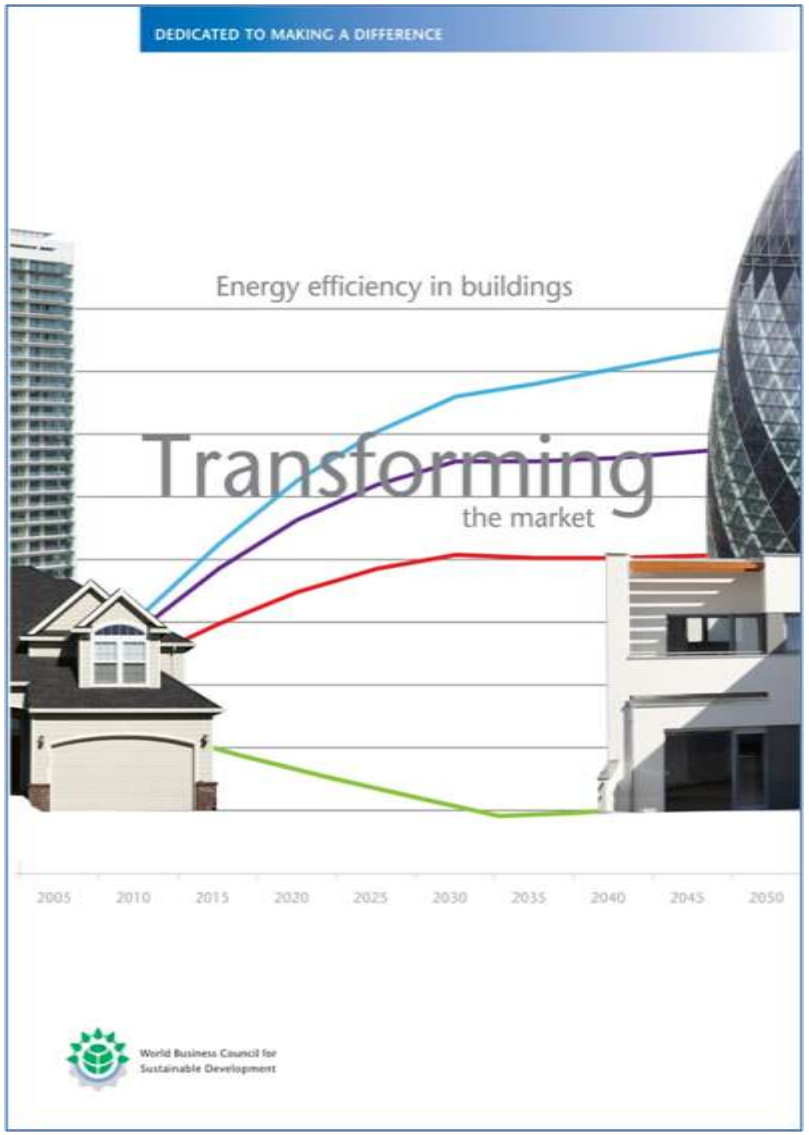


World Bank Building Energy Efficiency Workshop

November 19, 2009

William Sisson, UTC

World Business Council for Sustainable Development

United Technologies

You can see everything from here.

Energy Efficiency in Buildings Project

A world where buildings consume zero net energy

- Four year project with focus on energy
- Transform the way buildings are designed, built and used
- Draws on business voice and perspective
- Communicate openly and broadly
- Produced 2 Reports, Model, Roadmap and Manifesto for EEB

LAFARGE

World Business Council for Sustainable Development

United Technologies

ArcelorMittal

DUPONT The miracles of science

BOSCH

SKANSKA

ACTELIOS GRUPPOFALCK

PHILIPS

CEMEX

THE KANSAI ELECTRIC POWER CO.,INC.

GDF SUEZ

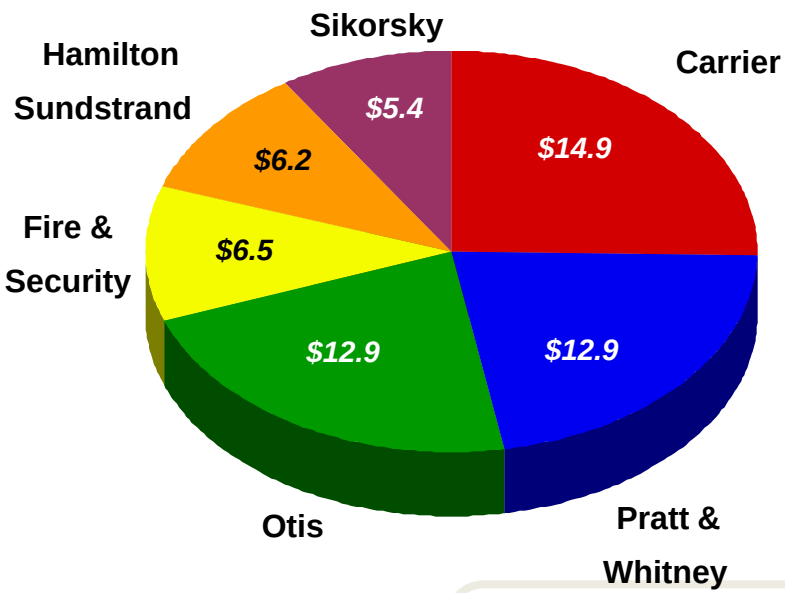
TEPCO

EDF

SONAE SIERRA

United Technologies (UTC)

