOE). As Assistant Secretary, he directed annually more than $1 billion in investments in energy research, development and deployment related to renewable energy, distributed generation and energy efficiency. Prior to that position, Mr. Reicher was DOE Chief of Staff (1996-97), Assistant Secretary of Energy for Policy (Acting) (1995-1996), and Deputy Chief of Staff and Counselor to the Secretary (1993-1995). He was also a member of the U.S. Delegation to the Climate Change Negotiations, Co-Chair of the U.S. Biomass Research and Development Board, and a member of the board of the government-industry Partnership for a New Generation of Vehicles. After leaving the Clinton Administration in 2001 he was a consultant to the Senate Environment and Public Works Committee and a Visiting Fellow at the World Resources Institute.

In 2002, Mr. Reicher became Executive Vice President of Northern Power Systems, a venture capital-backed renewable energy and distributed generation engineering, services and technology company with installations in more than forty-five countries. Mr. Reicher led the renewable energy sales group at Northern and also was actively involved with the company's project finance, government relations and public affairs initiatives. He also played a significant role in the successful sale of the company to Proton Energy Systems, a leading hydrogen company, and the simultaneous creation of Distributed Energy Systems, a new NASDAQ-listed holding company that now owns both Northern Power and Proton Energy.

Prior to his roles at the Department of Energy and in the business community, Mr. Reicher was a senior attorney with the Natural Resources Defense Council where he focused on the federal government's energy and nuclear programs as well as environmental law and policy issues in the former Soviet Union. He was also previously Assistant Attorney General for Environmental Protection in Massachusetts, a law clerk to a federal district court judge in Boston, a legal assistant in the Hazardous Waste Section of the U.S. Department of Justice, and a staff member of President Carter's Commission on the Accident at Three Mile Island.

Mr. Reicher currently is co-chairman of the advisory board of the American Council on Renewable Energy and a member of the boards of the American Council for an Energy Efficient Economy, the Vermont Energy Investment Corporation, the Keystone Center's Energy Program, and Circus Smirkus. He was also recently a member of the National Academy of Sciences Committee on Alternatives to Indian Point for Meeting Energy Needs.

Mr. Reicher also recently served as an adjunct professor at the Yale University School of Forestry and Environmental Studies and Vermont Law School. He holds a B.A. in Biology from Dartmouth College and a J.D. from Stanford Law School. He also studied at Harvard's Kennedy School of Government.

Mr. Reicher was a member of a National Geographic-sponsored expedition that was the first on record to navigate the entire 1888 mile Rio Grande and was also a member of the first group on record to kayak the Yangtze River in China.

Mr. Reicher is married to Carole Parker, who headed the Office of Pollution Prevention at the U.S. Department of Defense from 1994 to 1999. Carole and Dan have three children and live in Norwich Vermont. The family will be relocating to California in August 2007.

William R. Prindle
Acting Executive Director
American Council for an Energy-Efficient Economy

Mr. Prindle provides leadership and accountability for ACEEE. In addition, he directs ACEEE's energy policy program, which conducts policy analysis and advocacy on energy efficiency issues at the national and state levels. In more than 30 years in the energy field, he has worked in regional planning, corporate communications, management consulting, and association management. He has testified before Congress, appeared on radio and TV, and been published frequently as an expert on energy efficiency.

Bill earned a B.A. degree in Psychology from Swarthmore College and an M.S. from the University of Pennsylvania. He has served on the boards of such organizations as the Energy and Environmental Building Association, the Association of Energy Services Professionals, and the National Fenestration Rating Council.

About ACEEE: *The American Council for an Energy-Efficient Economy is an independent, nonprofit organization dedicated to advancing energy efficiency as a means of promoting both economic prosperity and environmental protection. Founded in 1980 by leading energy research experts, ACEEE has become a respected, independent voice for energy efficiency technology, policy, and consumer education. The organization conducts research, publishes technical and policy reports, holds conferences and other forums, and educates decision-makers, energy professionals, and consumers. For more information about ACEEE and its programs, publications, and conferences, contact ACEEE by mail at 1001 Connecticut Avenue, N.W., Suite 801, Washington, D.C. 20036-5525, by phone at 202-429-8873, or on the web at http://www.aceee.org*

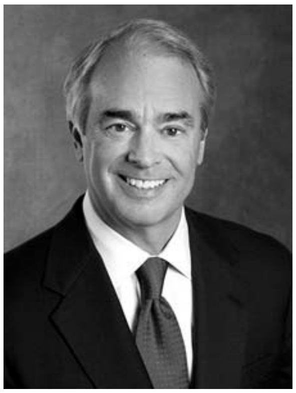
Keynote Address

James E. Rogers, *President and CEO*
DUKE ENERGY

Jon Wellinghoff, *Commissioner*
FEDERAL ENERGY REGULATORY COMMISSION

Duke Energy Executive Profile

James E. Rogers
Chairman, President and Chief Executive Officer



Jim Rogers is chairman of the board, president and chief executive officer of Duke Energy. He was named to his current position in January 2007, following the separation of Duke Energy's natural gas businesses into a new publicly traded company, Spectra Energy.

Rogers has more than 18 years of experience as a chief executive officer in the electric utility industry. He was named president and chief executive officer of Duke Energy following the merger of Duke Energy and Cinergy in April 2006. Before the merger, Rogers served as Cinergy chairman and chief executive officer for more than 11 years. Prior to the formation of Cinergy, he joined PSI Energy in 1988 as the company's chairman, president and chief executive officer. He served as executive vice president of interstate pipelines for the Enron Gas Pipeline Group before joining PSI. Before joining the Enron Corp., Rogers was a partner in the Washington, D.C., office of Akin, Gump, Strauss, Hauer & Feld.

Immediately before joining that firm, Rogers was deputy general counsel for litigation and enforcement for the Federal Energy Regulatory Commission (FERC). Previously, Rogers served as assistant to the chief trial counsel at FERC, as a law clerk for the Supreme Court of Kentucky, and as assistant attorney general for the Commonwealth of Kentucky, where he acted as intervener on behalf of state consumers in gas, electric and telephone rate cases. He was a reporter for the Lexington (Kentucky) Herald-Leader from 1967 to 1970.

In the course of his career, Rogers has served more than 40 cumulative years on the boards of Fortune 500 companies and has testified before congressional committees 14 times. He is currently a director of Fifth Third Bancorp and an incoming member of the board of CIGNA Corporation. He is chairman and serves on the Executive Committee of Edison Electric Institute. He serves as a member of the board of directors and the Executive Committee of the Nuclear Energy Institute, and an incoming member of the board of directors of the Institute of Nuclear Power. Rogers also serves on the boards of the Alliance to Save Energy, the U.S. Chamber of Commerce, The Business Roundtable, the National Coal Council and the American Gas Association.

Rogers also serves on numerous civic boards and has published numerous articles on energy and environmental issues. He currently co-chairs an Arts & Science Council (ASC) initiative to enrich cultural resources in the Charlotte area. He chaired the 1997 Greater Cincinnati United Way Campaign. He has served as director of Duke Realty Corporation, PSI Energy, Bankers Life Holding Corporation, A O Irkutskenergo (a Russian hydroelectric/coal-fired steam utility) and Indiana National Bank.

Rogers attended Emory University and earned a bachelor of business administration and a juris doctorate degree from the University of Kentucky, where he was a member of the Kentucky Law Journal and Beta Gamma Sigma National Honor Society. He was named to the Hall of Fame at the Carol Martin Gatton College of

(continued next page)

For more information, contact media relations, 704-382-8333.

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2/6/07

Business and Economics and the Hall of Fame of the College of Law, both of the University of Kentucky. He also received an honorary doctor of law degree from Indiana State University.

Past recognition includes the 1998 Hebrew Union College Cincinnati Associates Tribute Honoree, the 2004 NCCJ Distinguished Service Citation, the 2005 Keystone Center Leadership in Industry Award, the 2005 Ronald McDonald House Lifetime Achievement Award and the 2006 Human Relations Award from the American Jewish Committee, Cincinnati Chapter.

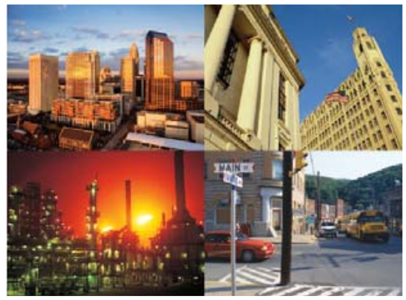
The Birmingham, Ala., native was born in 1947. Rogers and his wife, Mary Anne, have two daughters, a son and seven grandchildren.

Duke Energy Corp., one of the largest electric power companies in the United States, supplies and delivers energy to approximately 3.9 million U.S. customers. The company has nearly 37,000 megawatts of electric generating capacity in the Midwest and the Carolinas, and natural gas distribution services in Ohio and Kentucky. In addition, Duke Energy has more than 4,000 megawatts of electric generation in Latin America, and is a joint-venture partner in a U.S. real estate company.

Headquartered in Charlotte, N.C., Duke Energy is a Fortune 500 company traded on the New York Stock Exchange under the symbol DUK. More information about the company is available on the Internet at: www.duke-energy.com.

Investing in an Energy-Efficient Future

How we can tap the potential of the 'Fifth Fuel'



Jim Rogers
Chairman, President and CEO
Duke Energy

Investing in an energy-efficient future
3-2-07

Jim Rogers will share his vision of an energy efficient future:

- Why we should not overlook energy efficiency as the “fifth fuel.”
- What it will take to tap energy efficiency’s full potential
- Why I believe it’s a good investment in today’s climate.

The current energy climate is one of growing demand, rising fuel prices and increasing environmental concerns.

- To meet rising demand, will need both new generation and improved energy efficiency.
- Energy prices also on the rise, and under more pressure due to investments in energy infrastructure.
- Utilities stepping up to help solve problem of global climate change.
- Energy efficiency will be part of the solution.

Customers should have universal access to the benefits of energy efficiency.

- Electric utilities are positioned to lead in this area, assuming the right regulatory framework is put in place.
- New cutting-edge technologies will help take energy efficiency to the next level.

What this means for investors

- Energy efficiency can be a profitable business line: “Save-a-watts” could cost less to produce than new generation or purchased power.
- We can share those savings with customers, improving customer satisfaction.
- We can also sell energy efficiency products and services at a fair margin.

A new regulatory model will be needed to realize this vision.

- We need a new regulatory compact that puts investments in energy efficiency on an equal footing with new generation investments.
- Would make conserving electricity as profitable as selling it.
- That would allow utilities to be impartial to investments in new generation or in energy efficiency
- Customers also win, by saving money and taking advantage of new technologies.

Clearly, there is no “silver bullet” to solve our energy challenges. A diversity of generation fuels – including the “fifth fuel,” energy efficiency – along with the right regulatory framework – will make affordable, reliable and clean energy available to all.

Jon Wellinghoff
Commissioner

Commissioner Jon Wellinghoff was recommended by U.S. Senator Harry Reid and nominated by President Bush. He was sworn into office on July 31, 2006, for a term expiring June 30, 2008.

Before coming to the Commission, Mr. Wellinghoff was a partner with one of Nevada's largest law firms. He has concentrated his practice in the fields of energy law and utility regulation for the past thirty-two years. In addition to representing clients before the Nevada Commission where his regulatory practice was primarily focused, he also has represented clients before the regulatory commissions of California, Colorado, New Mexico, Arizona (Corporation Commission), Washington (UTC), and the Federal Energy Regulatory Commission. He has testified as an expert witness on behalf of clients in utility regulatory matters in Nevada, Texas, and the District of Columbia, and was retained as a consultant to the staff of the Oregon Commission. He has also advised the staffs of the Missouri, Minnesota, New York, and Georgia Commissions.

Mr. Wellinghoff's utility practice has included several public sector positions. Mr. Wellinghoff was appointed by the Attorney General of Nevada to serve as the state's first Consumer Advocate for Customers of Public Utilities. While Consumer Advocate, Mr. Wellinghoff represented Nevada's utility consumers before the Nevada Commission, the FERC, and in appeals before the Nevada Supreme Court. He served two terms as Consumer Advocate, and personally participated in dozens of complex utility rate and regulatory matters on behalf of Nevada Consumers. While Consumer Advocate, Mr. Wellinghoff authored one of the first comprehensive state utility integrated planning statutes and successfully lobbied that statute through the Nevada legislature. The statute became a model for utility integrated planning processes across the country and companion statutes were eventually adopted in seventeen other states.

The last public sector position that Mr. Wellinghoff held was as Staff Counsel to the Nevada Public Utilities Commission. In that position he was lead counsel in the merger proceeding between Nevada's two largest utilities, Nevada Power and Sierra Pacific Power Company.

In private practice, Mr. Wellinghoff represented numerous clients in the renewable energy sector. As part of that representation, he authored extensive amendments to the Nevada Renewable Portfolio Standard (RPS) and was also involved in RPS legislation and regulations throughout the Western U.S. and at the Federal level.

Mr. Wellinghoff also served as a Staff Attorney for the Federal Trade Commission, Energy and Product Information Division, Washington, D.C., Staff Counsel for the United States Senate Commerce Committee, Consumer Subcommittee, in Washington, D.C., and Deputy District Attorney in the Consumer Fraud Division for Washoe County District Attorney's Office in Reno, Nevada.

Since joining the Commission in July of 2006, Mr. Wellinghoff has been appointed to serve as an advisor to the Energy Policy Working Group of the Defense Science Board Task Force on Department of Defense Energy Strategy – Policy Panel, Chaired by Admiral Woolsey, and as Co-chair of the NARUC/FERC Demand Response Collaborative.

Born: May 30, 1949.

Education: Antioch School of Law, Washington, D.C., JD, 1975; Howard University, Washington, D.C., M.A.T., Mathematics, 1972; and University of Nevada, Reno, Nevada, BS, Mathematics, 1971.

Profession: Lawyer.

Monetizing Energy Efficiency: Environmental Credits, White Tags and Beyond

<u>Moderator</u>:
Bill Prindle, *Deputy Director*
AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY

<u>Panelists</u>:
Mel Jones, *CEO*
STERLING PLANET, INC.

Steve Baden, *Executive Director*
RESNET

Steven Schiller
SCHILLER CONSULTING

Michael Winka, *Director*
OFFICE OF CLEAN ENERGY NJBPU

William R. Prindle
Acting Executive Director
American Council for an Energy-Efficient Economy

Mr. Prindle provides leadership and accountability for ACEEE. In addition, he directs ACEEE's energy policy program, which conducts policy analysis and advocacy on energy efficiency issues at the national and state levels. In more than 30 years in the energy field, he has worked in regional planning, corporate communications, management consulting, and association management. He has testified before Congress, appeared on radio and TV, and been published frequently as an expert on energy efficiency.

Bill earned a B.A. degree in Psychology from Swarthmore College and an M.S. from the University of Pennsylvania. He has served on the boards of such organizations as the Energy and Environmental Building Association, the Association of Energy Services Professionals, and the National Fenestration Rating Council.

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Mel Jones, Co-Founder, Director, President and Chief Executive Officer

Mel Jones, a native of Atlanta, Georgia, helped found Sterling Planet with Mr. Therrell "Sonny" Murphy, Jr. in January 2000. As the President and Chief Executive Officer of Sterling Planet, Mr. Jones has overall management responsibility for business development and operations ranging from finding and contracting with green supply organizations, to bringing on new affiliate partners with utilities and helping resolve key customer care issues.

Sterling Planet caps a 32-year career focused on utilities solutions, with over 17 in the deregulated marketplace. Prior to Sterling Planet, Mr. Jones exhibited his core area of expertise in information technology solutions for the electric utility industry.

As a Vice President at Electronic Data Systems (EDS), Mr. Jones established a Global Power Generation Solutions business built around a unique re-engineering tool that combined artificial intelligence and Electricite de France software into an IT solution for reducing operating and maintenance costs at electric generating plants. Another EDS role was to lead the evaluation of merger/acquisition strategies for utilities worldwide facing restructuring and privatization issues.

Mr. Jones also demonstrated his entrepreneurial talents at NAC International, where as Group Senior Vice President of Consulting he established an Information Technology and Management Consulting division focused on delivering IT and management consulting solutions to the emerging deregulated energy market. In his role at NAC International, Mr. Jones also led its worldwide technical consulting business with offices in Moscow, Tokyo, New York, Washington, Zurich, San Jose and Atlanta. As part of this role, Mr. Jones directed the outsourced classified system by the Department of Energy.

Mr. Jones also led the worldwide utility vertical at the Reston, VA -based James Martin & Co., where he established an applications development business focused on utility solutions – leading this organization to numerous large, diverse software developed solutions for utilities. These executive positions followed Mr. Jones' experience as a long-time employee of Southern Company (one of the world's largest investor-owned utilities and electricity producers), where he advanced from engineering programmer analyst to Southern Electric International executive in charge of exporting IT solutions to other utilities on a global basis.

Mr. Jones holds a B.S. degree in statistics from the University of Georgia.

Monetizing Energy Efficiency: Environmental Credits, White Tags™ and Beyond

April 13, 2007

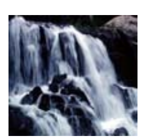
Sterling Planet

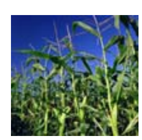
Renewable Energy

Solar. Wind. Water. Bioenergy.

Company Background and Introduction

- First nationwide green power marketer with 100% green energy choice
- Founded January 2000
- Sold over 10,552,591,132 kWh of green energy (equal to 969,551 average residential customers)
  - Nation's leader in renewable kWh sales
  - Includes largest transaction in U.S. green energy history
- Buyer and seller of green energy certificates
- Intellectual Property Includes:
  - Energy Efficiency Credits Measurement and Verification Software for White Tags™
  - Twelve Unique Renewable Energy Retail Products – Including Sterling Planet Fixed-Price Hedge™
  - Investment in the Greater Good™ Program
  - Investment in Today's Youth™ Program
  - Investment in a Greener Future™ Program
- Customers in 45 states
- 507 Commercial and Industrial Customers (many the largest purchase in their sector)
- Utility partnership-based enterprise – 41 utilities to date
  - Most utility partnerships in green industry
- Certified Products by Both Major Certification Organizations
  - Center for Resource Solutions (Green-e)
  - Environmental Resources Trust (ERT)
- Endorsed by environmental groups and government agencies





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Some of Our Clients

Some of our 507 Customers

Universities (30)

- Harvard
- Yale
- Duke
- Utah
- Florida State

Government (63)

- US Air Force
- US GSA
- US NASA
- US Homeland
- US EPA

Commercial & Industrial (373)

- Alcoa
- DuPont
- Johnson and Johnson
- Pfizer
- Staples
- Nike

Utilities (41)

- Florida Power & Light
- Consolidated Edison
- City of Austin
- City of Tallahassee
- Constellation NewEnergy

Sterling Planet is Active in All 3 Markets

REC Markets

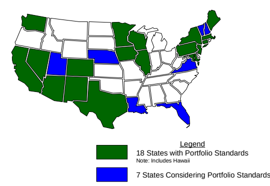
Voluntary Markets

- **Customers voluntarily pay more for renewable energy**
- **Participating in 22 (41 Overall) utility renewable marketing programs in:**
  - **Florida, Massachusetts, New York, Connecticut, New Jersey, Rhode Island and Washington, DC**

Mandated Markets

- **Sell RECs to utility to satisfy RPS**
- **Manage RECs exchange among utilities**
- **Provide RECs to government agencies**

Target Marketing – Portfolio Standards States



GHG Emission Markets

Greenhouse Gas Emission Markets

- **Very Early in its Definitions and Rules**
- **More Advanced in:**
  - **Europe**
  - **Japan**

"Voluntary" Market

• RECs represent the contractual right to claim the <u>environmental and other attributes</u> associated with electricity generated from renewable energy. Companies apply these to their Greenhouse Gas (GHG) emissions.

