business solutions for a sustainable world

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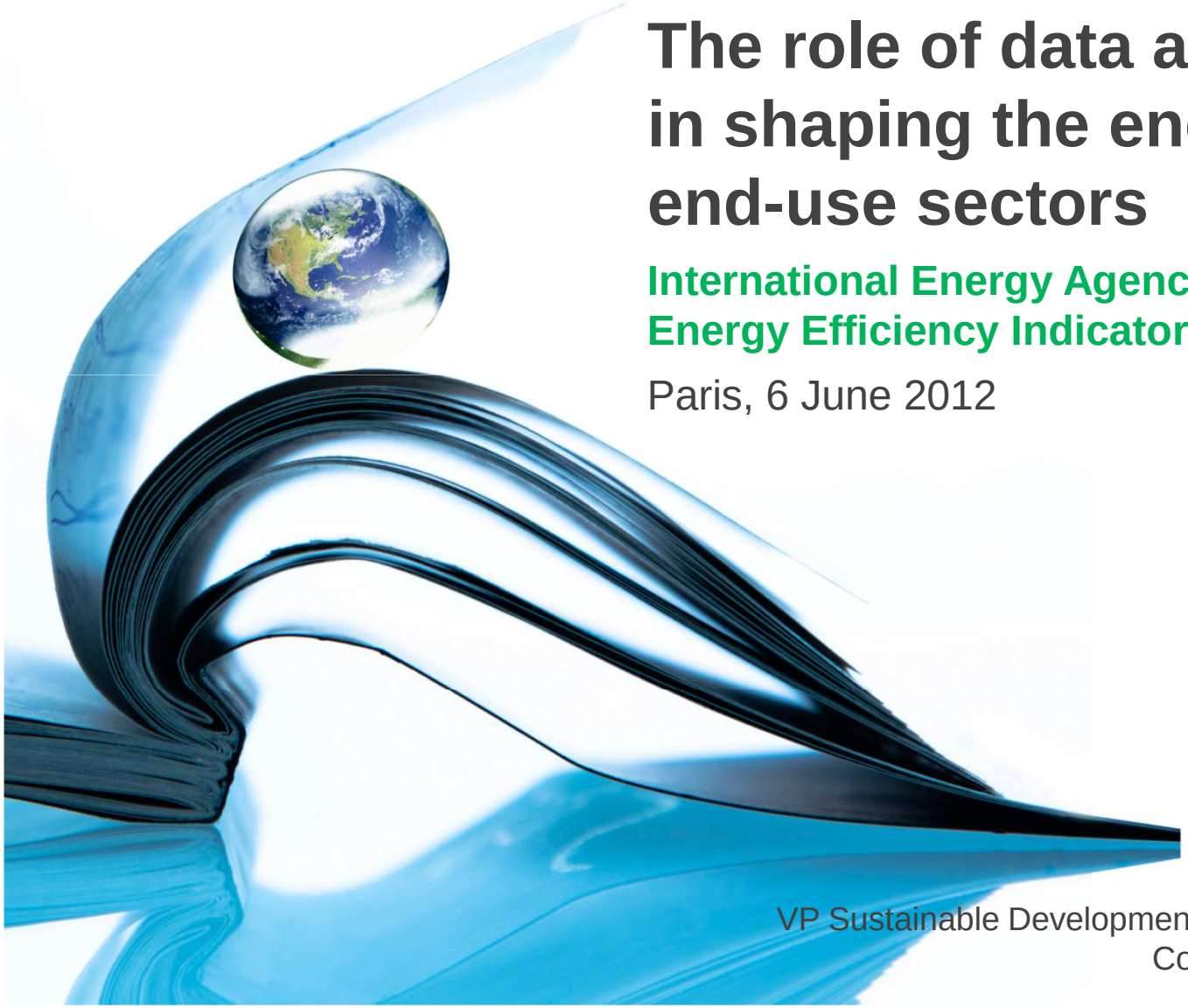

The role of data and indicators in shaping the energy future of end-use sectors

International Energy Agency
Energy Efficiency Indicators Workshop

Paris, 6 June 2012

Constant VAN AERSCHOT
VP Sustainable Development & Public Affairs, LAFARGE
Co-chair EEB project, WBCSD

What is the WBCSD?

World Business Council for Sustainable Development

The WBCSD is a CEO-led organization of forward-thinking companies that galvanizes the global business community to create a sustainable future for business, society and the environment

Collectively, the WBCSD member companies represent:

- US$ 7,000bn market capitalization
- 13 million direct employees
- A global outreach: members supply collectively products and services to half of the world's population every day

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WBCSD's member companies

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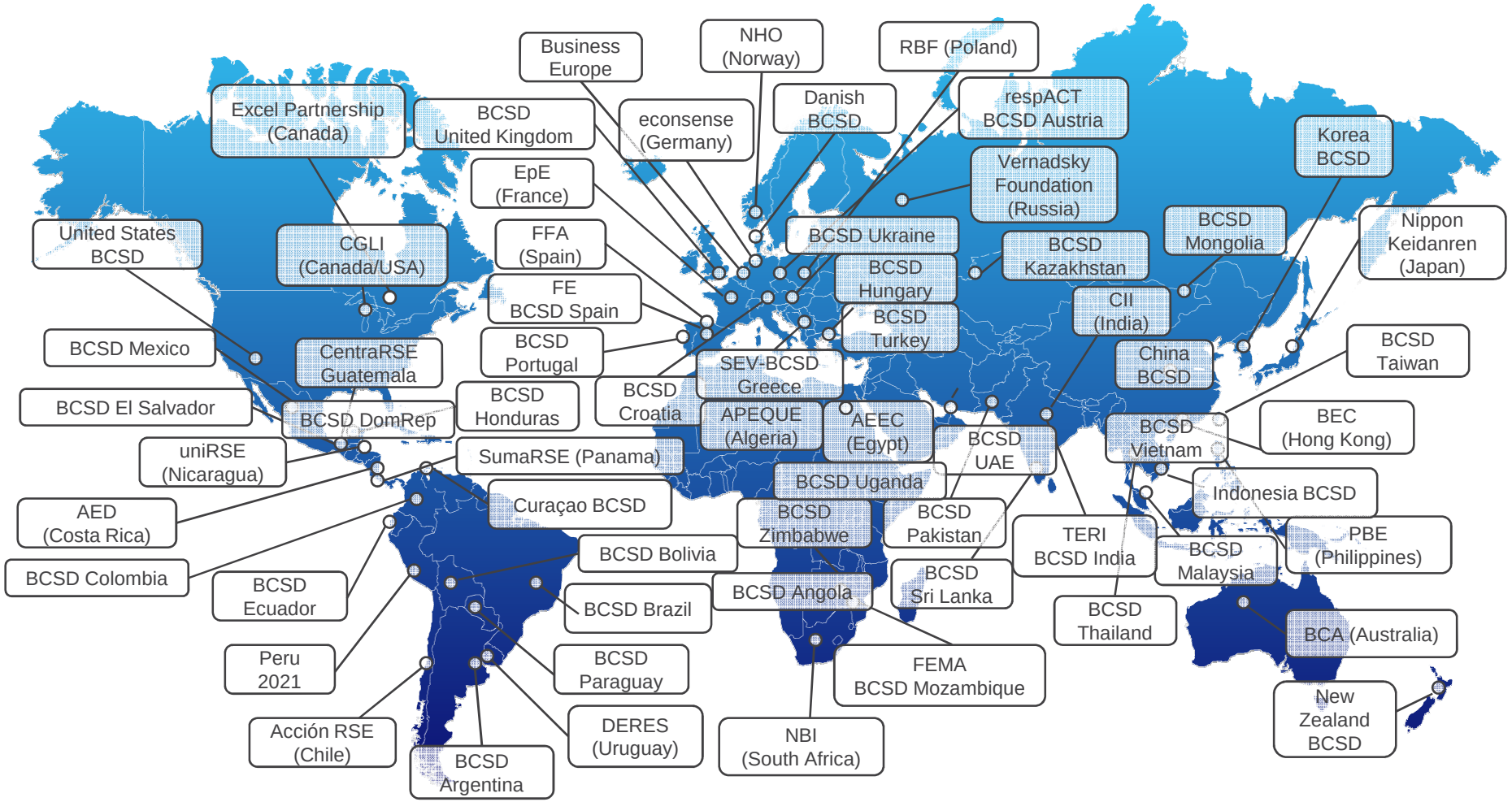
WBCSD's network of partner organizations



The Energy Efficiency in Buildings project

Leading companies join forces to address the challenge of energy use in buildings

Started in 2006, the project

- Focuses on energy used in buildings
- Gives a business perspective
- Shares research findings openly with markets and regulators

The first EEB report – a real success in 2007

A concise summary on facts and trends of energy use in buildings

The report includes:

- High level data on building energy use in Brazil, China, India, EU, Japan, USA
- Unique global perception study on green/sustainable buildings