2008 Revenue - $59 billion



United Technologies

aerospace systems

Sikorsky

commercial power solutions

Pratt & Whitney

UTC Power

Hamilton Sundstrand

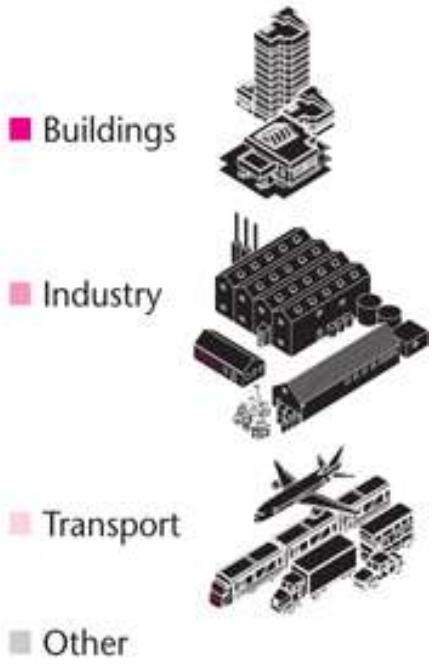
Carrier

UTC Fire & Security

Otis

commercial building systems

Energy Awareness

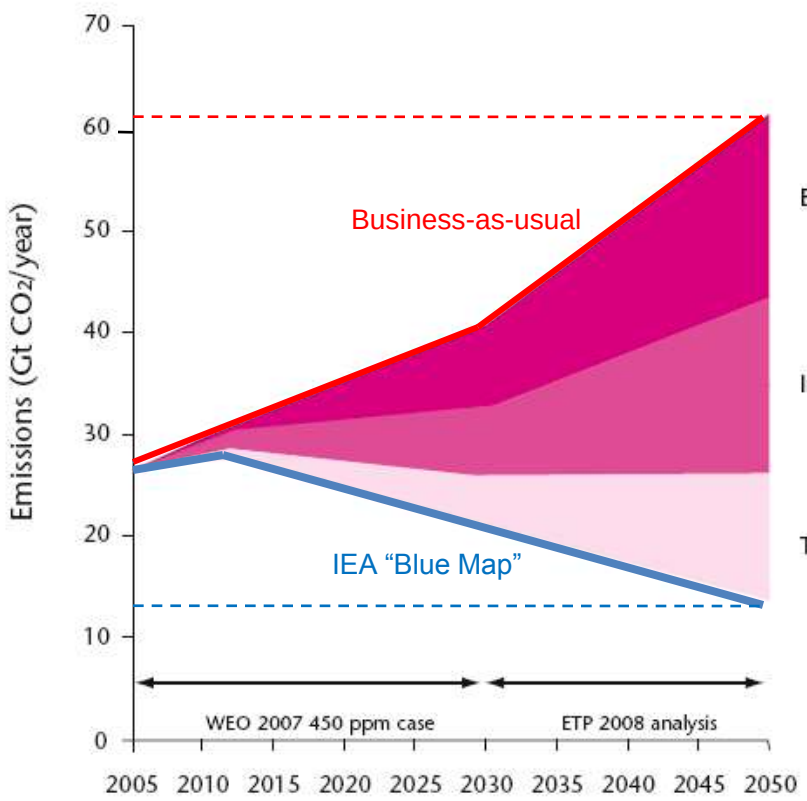


Buildings are "invisible" but large consumers of energy and emitters of CO2

Source: IEA "Worldwide Trends in Energy Use and Efficiency", (2008)

Sector Wide Goals

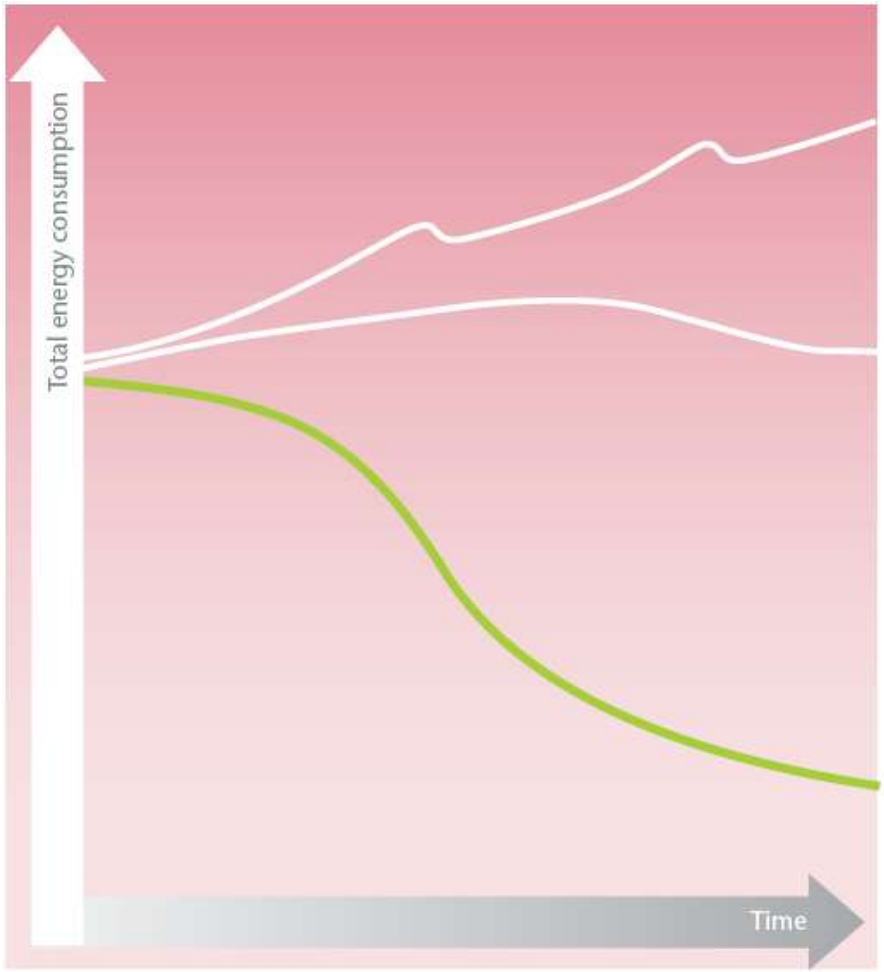
Primary Energy



CO2 Reductions	CO2 Levels (BAU) 2005	2050(e)
Buildings (38%)	8.8Gt	20.1Gt
Industry (36%)	8.6	23.2
Transport (26%)	6.6	18.0