• Bank of America pledges to reduce its total U.S. GHG emissions by 9% from 2004 to 2009.

• Eastman Kodak pledges to reduce total global GHG emissions by 10% from 2002 to 2008.

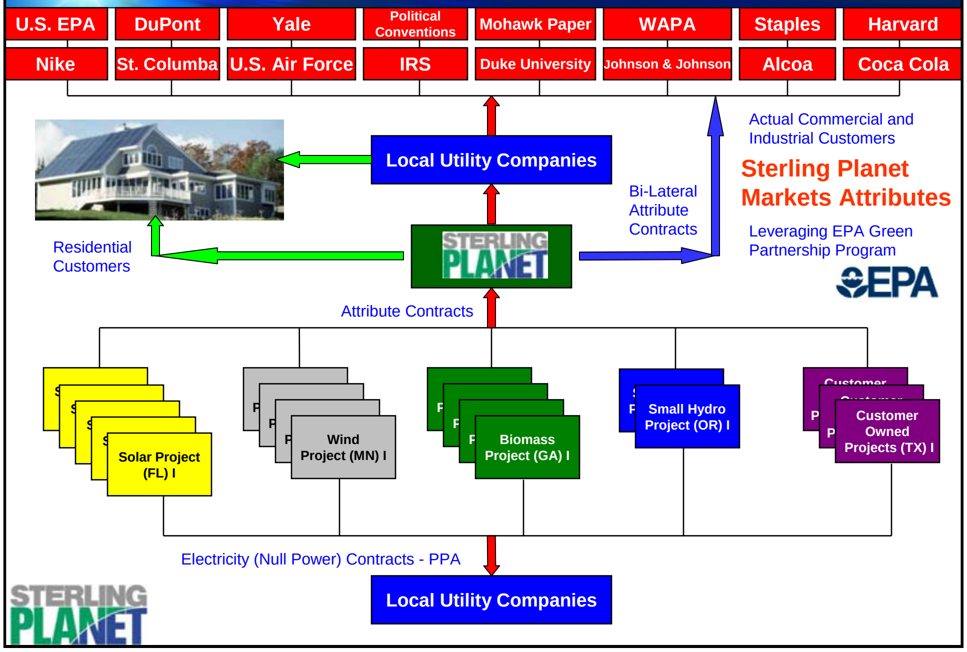
• Gap pledges to reduce its U.S. GHG emissions by 11% per square foot from 2003 to 2008.

• Marriott pledges to reduce U.S. GHG emissions by 6% per available room from 2000 to 2010.

• Pfizer pledges to reduce global GHG by 35% per $ of revenue from 2000 to 2007.

• Baxter, IBM, NREL and SC Johnson <u>achieved</u> their ambitious 2000 to 2005 goals.

Connecting The Market



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Marketing Scope

Sterling Planet Has Created Numerous "Green" Marketing Deliverables for its Clients Including:

- Banners
- Plaques
- News Releases
- Environmental Benefits Calculations
- News Events
- Coordinated Dedication Ceremonies
- Coordinated Open Houses
- Window Decals
- Environmental Newsletters
- Brochures
- Information and Educations Handouts
- Client Certificates
- Additional Marketing Materials ... As Needed

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What are White Tags?

- A new tradable attribute similar to green tags or Renewable Energy Credits (REC)
- Represents the value of energy not used (conserved) at facilities
- Created through the implementation of energy conservation (Demand-Side Management) projects
- Also known as Energy Efficiency (EE) Certificates & White Certificates

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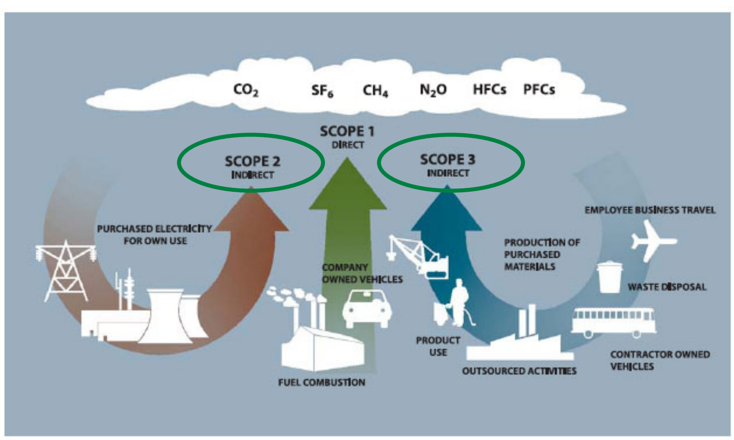
Intersection of RECs, White Tags™ and Carbon Credits

FIGURE 5 | OPERATIONAL BOUNDARIES



Source: New Zealand Business Council for Sustainable Development.

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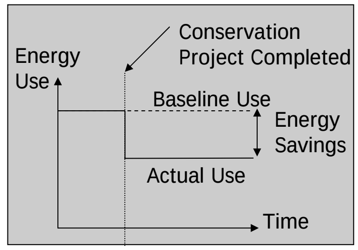
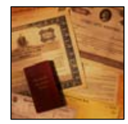
How are White Tags Created?

Implementation of energy conservation projects at a facility, including:

- Equipment upgrades, retrofits, & replacement
- Operational modifications & set point changes
- Energy management and monitoring systems
- Combined Heat and Power (CHP) or cogeneration
- New technologies (e.g. High Efficiency Lighting).



Save $



Create White Tag

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Measurement & Verification

White Tags™

- Prescriptive method for direct replacement/retrofit
- Metered method for cogeneration or CHP
- Design method for new buildings (LEED)
- Modeled method for operational changes (existing and new buildings)
  - Requires establishing a baseline (actual building or reference)
  - Traditionally used facility simulation models or statistical models
    - Facility: on-site, complex, expensive, subjective - but accurate
    - Statistical, off-site, simple, inexpensive, objective - but inaccurate
  - Sterling Planet has developed neural network model - best of both

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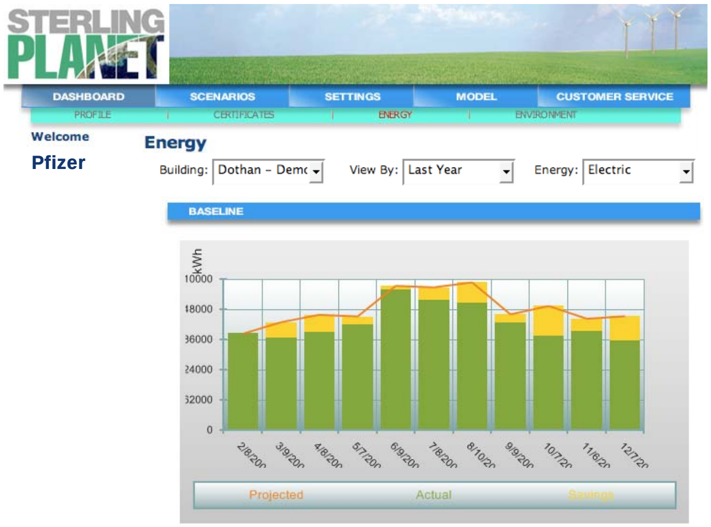
M&V: WhiteTag Pro™



- Neural Network
- Online System
- Large Portfolio
- Baseline
- M&V
- Scenarios
- Track
  - Energy Use
  - White Tags™
  - CO_2 (GHG)
  - NOx & SO_2
- Database (I/O)
  - Building
  - Billing
  - Weather

Comparison to RECs

White Tags™

Many Ways the Same

- Mandated Market - Same States & Similar Mandates (%)
- Voluntary Market - Same rationale, but larger market share (vs mandated)
- Market Size - Similar, but likely larger with broader scope & faster adoption
- Certification - Similar, but more complex (savings vs generation)

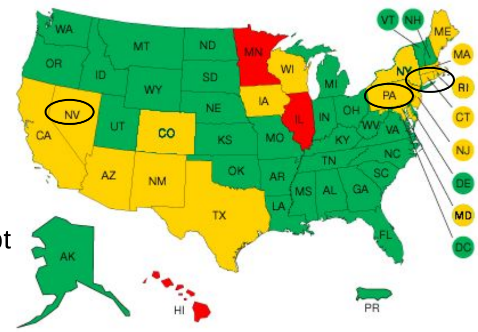
Some Ways Different

- Regulations - Facility based, not equipment based
- Measurement & Verification (M&V) - Historically problematic

Where Are White Tags Sold?

- Implemented in Italy & France (Mandated in UK)
- Mandated in 3 US states
  - Connecticut (2007)
  - Pennsylvania (2007)
  - Nevada (2007)
  - 9 Others Evaluating Concept
- Likely in 20 other RPS states

RPS states shown in yellow & red*



- Mandates require utilities in that state to purchase White Tags - creating minimum demand, certain buyers & a price floor
- May be created in one state and sold in another (global perspective)
- May be sold to corporations & federal gov't (CO_2 reduction - not mandates)

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* States that have voluntary renewable energy goals or RPS-type legislation without enforcement provisions

CT Regulations

White Tags™

- 1% of total electricity use in 2007; 4% by 2010
- Owner of facility, not equipment, has title to the tags
- If utility funds project (e.g rebates), utility owns tags
- Demand-side projects must involve physical activity
- CHP projects must achieve 50% efficiency & 20% thermal output
- Projects completed after January 1, 2006 qualify for tags
- Mandated markets began trading January 1, 2007
- Compliance prices in mandated markets range from 31 to 45 $/MWh
- Tags have a "vintage" and expire the year after created (+ 3 months)
- Certification requires the approval of a M&V plan

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Other Energy Efficiency Regulations/Policy

PA - Tier 2 “advanced energy resources” must account for an additional 10% of power sold. Tier 2 include energy efficiency, hydro, waste coal generation.

NV - 2005 amendment to the RPS to require Renewable Energy and Energy Efficiency to meet 20% of electricity by 2015, of which up to 25% can be met with energy efficiency. Considering peak demand multipliers.

TX – Utilities must offset 10% of demand growth.

CA – 12% of peak demand reduction and 10% of electricity use.

IL – 25% of projected load growth by 2017.

HI – Energy efficiency projects are treated the same as renewables.

Federal Government – 3% Energy Efficiency per Agency per Year for next 10 years.

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Questions?

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Steve Baden
Executive Director
RESNET

Steve Baden has worked in the residential energy efficiency field for over thirty years, including twenty-five years with home energy ratings and energy mortgages on both the state and national levels, and ten years administering a state energy office. Mr. Baden initiated the "Warm Homes for Alaskans Initiative" which received the "1993 National Award for the Most Outstanding State Housing Program" from the National Council of State Housing Agencies. Steve was also awarded "Lifetime Achievement Awards" from the U.S. Department of Energy and RESNET.

RESNET
Residential Energy Services Network
Setting the STANDARD for QUALITY

Monetizing Energy Savings: A Path to Low Emission Buildings

The Energy Efficiency Financing Forum
April 13, 2007

Steve Baden, RESNET
www.resnet.us

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RESNET's Key Services

Maintain National Home Energy Rating Standards

Accredit Rating Providers, Rating Software Programs, & Rater Training Providers

Work with the Financial Market Industry in Developing and Promoting New Energy Financing Products

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Home Energy Ratings

Are Voluntary

Accredited Rating Programs in all 50 States

Over 5,000 Raters Certified Across Nation

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National Home Energy Rating Standards

Rating Program Administration

Technical Guidelines

Rater Training and Certification

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What Are Ratings Used For?

Energy Efficient Mortgages

ENERGY STAR Home labeling

Performance option for energy code compliance in 16 states

Federal tax credit

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Setting the STANDARD for QUALITY

What Environmental Trading Has to Do With Building Performance?

Buildings Produce 39% of U.S. Carbon Emissions

- Residential – 21%
- Commercial – 18%

- Industrial – 28%
- Transportation – 33%

Improved Building Performance is Low Hanging Fruit in Carbon Offset Market

RESNET Residential Energy Services Network — Setting the STANDARD for QUALITY

Monetizing Energy Savings: A Path to Low Emission Buildings

Private Investment Decisions on the Energy Performance of Buildings do not Fully Reflect the Value of Building Energy Saving Investments

Financing Practices that Monetize Long-Term Energy Savings in Near-Term Investment Decisions can make a Major Contribution to Growing the Demand for High Performance Buildings

RESNET Residential Energy Services Network — Setting the STANDARD for QUALITY

Why Monetizing Energy and Pollution Savings is Important to the Path to Low Emission Buildings

Addresses "First Cost" Barrier

The barrier to the up-front cost can be reduced if the consumer can access long-term, no-down-payment, affordable interest financing or if a third party finances the upgrades in order to have title to the monetized energy and pollution savings to trade in the open market

RESNET Residential Energy Services Network — Setting the STANDARD for QUALITY

Monetizing Building Energy Savings in Private Investment Decisions

Opportunities

- + Carbon Emission Savings
- + White Tags
- + Utility Capacity Market
- + Energy Efficient Mortgages

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Carbon Cap & Trade

Created by Kyoto Protocol

European Union Taken Lead in Develop Carbon Cap and Trade Market

In EU a Total of $8 Billion Traded in 2005

European Climate Exchange, 2006

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U.S. Carbon Voluntary Offset Market

Market is experiencing significant growth as companies not subject to caps decide voluntarily to offset their emissions

Los Angeles Times Projects That US Market for Carbon Offsets Will Reach $40 Billion by End of Next Decade

Associated Press Reported in 2006 the Carbon Offsets Traded in the Chicago Climate Exchange Increased by 1,425%

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Carbon Cap & Trade

Potential Size of Market

"Global Market Worth $1 Trillion in the First Five Years Alone"

James Smith, Chairman, Shell Oil

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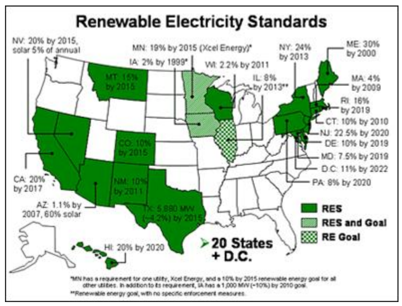
U.S. White Tags

Follow-up to Renewable Energy Certificates

State Sets Production Targets to Meet and Credits Can Be Bough or Sold - $900 Million Traded in 2005 (Navigant Consulting 2006)



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Capacity Markets

Need for New Electrical Capacity

Development of Capacity Credits that would allow energy efficiency as alternative to new power plant construction.

New England Forward Capacity Market – Levels playing field among all types of resources

Energy Mortgages

Increases the Home Buying Power of Consumers and Their Home's Equity

Energy Improvement Mortgage

+ Finances the Energy Upgrade of an Existing Home in the Mortgage Loan Using the Monthly Energy Savings

Energy Efficient Mortgage

+ Uses Energy Savings of Efficient Home to Increase the Consumer's Buying Power
+ Capitalizes Energy Savings in the Appraisal

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Energy Mortgages Offered By Secondary Mortgage Market

hud HOMES AND COMMUNITIES

DEPARTMENT OF VETERANS AFFAIRS UNITED STATES OF AMERICA

FannieMae

Freddie Mac
We Open Doors

Energy Mortgages

Although Seamless to Underwrite – Not Very Widely Used – Why?

+ Lenders and the Housing Industry Not Aware of the Products and Their Benefits
+ The value of the Product is Limited Because Aimed at Boosting Applicant's Income for Loan Qualification

Energy Mortgages

RESNET New Policy

Congress Adopt as Federal Policy That by 2020 Homes be 50% More Efficient Than They are Today

That Federal Sponsored Secondary Mortgage Market Has Responsibility to Meet Goal and Must Prepare a Plan to Congress on How They will Assist in Meeting This Goal and Report Annually to Congress

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Energy Mortgages

RESNET New Policy

The Secondary Mortgage Market Change Calculation of Housing Costs to "Principal. Interest, Taxes, Insurance Minus Monthly Energy Savings"

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RESNET New Policy

Why Feasible:

- + **Fannie Mae Already Has Incorporated Monthly Energy Savings in Desk Top Underwriter**
- + **The Rating Already Calculates the Energy Savings and Produces Mortgage Report**
- + **Secondary Mortgage Already Recognize RESNET Standards in Mortgage Underwriting**
- + **Certified Raters in Every State and Number is Growing**

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EU Directive on Energy Performance of Buildings

EU Priority on Energy Efficiency

"Energy saving is without doubt the quickest, most effective, and most cost-effective manner for reducing greenhouse gas emissions."

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EU Directive on Energy Performance of Buildings

Requirements

- **Establish Common Methodology for Calculating Building Energy Performance**
- **Ratings of All Buildings at the Time of Sale/Change of Occupancy**
- **New Building Thermal Regulations**
- **Annual Inspections of Boilers, Heating and Air Conditioning Systems**

Was to go into effect on January 1, 2006

2006 European Union Action Plan for Energy Efficiency

Priority Action 5: "Facilitating appropriate financing of energy efficiency investments"

The plan recognizes financing instruments because, "even though many energy efficiency measures are fully cost effective with very short pay-back periods, many such measures are not undertaken due to financial barriers."

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Creating A Tipping Point

Need for International Agreement on Defining Aspects of Calculating, Labeling and Certifying Building Performance

Need to Answer Question from Investment Community:

"Compared to What?"

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Creating A Tipping Point

Technical Issues

+ Common Definitions & Rules for Reference Building
+ Standards for Computation of Energy & Pollution Savings
+ Standards of Verification of Software & Calculation Methods
+ Protocols for recommending upgrades & estimating costs

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Creating A Tipping Point

Verification Issues

+ Qualification & Certification of Raters
+ Standards for Field Testing & Inspections
+ Definition of Quality Assurance Procedures
+ Definition of Insurance Requirements

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Why Important?

The Stakes Could Not Be More Critical

+ National Security

+ Global Environment

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What Has to Do With Building Performance?

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EU Directive on Energy Performance of Buildings

"Energy saving is without doubt the quickest, most effective, and most cost-effective manner for reducing greenhouse gas emissions."

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Why Monetizing Energy and Pollution Savings is Important to the Path to Low Emission Buildings

Economic Potential

If *LA Times* prediction of $40 carbon market by end of next decade & able to capture same % of residential carbon production - it would equate to:

$8.4 billion annual investment in U.S. in home energy performance improvements

Steven Schiller

Steve Schiller has thirty years of experience in the energy efficiency industry. His career has included senior management, engineering and project management roles. Steve has overseen the development and implementation of energy efficiency and load response programs and projects in the United States and other countries. Steve is also an internationally recognized evaluation, measurement and verification (EM&V) expert having been responsible for many of the guidelines used in the energy efficiency industry. Steve's domestic energy efficiency program work has included extensive activity in California as well as substantial program development, program management and strategic consulting for the federal government and in Colorado, New York, Oregon, Texas and Wisconsin for public agencies as well as investor owed utilities.

His international work has included energy efficiency utility program development for the World Bank in Poland, Croatia, Thailand and Vietnam. Steve is also active in California and national efforts associated with incorporating energy efficiency into emission reduction strategies; with respect to this role he is a consultant to the US EPA's Clean Energy-Environment State Partnership and National Action Plan for Energy Efficiency preparing guidance documents on efficiency, renewables and emissions mitigation.