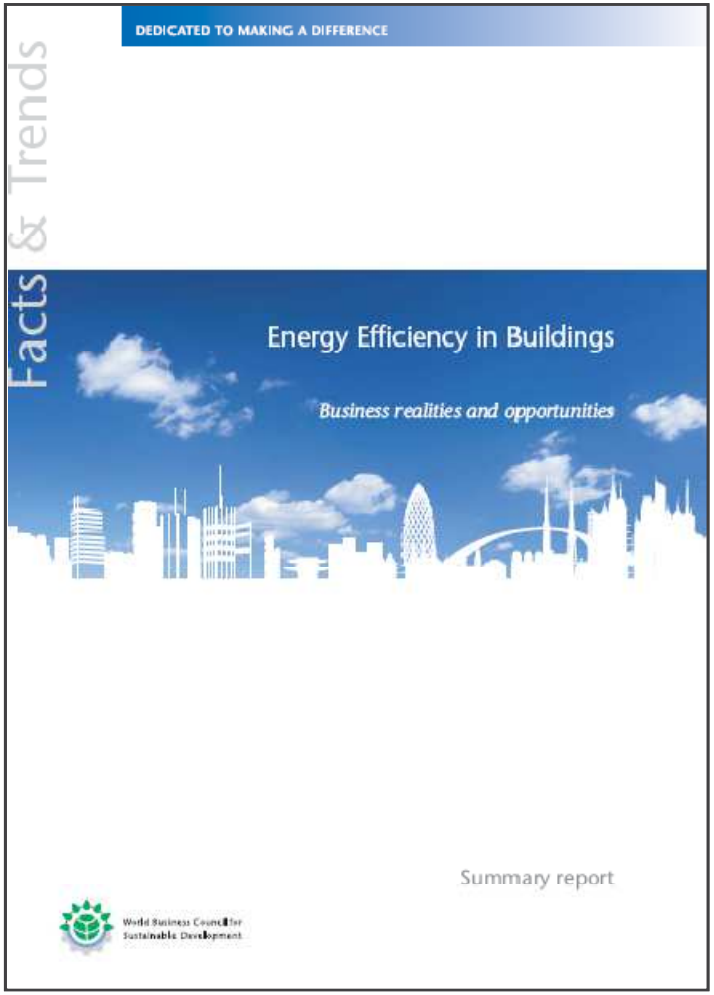
Key figures

50’000+ downloads

10’000 hard copies

Available in English, Chinese, Japanese, Spanish, Portuguese and Russian

Teaching reference in 6+ universities



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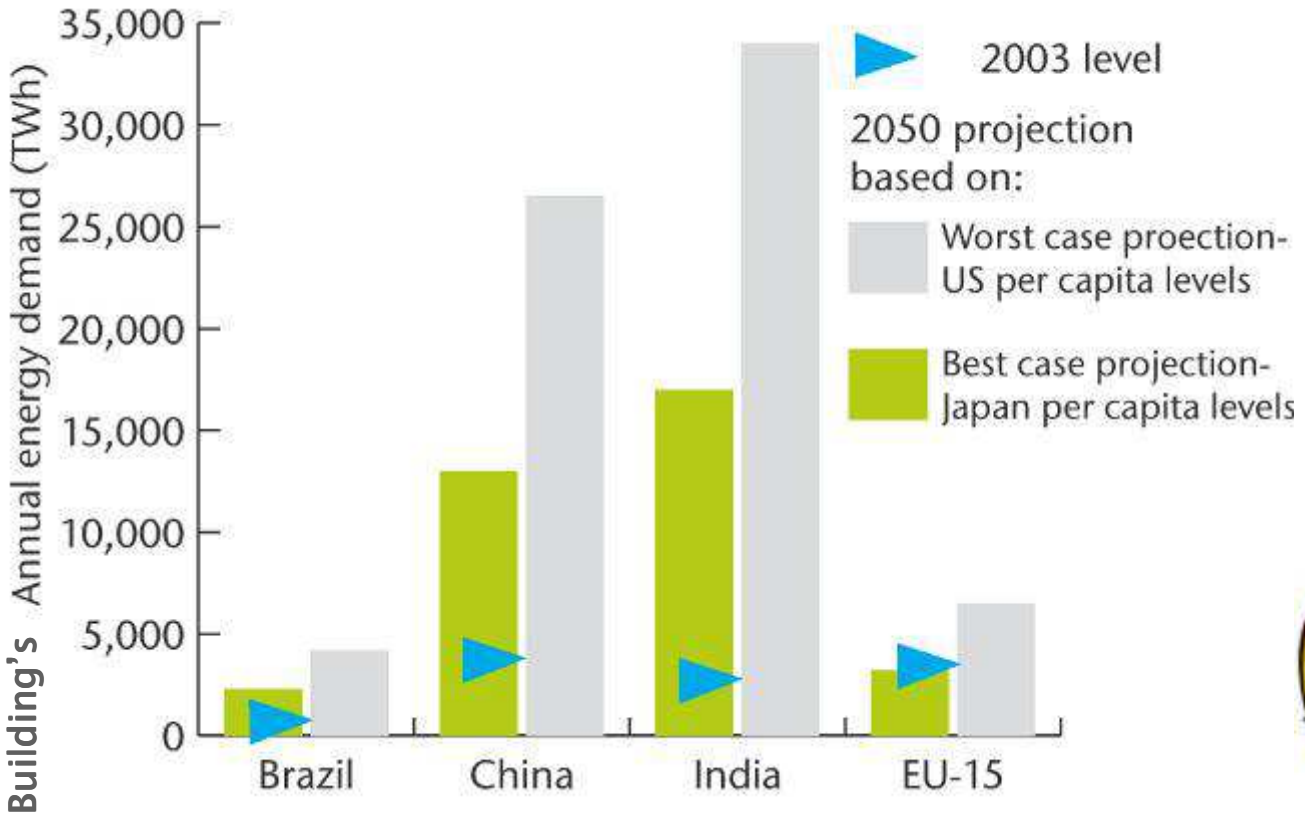
Energy in buildings: a time bomb if we don't act now

Rising living standard has an exponential effect on energy used in buildings



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Identified levers for change

Policy as a supportive framework

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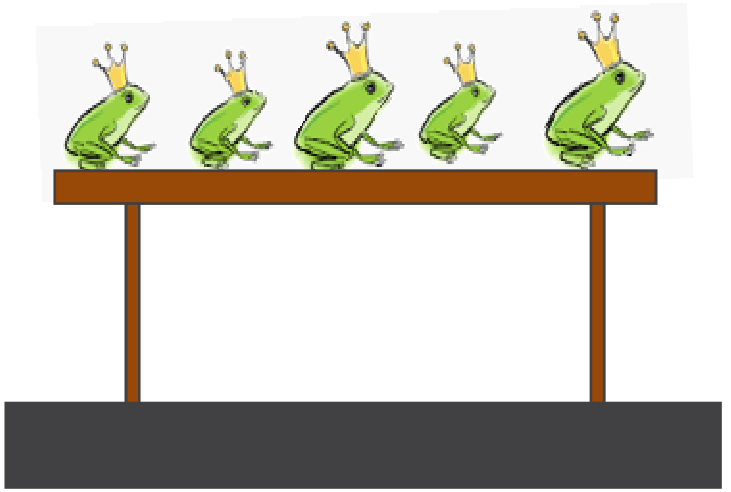
The frog test

5 frogs sit on the edge of a table
4 decide to jump off

How many remain on the table?

Answer: 5



Why?
Because there is a difference between **DECIDING** and **DOING**

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Which policy packages trigger implementations?

The EEB model can evaluate carbon emissions and total energy use in the context of adoption preferences and building system interactions

EEB model goals

- What solutions will key stakeholders (i.e. decision makers) adopt?
- What is the submarket energy and emission impact of adopted technologies?
- How will various policy actions affect stakeholder selections?
- How will potential scenarios and exogenous factors affect stakeholder decisions?
- What construction options, prices and policies will be required to meet a given target?

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Following a bottom up approach

Implementation is done at submarket level

- Model relies on a submarket approach
- Submarkets are defined by building end use and location (climate)
- Project is focused on thorough evaluation of a limited submarket set

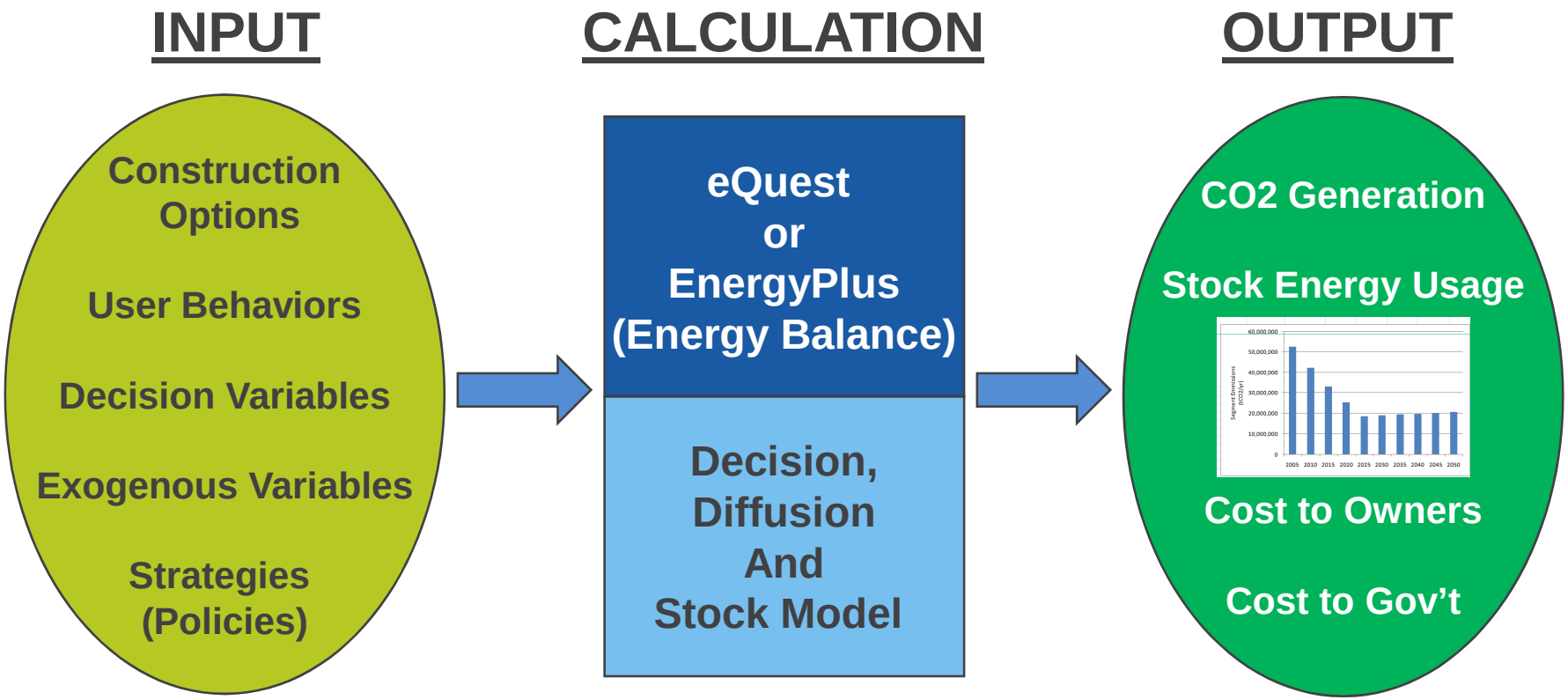
Published cases

- Single Family Home: France; Multi-Family Home: China (Beijing); Office: Japan (Kanto); Retail: Brazil