Source: International Energy Agency, WEO 2007 and ETP 2008

Transformation is Critical



Relation to IPCC scenario families

>750ppm
6°C

550ppm
4°C

450ppm
< 2°C

Relation to Building Energy & CO2

60 to 80%

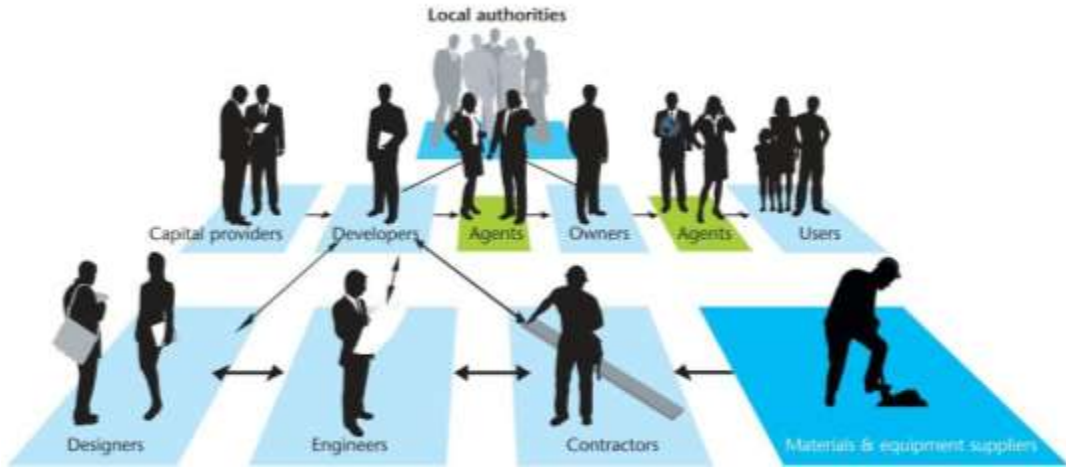
The Challenge …

The Challenge …

The Challenge …

Decision Making Complexity

The building professionals:

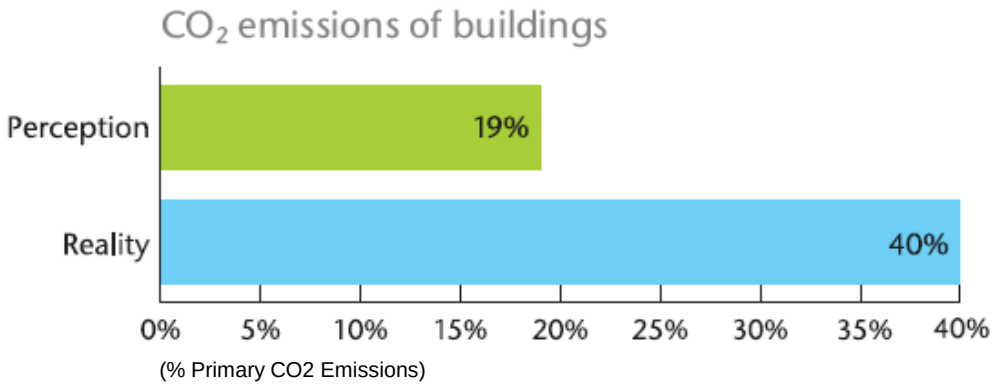


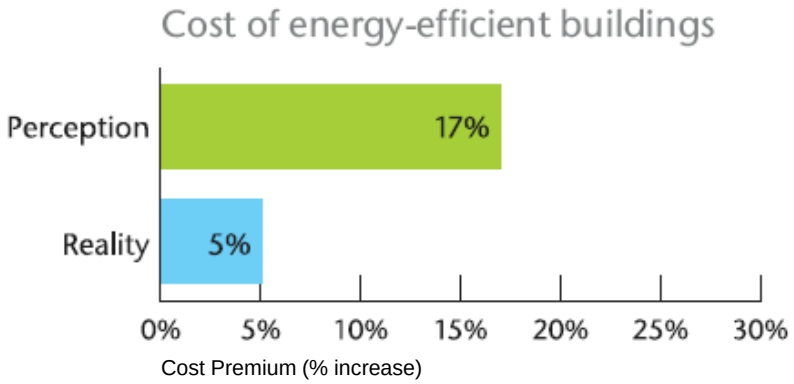
Source: WBCSD Energy Efficiency in Buildings, Facts & Trends Full Report (2007), Perception Study

Views on who are the largest barriers:

Perceptions in Market

Today's perception from sector professionals …

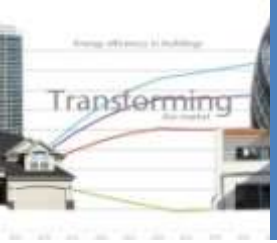




	Certified	Silver	Gold
Energy efficiency	8%	30%	37%
On-site renewable energy	0%	0%	4%
Green power	10%	0%	7%
Total efficiency gains	**18%**	**30%**	**48%**
Related cost premium	**1%**	**2%**	**2%**

Source: USGBC data, Capital E analysis.

Source: EEB Facts and Trends, August 2007



Value and Sustainability Delivery

Many, MANY, hands…

Client

Design team

Plot developers

Project Managers

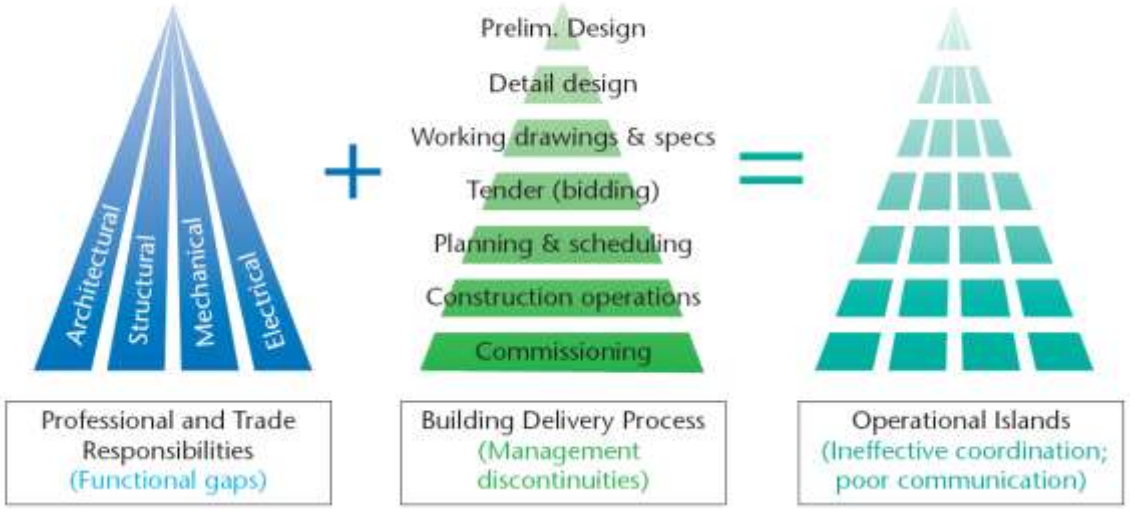
Contractors

Suppliers

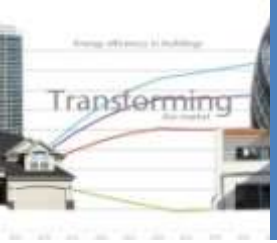
Installers

Occupiers.....!

