

How to boost building renovation : the European experience

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 - Energy efficiency & demand
- Leveraging globally recognized **databases & forecasting models**
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 - CEPAL's [Energy Efficiency Indicators Database](#) (Latin America)
 - [G20](#) indicators
 - [MEDENER](#) indicators (Mediterranean countries)
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 - WEC energy efficiency reports

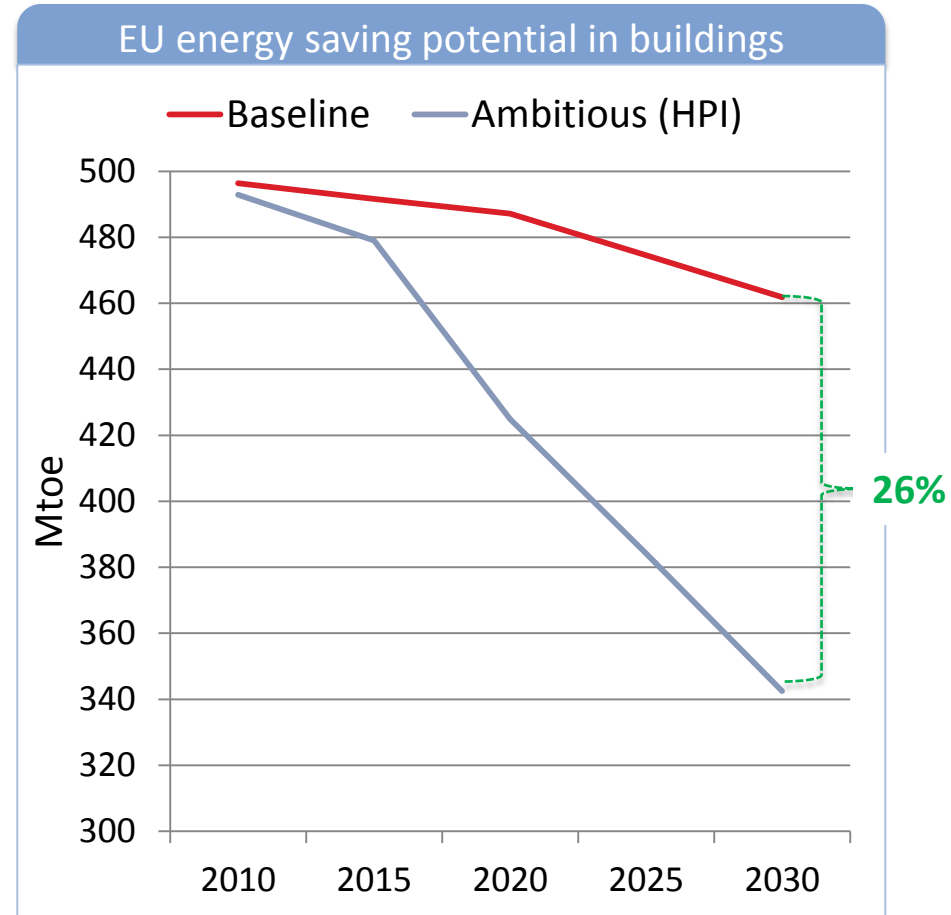
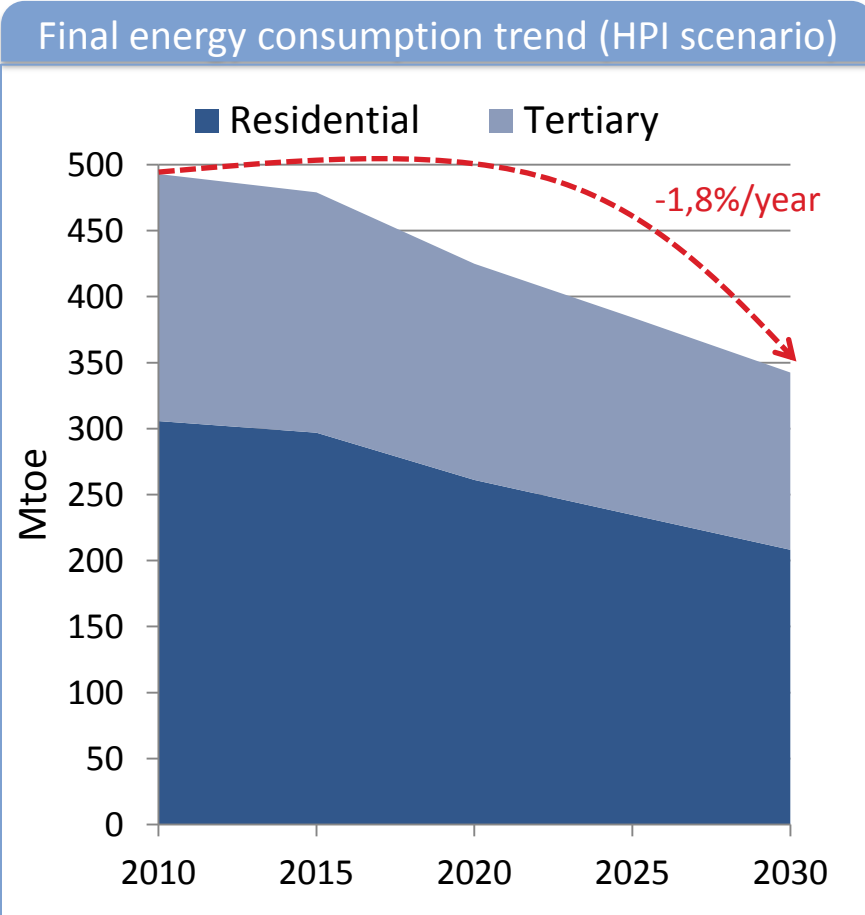