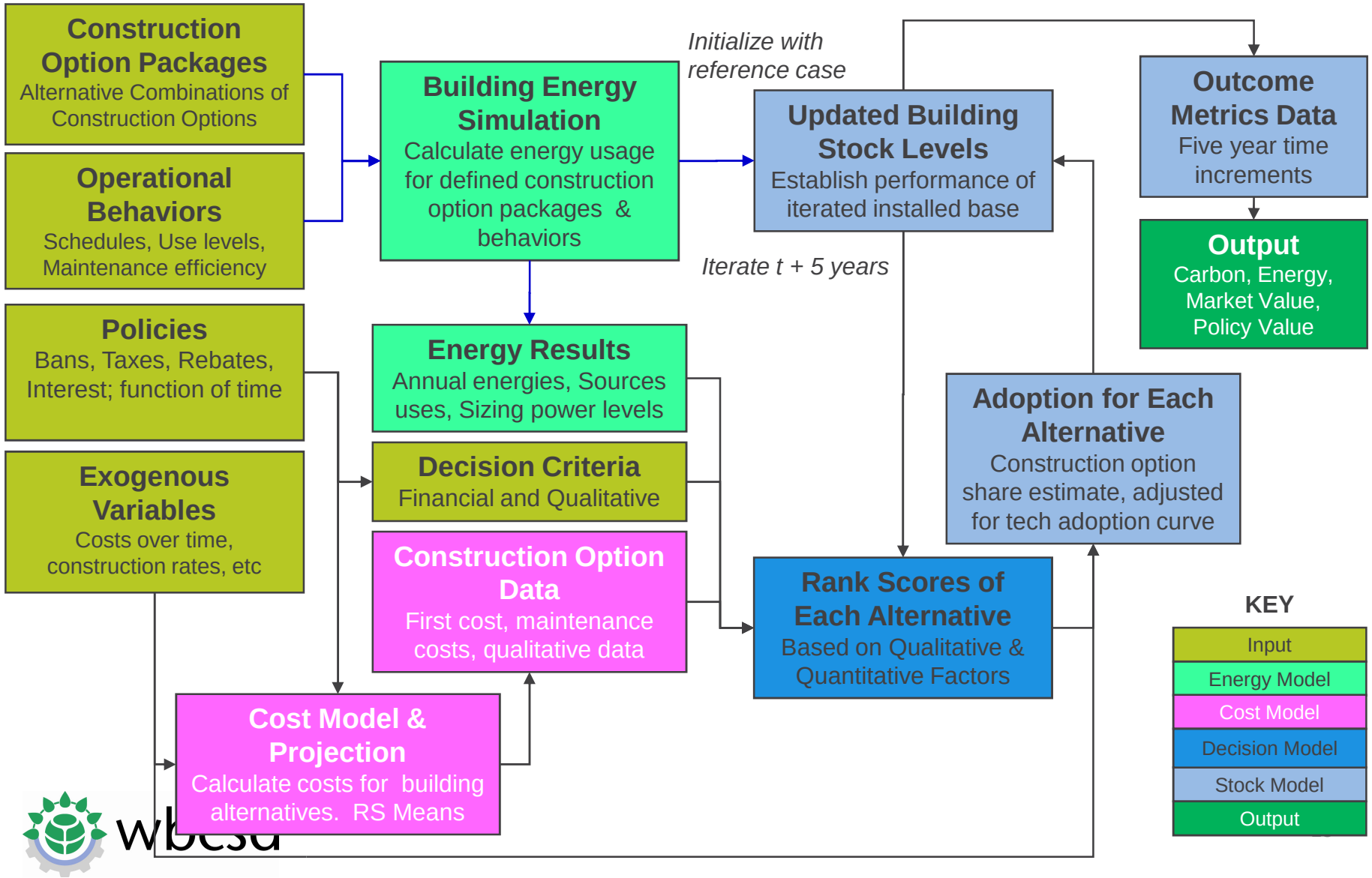
Other Submarkets modelled (but not published)

- Single Family Home: US (warm), Japan (Kansai); Multi-Family Home: China (Shanghai), India & Sweden; Office: US (cold), France, Brazil, India, China (warm climate); Retail: China (cold) & India

Used data and indicators



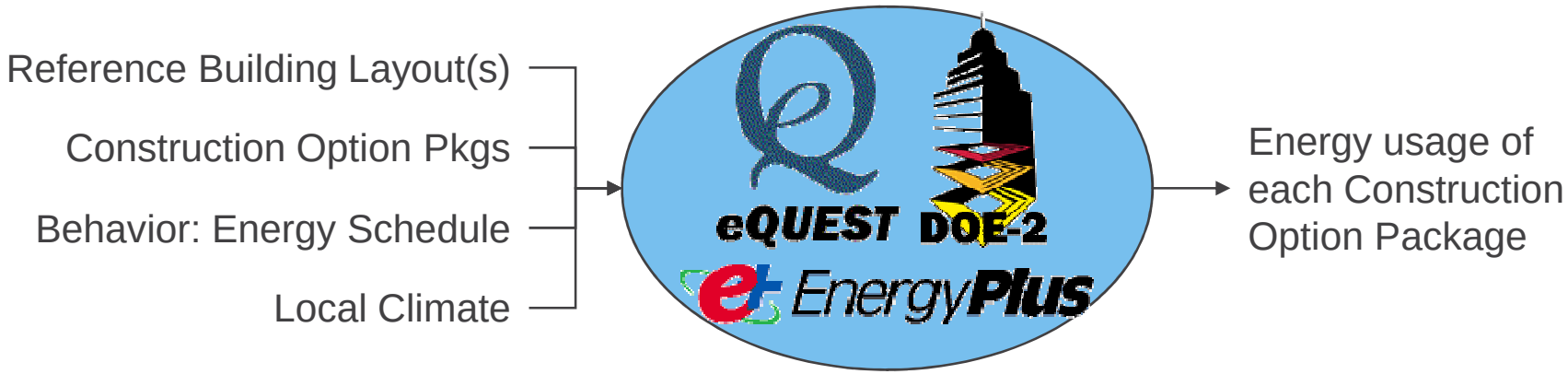
Submarket Model Analysis Process



Building Energy Simulations

Implementation is done at submarket level

- Software used to calculate building performance
- Creates yearly energy consumption data to be used in spreadsheet calculations
- Creates peak power for sizing calculations
- Results consider interactions of systems



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What are the criteria for decision making?

Implementation of construction options is based on

- Financial factors
- Value Enhancement factors
- Linear utility model of non-financial factors

Decision Weighing	Stakeholder Financial Factors	Other Stakeholder's Thresholds	Financial Factors	Energy Cost	Qualitative Factors	Behavior Levels
Level to which stakeholder considers cost, value enhancers, qualitative factors	Level to which the stakeholder realizes the relevant costs & savings	Provides other stakeholders limits on items like First Cost, Break Even Time, Green performance, etc	Discount rates, time horizon	Price paid for energy from various sources	Decision maker importance to the various non-financial factors used	% of compliance to maintenance and commissioning costs

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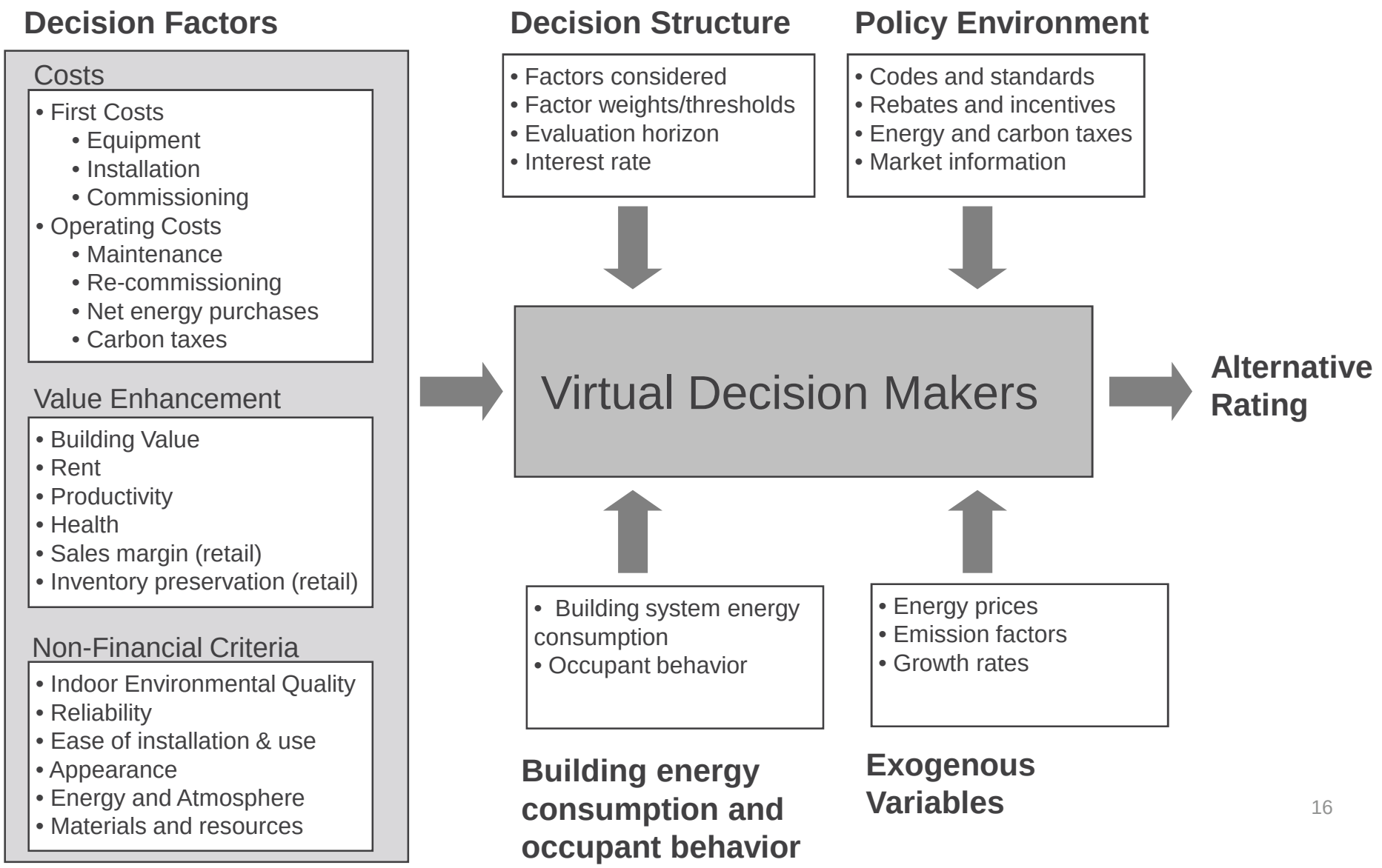
Decision model to engage in energy retrofits



Modelling Behaviour

Building occupant behaviour impacts energy use by a factor of +/-30%

- Consolidation of building occupant usage behaviour
- Includes items such as maintenance, thermostat setback, lighting usage, etc.
- Lumped into “Good,” “Modest,” and “Low” categories

Behavior Level	Representative Behaviors
“Low”	75ºW/73ºS set points, high air leakage rate, high internal load rates, poor load schedule, poor solar gain, -50% system maintenance efficiency effect
“Modest”	70ºW/75ºS set points, standard air leakage rate, standard internal load rates, standard load schedule, standard solar shading, standard system maintenance
“Good”	65ºW/80ºS set points, low air leakage rate, low internal load rates, optimized load schedule, high solar shading, perfect maintenance (no loss)