Complexity of Delivery …



Sources: Arup, WBCSD EEB Facts & Trends, 2007



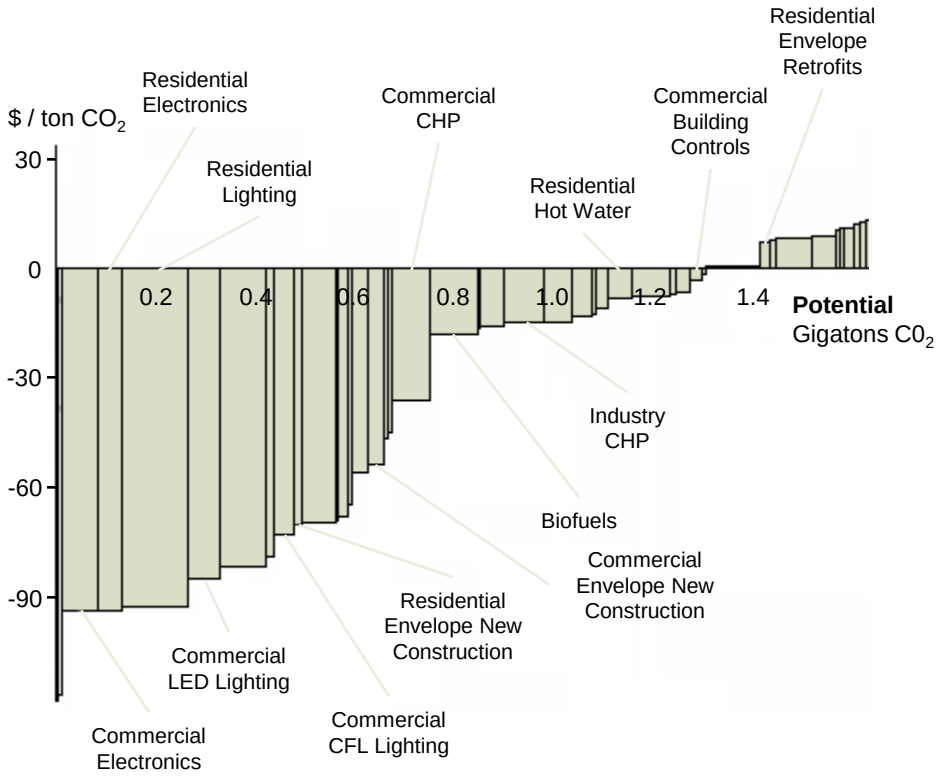
Major Decision Factors

Interests	Investor	Split	Owner	Split	Tenant
Invested Cost	✓		✓		
Location	✓		✓		✓
Capital Cost			✓		
Market Value	✓		✓		
Risk & Return	✓		✓		?
Rent			✓ (income)		✓ (cost)
Operational Cost			✓		✓
Energy Cost			?		?
"Green-ness"	⇗		⇗		⇗
Energy Rating	⇗		⇗		⇗

✓ = impacts energy efficiency decision

? = depends on owner-occupier or lease-terms

Thus, It isn't Happening …



Source: McKinsey, Dec. 2007; *Reducing US Greenhouse Gas Emissions: How much and at what cost?*

A financial economist and passionate defender of the Efficient Markets Hypothesis (EMH) is walking down the street one day with a friend.

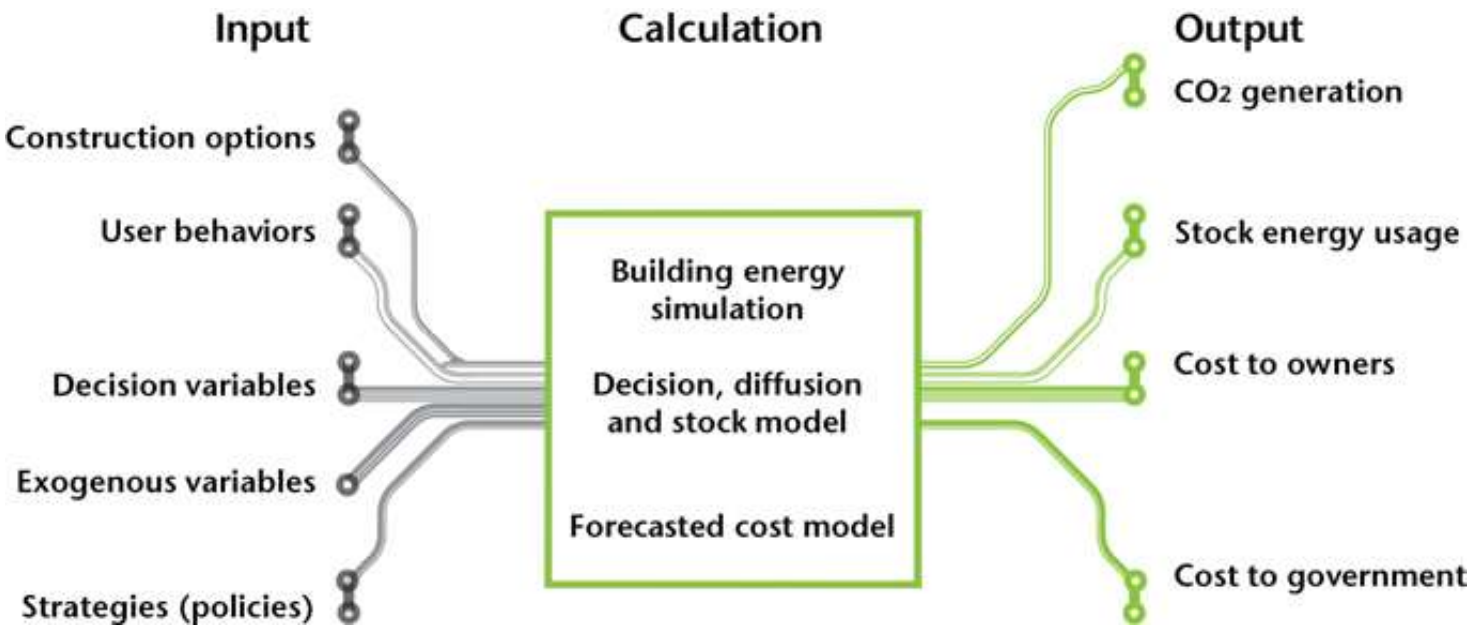
The friend stops him and says, "Look, there's a $20 bill on the ground!"