Steve is the Principal of Schiller Consulting, Inc. He is also:

- Senior Advisor at the University of California's California Institute for Energy and Environment
- Vice Chairman, Board of Directors California Climate Action Registry (appointed by the California State Senate)
- Steering Committee, United States Multi-State Climate Registry
- Board of Directors, International Efficiency Valuation Organization (the organization responsible for the M&V standard – IPMVP) and IPMVP Fellow
- United Nations Framework Convention on Climate Change CDM Methodology Roster of Experts
- Arbitrator with American Arbitration Association

Prior to starting Schiller Consulting, Steve was a Senior Vice President of Nexant, Inc. Nexant acquired Steve's firm, Schiller Associates, in 2000. Before launching Schiller Associates, Steve was a manager and engineer with several consulting firms and a staff scientist at the Lawrence Berkeley National Laboratory. Steve holds a M.S. in Mechanical Engineering from the University of California, Berkeley and a B.S. in Mechanical Engineering from the University of Michigan. He is a registered Mechanical Engineer in California.

He can be contacted at steve@schiller.com.

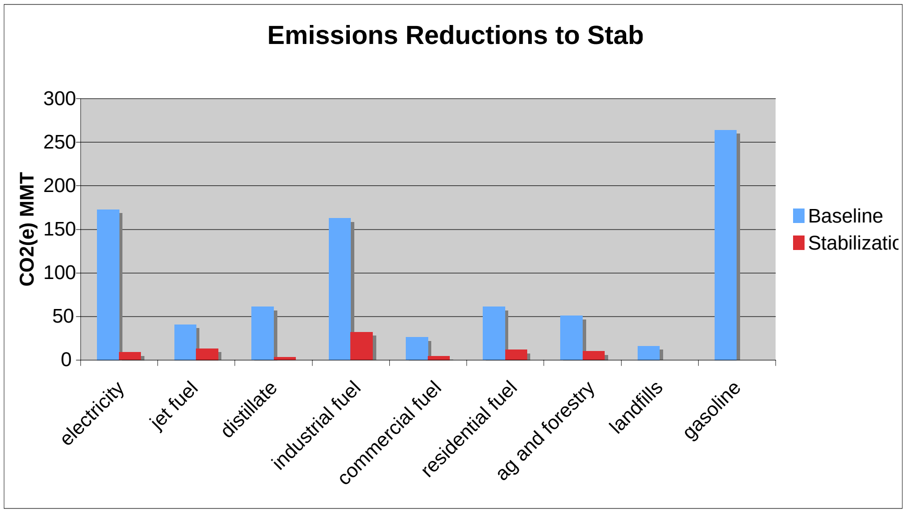
A Fifteen Minute Primer to Energy Efficiency, Avoiding Emissions, and Documenting Both - Just the Facts (sort of)

Steve Schiller
Schiller Consulting, Inc.
steve@schiller.com
April 2007
Monetizing Energy Efficiency: Environmental Credits, White Tags and Beyond

Summary

- We need to reduce use of carbon fuels
- Efficiency is the first and best option and will require a great deal of investment - and thus provide a great deal of opportunity
- There are a number of ways to integrate efficiency into GHG programs
- No mater how we integrate efficiency into climate or other programs documenting benefits is an established science (and art)

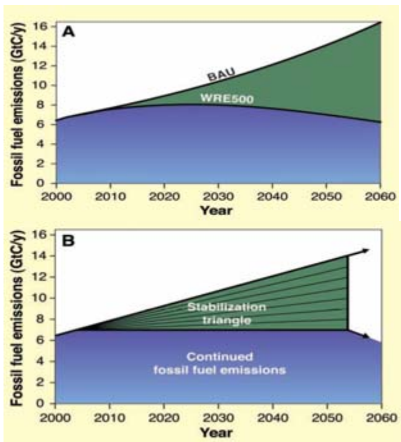
What We Need Do



Power Industry Mitigation Strategies

- End use efficiency
- Supply (generation, T&D) efficiency
- Renewables
- Lower carbon fuels - e.g, IGCC and the “nuclear option”
- Changes in operations (transportation, leakage)
- Sequestration
- - There is no carbon scrubber available -

Multiple technologies can contribute to stabilizing concentrations…



Today's Technology	Actions that Provide 1 Gigaton/year of Mitigation	Major Issues
Coal Plants	Replace1,000 conventional 500-MW plants with "zero-emission" power plants	Technical, Social, & Economic Viability
Geologic Sequestration	Install 3,500 Sleipners, at 1 Mt of CO_2 per year	Technical, Social, & Economic Viability
Nuclear	Build 500 1 GW plants	Economics, Safety, Non-proliferation,
Efficiency	Deploy 1 billion cars at 40 mpg instead of 20 mpg	Distributed opportunity that is hard to capture
Wind	Install 750 x current U.S. wind generation	Geographic Limitations, Storage
Solar PV	Install 4,500 x current U.S. solar generation	Geographic Limitations, Storage

Source: Pacala and Socolow, Science, 2004

Hierarchy of Policy Actions to Stable Carbon Levels

1. Research
2. Voluntary reporting
3. Voluntary reductions
4. Mandatory reporting
5. Incentive based reductions and mandatory reductions in specific sectors
6. Universal mandatory reductions
7. Ratcheting up of reduction requirements

U.S. federal

Europe
CA
RGGI

Incentive Based and Mandatory Reductions - Options

- Carbon tax
- Mandatory energy efficiency resource standards
- Incentive programs
- Codes and standards
- Cap and trade
- Other …..

Issues for Resolution - Efficiency and Cap & Trade

- Ownership
- Additionality
- Double counting
- Transaction costs/aggregation
- Real reductions

Aggregation and Transaction Costs

Assumption: tons of carbon reduction assume a rate of 1000 metric ton/GWh and $10/metric ton value

- 500,000 kWh (0.5 GWh) Efficiency Project (a big project)
  - Annual economic value of CO_2 savings
    ~ $5,000 (a few percent of energy value)

- 2005 Southern California Edison goal = 826 GWh
  - Annual economic value of CO_2 savings
    ~ $8,000,000

Cap and Trade - are there reductions below the cap?

- A regulating authority sets a cap on total mass emissions for a group of sources for a fixed compliance period (e.g., 1 year) - example - 40 million tons per year for CA

- The regulating authority divides the cap into allowances, each representing an authorization to emit a specific quantity of pollutant (e.g., 1 ton of CO_2) and allocates those allowance

- Efficiency only results in emissions below the cap, in a "capped system", if the "allowance" is retired

Incentive Based and Mandatory Reductions - Options, if Cap and Trade Does Not Work for Efficiency

- Carbon tax
- **Mandatory energy efficiency resource standards**
- **Incentive programs**
- **Codes and standards**
- Cap and trade

And we have something already - The Consortium for Energy Efficiency reports that in 2006, US state demand-side management budgets totaled an estimated $2.6 billion, an increase of 13 percent from 2005

How Do We Document the Savings From This Investment - Measurement and Verification (M&V)

- We use protocols that have been established over the past 20+ years and have been proven to document when savings occur
- Thus, the "infrastructure" has been developed and, while not perfect, is more than "good enough" to make investors confident, especially when looking at energy efficiency investments on a portfolio basis

What is M&V

Measurement and Verification of savings is a balancing act

between cost and risk.

risk = uncertainty

and

uncertainty = volatility

M&V seeks to cost-effectively **identify and measure** technical and contractual volatility.

M&V Protocols (Partial Listing)

- 1970s Case by Case Measurements
- 1983 - International Energy Agency's "Guiding Principles for Measurement"
- 1985 - Oak Ridge National Laboratory's "Field Data Acquisition for Building and Equipment Energy Use Monitoring"
- 1988 First NAESCO M&V Guideline used by New Jersey Utilities
- 1989 Texas LoanSTAR Program M&V Guidelines
- 1991 - ASHRAE Handbook, Chapter 37 "Building Energy Monitoring" (revised in 1995 and 1999)
- 1993 New England AEE M&V Protocol
- 1993 NAESCO M&V Guideline ver. 1.3
- 1994 PG&E PowerSaving Partners "Blue Book"
- 1995 EPA Conservation Verification Protocols
- 1996 NEMVP -
- 1996 FEMP M&V Guideline (revision in 2000)
- 1997 IPMVP
- 1999 California SPC M&V Guidelines
- 2000 TXU Standard Offer M&V Guidelines
- 2001 IPMVP
- 2002 ASHRAE Guideline 14

Today - lots of resources - partial list

- 2006 California Energy Efficiency Evaluation Protocols
- 2006 US DOE Guide for Managing General Program Evaluation Studies
- 2007 New England ISO M&V Handbook for Demand Side Resources (forthcoming)
- 2005 International Energy Agency Guide on Evaluating Energy Efficiency Policy Measures & DSM Programmes
- 2004 Protocols to Measure Resource Savings (New Jersey Clean Energy Program)
- 2002 ASHRAE Guideline 14
- 2001 IPMVP
- 2000 FEMP M&V Guideline

And More Forthcoming

- 2007 IPMVP
- 2007 WRI Electricity Sector Project GHG Protocol (forthcoming)
- 2007 US EPA Evaluation, Measurement and Verification of Electricity Savings for Determining Emission Reductions
- 2007 EPA/DOE National Action Plan for Energy Efficiency, Guide for Program Evaluation

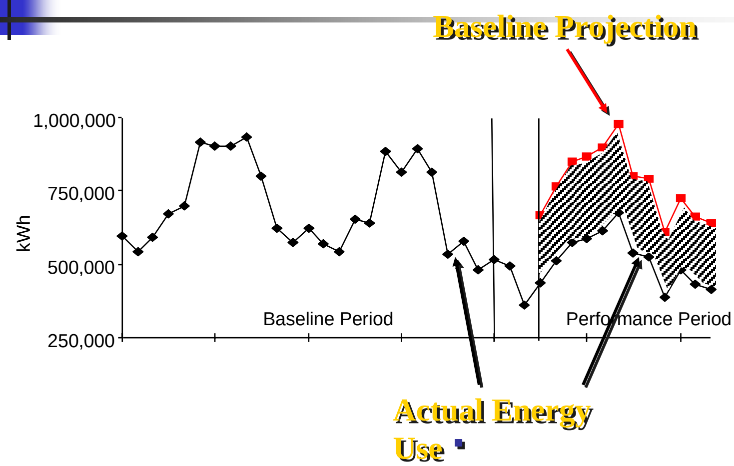
International Performance Measurement and Verification Protocol (IPMVP)

- Today, IPMVP is the leading international energy efficiency M&V protocol:
  - IPMVP has been translated into 10 languages and is used in more than 40 countries
  - In 2006 alone, EVO presented 18 IPMVP/M&V workshops, seminars and trainings on four continents in nine countries
  - Since going online, there have been 20,000 downloads of the IPMVP
  - Certified M&V Professional Training program started (in 2006 trained 270 new CMVPs in the US, Canada and South Africa)
- More information can be found at www.evo-world.org

Greenhouse Gas Protocols

- Voluntary Protocols - Chicago Climate Exchange
- Protocols in Mandatory World
  - CA Climate Action Registry
  - Multi-State Registry

Determining the Savings



Two Components to M&V

- Verify potential to generate savings
- Determine savings

Example: Lighting Retrofit -

Potential to Generate Savings:
Before
100 Watts/fixture

After
23 Watts/fixture

Savings:
Savings determined by how many fixtures and operating hours

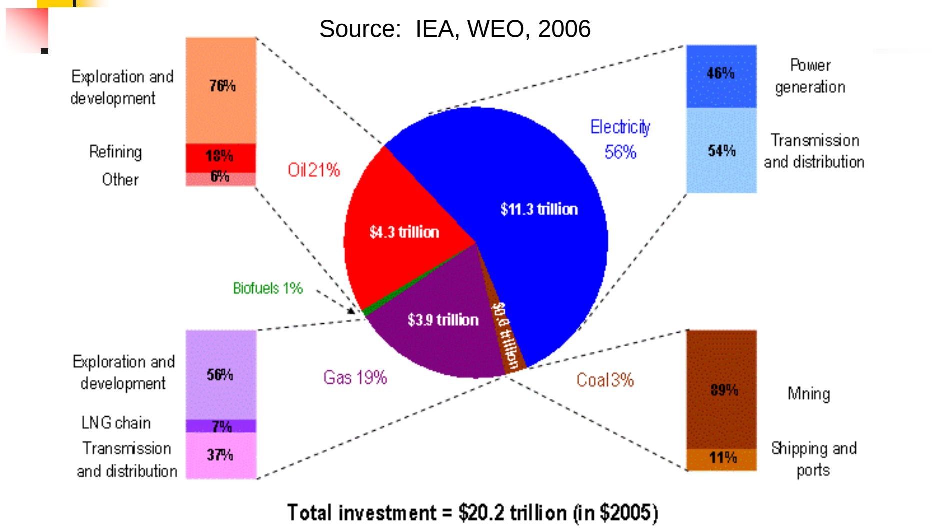
Determining Savings

- Deemed or stipulated savings for common, predicable "plug and play" measures
- Project-based Measurement and Verification approaches for larger, custom projects, based on accepted protocols - typically using utility billing data
- Portfolio wide savings calculations using sampling
- Within IPMVP there are four options:
  - OPTION A - Retrofit isolation with measured performance and stipulated operation
  - OPTION B - Retrofit isolation with measured performance and measured operation
  - OPTION C - Whole building or utility bill comparison
  - OPTION D - Calibrated computer simulation

Summary

- We need to reduce use of carbon fuels
- Efficiency is the first and best option and will require a great deal of investment
- There are a number of ways to integrate efficiency into GHG programs
- Integrating it into cap and trade programs may not be the best way, but irrespective there are tried and true mechanisms
- No mater how we integrate efficiency into climate or other programs documenting benefits is an established science (and art)

Cumulative Investment in Energy Infrastructure, 2005 - 2030 (Slide from Jonathon Pershing, World Resources Institute)



Michael Winka

Director

New Jersey Board of Public Utilities
Office of Clean Energy

In 2003 Mike was named the Director of the newly organized Office of Clean Energy in the New Jersey Board of Public Utilities. He manages the New Jersey Clean Energy Program and the State Energy Plan. The Office is responsible for promoting energy efficiency, clean energy generation and renewable energy generation through the various regulatory and non-regulatory tools available to NJBPU including the USDOE State and special project funding, societal benefits charge Energy Efficiency and Renewable Energy funding, renewable portfolio standards, RECs and emissions portfolio standards and soon to be established energy efficiency portfolio standards.

Mike is the designated State Energy Officer for Energy Efficiency and Renewable Energy activities and is support staff for the NARUC Renewable Energy and Greenhouse subcommittee. Mike is also a working group member of the Regional Greenhouse Gas Initiative (RGGI).

Mike worked for the New Jersey Department of Environmental Protection for 22 years. His past duties included Chief in the NJDEP's Bureau of Resource Recovery and Administrator for the NJDEP's Office of Innovative Technology and Market Development. This included managing an interstate technology acceptance reciprocity program. At NJDEP Mike was responsible for overall management of the NJ Sustainability Greenhouse Gas/Climate Change Action Plan

Refreshment Break

Institutional Investor Roundtable:
Perspectives on Investing in Energy Efficiency

Moderator:
Everett Smith III**,** *Chief Financial Officer*
NEW ENERGY CAPITAL

Panelists:
Scott Barrington, *Director of Private Equity*
PIPER JAFFRAY PRIVAL CAPITAL

Thomas Martin, *Vice President*
PACIFIC CORPORATE GROUP

Andrew Musters, *Partner*, *Alternative Investments*
ROBECO

Everett Smith III

Mr. Smith is Chief Financial Officer of New Energy Capital, a leading investor in renewable energy, and a member of the VantagePoint Venture Partners CleanTech Practice Group where he focuses on CleanTech Infrastructure investments. Previously, Mr. Smith was employed by the GE Capital Structured Finance Group ("SFG") "), the business unit responsible for GE's energy investment activities, for 15 years in a variety of senior executive positions as a Managing Director and Executive Vice President. Among his roles, Mr. Smith led business development for SFG, including asset and business acquisitions as well as the development of new business platforms and channels to market. Previously, he was head of SFG-International, with responsibility for the group's investment activities outside North America, managing a team of 80 professionals around the world, building a $1.5 billion financing and private equity portfolio. He was involved in the establishment of the $1.2 billion AIG-GE Capital Latin America Infrastructure Fund and was a member of the Fund's Investment Committee for 8 years during which time the Fund made numerous energy and infrastructure investments. Previously, Mr. Smith was based in Singapore as Head of SFG-Asia Pacific where he led the closing of multiple project financed energy investments including Indonesia's first independent power plant as well as private equity investments in China, India and the Philippines. Mr. Smith joined GE Capital in 1989 with investment responsibility for U.S. utility and utility affiliated energy companies, providing debt and private equity capital for corporate and project finance transactions. During this time he co-developed and financed a number of cogeneration facilities including a development joint-venture with Pacific Gas & Electric and Bechtel which led to GE's largest private equity investments in power at that time.

Prior to joining GE Capital, Mr. Smith spent over a decade at Chemical Bank as a Vice President in Energy & Minerals Group focused on utility corporate and project finance and financings for the independent oil and gas industry. Following GE, Mr. Smith was a Partner at Coller Capital, a private equity secondary investment firm

Scott Barrington
Private Capital
612 303-1110
scott.l.barrington@pjc.com

Scott Barrington is a founder of the fund of funds team, which was established in January 2000 to build upon the extensive private equity capabilities of Piper Jaffray. He is also a member of the Private Equity Partners Investment Committee.

Prior to joining Piper Jaffray, Barrington practiced law at Dorsey and Whitney LLP. At Dorsey, he was a member of the emerging companies group where he advised start-up companies and private equity firms regarding LBO and VC transactions, M&A, IPOs and other corporate finance matters. Previously, Barrington was an analyst in the M&A department of Citigroup. He also is the Chairman of a private health care company, a board member of a private software company and is a regular guest lecturer at Macalester College's entrepreneurship and capital markets classes. Barrington graduated Phi Beta Kappa with a bachelor's degree in mathematics and economics from Macalester. He earned his Juris doctor from the University of Michigan Law School.

Thomas Martin, *Senior Vice President*, serves as a member of the Investment Committee and leads the identification, analysis, due diligence and selection of private market investments in the Clean Technology, Energy & Infrastructure sectors. Prior to joining PCG in 2002, Mr. Martin was a Vice President at Laffer Associates, a boutique investment research and consulting firm where he was responsible for producing investment research and analysis for a global client base of institutional investors. Mr. Martin received a Masters of International Affairs from the University of California San Diego, a Masters of Science in International Economics and Business from the Stockholm School of Economics, and a Bachelor of Arts from Bucknell University. Mr. Martin also attended special educational programs at the London School of Economics and Doshisha University in Kyoto, Japan.