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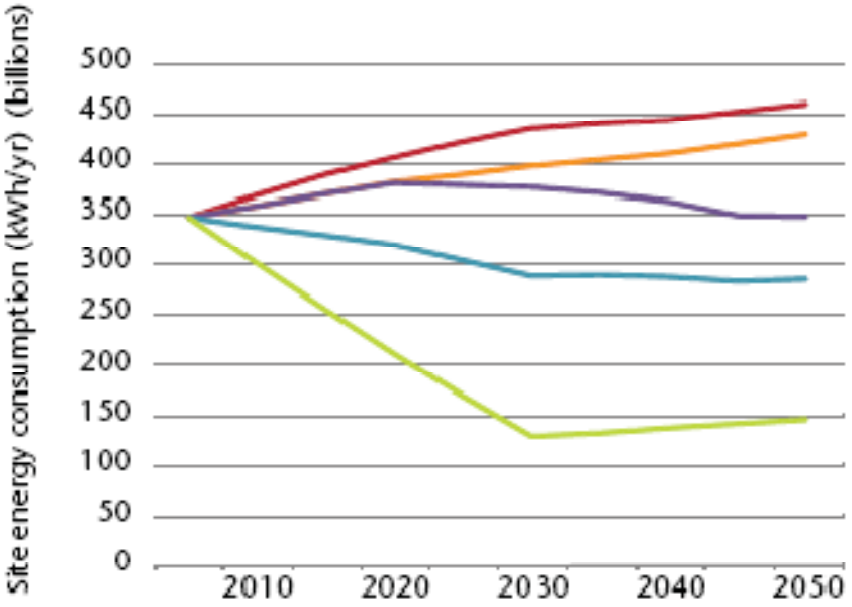
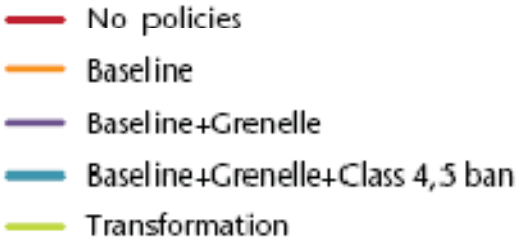
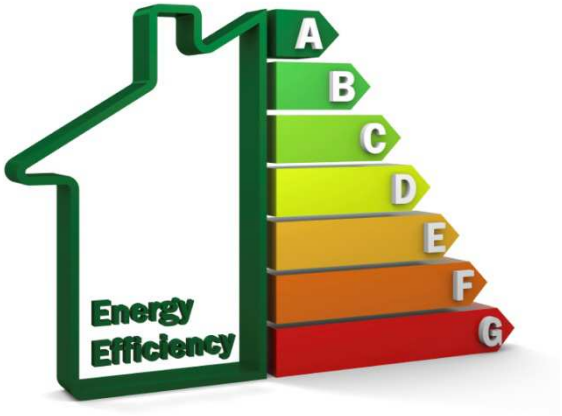
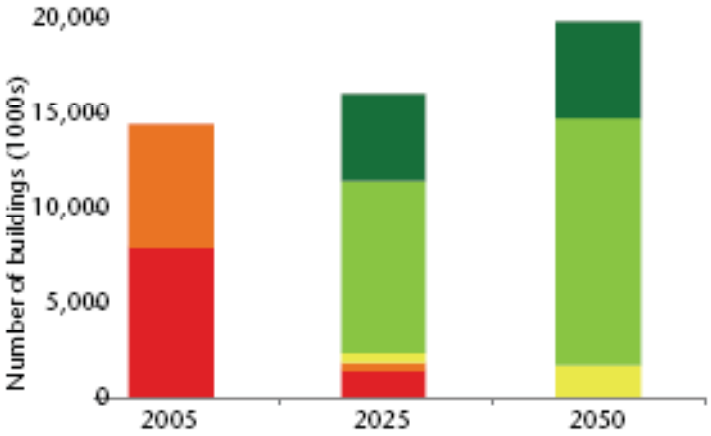
Sample results

Results for a submarket building stock









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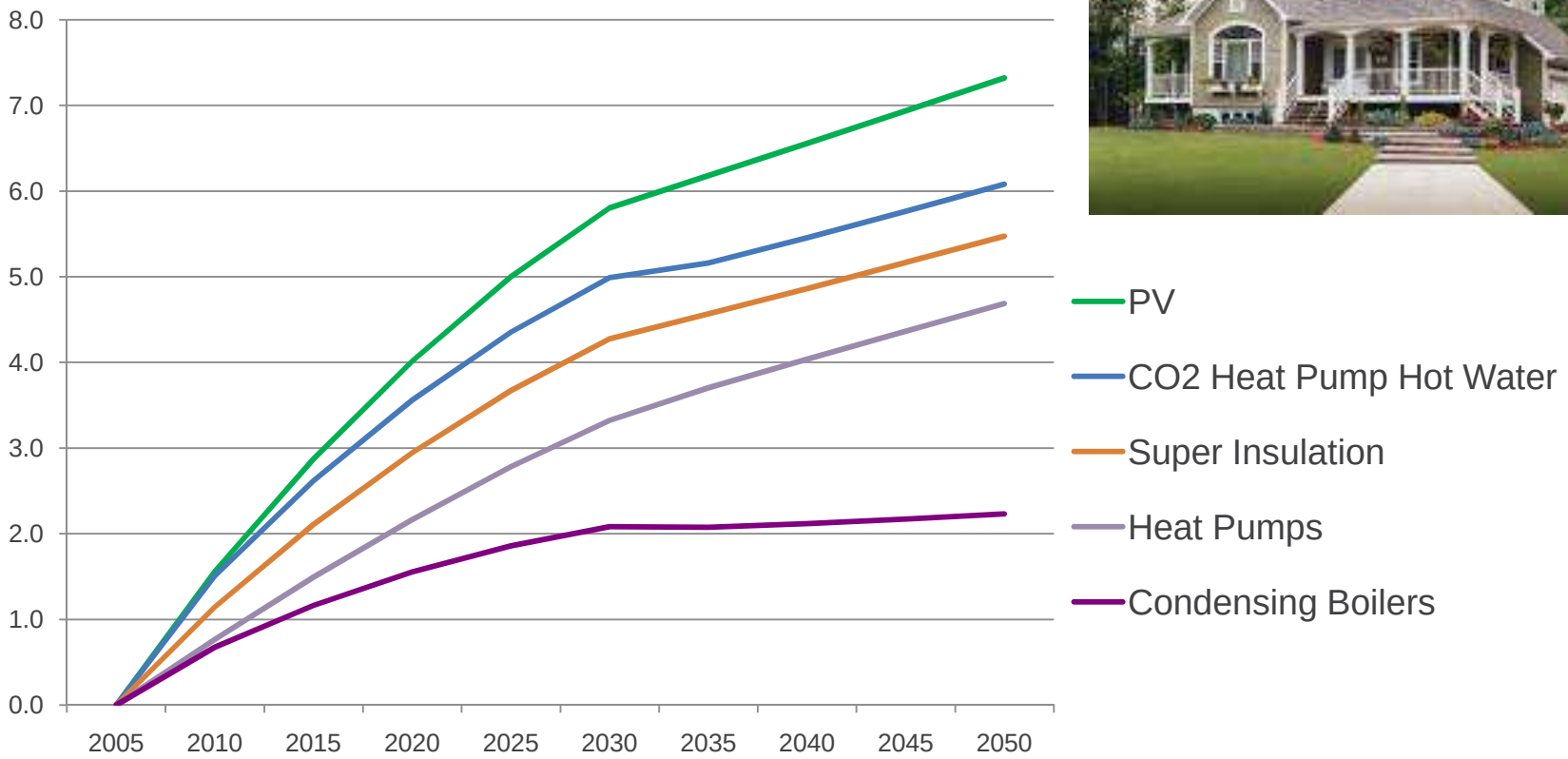
Adopted technologies in the US South-East for the single-family-homes case



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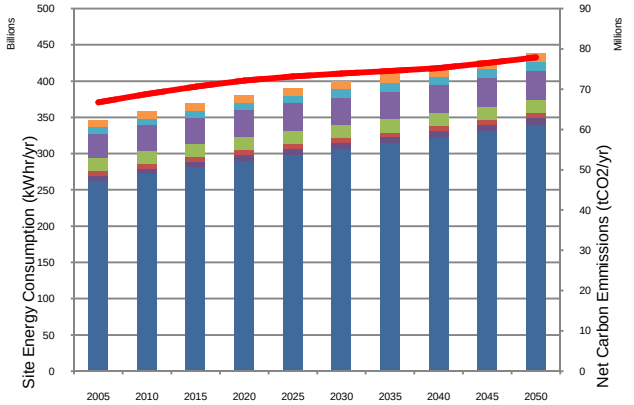
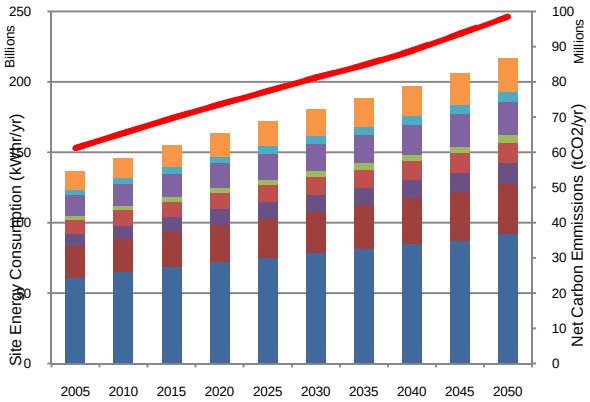
Results for a selection of submarket / policy package