The economist replies, "There can't be. If there were a $20 bill on the ground, somebody would have already picked it up."

Source: The Educated Investor, "The $20 Bill Tale", March 2004

How Decisions Affect Outcomes

WBCSD EEB Decision Heuristic Model

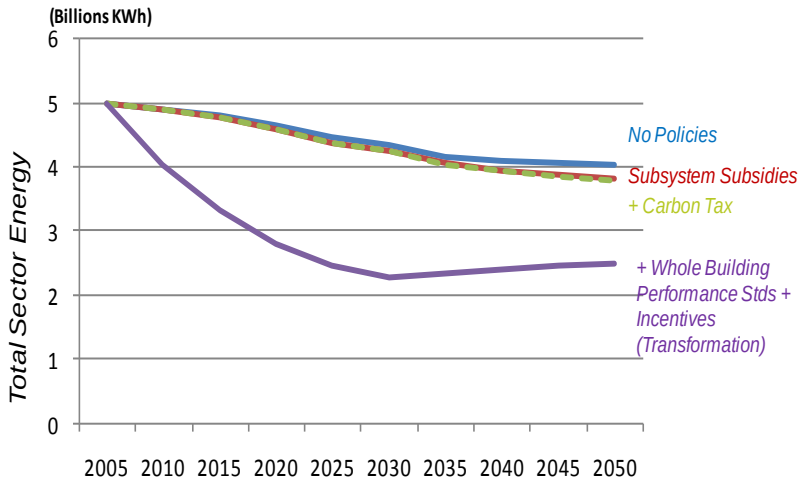


Decisions are simulated by comparing the net present value of available options, with selected choices based on best outcomes and limited to those with the lowest first costs over a market defined time horizon (0-5 yrs, typically).

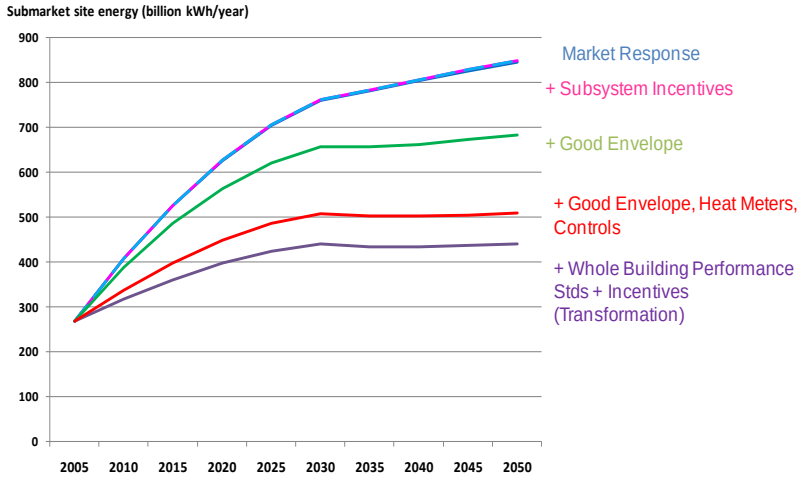
Offices and Apartments

Japan Kanto Region – Midrise Offices

China – Northern Region Multi-family



(Developed)



(Developing)

Source: WBCSD Energy Efficiency in Buildings "Transforming the Market" (2009)

Key Findings from the EEB Model

Transformation is attainable, change of tactics is critical

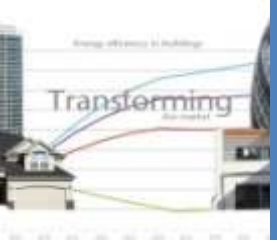
Markets will not adopt attractive solutions without tight regulatory structures

Rational price signals had surprisingly low effect, particularly carbon pricing

Integrated/coordinated technical approaches were most effective, but demand limited by high first cost

Model assumes necessarily, the principle-agent problem is overcome

Market response will be distinguished by local economic, behavior and cultural characteristics