Andrew Musters, Partner. Mr. Musters is responsible for all European private equity investments of Robeco and Clean Technology investments worldwide. Mr. Musters has a seat on the advisory board of nine private equity funds in the current portfolio. In addition, Mr. Musters is a member of the advisory board of the Clean Tech Venture Network Europe. Prior to joining Robeco in 2000, Mr. Musters was in the Structured Investments division of the Dutch pension fund ABP, where his responsibilities included public and private equity investing. Previously, he was on the Faculty of Technology Management of the Eindhoven University of Technology, focusing on research and consultancy in the field of mathematical business modeling and decision support tools for energy companies. He has lectured and carried out research projects in clean tech and has spent time in South Africa assessing the environmental aspects of the local energy system. Prior his academic engagements, Mr. Musters worked for the Policy Studies Unit of the Netherlands Energy Research Foundation, where he conducted research in the field of energy-economy-environment interaction. Mr. Musters, who is the author of a number of scientific and applied papers, received an M.Sc. cum laude in Industrial Engineering from the Eindhoven University of Technology with a specialization in Energy and Environmental Technology, an M.A. cum laude in Economics from Tilburg University, and continued his executive education at the University of Amsterdam and INSEAD.

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Robeco Clean Tech Private Equity II

a fund investing in the next wave of innovation

Andrew Musters

Robeco

The Energy Efficiency Finance Forum

New York, 13 April 2007

Contents

Introduction to Robeco

- Robeco Group – independently operating asset management firm with more than 700 institutional and over 1.5 million retail clients with $156 billion in assets under management as of 12/31/05

- Founded in The Netherlands in 1929

- Global organization
  - Global experience since 1930s
  - One of Europe's first international asset managers
  - Headquartered in Rotterdam, the Netherlands, with offices in the United States, Germany, France, Belgium, Switzerland, and Spain

- Fully owned by Rabobank and independent with regard to its company strategy and investment policy

Rabobank

- Rabobank - one of Europe's largest diversified financial groups with interests in commercial banking, insurance and securities
  - Assets of $600 bln as of 12/31/05
  - Top fifteen largest financial institutions globally by Tier I capital

- The only privately-held commercial bank in the world rated Triple-A by Moody's and Standard & Poor's

- Global organization
  - 248 banks in The Netherlands with 1249 branch offices
  - 267 offices in 37 countries, including New York, San Francisco, Dallas, Chicago and Atlanta

ROBECO

Robeco Private Equity

- Strong team of 20
  - 11 Experienced investment professionals
  - 100+ back office staff, 6 dedicated
  - 13 internal legal and 3 tax counsel, of which 3 dedicated

Professionals	*Title*	*Experience*	*Responsibilities*
Ad van den Ouweland	**Managing Partner**	**20**	**Emerging Markets**
Harrie Meijers	**Partner**	**30**	**CIO**
Andrew Musters	**Partner**	**12**	**Europe, Cleantech**
Mikan van Zanten	**Partner**	**9**	**North America, Secondaries**
Erwin Quartel	**Investment Officer**	**11**	**Midoffice, Emerging Markets**
Stefan den Doelder	**Investment Manager**	**9**	**Cleantech**
Jesse de Klerk	**Investment Manager**	**6**	**Cleantech, Europe**
Ewoud van de Sande	**Investment Manager**	**7**	**North America, Coinvestments**
Brian Frieser	**Analyst**	**1**	**Europe**
Craig Cummins	**Analyst**	**1**	**Cleantech**
Niels van Zijl	**Analyst**	**1**	**North America**

ROBECO

What is Clean Tech?

The term 'clean tech' refers to technologies that:

- Use energy, water and other raw materials more efficiently and productively,
- Deliver equal or superior performance,
- Improve customer profitability, through cost reduction and/or increased revenues, and
- Create less waste or toxicity

... compared to incumbent technologies.

Source: http://cleantechvc.blogspot.com

Clean tech sectors:

Energy
- Energy Generation
- Energy Storage
- Energy Infrastructure & Metering
- Energy Efficiency

Transportation & Logistics

Water Purification & Management

Air Quality

Materials & Nanotechnology

Manufacturing/ Industrial

Agriculture & Nutrition

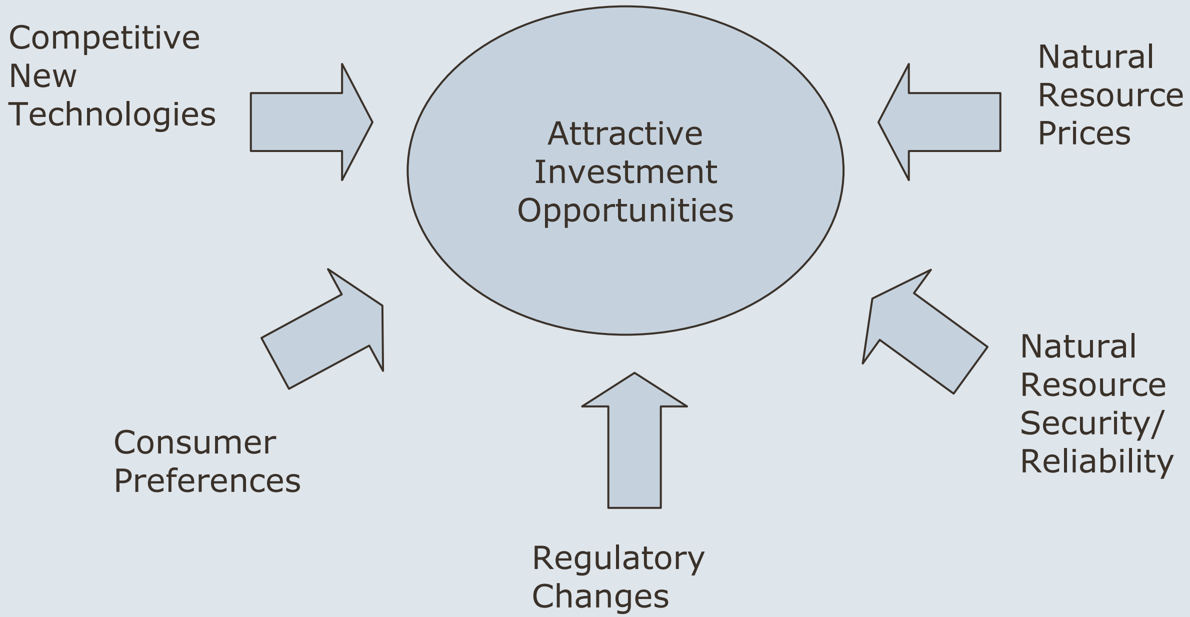
Enabling Technologies

Environmental IT

Materials Recovery and Recycling

Why Clean Tech?

The market dynamics for clean tech investing are very favorable:



Robeco's Approach

- Our approach is dedicated to investing in the **new clean tech stars.**
- Our approach integrates the strengths of Rabobank and Robeco:
  - **Rabobank** is a world leader in sustainability and clean technology
  - **Robeco** has one of the most experienced private equity teams in Europe
  - Sponsors' interests are **uniquely aligned** with investors'– their combined potential **$100+ million** commitment illustrates their belief in and commitment to clean tech
- Our approach builds on our experience gained with Robeco Sustainable Private Equity, a pioneering fund (2004) in the clean tech fund-of-funds area with strong support from leading institutional investors.

Market Leader in Clean Tech

- Strong deal flow
  - Proprietary database clean tech private equity funds dating back to 2003
  - Robeco Clean Tech is renowned in the clean tech universe
    - Launched first sustainable private equity fund of funds globally in 2004
    - Advised by Rabobank

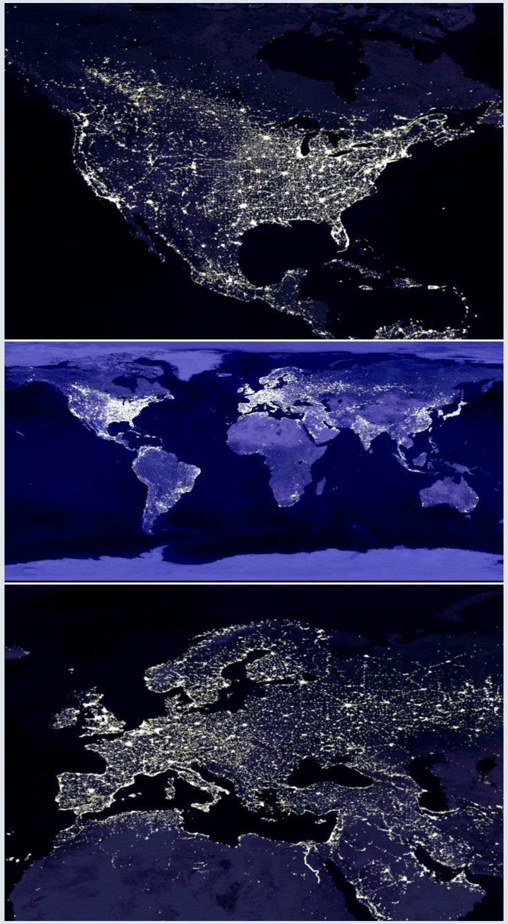
      »Ranked #2 worldwide in sustainability performance [1)]

      »Recipient of the Royal Award for Responsible Investment, a joint award by United Nations Environment Programme ('UNEP') Finance Initiative and the Royal Awards Foundation.

- Deep Domain Expertise
  - Extensive experience in clean tech
  - Advised by Rabobank Corporate Social Responsibility Division
    - 30 professionals, of which 3 are dedicated Clean Tech advisors

[1)] Source: Swiss Asset Management 2005 Corporate Sustainability Assessment, September 8th, 2005.

Investment Strategy


Source: NASA

Our approach is diversified across geographies:

Geography	Target allocation
North America	40% - 70%
Western Europe	20% - 50%
Emerging Markets	0% - 20%

Our approach is diversified across sectors:

Sectors
Renewable Energy (Solar, Biofuels, Wind, Wave and Thermo), Energy Efficiency, Waste-to-Energy, Advanced Metering, Material Recycling and Biomaterials, Water Technology and Air Treatment Technology

Our approach is diversified across managers:

- 15 to 25 funds
- Primary funds, secondary funds, co-investments

ROBECO

Strong track record prior Funds - Absolute basis

First Generation Funds Performance as of September 30, 2006

Fund	Currency	Committed Capital	Invested Capital	Realized Distributions	Unrealized Fair Value	Total Value	Gross IRR [15]	Net IRR [16]	Net Multiple [17]
Robeco Global Fund I	USD	183.4	143.6	72.2	122.4	194.6	17.3%	14.7%	1.55
Robeco European Fund I	USD	94.2	59.7	27.9	52.8	80.7	27.1%	22.0%	1.53
Total	USD	277.6	203.3	100.1	175.2	275.3	19.2%	16.2%	1.54

All figures in millions

15 Gross IRR is the annualized internal rate of return of the respective fund based on the cashflows between such fund and its investee funds.
16 Net IRR is the average annualized internal rate of return of the investors who invested in the applicable fund from inception in April 2001 through September 30, 2006, and is calculated after deduction of all operating expenses (including transaction and related costs), average annual management fees of 0.7% and incentive compensation equal to 5 to 10%. Past performance is not necessarily indicative of future results, and investors must be prepared to lose all or substantially all of their investment.
17 For each fund, the Net Multiple is equal to (i)(x) the sum of all distributions made by the respective fund to its investors plus (y) the sum of the capital accounts of all investors of such fund as of September 30, 2006 divided by (ii) the sum of all contributions made by the investors of such fund. Note that the Net Multiple is higher than Total Value divided by Invested Capital as a result of the reinvestment of Distributions.

ROBECO

Strong track record prior Funds – Relative basis

Commitment Weighted Breakdown of Global Fund I Investee Funds as of September 30, 2006
Compared to Thomson Venture Economics as of June 30, 2006

- 4th Quartile - 8%
- 3rd Quartile - 21%
- 2nd Quartile - 25%
- 1st Quartile - 45%

Comparison of Robeco Net Returns in USD [19]

Dow Jones Industrial	8.4%
S&P 500	9.2%
MSCI World	13.5%
Global Fund I	14.7%

Source: Robeco

MSCI Europe	21.1%
European Fund I	22.0%

Source: Robeco

Comparison of Robeco Gross Returns in Local Currency [20]

Median	-1.0%
Top quartile	10.5%
Pooled average	13.4%
Global Fund I	17.3%

Source: Robeco

Median	-2.3%
Top quartile	2.1%
Pooled Average	14.0%
European Fund I	22.8%

Source: Robeco

19 The comparison of net returns for the public indices are constructed such that gross cash flows that would be invested in the selected funds are instead invested in the public indices. No costs are assumed for the investments in the public indices, whereas the comparison is with the Net IRR's of the funds including costs.
20 The Median and Top Quartile returns are based on the Cumulative Benchmark Summary of Thomson Venture Economics data for private equity funds with vintage years 2001 up to and including 2005 dated as of June 30, 2006.The Top Quartile return shows the bottom of the 25% best performing funds ranked by net internal rate of return. The Pooled Average return shows the net internal rate of return of the aggregated cash flows of all funds. Robeco's returns are as of September 30, 2006. Please note that for the Global Fund I comparison, the Thomson Venture Economics data relates to U.S. funds only. Also, note that the returns of European Fund I are shown in euros in this graph for better comparison with the relevant indices. Note that in the shown period, the Pooled Average returns were higher than the Top Quartile returns probably as a result of the good performance of several large funds.

The value of your investments may fluctuate. Results achieved in the past are no guarantee of future results.

Returns of prior funds are shown for information purposes only – there is no guarantee that the current fund will achieve similar returns.

Summary

- **Large market potential for clean tech**
- **One of the most experienced private equity teams in the world**
- **Market leader in clean tech**
- **Proven track record**
- **Robeco's cornerstone commitment**
  - Strong alignment of interests
  - Exceptional institutional commitment to private equity

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THIS PRESENTATION DOES NOT PROVIDE SUFFICIENT DATA TO EVALUATE THE MERITS AND RISKS OF AN INVESTMENT IN THE FUND AND IS NEITHER AN OFFER TO SELL NOR A SOLICITATION OF AN OFFER TO PURCHASE AN INTEREST IN THE FUND. SUCH OFFER OR SOLICITATION MUST BE ACCOMPANIED BY A CONFIDENTIAL INFORMATION MEMORANDUM (PROVIDED TO QUALIFIED OFFEREES ONLY) THAT DESCRIBES THE RISKS, CONFLICTS OF INTEREST AND FEES AND EXPENSES RELATING TO AN INVESTMENT AND YOU SHOULD READ THOSE DOCUMENTS CAREFULLY BEFORE YOU INVEST IN THE FUND.

PAST PERFORMANCE IS NOT AN INDICATION OF FUTURE RESULTS. THERE CAN BE NO ASSURANCE THAT THE FUND WILL ACHIEVE ITS OBJECTIVES. RETURNS REFLECT THE REINVESTMENT OF DIVIDENDS AND OTHER EARNINGS AND ARE NET OF TRANSACTION COSTS AND INVESTMENT MANAGEMENT FEES. THE FUND IS NOT AND WILL NOT BE REGISTERED UNDER, AND AN OFFERING OF INTEREST IN THE FUND WILL BE MADE IN RELIANCE UPON AN EXEMPTION FROM, THE REGISTRATION REQUIREMENTS OF THE SECURITIES ACT OF 1933, AS AMENDED AND STATE SECURITIES LAWS FOR OFFERS AND SALES OF SECURITIES WHICH DO NOT INVOLVE ANY PUBLIC OFFERING. THE FUND IS NOT REGISTERED AND DOES NOT INTEND TO REGISTER AS AN INVESTMENT COMPANY UNDER THE INVESTMENT COMPANY ACT OF 1940, AS AMENDED, AND IS NOT SUBJECT TO THE SAME REGULATORY REQUIREMENTS AS MUTUAL FUNDS.

AN INVESTMENT IN THE FUND IS SPECULATIVE, INVOLVES SIGNIFICANT RISKS AND IS SUITABLE ONLY FOR THOSE PERSONS WHO CAN (I) BEAR THE RISK OF LOSING ALL OR A SUBSTANTIAL PORTION OF THEIR INVESTMENT; AND (II) WHO HAVE A LIMITED NEED FOR LIQUIDITY IN THEIR INVESTMENT AS THERE ARE RESTRICTIONS ON SELLING OR TRANSFERRING INTERESTS IN THE FUND, INCLUDING BUT NOT LIMITED TO SET REDEMPTION DATES, NOTIFICATION REQUIREMENTS, POTENTIAL WITHDRAWAL FEES AND THE ABSENCE OF ANY SECONDARY MARKET FOR THE FUND. THE FUND MAY DISTRIBUTE TO REDEEMING INVESTORS, SECURITIES THAT MAY NOT BE READILY MARKETABLE. THE FUND AND INVESTEE FUNDS (I) ENGAGES IN LEVERAGING AND OTHER SPECULATIVE INVESTMENT PRACTICES THAT MAY INCREASE THE RISK OF INVESTMENT LOSS; AND (II) MAY HAVE VOLATILE PERFORMANCE. THE FUND'S AND INVESTEE FUNDS' HIGH FEES AND EXPENSES MAY OFFSET THE FUND'S TRADING PROFITS. THE FUND IS NOT REQUIRED TO PROVIDE PERIODIC PRICING INFORMATION TO INVESTORS, AND MAY INVOLVE COMPLEX TAX STRUCTURES AND DELAYS IN DISTRIBUTING TAX INFORMATION. TAX EXEMPT INVESTORS MAY BE SUBJECT TO UBTI. THE PERFORMANCE FEE MAY CREATE AN INCENTIVE TO MAKE RISKIER INVESTMENTS. THE SUCCESS OF THE FUND DEPENDS PRIMARILY ON INVESTMENT MANAGER'S ABILITY TO CHOOSE THE UNDERLYING FUND MANAGERS AS THE MULTIMANAGER APPROACH DELEGATES CONTROL OF THE FUND'S INVESTMENTS TO PERSONS OTHER THAN THE MANAGER OF THE FUND OF FUNDS. THE SUCCESS OF A FUND OF FUNDS DEPENDS ON THE ABILITY OF THE MANAGER OF EACH UNDERLYING FUND TO SELECT INVESTMENT OPPORTUNITIES, TO CORRECTLY INTERPRET MARKET DATA AND OTHERWISE IMPLEMENT THE UNDERLYING FUND'S STRATEGY.

THE FUND AND INVESTEE FUNDS MAY UTILIZE HIGHLY SPECULATIVE INVESTMENT TECHNIQUES, HOLD HIGHLY CONCENTRATED PORTFOLIOS, CONTROL POSITIONS AND ILLIQUID INVESTMENTS AND PARTICIPATE IN WORKOUTS. THE AVAILABILITY OF INVESTMENT OPPORTUNITIES GENERALLY WILL BE SUBJECT TO MARKET CONDITIONS. TO THE EXTENT A PORTION OF COMMITTED CAPITAL IS NOT INVESTED, THE FUND'S POTENTIAL FOR RETURN WILL BE DIMINISHED. THE FUND AND INVESTEE FUNDS MAY INVEST IN PORTFOLIO COMPANIES THAT ARE NEW VENTURES. THESE INVESTMENTS ARE SUBJECT TO GREATER RISK OF LOSS THAN THOSE IN COMPANIES WITH MORE STABLE OPERATIONS OR FINANCIAL CONDITION. THE FUND AND EACH INVESTEE FUND MAY HAVE LIMITED OR NO OPERATING HISTORY UPON WITH AN INVESTOR MAY EVALUATE LIKELY PERFORMANCE. NUMEROUS OTHER PRIVATE EQUITY INVESTORS HEAVE RAISED OR ARE RAISING NEW CAPITAL FOR INVESTMENTS. THIS COULD INCREASE COMPETITION FOR ATTRACTIVE INVESTMENTS AND MAKE IT DIFFICULT FOR THE FUND TO ACHIEVE ITS OBJECTIVES. INVESTMENTS MADE WITH NON US DOLLARS WILL BE SUBJECT TO FLUCTUATIONS IN THE EXCHANGE RATE WHICH MAY HAVE AN ADVERSE EFFECT ON THE VALUE, PRICE OR INCOME OF AN INVESTMENT. FUNDS TYPICALLY INVEST IN SECURITIES THAT ARE NOT READILY MARKETABLE. VALUATION PROCEDURES MAY BE SUBJECTIVE IN NATURE AND MAY NOT REFLECT ACTUAL VALUES AT WHICH INVESTMENTS ARE ULTIMATELY REALIZED. THE INVESTMENT MANAGER RELIES ON THE UNDERLYING MANAGERS' REPRESENTATIONS THAT THE VALUATION IS FAIR AND THE DISCLOSURE IS COMPLETE. THE FUND AND INVESTEE FUNDS MAY INVEST IN SECURITIES OF FOREIGN COMPANIES WHICH WILL EXPOSE THE FUND TO ADDITIONAL RISKS INCLUDING EXCHANGE, POLITICAL, SOCIAL, RISK, FOREIGN TAX RISK, LACK OF UNIFORM ACCOUNTING STANDARDS, PRICE VOLATILITY, POTENTIAL ILLIQUIDITY, HIGHER TRANSACTION COSTS AND LESS GOVERNMENT SUPERVISION OF EXCHANGES.