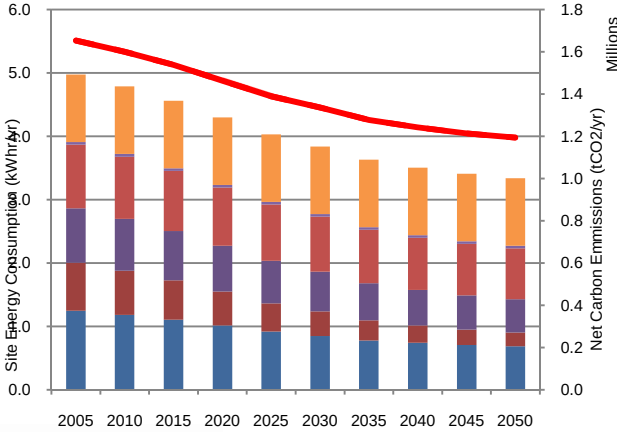
France Single Family homes



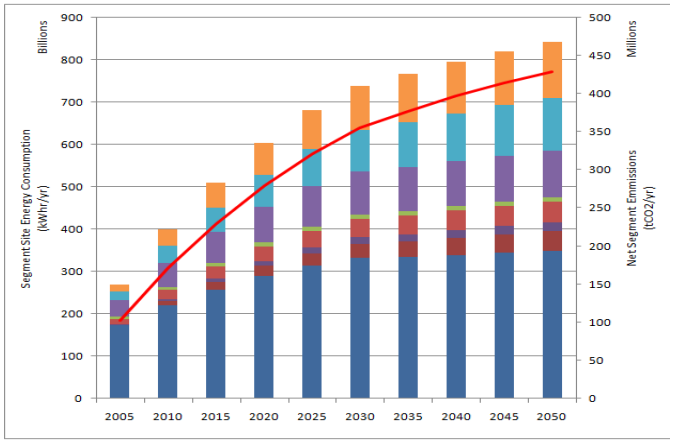
US SE Single family homes



Japan Kanto Mid-sized Office



Beijing Multi-family homes



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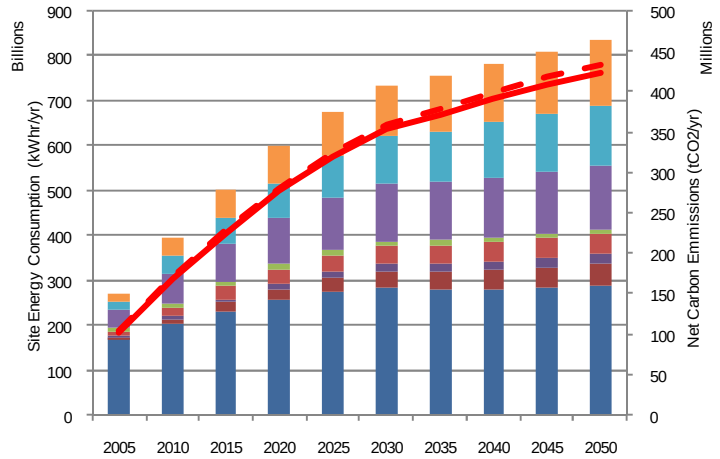
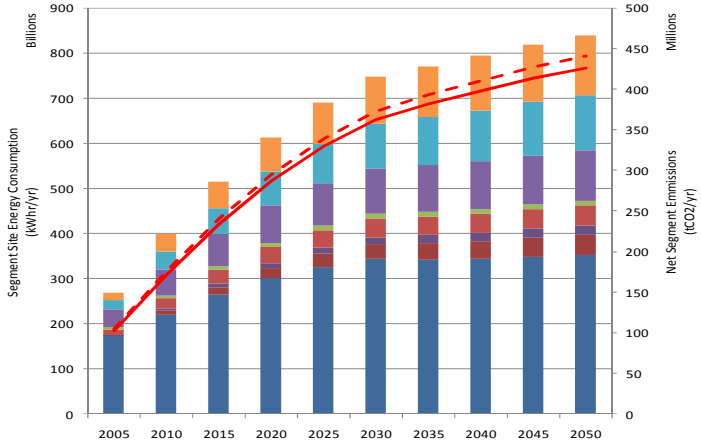
Beijing Multi family homes

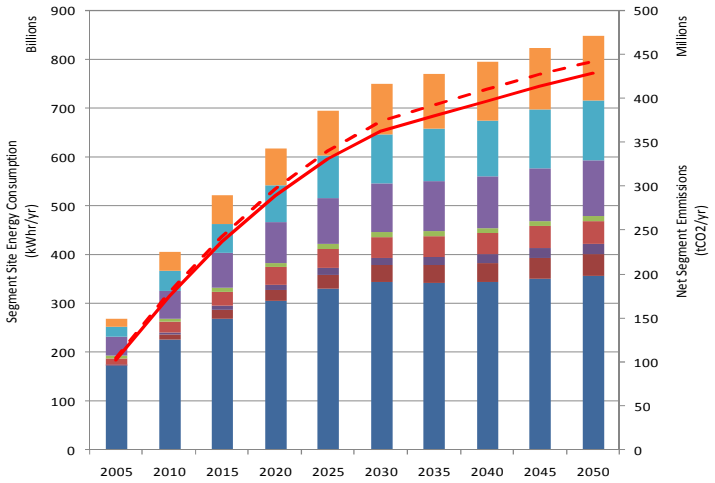
Market response



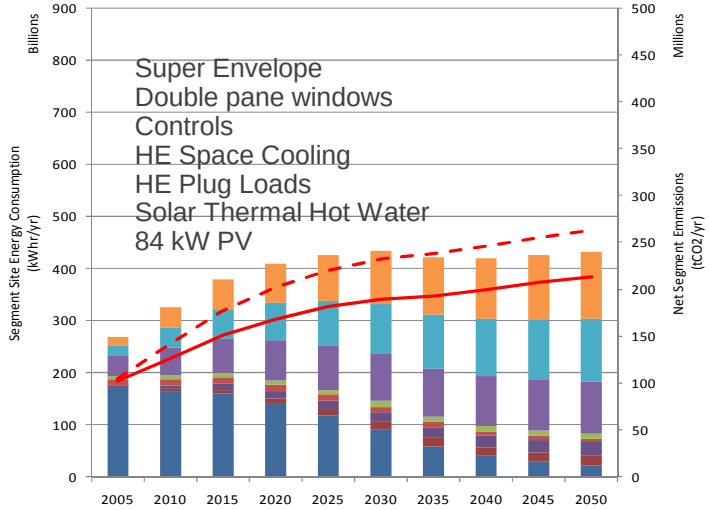
Policy Intervention



Policy + $30 Carbon

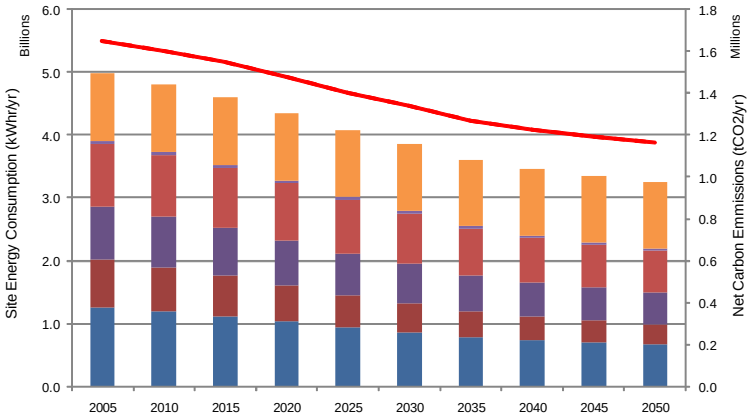


Policy + $30 Carbon + AB Inc + EFG Ban

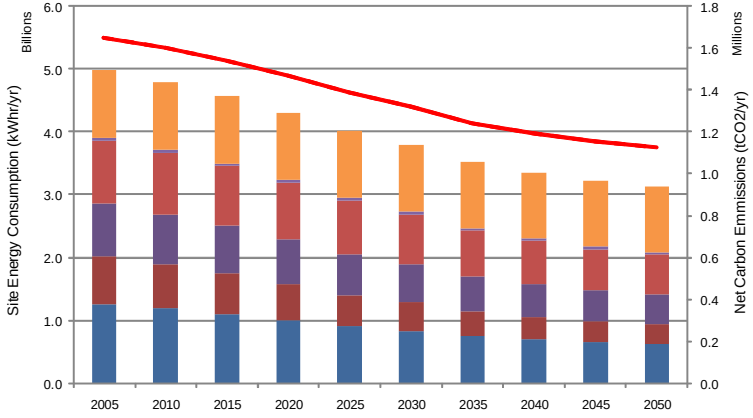


Japan mid-size offices

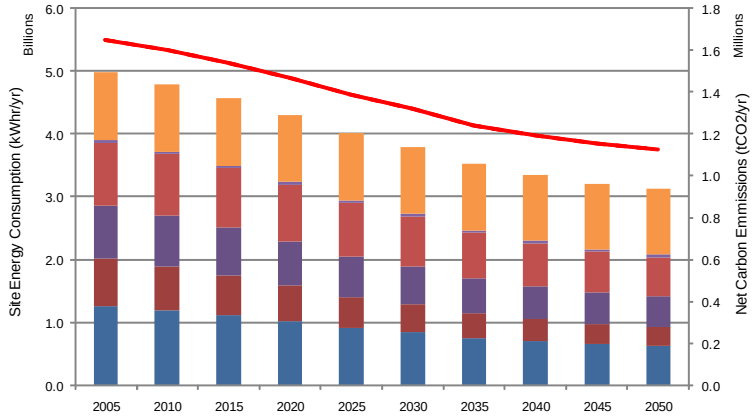
Market Response



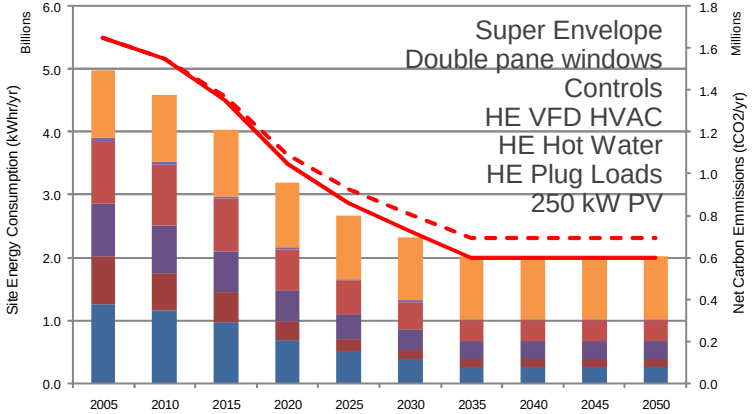
Policy Intervention



Policy + $30 Carbon



Policy + $30 Carbon + AB Inc + EFG Ban



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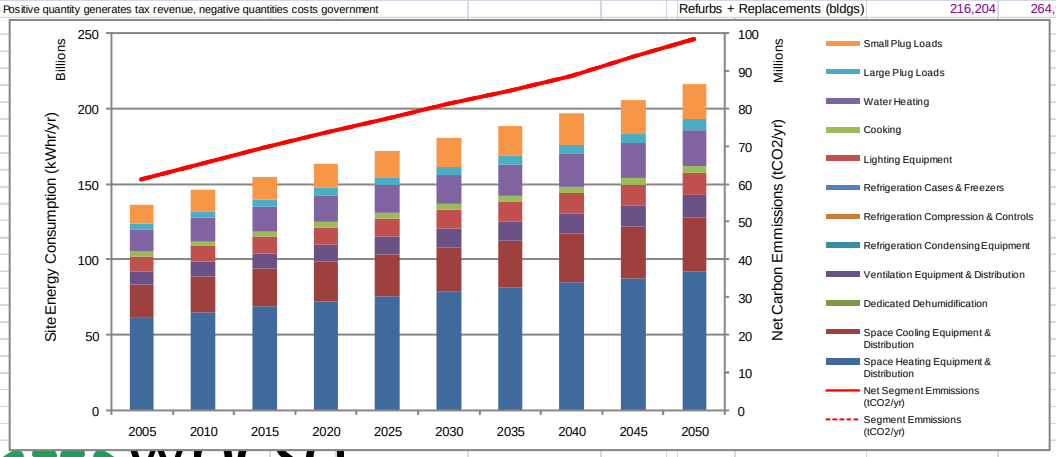
A1 Market Response 12-25 - Summary

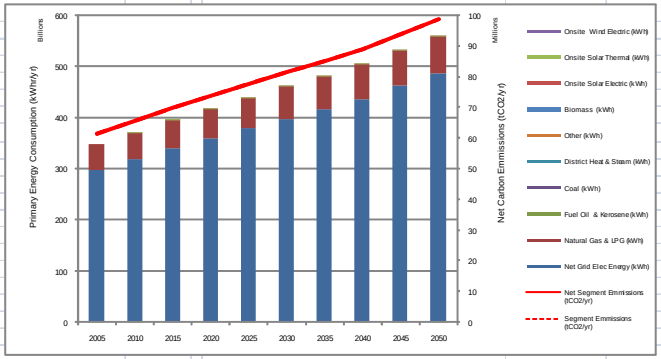
EEB Model v116 US SE SFR - A1 Market Response 12-25.xlsm