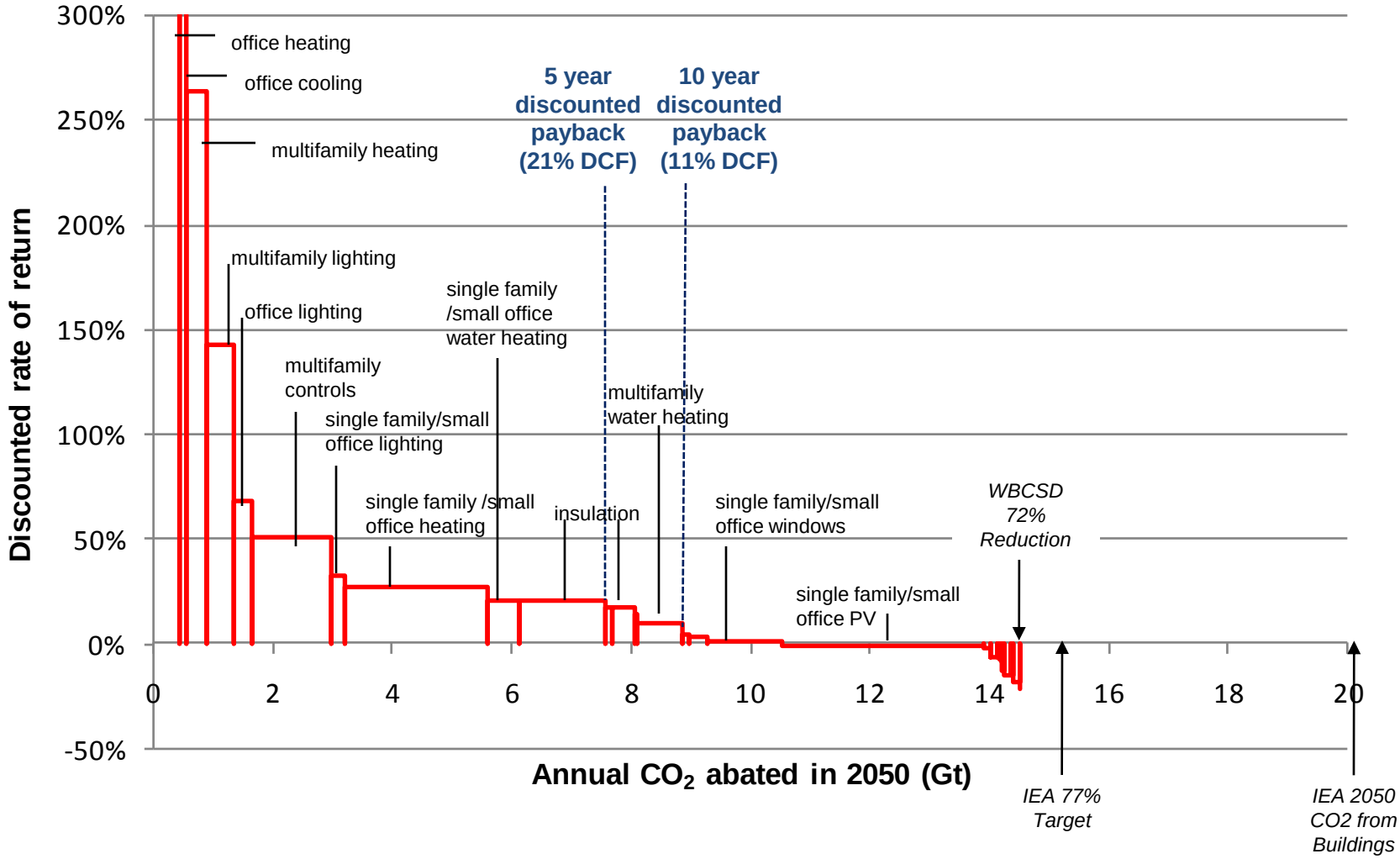
Transformation Must Address …

• A lack of transparency about energy use and cost, resulting in a limited focus on energy costs by all those in the building value chain, with viable investment opportunities overlooked and installed technology not operating at optimal levels
• Public policies that fail to encourage the most energy-efficient approaches and practices, or actively discourage them
• Delays and poor enforcement of policies and building codes, which concerns all countries
• Complexity and fragmentation in the building value chain, which inhibits a holistic approach to building design and use
• A lack of adequate offers today (affordable and quality energy-efficient solutions for new constructions and retrofitted works, adapted to local contexts)
• Split incentives (principle-agent) between building owners and users, which mean that the returns on energy-efficiency investments do not go to those making the investment
• Insufficient awareness and understanding of energy efficiency among building professionals – identified in EEB research published in our first report – which limits their involvement in sustainable building activity and results in poor installation of energy-related equipment.

…underlying all these are financial factors

Unleashing Favorable ROI

Global



Source: Modeled analysis from WBCSD Energy Efficiency in Buildings "Transforming the Market" (2009)

Peterson Institute Verification


Peterson Institute for International Economics

Policy Brief

The Economics of Energy Efficiency in Buildings

Building efficiency carbon abatement cost of $25/ton, investing annually $1T.

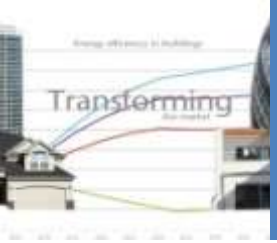
Cost of inaction is at least $500B p.a. globally, from costlier actions in other sectors.

For building energy efficiency investing, new financing is critical, coupled with new codes, standards, and transparency.

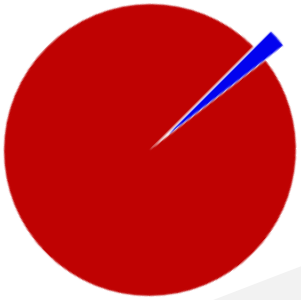
Transformative efficiency measures will lesson the energy cost impact on household income with carbonized higher energy prices

Given favorable financial considerations, use climate policy revenue to finance building efficiency,