INDEX RETURNS ARE PROVIDED FOR COMPARISON PURPOSES ONLY. DIRECT INVESTMENT IN THESE INDICES IS NOT POSSIBLE.

SECURITIES OFFERED THROUGH ROBECO SECURITIES, LLC, MEMBER NASD SIPC, AN AFFILIATE OF ROBECO INVESTMENT MANAGEMENT.

Luncheon Keynote

The Honorable Hillary Rodham Clinton
U.S. SENATE – ***Invited***

What is Corporate America Doing to Invest in Energy Efficiency?

Peter Molinaro, *VP Government Affairs*
THE DOW CHEMICAL COMPANY

James Stanway, *Sr. Dir. Global Supplier Initiatives* - *Energy*
WAL-MART ENERGY DEPARTMENT

Rick Meidel, *Vice President, Power Projects*
EXXONMOBIL POWER & GAS SERVICES, INC

BIOGRAPHY

PETER A. MOLINARO

Peter Molinaro is Vice President of Federal and State Government Affairs for The Dow Chemical Company based in Washington, D.C. He is responsible for supervision of federal and state government affairs professionals, advocacy management and maintaining relationships with national political and governmental organizations. He leads the company's advocacy efforts on U.S. energy policy.

Prior to joining Dow, Peter was Assistant Director of Government Affairs for Union Carbide Corporation. He is a 1997 recipient of the Union Carbide Chairman's Award in the category of Environmental Excellence for his advocacy work on the Land Disposal Program Flexibility Act of 1996.

After beginning his career in local government, he joined Union Carbide in 1981 as Manager of Community Affairs and then spent several years as Regional Manager of Public Affairs, responsible for state government relations in the northeast.

He is a member of the Board of Directors of the American Council for an Energy Efficient Economy, The Business-Government Relations Council and chairs the Federal Government Affairs Committee of the American Chemistry Council.

He holds a Masters degree in Public Administration from the University of Hartford and a Bachelors degree in Political Science from Central Connecticut State University.

A native of Danbury, Connecticut, he currently resides in Oakton, with his wife and two daughters.

3/18/07

What is Corporate America Doing to Invest in Energy Efficiency?

Addressing Energy Challenges through Innovation, Technology & Leadership

Peter Molinaro
Vice President, Government Affairs
The Dow Chemical Company
April 13, 2007

About The Dow Chemical Company

- Diversified chemical company, harnessing the power of science and technology to improve living daily
- Founded in Midland, Michigan in **1897**
- Supplies more than **3,300 products** to customers in **175 countries**
- Annual sales of **$49 billion**
- **43,000 employees** worldwide
- Committed to Sustainability
- Combining chemistry and the power of Dow people

Petrochemical Industry:
Turning Oil & Natural Gas into Essential Products

Importance of Energy to Dow

- One of the world's largest industrial consumers of power and steam
  - Requires 3,700 MW of electricity to operate
  - Equivalent to the energy used by San Francisco, San Diego & Oakland combined
- Feedstock demand is **800,000 barrels/day**, estimated value $15-20 billion/year
  - 40-50% of Dow's total annual operating costs and expenses
- Leading innovator in cogeneration
  - Increased efficiency with reduced impact on the environment
  - Uses 20-40% **less fuel**

- Self-generates ~75% of all power & steam
- Operates over **$6.2 billion** in energy assets & supports **$2.5 billion** in JV assets

Challenges to Overcoming Energy Issues

- Global Business Environment
  - High and **volatile** feedstock and energy costs
  - Political and economic uncertainty
  - Geographic shift
- Impact on U.S. Chemical Industry
  - Permanent U.S. plant shutdowns
  - More than 300,000 U.S. jobs lost
  - Higher prices for our customers, who are often other manufacturers
  - Diminished global competitiveness

Challenges to Overcoming Energy Issues

- Bringing new technologies to market
  - Many exist, but in development stages
  - Some solutions not invented yet
    - » Need public-private partnerships to develop game-changing technologies and bring costs down to a commercially-viable level
    - » Time, energy, & expenses need to be devoted
  - How can we bring them to market in rapid & cost-effective manner?
  - Dow willing to partner with others

Challenges to Overcoming Energy Issues

- Company growth while reducing overall emissions
  - Adding capacity, new sites while continuing overall emissions reductions
  - Developing legislation
  - Need for technological breakthroughs
- Global climate change
  - One of the most serious issues facing society today
  - Dow is committed to being part of the solution… through our products, innovation, & optimization
  - A long-term issue, requiring staged solutions:
    - » Long-term: breakthrough technologies
    - » Mid-term: renewable & alternative energy
    - » Short-term: optimized use of fossil fuels
    - » Right now: energy efficiency

DOW TAKING ACTION

Our Response: Innovation, Technology, & Leadership

"No one in the world is more intensely aware of the need, ultimately, to reinvent our dependency on oil and natural gas than we are… We will lead the way on energy transformation because we have to. And we have taken important steps already."
- Andrew Liveris
Chairman & CEO
The Dow Chemical Company

DOW TAKING ACTION

Our Response: Innovation, Technology, & Leadership

- Advocating for sound energy and climate policy
- Exploring new energy sources and emerging science
- Dow product solutions to help improve energy efficiency
- Focus on becoming more energy efficient

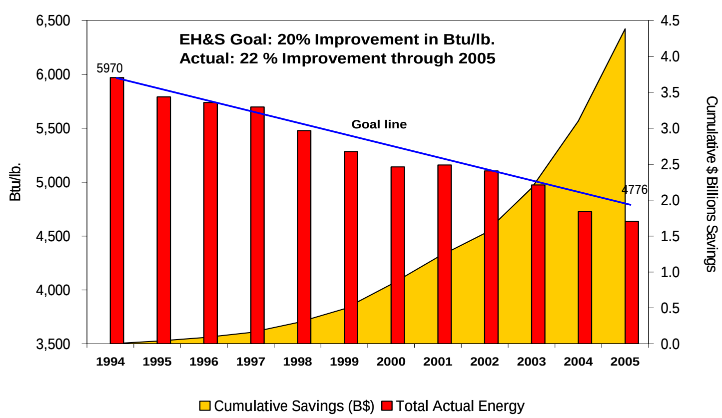
Driving Energy Efficiency at Dow

Cogeneration

DOW TAKING ACTION

Focusing on Energy Efficiency

Energy Intensity Performance



Cumulative Energy Savings = ~900 Trillion Btu's

Cumulative Cost Savings = >$4 Billion

DOW TAKING ACTION

Raising the Bar: 2015 Goals

- We will further reduce our global energy intensity by 25% from 2005-2015
- We will reduce our GHG emissions intensity by 2.5% per year thru 2015
- By 2025, we aspire to reduce absolute emissions within the company

Dow's Climate Change Vision:

- Dow will advocate for and participate in the monetization of carbon in fair marketplaces
- Dow pledges to be the most efficient producer using available energy and feedstocks, wherever we operate.

DOW TAKING ACTION

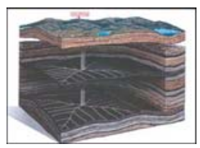
Dow Product Solutions

- Home and building energy efficient products
  - STYROFOAM™ brand insulation
  - GREAT STUFF™ polyurethane foam sealants
  - Help reduce energy use for homeowners & businesses by 20–30%
- Dow Automotive products
  - Diesel particulate filters - improved engine performance and fuel efficiency
  - Plastics, composites and adhesives to help make cars stronger and lighter while improving overall gas mileage

DOW TAKING ACTION

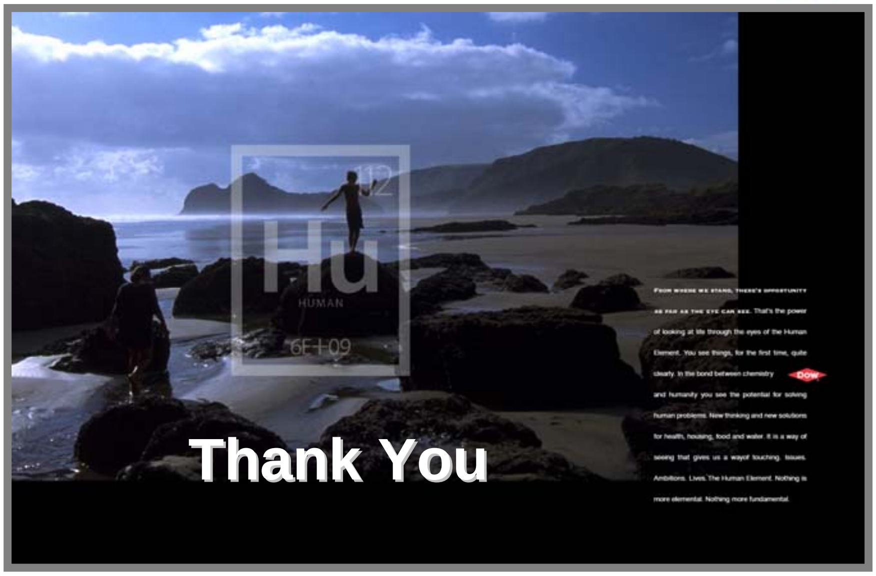
New Energy Sources & Emerging Science

- On-site wind, landfill gas, biomass to energy & coal gasification
- Photovoltaic roofing materials
- Operations and process adjustments to reduce emissions
- Exploring alternative feedstocks
  - Bio resources to produce products
    - » Soy-based polyols
    - » Glycerin to epichlorohydrin
    - » Glycerin to propylene glycol
- Aligns with 2015 Sustainability Goals



The Time to Act is Now

- Immediate priority on energy conservation & efficiency
- Technological innovation a must for the future
- Energy Policy and Climate Policy go hand-in-hand
- We all need to work together to find sustainable solutions



DOW TAKING ACTION

Advocating for Sound Energy Policy

Four Pillars:

1. Energy efficiency and conservation emphasized
2. Greater fuel diversity – promote increased use of clean coal, safe nuclear, and renewable energy
3. Additional gas supply – a new political consensus on development of domestic natural gas resources, in addition to LNG and coal-bed methane
4. Improved infrastructure – increased transmission and storage capacity

The Dow Chemical Company

Energy Efficiency and Conservation Efforts

High energy prices and energy price volatility – coupled with the environmental impact of energy production and consumption – make energy use a critical issue for Dow. Implementing an aggressive energy efficiency and conservation effort is an important part of Dow's plan to address this critical issue.

Business and Site energy efficiency teams have been established throughout the Company to focus both up and down as well as across the product chain. As a result of focused business and site efforts, over 700 Six Sigma projects have been chartered in the past five years to address all aspects of energy production, use, efficiency, and cost reduction.

Below are a few of the many projects that made significant contributions in 2004:

2004 Energy Intensity Reduction Projects

- A new cogeneration power plant, located at the Plaquemine, Louisiana site began commercial operation in 2004. The plant was built and is owned and maintained by American Electric Power (AEP). The facility efficiently provides steam energy for Dow's production processes and at the same time generates electricity to meet some of the plant's electrical needs. The facility replaces older cogeneration facilities and improves the energy efficiency of site power and steam by over 15%.

- The Polystyrene business unit reduced energy intensity in 2004 compared to 2003 by 7.4% which resulted in over $1 million savings. These results were achieved by activities leveraged through their Production Engineers Network including: improving DOWTHERM* heaters efficiency, improving train conversion rate and optimizing mechanical refrigeration unit operation.

- The Stade, Germany site produces hydrogen as a by-product. Much of the hydrogen is burned at the on-site cogeneration power plant thereby reducing the amount of natural gas that is consumed. A Six Sigma project was implemented to improve the availability of the hydrogen compressor thereby allowing even less natural gas to be burned saving the site over $500,000 in natural gas costs.

- The Ethylene Dichloride/ Vinyl Chloride Monomer (EDC/VCM) Business unit initiated projects at Plaquemine, Louisiana and at Freeport, Texas, to improve the efficiency and reduce the fuel consumption of process furnaces. Furnace efficiency was achieved through increasing the conversion of EDC to VCM within the furnace, thereby reducing the fuel gas requirements necessary to produce VCM. They also initiated projects to reduce steam consumption at these locations by optimizing steam and distillation systems as well as increasing energy recovery from systems already in place. Overall energy savings from these projects exceeded $5.8 million in 2004.

- In Freeport, Texas, reactor flows to two thermal oxidizer units were optimized to reduce fuel gas to the units. Work was also done to ensure full utilization of steam-generated from these units. Almost $1.9 million in energy was saved.

- A comprehensive project was implemented at the Plaquemine site to reduce the cost of compressed air and improve efficiency and saved the site over $350,000 in 2004. The project included the installation of condensate traps to eliminate continuous venting of air, the optimization of compressor production, reducing the venting of compressor blow-off-valves, repairing leaks and removal of unneeded dryers. The savings came from not only less power to make the compressed but from the need to rent fewer compressors during times of compressor maintenance outages.

- An optimization project at the Seadrift PP-1 unit, utilizing team members from different functions throughout the company and with varying areas of expertise, resulted in a significant reduction in nitrogen and fuel gas usage. The project resulted in just under $1 million in annual savings.

- The Cubatao LDPE plant in Brazil reduced its steam and power consumption by 9% and 2% respectively. Improvement actions included distillation columns optimization, reduction of centrifugal pumps in operation and the use of heat of reaction instead of steam in reactor water tanks.

- At the Dow Central Germany, Boehlen site, steam production was decreased by improved pressure and flow control and improved steam load shedding on the steam distribution system. This project reduced fuel oil purchases by $2.3 million per year.

Energy Efficiency at The Dow Chemical Company

The Dow Chemical Company is an industry leader in energy management. Energy efficiency has been part of our heritage since the very early years of our company, when Dow helped pioneer the use of industrial cogeneration, recovering waste heat to make power and steam to produce products more efficiently. In recent years, through a companywide focus on energy efficiency, we have dramatically reduced our energy intensity -- and exceeded an aggressive, long-term corporate energy efficiency goal. Today, Dow's leadership in energy efficiency is further evidenced by our strong corporate commitment to further energy efficiency improvements, our comprehensive approach to energy management, and our support for third-party energy efficiency programs, designed to help America's industrial and residential energy consumers save energy and money.

Aggressive Energy Efficiency Goals

In 2005 Dow exceeded an aggressive corporate goal to reduce the company's global energy intensity, measured in Btu's per pound of product produced, by 20% from 1994 to 2005. Utilizing a structured, focused approach, Dow exceeded that goal, reaching an energy intensity improvement of 22% vs. the 1994 baseline by year-end 2005. The cumulative energy saved between 1994 and 2005 was more than 900 trillion Btu's. That is equivalent to the amount of energy that when converted to electricity would be more than sufficient to supply the electricity used by the residential users in the State of California in one year. The cumulative value of this energy savings to Dow is in excess of $4 billion worldwide As part of its 2015 Sustainability Goals, Dow has committed to achieve an additional 25% improvement in energy efficiency.

Leadership Support and an Organization to Drive Energy Efficiency Worldwide

Dow's energy efficiency and conservation initiative relies strongly on our structured approach to resources conservation and energy intensity reduction. At the core is the sustained commitment and support of Dow's corporate leadership. The overall Energy Efficiency and Conservation effort within Dow is driven by a Global Energy Efficiency Leader, who has full responsibility and accountability for implementing and managing an aggressive global energy conservation plan. The energy conservation leader sponsors technology center and site energy efficiency teams and networks throughout the company to identify energy saving opportunities, develop long-term energy improvement plans and to implement projects.

In addition, each business unit at Dow is responsible for aligning its goals and plans to the corporate goal on energy efficiency. Focal points within each business unit are responsible for driving energy efficiency within their respective technologies. Energy efficiency is further driven by the energy conservation teams at our 13 largest energy-consuming sites, which account for over 90% of Dow's energy usage. These local teams actively engage employees in energy efficiency improvement projects at their sites and drive an energy efficiency mindset and culture at the local level.

Utilizing Proven Methodology to Accelerate Energy Efficiency Improvements

A significant contributor to our energy efficiency and conservation results has been the utilization of Six Sigma methodology a proven, breakthrough process that has been especially successful in improving energy efficiency and reducing energy costs. In the last five-year period, more than 700 Six Sigma type projects have been implemented throughout the company, yielding more than $260 Million in energy savings.

Producing Products that Support Energy Efficiency

Dow produces several products that can help reduce energy use for homeowners and businesses by 20 to 30%. STYROFOAM™ insulation products and GREAT STUFF™ Insulation Foam Sealants make homes and buildings more efficient. We also help consumers spend less at the pump. DOW AUTOMOTIVE offers a variety of plastics, composites and adhesives that make vehicles stronger, yet lighter, improving overall gas mileage.

Leading by Example -- Helping Other Consumers Save Energy

Outside of Dow, the company also supports government and third-party organizations in their efforts to promote energy efficiency among all consumers. Dow is a major sponsor of The Alliance to Save Energy's **The Power is in Your Hands** energy efficiency campaign, designed to help U.S. energy consumers save money and energy. Dow is also an active participant in the U.S. Department of Energy's "Save Energy Now" industrial energy efficiency campaign. Dow was one of the first six companies selected for a DOE Energy Savings Assessment (ESA) because of its interest and past success in setting an example in energy management. In the past year, the company hosted assessments at six of facilities.

Further, Dow collaborated with the DOE to pilot an Industrial Best Practices training program, conducted via Web Cast. Dow also led the establishment, in September, of the National Association of Manufacturers' (NAM) first ever energy efficiency task force, whose goal is to promote energy efficiency best practices to NAM's 13000 member companies.

Jim Stanway, Senior Director - Global Energy Services, has recently assumed responsibility for Wal-Mart's global climate change initiative. This involves business development activities aimed at profitable greenhouse-gas measures for customers and the supply chain. Stanway also serves on the board of Texas Retail Energy, a wholly owned subsidiary of Wal-Mart that buys wholesale power for use at its stores and distribution centers. He has 17 years of energy industry experience including five years with a deregulated power marketing company, three years with a regulated investor-owned utility and the balance with Wal-Mart Stores managing energy procurement and conservation in all 50 states and internationally. Jim has an Economics degree from Bellarmine College, Louisville, KY.