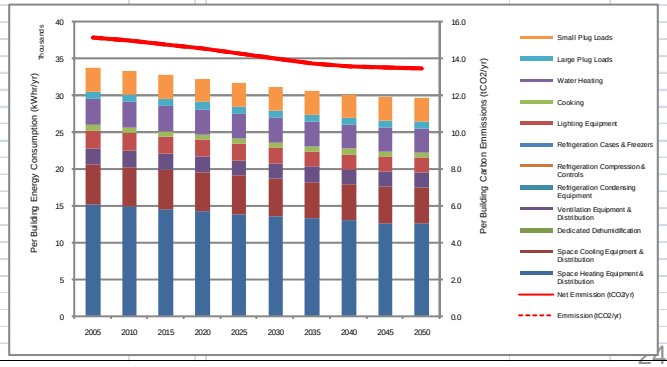
Values show n are computed over 5 year bins

	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)	**161%**	61,197,537	98,403,171	1.1%	89%	15.092	13.4	-0.3%	110,487,044	**-12%**
Onsite Generation Carbon Credit (tCO2/yr)	100%	0	129,504	100.0%	100%	0.000	0	100.0%	0	100%
CO2 Emissions (tCO2/yr)	161%	61,197,537	98,532,675	1.1%	89%	15.092	13	-0.3%	110,487,044	-12%
Net Primary Consumption (kWhr/yr)	**161%**	347,546,862,437	559,699,459,049	1.1%	89%	85,708	76,452	-0.3%	627,466,847,894	**-12%**
Net Site Consumption (kWhr/yr)*	**159%**	136,522,198,032	216,744,973,025	1.0%	* 88%	33,668	29,606	-0.3%	* 246,479,432,058	**-14%**
Onsite Generation (kWhr/yr)	100%	0	219,621,741	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%
Site Consumption (kWhr/yr)	159%	136,511,069,214	216,535,929,693	1.0%	88%	33,665	29,578	-0.3%	246,459,339,905	-14%
Business Opportunity					* Load Total rather than eQuest energy total. Possible eQuest roundoff error.					
Before Incentives and Penalties		($M)	($M)						($M)	
First Costs	125%	$12,008	$15,052	**0.5%**	100%	$38,505	$38,344	0.0% *	$21,459.628	-43%
Net Energy Purchases	160%	$11,287	$18,077	**1.1%**	89%	$2,784	$2,469	-0.3%	$20,378.438	-13%
Energy Purchases	160%	$11,287	$18,077	**1.1%**						
Onsite Energy Sales	0%	$0	$0	**0.0%**						
After Incentives and Penalties		($M)	($M)							
Incentivized & Penalized First Costs	125%	$12,008	$15,052	0.5%	100%	$38,505	$38,344	0.0% *		
Incentivized & Penalized Net Energy Purchases	160%	$11,287	$18,077	1.1%	89%	$2,784	$2,469	-0.3%		
Incentivized & Penalized Lifecycle Costs					98%	$50,069	$48,994	0.0% *		
Policy Costs**		($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	264,976		

Post-run Checksum (must be small)	0.086286352	
Post-run Exact Checksum (must be zero)	0	
	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	81 / 334	82 / 334
Meets Code & Available	320	320
Passed First Cost Decision Filter	81	82
Passed NPV Decision Filter	96	125
Refurbishments		
Considered Alternatives	80 / 334	81 / 334
Meets Code & Available	320	320
Passed First Cost Decision Filter	81	81
Passed NPV Decision Filter	91	121







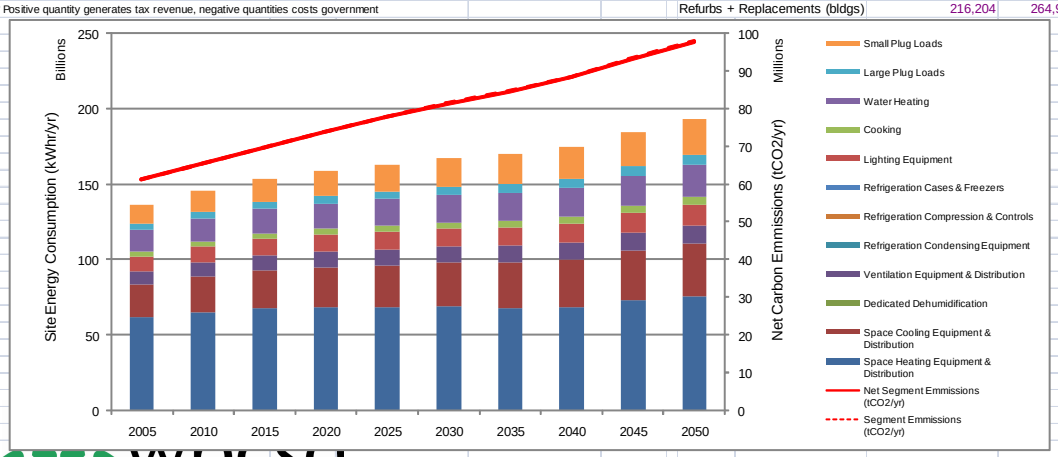
B1 Policy Intervention 12-25 - Summary

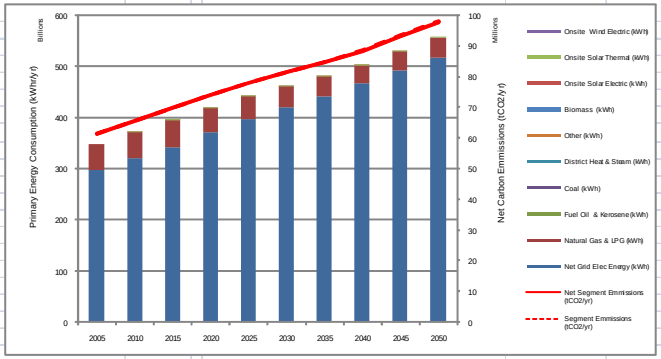
EEB Model v116 US SE SFR - B1 Policy Intervention 12-25.xlsm

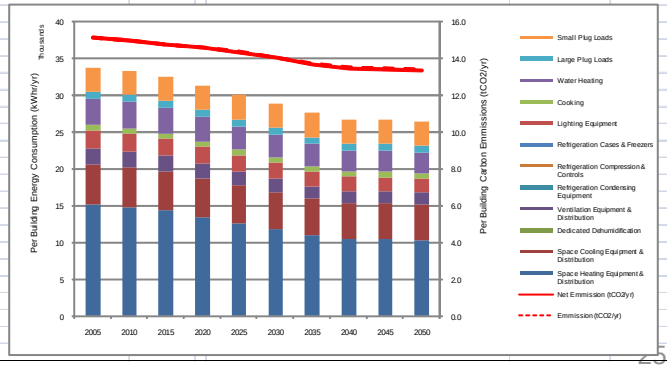
Values show n are computed over 5 year bins

	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	97,729,619	1.0%	88%	15.092	13.3	-0.3%	110,487,044	**-13%**
Onsite Generation Carbon Credit (tCO2/yr)	100%	0	295,900	100.0%	100%	0.000	0	100.0%	0	100%
CO2 Emissions (tCO2/yr)	160%	61,197,537	98,025,520	1.1%	89%	15.092	13	-0.3%	110,487,044	-13%
Net Primary Consumption (kWhr/yr)	**160%**	347,546,862,437	556,476,033,162	1.1%	89%	85,708	76,011	-0.3%	627,466,847,894	**-13%**
Net Site Consumption (kWhr/yr)*	**142%**	136,522,198,032	193,752,470,139	0.8%	* 79%	33,668	26,465	-0.5%	* 246,479,432,058	**-27%**
Onsite Generation (kWhr/yr)	100%	0	501,806,685	100.0%	100%	0	69	100.0%	0	100%
Onsite Energy Sales to Grid (kWhr/yr)	0%	0	0	0.0%	0%	0	0	0.0%	0	0%
Site Consumption (kWhr/yr)	142%	136,511,069,214	193,261,254,068	0.8%	78%	33,665	26,398	-0.5%	246,459,339,905	-28%
Business Opportunity					* Load Total rather than eQuest energy total. Possible eQuest roundoff error.					
Before Incentives and Penalties		($M)	($M)						($M)	
First Costs	125%	$12,027	$15,041	**0.5%**	99%	$38,564	$38,315	0.0%	* $21,459.628	-43%
Net Energy Purchases	154%	$11,287	$17,360	**1.0%**	85%	$2,784	$2,371	-0.4%	$20,378.438	-17%
Energy Purchases	154%	$11,287	$17,360	**1.0%**						
Onsite Energy Sales	0%	$0	$0	**0.0%**						
After Incentives and Penalties		($M)	($M)							
Incentivized & Penalized First Costs	122%	$11,775	$14,349	0.4%	97%	$37,758	$36,555	-0.1%	*	
Incentivized & Penalized Net Energy Purchases	154%	$11,287	$17,360	1.0%	85%	$2,784	$2,371	-0.4%		
Incentivized & Penalized Lifecycle Costs					95%	$49,302	$47,058	-0.1%	*	
Policy Costs**		($M)	($M)							
First Cost Incentives	275%	-$251	-$691	2.3%	219%	-$806	-$1,761	1.8%	*	
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	275%	**-$251**	**-$691**	2.3%	219%	-$806	-$1,761	1.8%		
Segment Input Statistics										
Number of Buildings	181%	4,055,000	7,320,964	1.3%			2005	2050		
Service Level (%)	100%	100%	100%	0.0%		New Construction Rate	2.3%	1.7%		
Electricity Price ($/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	264,977		

Post-run Checksum (must be small)	0.086286352	
Post-run Exact Checksum (must be zero)	0	
	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	81 / 334	81 / 334
Meets Code & Available	320	320
Passed First Cost Decision Filter	81	81
Passed NPV Decision Filter	173	242
Refurbishments		
Considered Alternatives	81 / 334	81 / 334
Meets Code & Available	320	320
Passed First Cost Decision Filter	81	81
Passed NPV Decision Filter	148	226







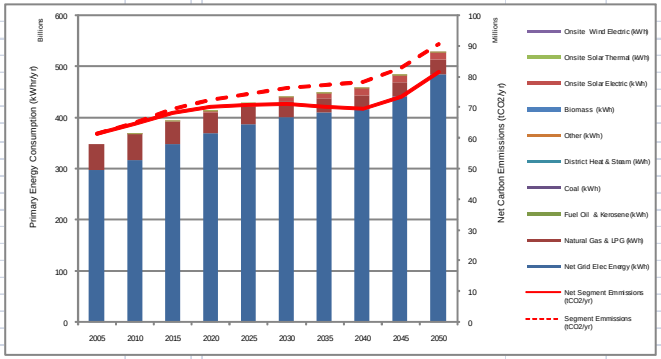
F3 Class 1+2 Incent + Class 3-5 Operating Penalty + B1 12-25 - Summary