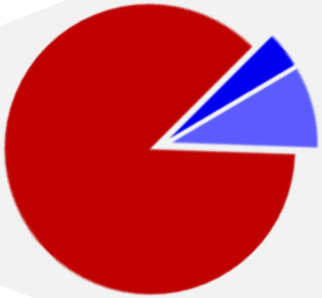
www.iie.com



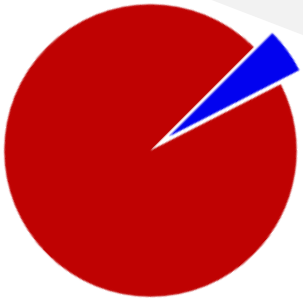
The Cost of a “Safe” Future



Auto Safety Regulations (US)
2% First Cost Premium

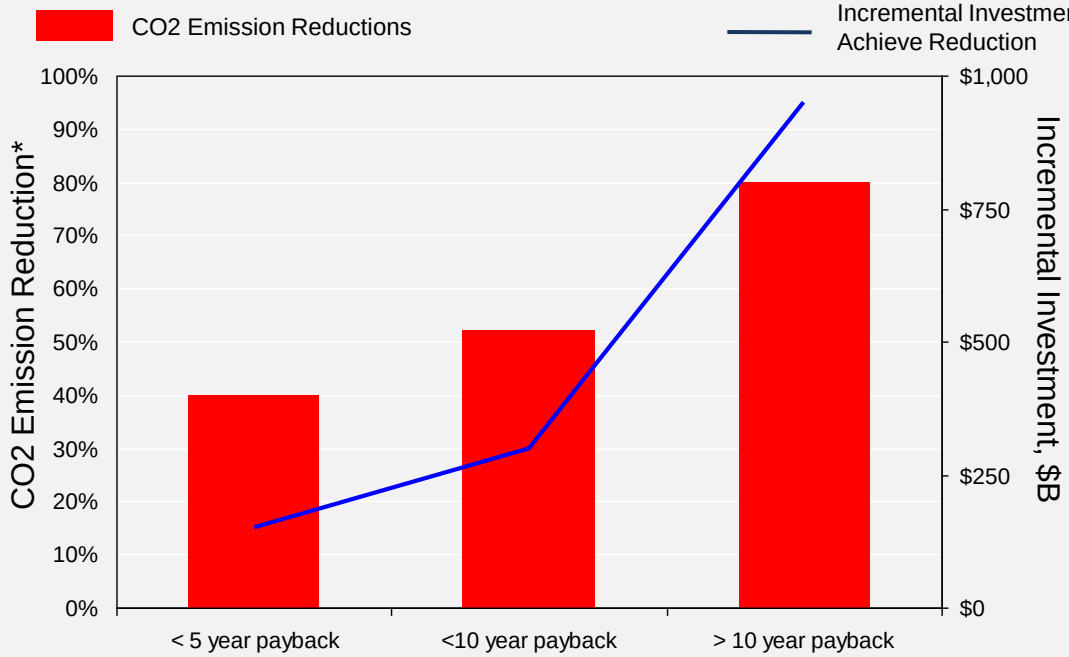


Required Building Efficiency Investments
3% Cost
13% Total Investment

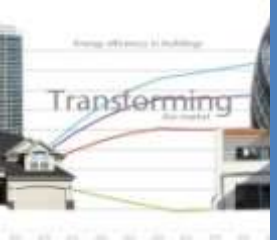


Building Fire Safety Regulations (US)
5% First Cost Premium

Six EEB Regions Assessment



*reflects scale up of buildings contribution to IEA Blue Map scenario, 2050



WBCSD Recommendations

Create and enforce building energy efficiency codes and labeling standards

- Extend current codes and tighten over time
- Display energy performance labels
- Conduct energy inspections and audits

Incentivize energy-efficient investments

- Establish tax incentives, subsidies and creative financial models to lower first-cost hurdles

Encourage integrated design approaches and innovations

- Improve contractual terms to promote integrated design teams
- Incentivize integrated team formation

Fund energy savings technology development programs

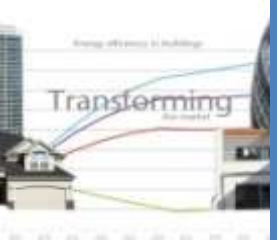
- Accelerate rates of efficiency improvement for energy technologies
- Improve building control systems to fully exploit energy saving opportunities

Develop workforce capacity for energy saving

- Create and prioritize training and vocational programs
- Develop “system integrator” profession

Mobilize for an energy-aware culture

- Promote behavior change and improve understanding across the sector
- Businesses and governments lead by acting on their building portfolios



Financial Interests for Transformation

Transparency

Risk and Certainty

Regulatory and capital incentives

ESCO/ESPC

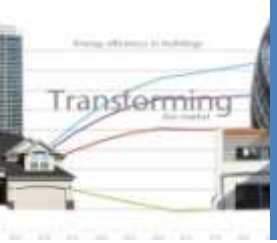
“Green” market valuation

Green lease terms (owner – tenant)

Insurance “green” premiums

Functional obsolescence

Cost avoidance and energy hedging



Thank You!

For more information see www.wbcsd.org

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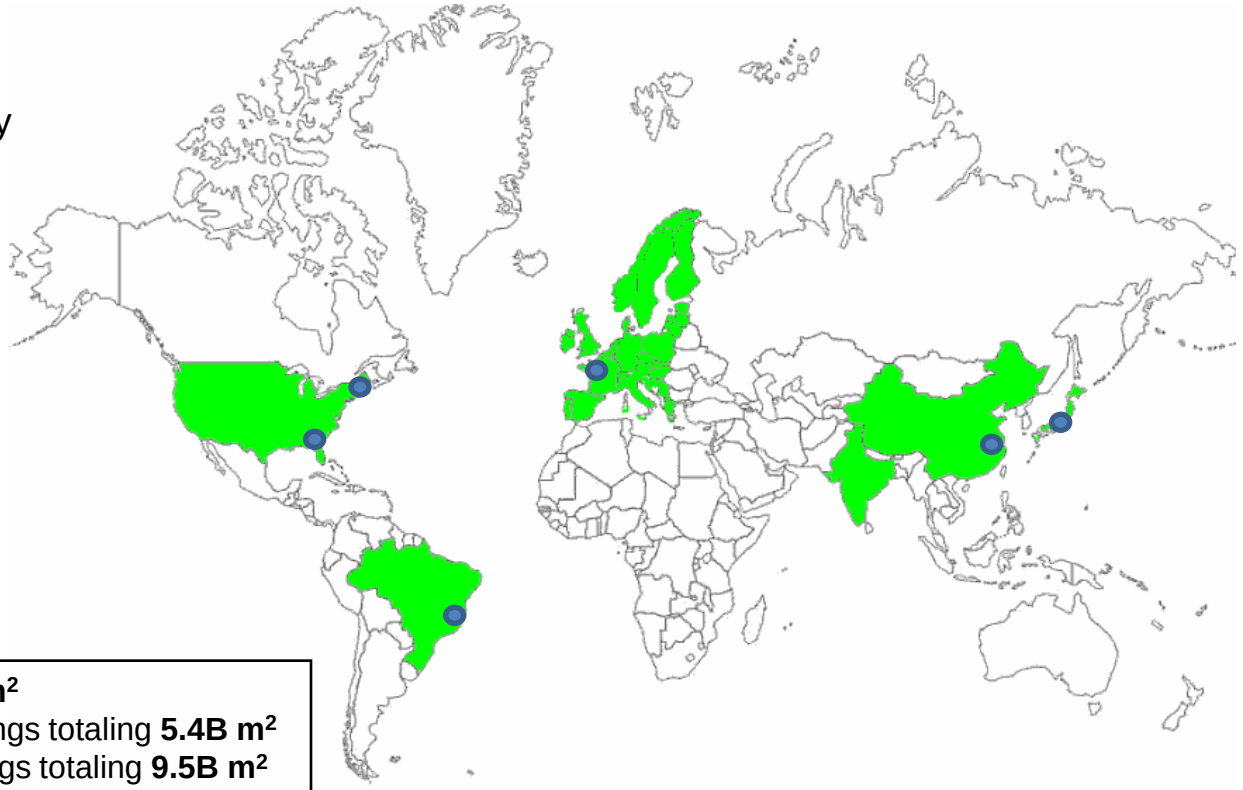
Submarkets Modeled