ROLLBACK
Smile, you're saving even more.
CO2

Rick Meidel is Vice-President, Power Projects within ExxonMobil Power & Gas Services, Inc and is responsible for worldwide, early power project development activities. Combining technical, commercial and market expertise, the organization evaluates power markets, recommends power plant configurations that maximize synergies with other parts of ExxonMobil's business capturing economies of scale. His team also develops long-term power price outlooks that underpin project economics. Rick has held numerous executive and management assignments within ExxonMobil in the areas of manufacturing / field operations, wholesale / retail sales, business analysis, and strategy development. Rick has degrees in Electrical Engineering from Washington University and Math / Physics from Illinois College. He is married with three children and resides in Houston, Texas, USA.

Baytown Cogen
Texas, USA

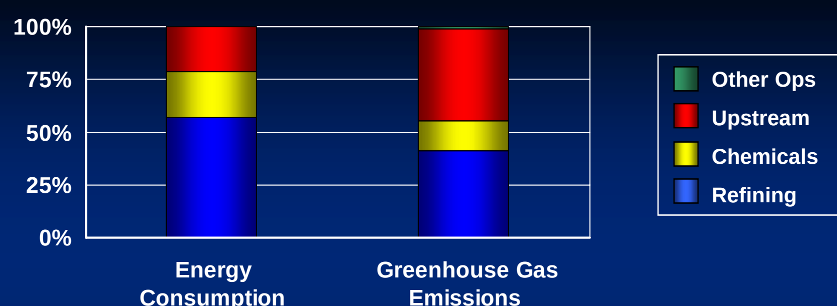
Energy Efficiency Pays

Energy Efficiency Finance Forum
New York City, NY
12-13 April 2007

Rick Meidel
Vice-President, Power Projects
ExxonMobil Power & Gas Services, Inc

ExxonMobil
Taking on the world's toughest energy challenges.™

Consumption and Emissions



- Refining and Chemicals account for over 75% of corporate energy consumption and over 50% of corporate greenhouse gas emissions
- Energy is the single-largest cash operating expense – about 50% of total
- Improving energy efficiency is a win-win-win …
  - Reduces plant operating costs and greenhouse gas emissions
  - Extends supply and affordability of conventional energy sources
  - Benefits industry, consumers, and the environment …. Now!

ExxonMobil

Global Energy Management System (GEMS)

Objectives

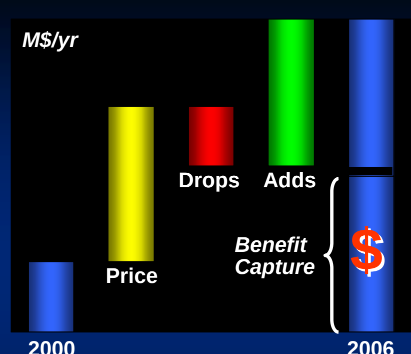
- Establish a single, comprehensive global energy management system (GEMS)
- Utilize a common methodology to identify performance gaps, implement closure plans, sustain progress, and continuously improve results

Business Model

- Operate existing facilities optimally and efficiently through application of best practices
- Identify economic investment opportunities above an optimized base for step-change improvement
- Implement strong management systems to sustain progress and drive continuous improvement

ExxonMobil

GEMS Implementation Results



- Identified over $1.5 G/yr potential opportunity at current energy prices
- Benefit capture at about 50% – mainly no / low cost steps to date
- Achieved best-ever EII performance every year since GEMS inception
- Pace of improvement significantly faster than industry groups

ExxonMobil

Environmental Performance Equivalents

> 40% of all wind capacity in Germany

> 85% of all wind capacity in the U.S.A.

> 75% of all wind capacity in Spain

Cogeneration Capacity in which ExxonMobil has Interests

ExxonMobil

Why Cogeneration?

ENERGY EFFICIENT

ECONOMIC

LOWER EMISSIONS

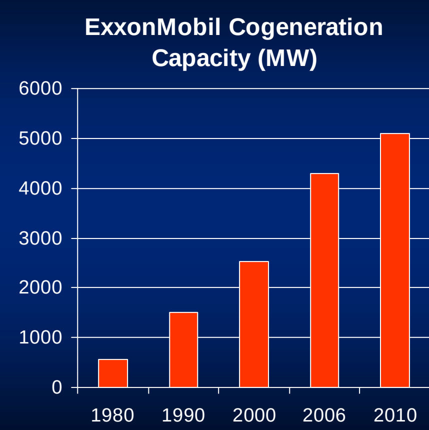
SUPPLY SECURITY

Beaumont Cogen
Texas, USA

ExxonMobil

ExxonMobil: A Leader in Cogeneration

- First installation in 1950's
- Over 4,300 MW installed with projects under development all around the world
- ExxonMobil self-generates well over 50% of its total electricity demand
- CO_2 emissions reduced >10.5 million metric tones per year
- Cogeneration provides high overall efficiencies, low costs per MWh & low CO_2 emissions. But ....
  - Higher total capital costs
  - Facilities must be base-loaded
  - Back-up power typically required



ExxonMobil

Enabling Power Market Structures

- Rational dispatch
  - No artificial separation of steam and power as discrete products
- Balancing mechanisms can't be punitive
  - Purchase net requirements or sell potential excess without discrimination
- Use-based transmission / ancillary charges
  - Charges based on cogen facility's impact on the overall grid
- Flexibility around market participation and compliance costs
- CHP Support Mechanisms
  - Reasonable reference values
  - Big picture perspective

SCP Cogen
Singapore

ExxonMobil

Low Carbon Technology – Bigger Scale & Impact

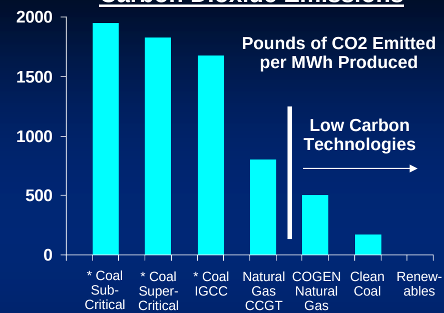
RENEWABLES

LOW CARBON
TECHNOLOGIES

RENEWABLES

COGENERATION
DISTRICT HEATING
DISTRIBUTED ENERGY

Carbon Dioxide Emissions



* Source: EPA   Clean Coal = IGCC w/ Carbon Capture
Note: For comparison purposes, cogeneration basis reflects reduced emissions from avoided fuel firing for process heat

- GHG emissions policies should be supportive of “low carbon technologies”
  – Provide same / similar incentives for technologies producing same / similar results

ExxonMobil

Final Remarks

- Cogeneration:
  – Increases energy efficiency and enhances cost competitiveness
  – Can improve overall reliability
  – Can reduce purchased fuel demands
  – Reduces emissions versus traditional methods of producing electricity and thermal heat / steam separately
- Enabling power market rules can drive additional – and larger - cogeneration investments allowing benefits for consumers, industry & environment alike
- ExxonMobil has a proud history of investing in cogeneration technology ......
- ...... and we continue to look for new opportunities all around the world !

LaBarge AGI Cogen
Wyoming, USA

Cold Lake Cogen
Alberta, Canada

ExxonMobil

Thank You !

Rick Meidel
rick.w.meidel@exxonmobil.com

ExxonMobil

Taking on the world's toughest energy challenges.™

Refreshment Break

Investing in Energy Efficiency Through 'Green' Building Technologies and Projects

James R. Green, CPE, LEED Accredited Professional, *VP Engineering*
GERALD HINES COMPANY

John Beldock, Ph.D., *President & CEO*
ECOBROKER INTERNATIONAL

Fiona Cousins, *Principal*
ARUP

James R. Green, CPE, LEED Accredited Professional
VP Engineering

Officer responsible for providing engineering support services to approximately 20 million square feet of commercial space in the East Region. Responsible for planning, implementation and management of regional building operation and maintenance projects, activities and programs.

Responsible for leadership on Hines sustainability and green programs.

Responsible for acquisition due diligence and base building design review on development projects, for issues relating to mechanical, electrical and plumbing systems.

Education
Studies in mechanical engineering, Northern Virginia Community College
Certified Plant Engineer, Association of Facility Engineers
LEED Accredited Professional, US Green Building Council

Career Highlights
Chief Engineer responsible for start-up of engineering functions and operations of the 500,000 square foot Franklin Square in Washington, D.C., and 520,000 square foot Two Twenty Two Berkeley Street in Boston, MA.

Led the building system due diligence effort on the acquisitions of 500,000 square foot 125 Summer Street, Boston, MA; 665,000 square foot Riverfront Office Park, Cambridge, MA; 800,000 square foot One Boston Place, Boston, MA; 800,000 square foot 60 State Street, Boston, MA; 500,000 square foot Rock Springs Park, Bethesda, MD; 403,000 square foot RiverPark, Norwalk, CT; 219,000 square foot Ten Bank Street, White Plains, NY.

Currently leading the Hines firm-wide effort to achieve the EPA's Energy Star Building Labels. To date, 89 Hines properties have earned this status with Hines earning The Energy Star Partner of the Year for three years and Award for Sustained Excellence.

Serve on several steering committees guiding company policy for issues including refrigerant management, tenant surveys, engineering training curriculum development and IAQ training.

Summary
Since joining Hines in 1987, Mr. Green has been involved in the start-up and operation of over 2 million square feet of commercial space and performance of acquisition due diligence for approximately 6 million square feet of commercial space. Mr. Green is also responsible for engineering assessments, quality control, personnel development, and support of over 20 million square feet of commercial space.

Hines

Investing in and Financing Energy Efficiency

Directive from Hines EVPs:

"All Hines developed office buildings will be LEED certified unless extraordinary circumstances prevent it"

Hines

Composite LEED Scoring

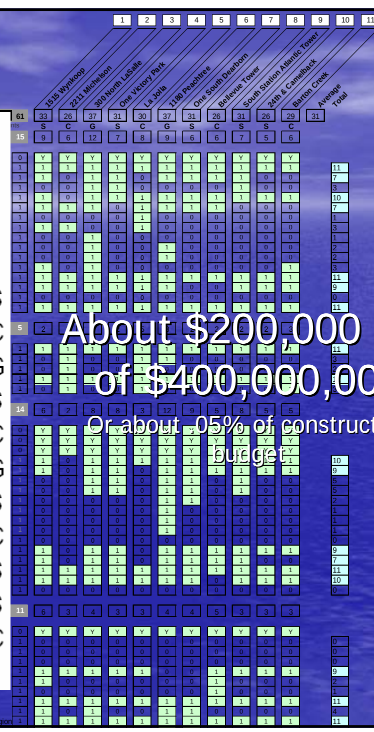
Hines

Composite LEED Scoring

LEED-CS version 2.0 | 61

Certified: 23 to 27 points, Silver: 28 to 33 points, Gold: 34 to 44 points, Platinum: 45 to 61 points

1	1515 Wynkoop	33	S
2	2211 Michelson	26	C
3	300 North LaSalle	37	G
4	One Victory Park	31	S
5	La Jolla	30	C
6	1180 Peachtree	37	G
7	One South Dearborn	31	S
8	333 Bellevue Tower	26	C
9	South Station Atlantic Tower	31	S
10	24th & Camelback	26	S
11	Barton Creek	29	C
	Average	31	



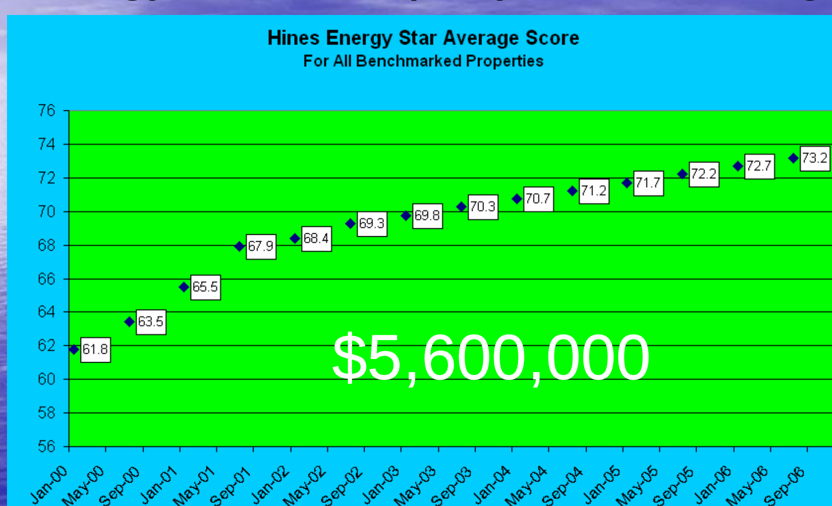
About $200,000 out of $400,000,000

Or about .05% of construction budget

Energy & Atmosphere									
		3	12	9	5	8	5	5	
Prereq 1	Fundamental Commissioning c	Y	Y	Y	Y	Y	Y	Y	
Prereq 2	Minimum Energy Performance	Y	Y	Y	Y	Y	Y	Y	
Prereq 3	Fundamental Refrigerant Mana	Y	Y	Y	Y	Y	Y	Y	
Credit 1.1	Optimize Energy Performance	1	1	1	1	1	1	1	10
Credit 1.2	Optimize Energy Performance	0	1	1	1	1	1	1	9
Credit 1.3	Optimize Energy Performance	0	1	1	0	1	0	0	5
Credit 1.4	Optimize Energy Performance	0	1	1	0	1	0	0	5
Credit 1.5	Optimize Energy Performance	0	1	1	0	0	0	0	2
Credit 1.6	Optimize Energy Performance	0	1	0	0	0	0	0	1
Credit 1.7	Optimize Energy Performance	0	1	0	0	0	0	0	1
Credit 1.8	Optimize Energy Performance	0	1	0	0	0	0	0	1
Credit 2	On-Site Renewable Energy	0	0	0	0	0	0	0	0
Credit 3	Enhanced Commissioning	0	1	1	1	1	1	1	9
Credit 4	Enhanced Refrigerant Manage	0	1	1	1	1	0	0	7
Credit 5.1	Measurement & Verification - E	1	1	1	1	1	1	1	11
Credit 5.2	Measurement & Verification - T	1	1	1	0	1	1	1	10
Credit 6	Green Power	0	0	0	0	0	0	0	0

Maintaining Persistence of Fundamental and Enhanced Commissioning

Energy Star Company-Wide savings



Financing Strategies

Core

- Stable
- Low vacancy/rollover
- Little/no renovation
- Premium building/design
- Desirable location
- Quality tenants
- Higher returns from income
- Lower leverage
- Moderate current cash
- Lower IRR

Value Add

- Value add opportunity
- Significant vacancy/rollover
- May need renovation
- Reposition class B to A
- Focus on capital appreciation VS income
- Moderately Leveraged
- Lower current cash
- Moderate IRR

Opportunistic

- Highly speculative
- New development
- High vacancy/re-leasing
- Major redevelopment
- Major repositioning
- High risk/high return
- Highly Leveraged
- High current cash
- High IRR
- Several "Flavors"

Hines/CalPERS Green Fund

In September 2006, Hines formed the Hines CalPERS Green Development Fund ("HCG"), capitalized with more than $120 million of committed equity and having the ability to invest up to $500 million.

HCG will concentrate on developing high performance, sustainable office buildings certifiable through LEED-CS.

The fund will focus on developing office projects throughout the United States.

Tower 333

Bellevue, Washington

1180 Peachtree
Atlanta, GA

Hines

Investing and Financing Energy Efficiency

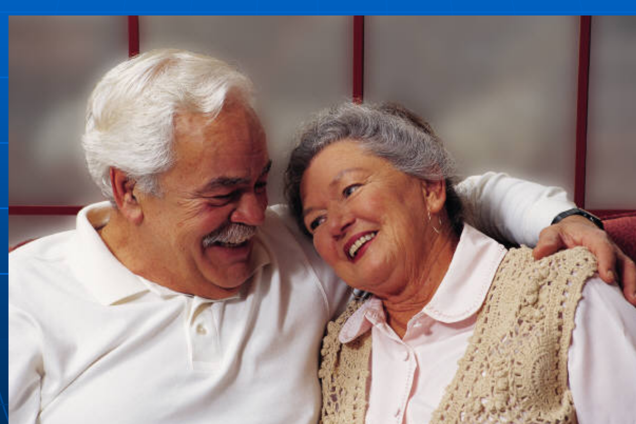
John Beldock, Ph.D., is the President and CEO of EcoBroker International and the Executive Director of the Association of Energy and Environmental Real Estate Professionals (AEEREP). Dr. Beldock is the former Director of the U.S. Department of Energy's Environmental Analysis Program in the Office of Energy Efficiency and Renewable Energy. An alumnus of the University of California and the Lawrence Berkeley National Laboratory, he was the 1991 recipient of the U.S. EPA's Outstanding Performance Award for Research in Pollution Prevention. Dr. Beldock is currently a member of the National Association of Realtors®, the Real Estate Educators Association, the Women's Council of Realtors®, and the Jefferson County Association of Realtors®. He is a licensed real estate professional in the state of Colorado.

Getting the Green to Go Green

Where's the Money?

John Beldock, Ph.D.
EcoBroker International
Association of Energy and Environmental Real Estate Professionals
800-706-4321
www.ecobroker.com www.aeerep.org

What Do We Really Know about Energy Efficiency Financing

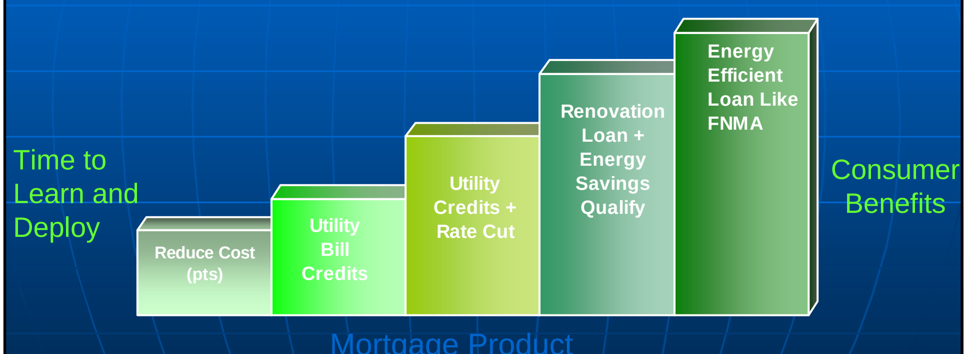


Getting the Green to Go Green

Non-Conforming Existing	***Non-Conforming New***
$417,000	$417,000
Conforming Existing	***Conforming New***

EcoBrokers are demanding innovative green financing from their mortgage lenders throughout the U.S. and beyond, and as you might expect, the response comes in different flavors and at different speeds.