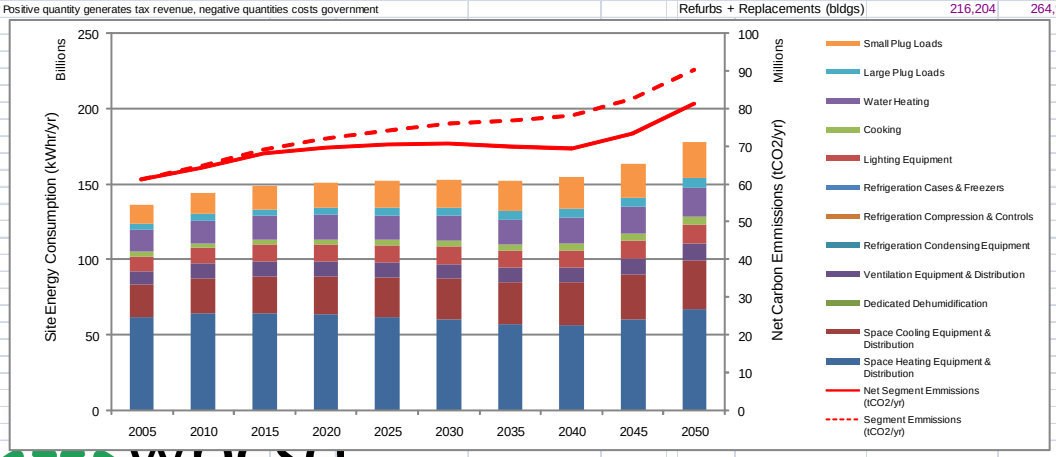
EEB Model v116 US SE SFR - F3 Class 1+2 Incent + Class 3-5 Operating Penalty + B1 12-25.xlsm

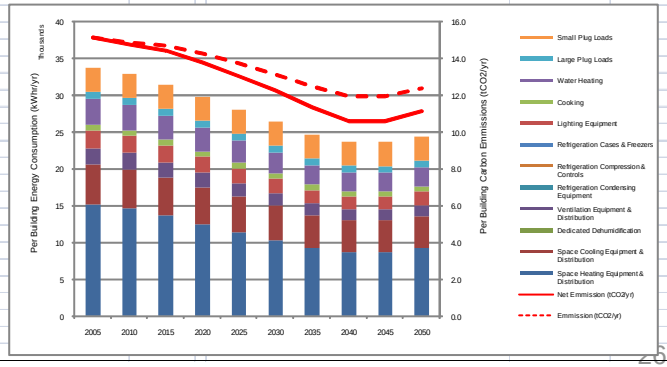
Values show n are computed over 5 year bins

	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)	**133%**	61,197,537	81,321,888	0.6%	74%	15.092	11.1	-0.7%	110,487,044	**-36%**
Onsite Generation Carbon Credit (tCO2/yr)	100%	0	9,131,669	100.0%	100%	0.000	1	100.0%	0	100%
CO2 Emissions (tCO2/yr)	148%	61,197,537	90,453,557	0.9%	82%	15.092	12	-0.4%	110,487,044	-22%
Net Primary Consumption (kWhr/yr)	**152%**	347,546,862,437	528,391,673,530	0.9%	84%	85,708	72,175	-0.4%	627,466,847,894	**-19%**
Net Site Consumption (kWhr/yr)*	**131%**	136,522,198,032	178,493,531,578	0.6% *	72%	33,668	24,381	-0.7% *	246,479,432,058	**-38%**
Onsite Generation (kWhr/yr)	100%	0	15,486,063,840	100.0%	100%	0	2,115	100.0%	0	100%
Onsite Energy Sales to Grid (kWhr/yr)	100%	0	10,905,901,410	100.0%	100%	0	1,490	100.0%	0	100%
Site Consumption (kWhr/yr)	138%	136,511,069,214	188,963,563,811	0.7%	77%	33,665	25,811	-0.6%	246,459,339,905	-30%
Business Opportunity					* Load Total rather than eQuest energy total. Possible eQuest roundoff error.					
Before Incentives and Penalties		($M)	($M)						($M)	
First Costs	141%	$12,598	$17,730	**0.8%**	112%	$40,395	$45,166	0.2% *	$21,459.628	-21%
Net Energy Purchases	189%	$11,287	$21,350	**1.4%**	105%	$2,784	$2,916	0.1%	$20,378.438	5%
Energy Purchases	141%	$11,287	$15,897	**0.8%**						
Onsite Energy Sales	100%	$0	-$5,453	**100.0%**						
After Incentives and Penalties		($M)	($M)							
Incentivized & Penalized First Costs	118%	$11,708	$13,831	0.4%	94%	$37,541	$35,233	-0.1% *		
Incentivized & Penalized Net Energy Purchases	177%	$13,545	$24,030	1.3%	98%	$3,340	$3,282	0.0%		
Incentivized & Penalized Lifecycle Costs					85%	$50,189	$42,412	-0.4% *		
Policy Costs**		($M)	($M)							
First Cost Incentives	438%	-$890	-$3,899	3.3%	348%	-$2,854	-$9,933	2.8% *		
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	119%	$2,257	$2,680	0.4%	66%	$557	$366	-0.9%		
Overall Cost of Policies	-89%	**$1,367**	**-$1,219**	-199.7%	416%	-$2,297	-$9,567	3.2%		
Segment Input Statistics										
Number of Buildings	181%	4,055,000	7,320,964	1.3%			2005	2050		
Service Level (%)	100%	100%	100%	0.0%		New Construction Rate	2.3%	1.7%		
Electricity Price ($/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	264,978		

Post-run Checksum (must be small)	0.086286352	
Post-run Exact Checksum (must be zero)	0	
	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	81 / 334	81 / 334
Meets Code & Available	320	320
Passed First Cost Decision Filter	81	81
Passed NPV Decision Filter	239	265
Refurbishments		
Considered Alternatives	81 / 334	83 / 334
Meets Code & Available	320	320
Passed First Cost Decision Filter	81	83
Passed NPV Decision Filter	224	258







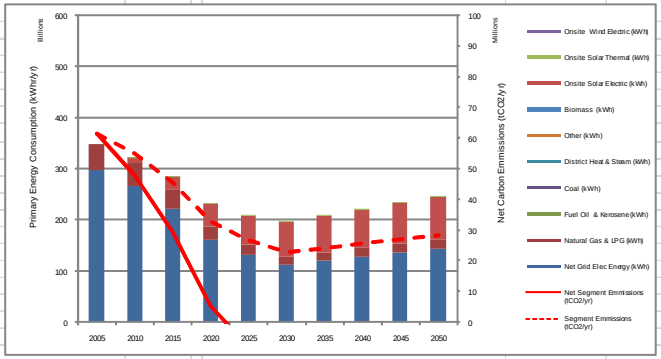
G2 $30 Carbon + Class 3-5 Ban + Class 1+2 Incent + B1 12-25 - Summary

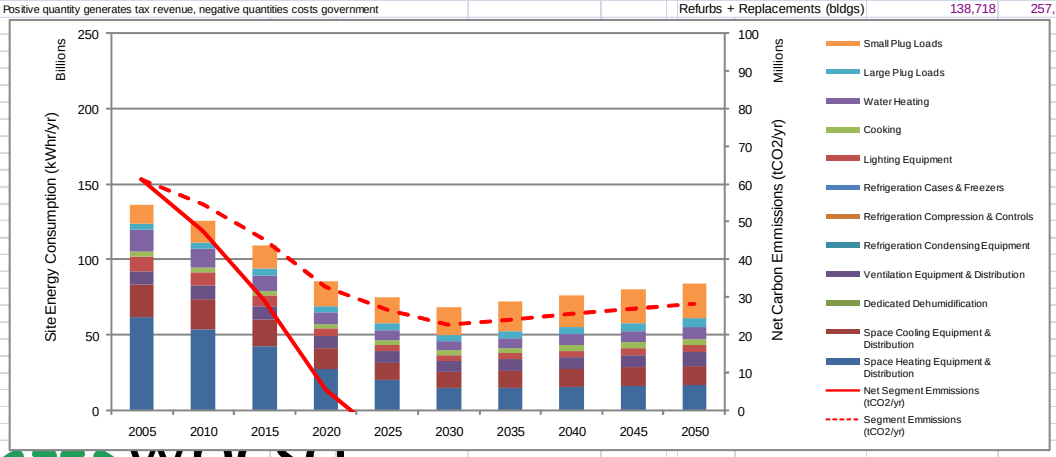
EEB Model v116 US SE SFR - G2 $30 Carbon + Class 3-5 Ban + Class 1+2 Incent + B1 12-25.xlsm

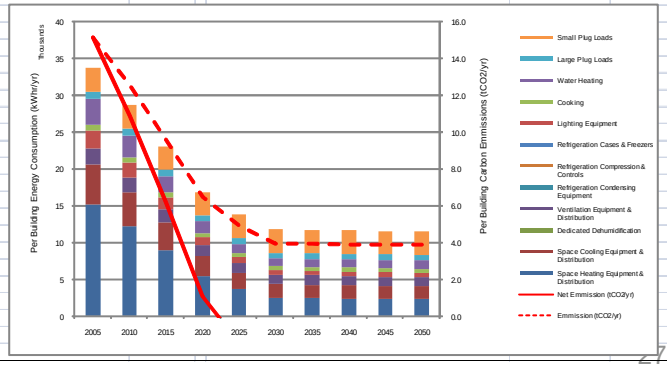
Values show n are computed over 5 year bins

	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)	**-37%**	61,197,537	-22,612,016	-197.8%	-20%	15.092	-3.1	-196.5%	110,486,969	**589%**
Onsite Generation Carbon Credit (tCO2/yr)	100%	0	50,912,875	100.0%	100%	0.000	7	100.0%	0	100%
CO2 Emissions (tCO2/yr)	46%	61,197,537	28,300,860	-1.7%	26%	15.092	4	-3.0%	110,486,969	-290%
Net Primary Consumption (kWhr/yr)	**71%**	347,546,862,437	246,961,562,067	-0.8%	39%	85,708	33,733	-2.1%	627,466,419,353	**-154%**
Net Site Consumption (kWhr/yr)*	**63%**	136,522,198,032	85,978,861,910	-1.0%	* 35%	33,668	11,744	-2.3%	* 246,479,263,720	**-187%**
Onsite Generation (kWhr/yr)	100%	0	86,341,284,112	100.0%	100%	0	11,794	100.0%	0	100%
Onsite Energy Sales to Grid (kWhr/yr)	100%	0	61,847,003,537	100.0%	100%	0	8,448	100.0%	0	100%
Site Consumption (kWhr/yr)	107%	136,511,069,214	145,774,100,676	0.1%	59%	33,665	19,912	-1.2%	246,459,171,580	-69%
Business Opportunity					* Load Total rather than eQuest energy total. Possible eQuest roundoff error.					
Before Incentives and Penalties		($M)	($M)						($M)	
First Costs	160%	$17,441	$27,898	**1.0%**	85%	$84,775	$72,472	-0.3% *	$14,120.967	49%
Net Energy Purchases	319%	$11,287	$36,041	**2.6%**	177%	$2,784	$4,923	1.3%	$20,378.424	43%
Energy Purchases	45%	$11,287	$5,117	**-1.7%**						
Onsite Energy Sales	100%	$0	-$30,924	**100.0%**						
After Incentives and Penalties		($M)	($M)							
Incentivized & Penalized First Costs	174%	$7,158	$12,458	1.2%	93%	$34,794	$32,364	-0.2% *		
Incentivized & Penalized Net Energy Purchases	319%	$11,287	$36,041	2.6%	177%	$2,784	$4,923	1.3%		
Incentivized & Penalized Lifecycle Costs					88%	$20,462	$17,985	-0.3% *		
Policy Costs**		($M)	($M)							
First Cost Incentives	150%	-$10,283	-$15,439	0.9%	80%	-$49,981	-$40,109	-0.5% *		
First Cost Penalties	0%	$0	$0	0.0%	0%	$0	$0	0.0% *		
Carbon (Net Carbon) Policy Value	-37%	$1,836	-$678	-197.8%	-20%	$453	-$93	-196.5%		
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	191%	**-$8,447**	**-$16,118**	1.4%	81%	-$49,529	-$40,201	-0.5%		
Segment Input Statistics										
Number of Buildings	181%	4,055,000	7,320,959	1.3%			2005	2050		
Service Level (%)	100%	100%	100%	0.0%		New Construction Rate	2.3%	1.7%		
Electricity Price ($/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)	67,020	127,572		
** Positive quantity generates tax revenue, negative quantities costs government						Refurbs + Replacements (bldgs)	138,718	257,370		