- Residential
  - France single family
  - US Southeast single family
  - Japan single family
  - China Beijing Multifamily
  - *Swedish Multifamily*
- Office
  - Japan Kanto Midsized
  - US Northeast Large
- Retail
  - *US Supermarkets*
  - *Brazil Shopping Center*



Six EEB Regions: Building area **>130B m²**
Submarkets Analyzed, 2005: **19 M** buildings totaling **5.4B m²**
Submarkets Analyzed, 2050: **29M** buildings totaling **9.5B m²**
Percent of region building stock analyzed (m2 basis): **4.1%**

Not included in EEB Reported Analysis

Model: A Baseline Case

EEB Model v120 US SE SFR - A1 Market Response 12-25.xlsm

Values shown are computed over 5 year bins

	Segment Total				Building or Job* Average				Improvement vs Fixed Stock		
	Change	2005	2050	per year	Change	2005	2050	per year	2050	% Diff	
Outcomes											
Net CO2 Emissions (tCO2/yr)	160%	61,197,537	98,005,957	1.1%	89%	15.092	13.4	-0.3%	110,487,044	**-13%**	
Onsite Generation Carbon Credit (tCO2/yr)	**0%**	0	0	0.0%	0%	0.000	0	0.0%	0	0%	
CO2 Emissions (tCO2/yr)	160%	61,197,537	98,005,957	1.1%	89%	15.092	13	-0.3%	110,487,044	-13%	
Net Primary Consumption (kWhr/yr)	**160%**	347,546,862,437	556,746,480,314	1.1%	89%	85,708	76,048	-0.3%	627,466,847,894	**-13%**	
Site Consumption (kWhr/yr)	**159%**	136,522,198,032	216,936,447,478	1.0% *	88%	33,668	29,632	-0.3% *	246,479,432,058	**-14%**	
Onsite Generation (kWhr/yr)	100%	0	219,824,810	100.0%	100%	0	30	100.0%	0	100%	
Onsite Energy Sales to Grid (kWhr/yr)	0%	0	0	0.0%	0%	0	0	0.0%	0	0%	
Net Site Consumption (kWhr/yr)	159%	136,522,198,032	216,936,447,478	1.0%	88%	33,668	29,632	-0.3%	246,479,432,058	-14%	
Business Opportunity					* Load Total rather than eQuest energy total. Possible eQuest roundoff error.						
Before Incentives and Penalties		($M)	($M)						($M)		
First Costs	125%	$12,016	$15,042	**0.5%**	99%	$38,529	$38,319	0.0% *	$21,459.628	-43%	
Net Energy Purchases	160%	$11,287	$18,018	**1.0%**	88%	$2,784	$2,461	-0.3%	$20,378.438	-13%	
Energy Purchases	160%	$11,287	$18,018	**1.0%**							
Onsite Energy Sales	0%	$0	$0	**0.0%**							
After Incentives and Penalties		($M)	($M)								
Incentivized & Penalized First Costs	125%	$12,016	$15,042	0.5%	99%	$38,529	$38,319	0.0% *			
Incentivized & Penalized Net Energy Purchases	160%	$11,287	$18,018	1.0%	88%	$2,784	$2,461	-0.3%			
Incentivized & Penalized Lifecycle Costs					98%	$50,085	$48,902	-0.1% *			
Policy Costs**		($M)	($M)								
First Cost Incentives	0%	$0	$0	0.0%	0%	$0	$0	0.0% *			
First Cost Penalties	0%	$0	$0	0.0%	0%	$0	$0	0.0% *			
Carbon (Net Carbon) Policy Value	0%	$0	$0	0.0%	0%	$0	$0	0.0%			
EEB Energy Cost Incentives	0%	$0	$0	0.0%	0%	$0	$0	0.0%			
Non-EEB Energy Cost Penalties	0%	$0	$0	0.0%	0%	$0	$0	0.0%			
Overall Cost of Policies	0%	**$0**	**$0**	0.0%	0%	$0	$0	0.0%			
Segment Input Statistics											
Number of Buildings	181%	4,055,000	7,320,964	1.3%			2005	2050			
Service Level (%)	100%	100%	100%	0.0%		New Construction Rate	2.3%	1.7%			
Electricity Price ($/kwh)	100%	$0.10	$0.10	0.0%		Building Destructon Rate	0.7%	0.7%			
Natural Gas Price ($/kwh)	100%	$0.05	$0.05	0.0%		Net Growth Rate	1.6%	1.0%			
OTHER Price ($/kwh)						Refurb + Replace Rate	6.2%	6.2%			
Capital Cost Multiplier	100%	100%	100%	0.0%		Average Area (m2/Apt)	274.3	274.3			
Labor Cost Multiplier	100%	100%	100%	0.0%		New Construction (bldgs)	95,657	127,572			
** Positive quantity generates tax revenue, negative quantities costs government						Refurbs + Replacements (bldgs)	216,204	264,975			

Post-run Checksum (must be small)	#VALUE!		
Post-run Exact Checksum (must be zero)	#VALUE!		
	2005	2050	
Stakeholders Decision Discretionary Inputs			
Time Horizon (years)	5	5	
Interest Rate (%)	6%	6%	
Minimum NPV	-$5,000	-$5,000	
Maximum First Cost over Lowest	25%	25%	
Unfiltered Set (New Construction)	334	334	
New Construction			
Considered Alternatives	80 / 334	81 / 334	
Meets Code & Available	319	319	
Passed First Cost Decision Filter	80	81	
Passed NPV Decision Filter	95	128	
Refurbishments			
Considered Alternatives	79 / 334	80 / 334	
Meets Code & Available	319	319	
Passed First Cost Decision Filter	80	80	
Passed NPV Decision Filter	90	120