Financial Benefits



Getting the Green to Go Green

- Green Financing Flavors
  - Portfolio EEM
  - Utility Bill Credits
  - Point Discounts
  - Energy Savings = Qualifying Income
  - Paid Energy Ratings
  - Location-specific Mortgages (TOD)

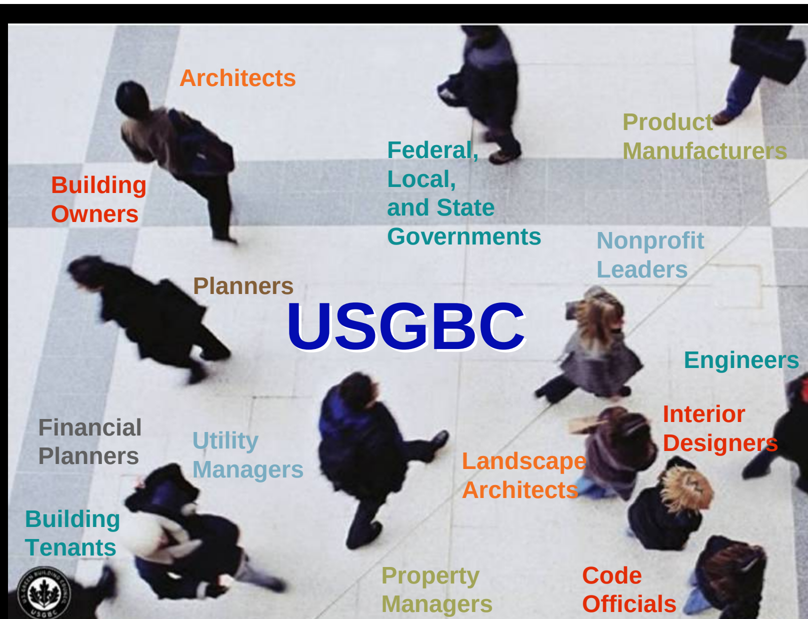
Fiona Cousins is a Principal at Arup. She has extensive project management, mechanical engineering and sustainable consulting experience. She has worked for both corporate and institutional clients on a wide variety of building projects. Fiona has maintained a strong interest in the thermal performance of buildings throughout her career and has also made significant contributions to projects where the broader aspects of sustainable design have been important. She has worked with SPeAR®, the in-house Arup sustainability analysis software, and is also a LEED® accredited professional with experience on a number of projects that are pursuing LEED® goals.

She has presented technical papers at EnvironDesign, Earthday New York, Green Building Challenge, GreenBuild and the Architectural Record Innovation Conference. She is currently the chair of the USGBC NY Chapter.

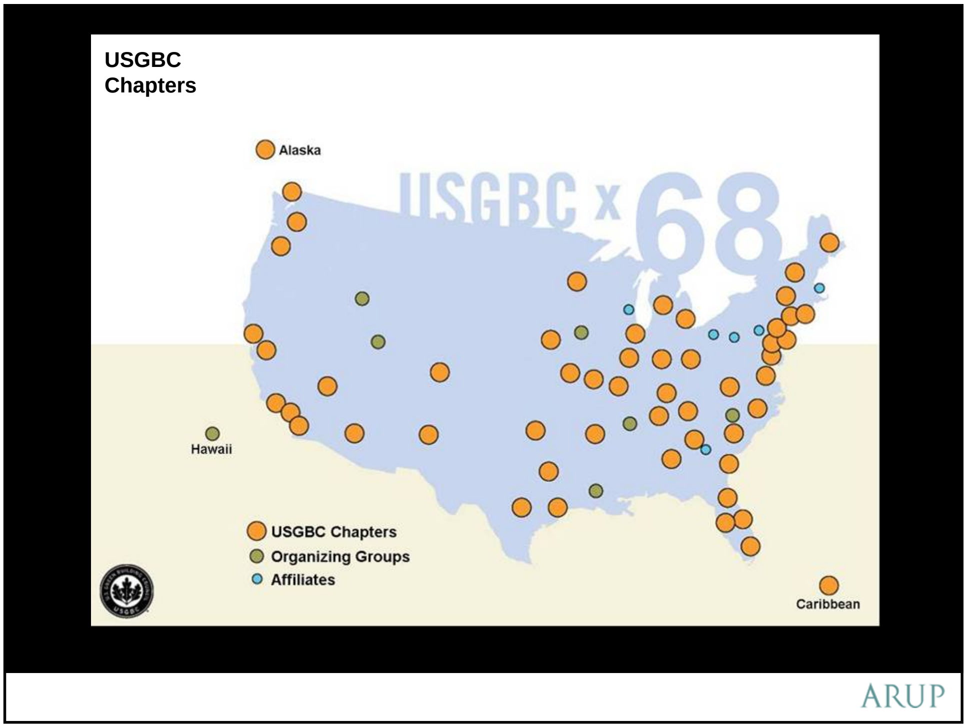
Is LEED Making an Impact?

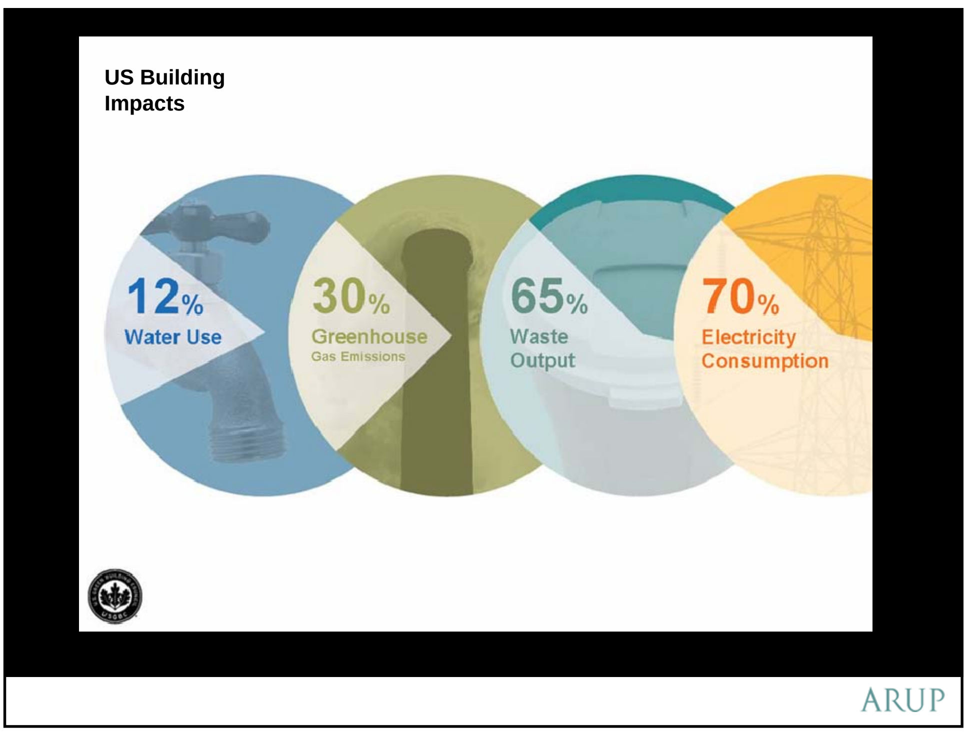
Fiona Cousins, PE, LEED AP

ARUP

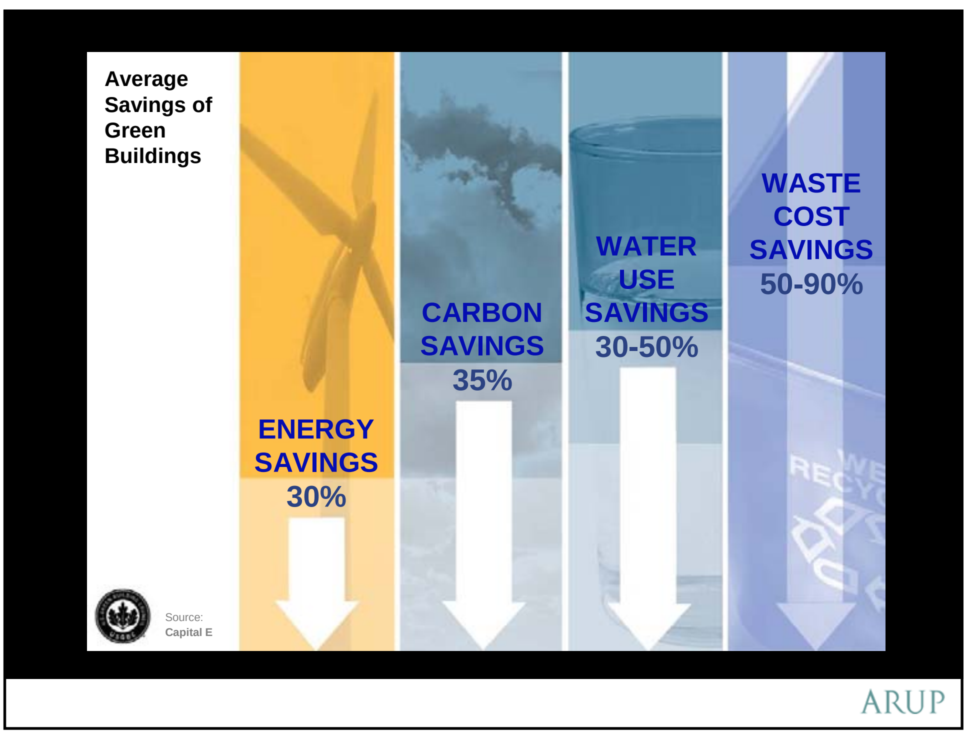


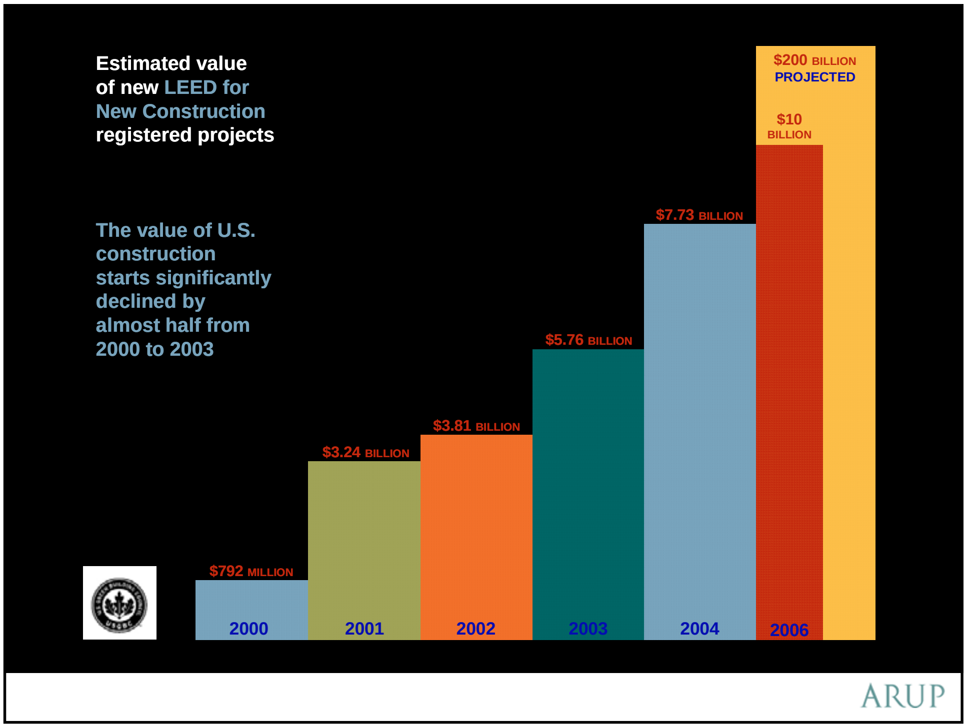
ARUP

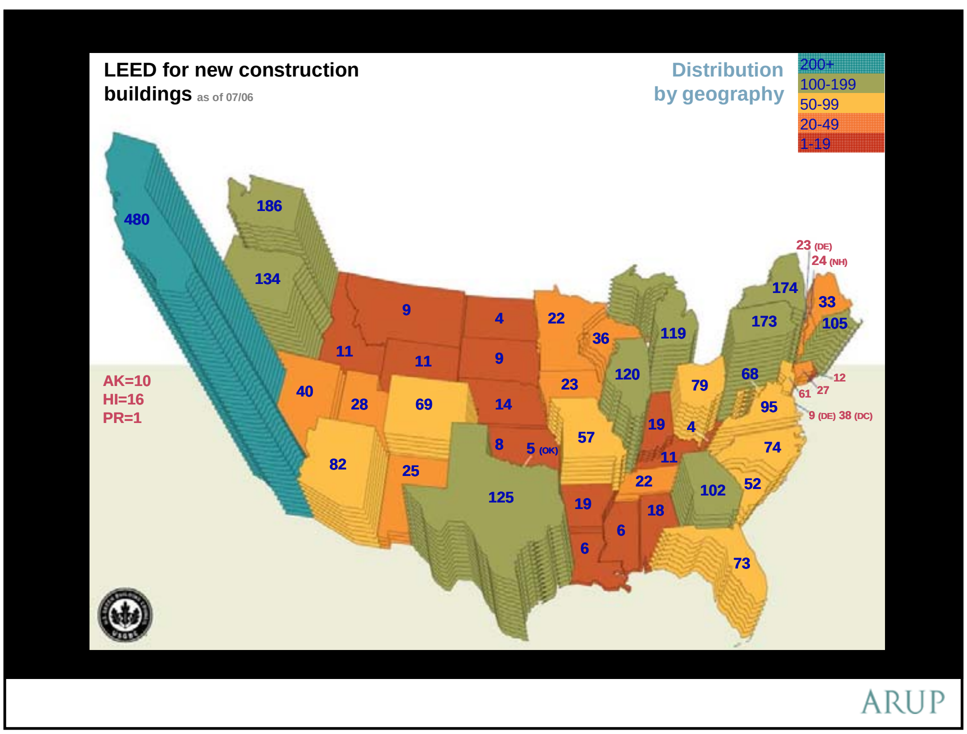

USGBC
Chapters
Alaska
USGBC x 68
Hawaii
USGBC Chapters
Organizing Groups
Affiliates
Caribbean
ARUP


US Building
Impacts
12%
Water Use
30%
Greenhouse
Gas Emissions
65%
Waste
Output
70%
Electricity
Consumption
ARUP


LEED Rating System
LEADERSHIP in ENERGY and ENVIRONMENTAL DESIGN
A leading-edge system for certifying DESIGN, CONSTRUCTION, & OPERATIONS of the greenest buildings in the world
Scores are tallied for different aspects of efficiency and design in appropriate categories.
For instance, LEED assesses in detail:
1. Site Planning
2. Water Management
3. Energy Management
4. Material Use
5. Indoor Environmental Air Quality
6. Innovation & Design Process
Green Facts
John M. Langston High School Continuation & Langston-Brown Community Center
Arlington, Virginia
LEED-NC rating out of 69
Silver 35
Sustainable Site 8
Water Efficiency 3
Energy & Atmosphere 4
Materials & Resources 6
Indoor Environmental Quality 11
Innovation & Design 3
ARUP


Average Savings of Green Buildings
ENERGY SAVINGS 30%
CARBON SAVINGS 35%
WATER USE SAVINGS 30-50%
WASTE COST SAVINGS 50-90%
Source: Capital E
ARUP


Estimated value
of new LEED for
New Construction
registered projects
The value of U.S.
construction
starts significantly
declined by
almost half from
2000 to 2003
$200 BILLION
PROJECTED
$10
BILLION
$7.73 BILLION
$5.76 BILLION
$3.81 BILLION
$3.24 BILLION
$792 MILLION
2000
2001
2002
2003
2004
2006
ARUP


LEED for new construction
buildings as of 07/06
Distribution
by geography
200+
100-199
50-99
20-49
1-19
AK=10
HI=16
PR=1
480
186
134
9
4
22
36
119
174
173
33
105
23 (DE)
24 (NH)
11
11
9
23
120
79
68
95
12
61
27
9 (DE) 38 (DC)
40
28
69
14
57
19
4
74
8
5 (OK)
11
82
25
125
19
22
102
52
18
6
6
73
ARUP

Future of LEED

- Further streamlining of submission process
- Incorporate life cycle cost analysis
- Address different building types
  - Retail
  - Schools
  - Laboratories
  - Sports Facilities
  - Hospitals

Adobe

LEED-**NC**

LEED-**EB**

LEED-**CI**

LEED-**CS**

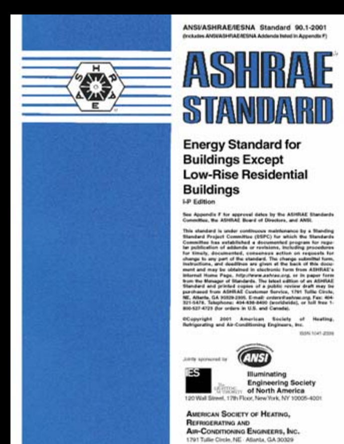
LEED-**H**

LEED-**ND**

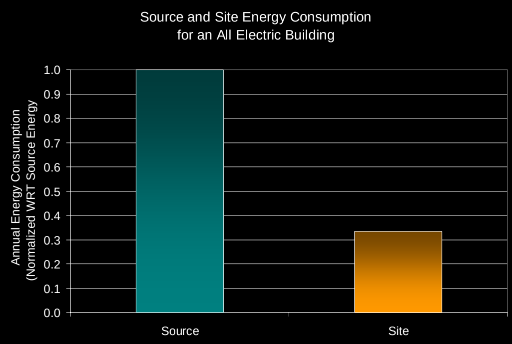
LEED and Energy

- **Up to 10 Points – Improved Energy Performance**
- **Up to 3 Points – Use of Renewable Energy**

New Buildings	Existing Building Renovations	Points
10.5%	3.5%	1
14%	7%	2
17.5%	10.5%	3
21%	14%	4
24.5%	17.5%	5
28%	21%	6
31.5%	24.5%	7
35%	28%	8
38.5%	31.5%	9
42%	35%	10

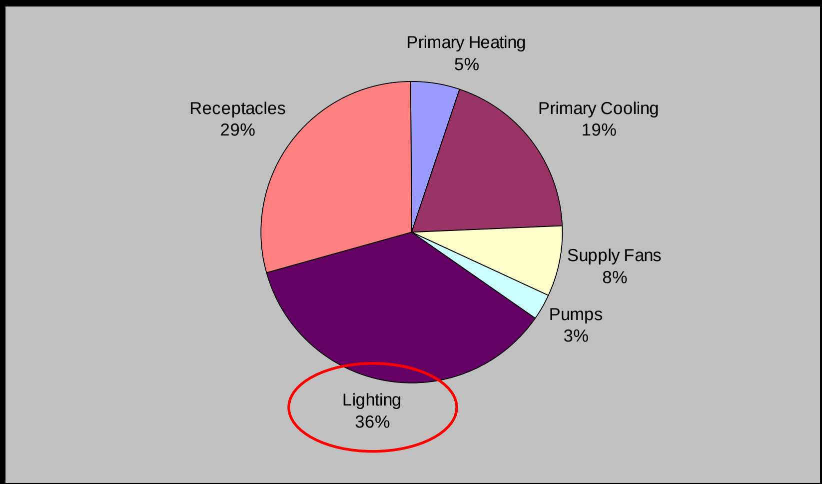


Energy Use versus Energy Cost?