Post-run Checksum (must be small)	143.2742864	
Post-run Exact Checksum (must be zero)	0	
	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	13 / 334	18 / 334
Meets Code & Available	221	221
Passed First Cost Decision Filter	57	57
Passed NPV Decision Filter	14	18
Refurbishments		
Considered Alternatives	11 / 334	11 / 334
Meets Code & Available	221	221
Passed First Cost Decision Filter	56	57
Passed NPV Decision Filter	11	11







Model verification and validation

Model validation process and quality reviews

October 2007 – UTRC Experts
November 2007 – IEA Workshop
January 2008 – EDF Energy Modeling Experts
January 2008 – Core Group
January 2008 – Internal UTC Review
February 2008 – IEA Workshop
February 2008 – EDF, GDFSUEZ Review
February 2008 – WBCSD Core Group
March 2008 – LBNL Energy Modeling Experts
March 2008 – California Thought Leaders
April 2008 – Internal UTC Review
May 2008 – WBCSD Core Group
May 2008 – New England Thought Leaders
May 2008 – NREL Visit
May 2008 – LBNL China/India Energy Experts
May 2008 – EDF, GDF, Lafarge Review
May 2008 – QRB Review
June 2008 – Core Group Review
June 2008 – IEA Review`
June 2008 – Assurance Group Review
July 2008 – Core Group Review
July 2008 – WBCSD CEO Review
September 2008 – Core Group Review
October 2008 – UTRC Technical Review
February 2009 – QRB review

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Blind validation with real case in Sweden

External validation of market adoption

- Skanska CEO requested to validate the EEB model using Skanska built apartments in Sweden
- Skanska supplied building stock data and costs
- EEB model output provided to Skanska
- Skanska compared against their known decisions

SKANSKA

Positive outcome

- CEO Carl Jonsson: “The results are close to what we found. They do not match exactly, but that’s because in our analyses we have not quantified such things as policy strategies and filters, as is done in the EEB model.”
- “Our recommendation is to use the model with the known limitations in mind.”

Alternative	Rank Order	
	EEB	Skanska
Current Design	4	5
Water Taps	2	2
Better Windows	3	4
Gas Submetering	6	1
Heat pump hot water	1	3
Solar Thermal	5	6

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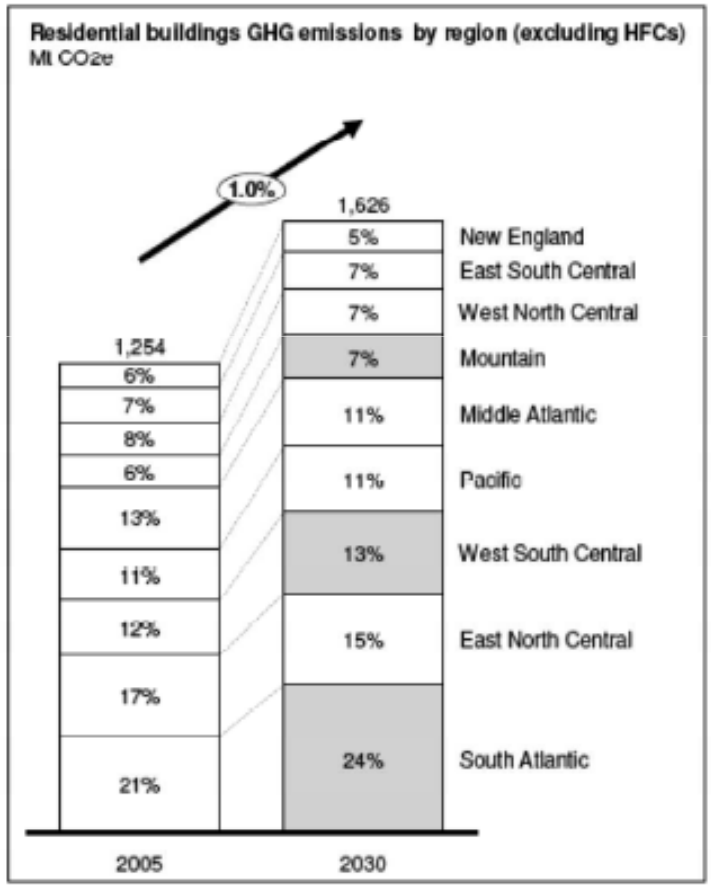
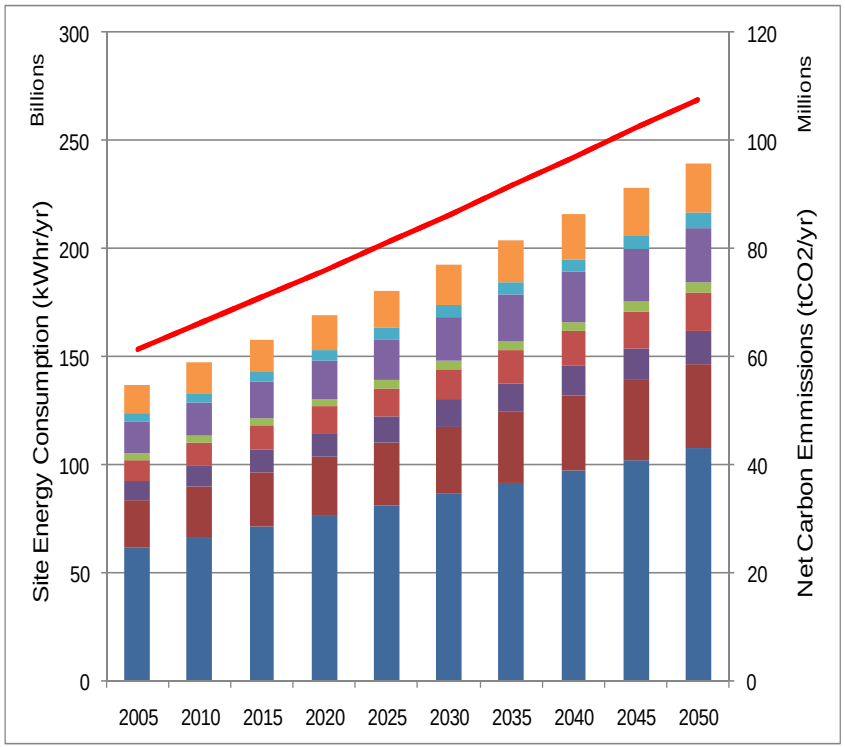
Validation for Carbon Emission Data for US Single family homes

US EIA: +48% CO_2 by 2030



Source: Annual Energy Outlook 2008 with projections to 2030, DoE

A0: +41% CO_2 by 2030



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Costs Validation for French single family home

External validation of market adoption

- 7-10 bn€ worth of envelope and space heating refurbishment work done in 2005
- Source: EDF from CEREN database
- Current French Policy package
- EEB model 10.3bn€

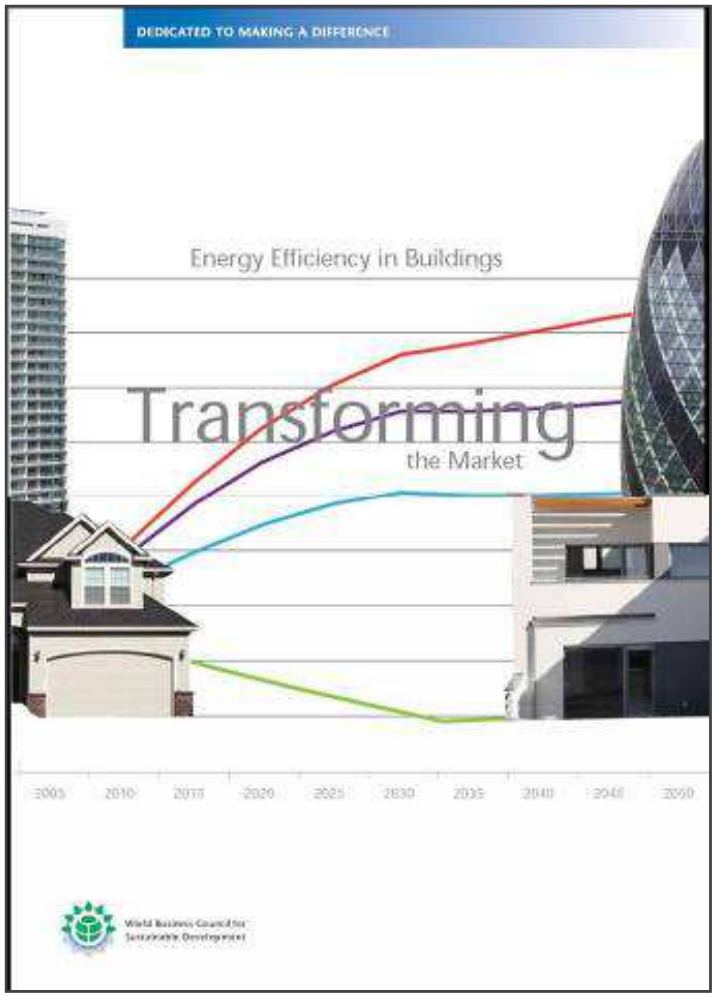
Conclusions

2nd EEB report: How to transform the market (2009)

Based on the analysis of modelling results

The report includes:

- Effectiveness of policy packages by submarket and country
- Recommendations by building segment
- Detailed roadmap on how to achieve transformation by actor



Key figures

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Conclusions on data and indicators

The role of data and indicators in shaping the energy future of end-use sectors

Main conclusions are:

- Data availability allows to quantify future energy end-use
- Governments, which invest in data collection and analysis, will be in a better position to make informed decisions on policy effectiveness
- Policy decisions can be planned with a longer time horizon because risks and benefits are better understood
- A longer policy “shelve live” is beneficial for the private sector to plan technology investments and reduce costs

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