ARUP

Energy Consumption by End Use



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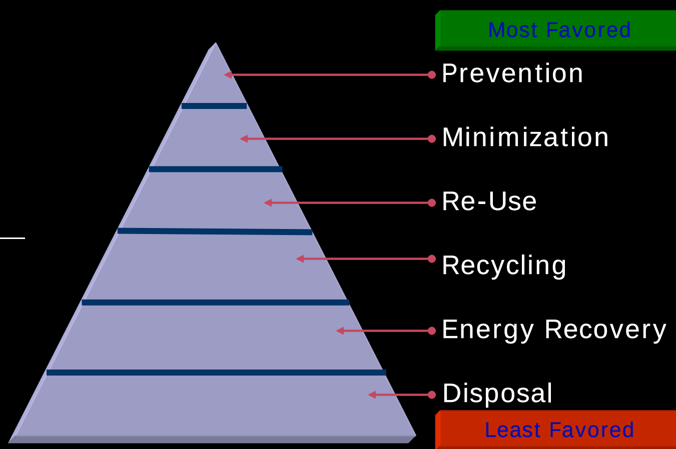
Development Flows

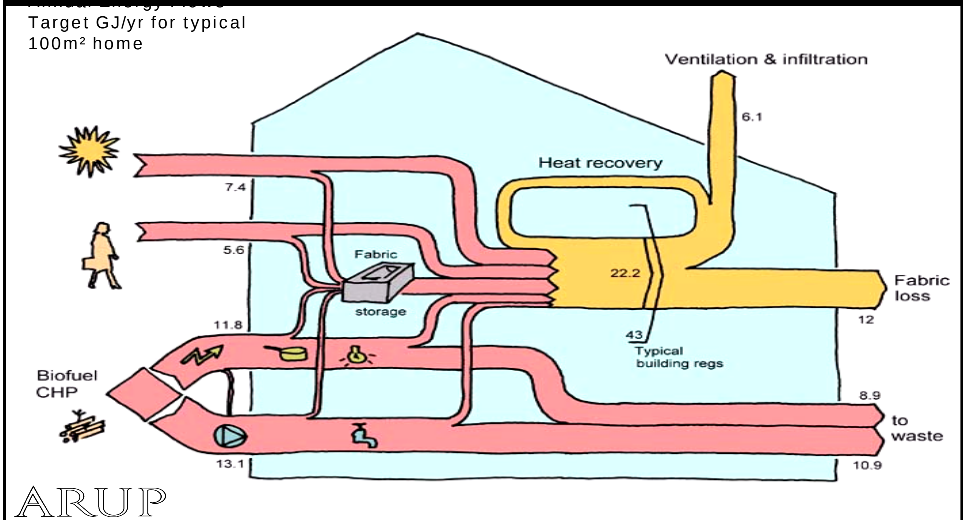
- Materials
- Water
- Energy
- Land

- People
- Money



Built Case Study

BedZED



BedZED

Keynote Panel Discussion:
The Role of Utilities and Regulators in Energy-Efficiency Investing

John Rowe, *Chairman and CEO*
EXELON

Patrick Henry Wood III, *former Chairman, Federal Energy Regulatory Commission*
WOOD3 RESOURCES

Peter R. Smith, *President*
NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY

John W. Rowe

John W. Rowe is the chairman, president and chief executive officer of Exelon Corporation - one of the nation's largest electric utilities, with 5.1 million customers and revenues of about $15 billion. *Forbes* ranked Exelon as the number one utility company in the United States for the second straight year on its 2005 list of "The World's 2000 Leading Companies." Mr. Rowe has led electric utilities since 1984, consecutively serving as chief executive officer of Central Maine Power Company, the New England Electric System and Unicom Corporation (one of Exelon's predecessors). He is a lawyer, and was general counsel of Consolidated Rail Corporation and a partner in the firm of Isham, Lincoln and Beale. Mr. Rowe's business activities have been marked by his attention to balance sheet strength, earnings consistency, service reliability and environmental performance

Mr. Rowe is a member of the boards of directors of Sunoco and the Northern Trust Company. He has previously served on the boards of UnumProvident, Fleet Boston Financial Corporation, Wisconsin Central Transportation Company and MidSouth Corporation. His civic and professional commitments emphasize historical education and diversity, and include serving as chairman of the Chicago Historical Society, chairman of the Board of Trustees of Illinois Institute of Technology, chairman of the Mies van der Rohe Society, vice chairman of The Commercial Club of Chicago and is a member of the Board of Governors for Argonne National Laboratory, the Chicago Urban League, the Field Museum, the Art Institute of Chicago, Northwestern University, the Edison Electric Institute, the Nuclear Energy Institute, the Chicago Club and the visiting committees of the Oriental Institute and the University of Pennsylvania Museum. He has previously been chairman of the Edison Electric Institute, president of the USS Constitution Museum, and chairman of the Massachusetts Business Roundtable.

Mr. Rowe is also a member of the board of the Wisconsin Alumni Research Foundation, WiCell Research and has received the university's Distinguished Alumni Award. He holds honorary doctorates from DePaul University, Illinois Institute of Technology, Drexel University, University of Massachusetts-Dartmouth and Bryant College. He received the Founder's Award for business Leadership from The Union League of Philadelphia in 2005, a Civic Leadership Award from the American Jewish Committee in 2004, the City Club of Chicago's Citizen of the Year award in 2002, the Corporate Leadership Award from the Spanish Coalition for Jobs in 2002 and the Anti-Defamation League's World of Difference award in 2000. He has chaired fund raising events for the Urban League of Chicago, the Spanish Coalition For Jobs, El Valor, the Merit School of Music, and the Cosmopolitan Chamber of Commerce.

Mr. Rowe holds a bachelor's and a Juris Doctor degree from the University of Wisconsin and its law school, where he was elected to Phi Beta Kappa and the Order of the Coif and is the founder of the Rowe Professorship in Byzantine history.

Mr. Rowe is married to Jeanne M. Rowe and has one son, William. The Rowes reside in Chicago.

November 9, 2006

Pat Wood, III
Principal, Wood3 Resources

Pat Wood, III, an energy developer based in Houston, is the past Chairman of the Federal Energy Regulatory Commission and of the Public Utility Commission of Texas. Throughout his career, he has been a strong advocate for increasing the role of market forces in traditionally-regulated industries and for investment in a robust energy infrastructure.

Today, in developing energy infrastructure, Wood's chief focus is on clean power generation, independent power transmission and natural gas facilities. In addition, he serves as an independent director of SunPower Corp. and of Quanta Services, and he heads the North American Advisory Committee of Airtricity, an international wind energy firm. Wood holds a civil engineering degree from Texas A&M University and a law degree from Harvard.

Peter R. Smith
President & CEO
New York State Energy Research and Development Authority

Peter R. Smith was appointed President of the New York State Energy Research and Development Authority by the NYSERDA Board of Directors on January 26, 2004.

Mr. Smith joined NYSERDA in 1995 as Program Director for Energy Analysis. He also represented NYSERDA's Chairman on the New York State Board on Electric Generation Siting and Environment.
Peter is responsible for the overall management of the Authority which is a public benefit corporation of the State of New York with assets of more than $330 million. NYSERDA is also the third party administrator of New York's five year $875 million public benefits program which was created as part of the State's move to electric competition. As administrator, NYSERDA operates over 30 programs under the umbrella of **New York Energy $mart**SM.

As President and CEO he also serves the State of New York as Chairman of the Energy Planning Board; and as a member of the State Environmental Board, the Water Resources Planning Council, and the Disaster Preparedness Commission. He is the State’s liaison officer to the U.S. Nuclear Regulatory Commission and represents New York State on the National Low-Level Radioactive Waste Forum.
Mr. Smith is also very active on the national energy scene as President of the Board of the American Council for an Energy Efficient Economy and Chairman of Board of the National Association of State Energy Officials; as well as serving on the Board of Directors of the Alliance to Save Energy.
Peter has more than 26 years of experience in analyzing and studying energy and environmental issues and problems. He holds a Masters Degree in Public Administration from the Nelson A. Rockefeller School of Public Affairs and Policy, State University of New York at Albany, and a Bachelor of Arts from LeMoyne College in Syracuse, New York.

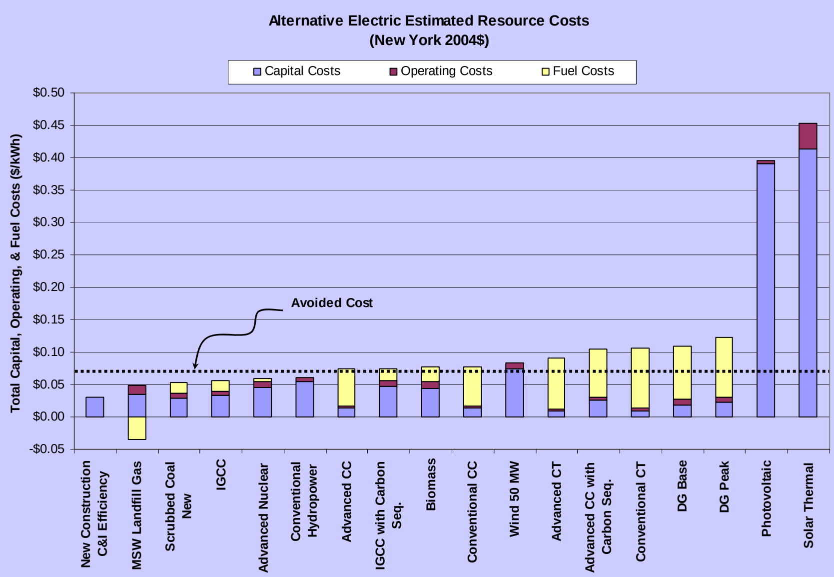
American Council for an Energy Efficient Economy
Energy Efficiency Finance Forum

April 13, 2007

Peter R. Smith
President & CEO
NYSERDA

NYSERDA
New York State Energy Research and Development Authority

Electricity Technology Costs



WHAT ENERGY EFFICIENCY/DEMAND REDUCTION BRINGS TO THE TABLE

- Applies to nearly all sectors and sizes of users
- Technology can be applied to direct benefit of user
- Persistence of savings represents continued opportunity
- As demand rises and generation remains constant EE/Demand Reduction provides additional options
- Promotes economic opportunity

NYSERDA

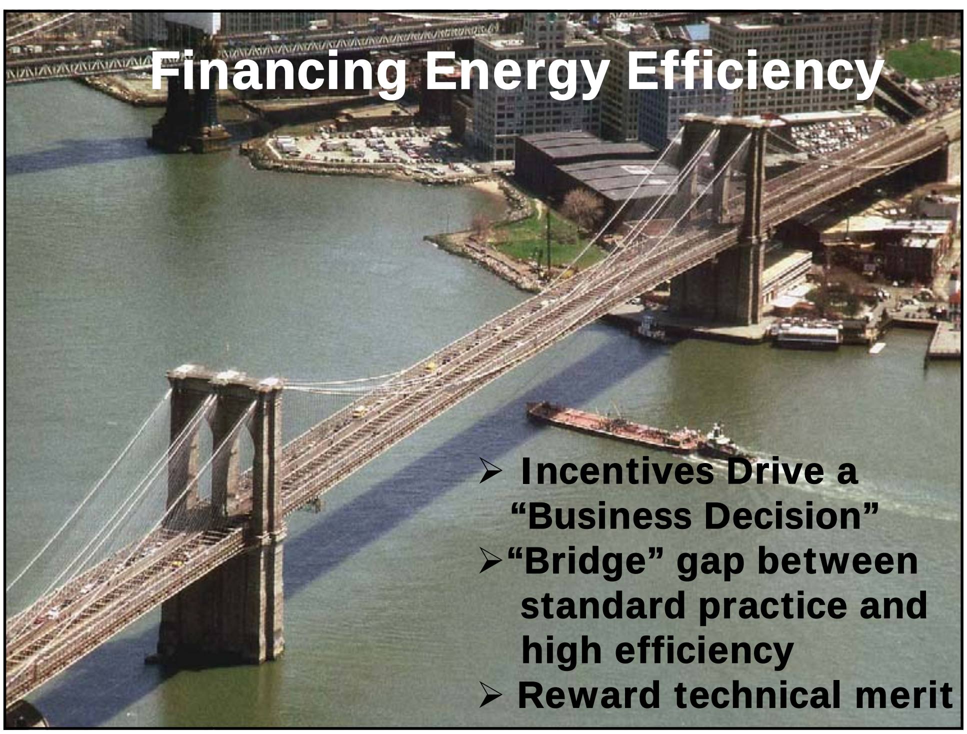
New York State
Energy Research and
Development Authority

Keys to Success

- Use all the tools in the toolbox – Energy Efficiency, Load Management, Demand Response, Combined Heat and Power
- Work to create markets with strong business cases – this will attract project developers
- Work with the middle market – ESCO's, Demand Response Providers, etc.
- Value energy efficiency and demand response equal to generation

Energy Efficiency Assistance Provided to Market Place by NYSERDA

Upstream	**Midstream**		**Downstream**
Industry Processing Trade Associations	Wholesalers Energy companies Equipment suppliers Trade professionals	Big box Small retail Mail order E-commerce	Consumers Final consumption
Manufacturing	**Distributors & Vendors**	**Retailers**	**End-Users**
RD&D Proof of concept Product development Demonstration Testing Manufacturing	Information Training Financial incentives (sales and stocking) Marketing assistance	Information Training Financial incentives (sales and stocking) Marketing assistance	Financial incentives Technical assistance



Role of Project Financing is Risk Reduction

- INTEREST BUY DOWN
- GRANTS
- INSTALLATION INCENTIVES
- BOUNTIES

NYSERDA

- LOAN GUARANTEES?
- BONDING ENERGY EFFICIENCY?

New York Energy $mart SM Program

- More than $300 Million in utility bill savings
- 2,090 GWh annual savings
- 1,240 MW Permanent/callable demand reduction
- 1,840 Annual tons of NO_x, 3,300 tons SO_2, and 1.4 million tons CO_2
- 4,250 jobs

Status of C/I Performance Program

- 1,090 Projects with more than $108 million in total incentives
- Annual savings of 970 million kWh and 208 MW total peak demand reduction
- Incentives averaging 17% of project cost
- Total cost of projects exceeds $644 million
- 195 different ESCOs participating
- Installation complete on 775 projects delivering 164 MW of peak demand reduction

NYSERDA

One New York Plaza

- Installed two, 2,000 ton steam chillers and two, 2,000 ton gas chillers
- Reduced demand by 2,150 kW
- Can now choose between cooling with electric, gas, or steam - based on price
- NYSERDA provided $560,000 incentive

Distributed Generation & Combined Heat and Power

NYSERDA has cost-shared:

- **100 CHP Installations**
  ($52 million / 100 MW)

> 125 CHP Feasibility Studies

Phosphoric Acid Fuel Cell
Sheraton Times Square

717 5th Ave. - Synchronous Generator
$500,000 annual net energy savings
$745,000 NYSERDA Incentive

THANK YOU

Peter R. Smith
President & CEO
New York State Energy Research and Development Authority
www.nyserda.org

Chair's Closing Remarks

Dan Reicher, *Director of Climate Change and Energy Initiatives*
GOOGLE

Bill Prindle, *Deputy Director*
AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY

Dan W. Reicher has over 20 years of experience in business, government and non-governmental organizations focused on energy and environmental technology, policy, finance and law. He recently joined Google where he serves as Director of Climate Change and Energy Initiatives for the company's new venture called Google.org. Google.org has been capitalized with more than $1 billion of Google stock to make investments and advance policy in the areas of climate change and energy, global poverty, and global health.

Prior to his recent position at Google, Mr. Reicher served as President and Co-Founder of New Energy Capital Corp., a New England-based company that develops, invests in, owns and operates renewable energy and distributed generation projects. Mr. Reicher is also a member of General Electric's Ecomagination Advisory Board.

From 1997-2001, Mr. Reicher was Assistant Secretary of Energy for Energy Efficiency and Renewable Energy at the U.S. Department of Energy (DOE). As Assistant Secretary, he directed annually more than $1 billion in investments in energy research, development and deployment related to renewable energy, distributed generation and energy efficiency. Prior to that position, Mr. Reicher was DOE Chief of Staff (1996-97), Assistant Secretary of Energy for Policy (Acting) (1995-1996), and Deputy Chief of Staff and Counselor to the Secretary (1993-1995). He was also a member of the U.S. Delegation to the Climate Change Negotiations, Co-Chair of the U.S. Biomass Research and Development Board, and a member of the board of the government-industry Partnership for a New Generation of Vehicles. After leaving the Clinton Administration in 2001 he was a consultant to the Senate Environment and Public Works Committee and a Visiting Fellow at the World Resources Institute.

In 2002, Mr. Reicher became Executive Vice President of Northern Power Systems, a venture capital-backed renewable energy and distributed generation engineering, services and technology company with installations in more than forty-five countries. Mr. Reicher led the renewable energy sales group at Northern and also was actively involved with the company's project finance, government relations and public affairs initiatives. He also played a significant role in the successful sale of the company to Proton Energy Systems, a leading hydrogen company, and the simultaneous creation of Distributed Energy Systems, a new NASDAQ-listed holding company that now owns both Northern Power and Proton Energy.

Prior to his roles at the Department of Energy and in the business community, Mr. Reicher was a senior attorney with the Natural Resources Defense Council where he focused on the federal government's energy and nuclear programs as well as environmental law and policy issues in the former Soviet Union. He was also previously Assistant Attorney General for Environmental Protection in Massachusetts, a law clerk to a federal district court judge in Boston, a legal assistant in the Hazardous Waste Section of the U.S. Department of Justice, and a staff member of President Carter's Commission on the Accident at Three Mile Island.

Mr. Reicher currently is co-chairman of the advisory board of the American Council on Renewable Energy and a member of the boards of the American Council for an Energy Efficient Economy, the Vermont Energy Investment Corporation, the Keystone Center's Energy Program, and Circus Smirkus. He was also recently a member of the National Academy of Sciences Committee on Alternatives to Indian Point for Meeting Energy Needs.

Mr. Reicher also recently served as an adjunct professor at the Yale University School of Forestry and Environmental Studies and Vermont Law School. He holds a B.A. in Biology from Dartmouth College and a J.D. from Stanford Law School. He also studied at Harvard's Kennedy School of Government.

Mr. Reicher was a member of a National Geographic-sponsored expedition that was the first on record to navigate the entire 1888 mile Rio Grande and was also a member of the first group on record to kayak the Yangtze River in China.

Mr. Reicher is married to Carole Parker, who headed the Office of Pollution Prevention at the U.S. Department of Defense from 1994 to 1999. Carole and Dan have three children and live in Norwich Vermont. The family will be relocating to California in August 2007.

William R. Prindle
Acting Executive Director
American Council for an Energy-Efficient Economy

Mr. Prindle provides leadership and accountability for ACEEE. In addition, he directs ACEEE's energy policy program, which conducts policy analysis and advocacy on energy efficiency issues at the national and state levels. In more than 30 years in the energy field, he has worked in regional planning, corporate communications, management consulting, and association management. He has testified before Congress, appeared on radio and TV, and been published frequently as an expert on energy efficiency.

Bill earned a B.A. degree in Psychology from Swarthmore College and an M.S. from the University of Pennsylvania. He has served on the boards of such organizations as the Energy and Environmental Building Association, the Association of Energy Services Professionals, and the National Fenestration Rating Council.

About ACEEE: *The American Council for an Energy-Efficient Economy is an independent, nonprofit organization dedicated to advancing energy efficiency as a means of promoting both economic prosperity and environmental protection. Founded in 1980 by leading energy research experts, ACEEE has become a respected, independent voice for energy efficiency technology, policy, and consumer education. The organization conducts research, publishes technical and policy reports, holds conferences and other forums, and educates decision-makers, energy professionals, and consumers. For more information about ACEEE and its programs, publications, and conferences, contact ACEEE by mail at 1001 Connecticut Avenue, N.W., Suite 801, Washington, D.C. 20036-5525, by phone at 202-429-8873, or on the web at* *http://www.aceee.org*

Conference Concludes