A-EU background



- ▶ **1. Potential energy savings**
- 2. EU legislation
- 3. Cost optimality concept

In a recent study for the European Commission, the additional potential of energy savings in buildings is estimated at 26% in 2030 in an ambitious policy scenario (HPI), compared to the trend to be achieved with existing measures (baseline). This implies a decrease by 1,8%/year of the energy consumption in buildings in the EU .

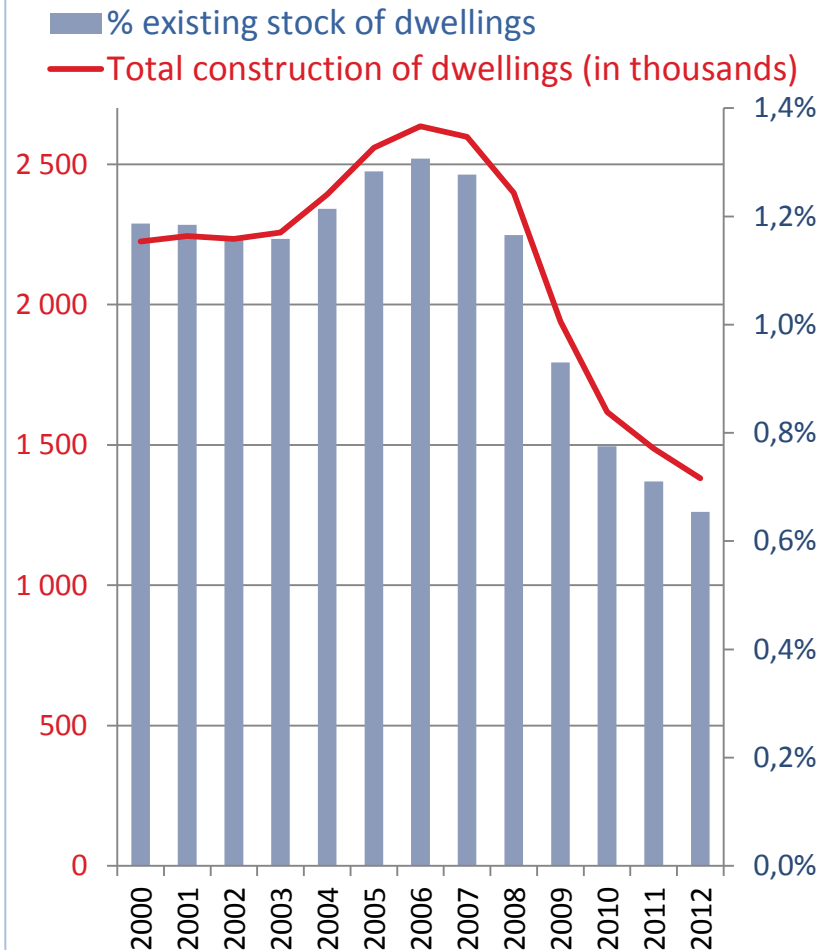


Source: PwC, Fraunhofer & TU Wien-Sept 2014-analysis Enerdata

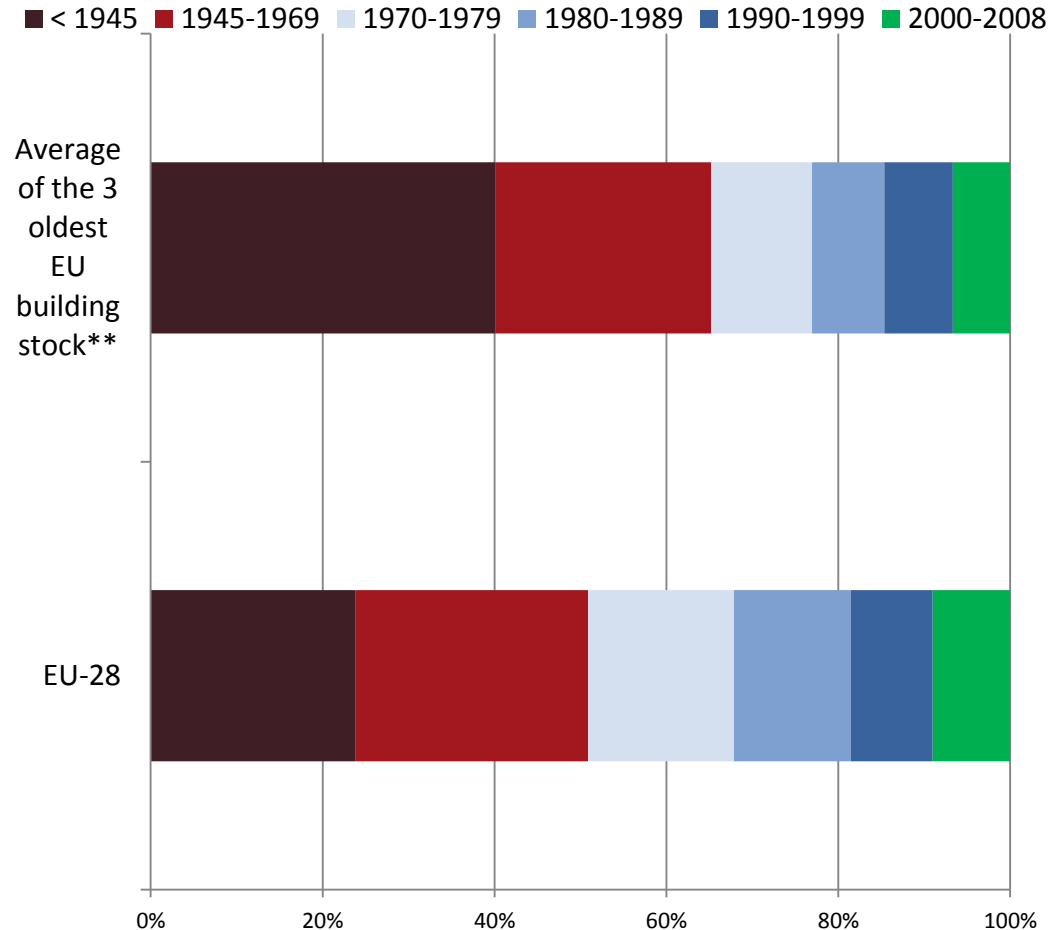
HPI-high policy intensity scenario: based on low discount rates and barriers removed.

Most of this potential will have to come from existing buildings as new construction only represent ~1% of the existing stock, and even less since the 2009 crisis.
 Half of the residential stock was built before 1970, i.e. before the first thermal regulations
 → Target of policies and measures : refurbishment of existing building stock

Dynamics of new dwellings in EU



EU residential building stock by age



1. Potential energy savings
- ▶ **2. EU legislation**
3. Cost optimality concept

First EU building directive (EPBD1)

- Following the oil price increases in the 1970s, most EU countries introduced energy related building codes that were regularly tightened for some of them, with no common rule and approach.
- The **Energy Performance of Buildings Directive (EPBD) of 2002** was the first major attempt to harmonize building codes in the EU: it required all EU countries to set their building energy code requirements based on a “whole building” approach (so called *performance-based*).
- It also required a regular update of these standards every 5 years.
- The Directive also required the implementation of minimum requirements on the energy performance for **large existing buildings** (>1000m²) subject to major renovation
- It also introduced a mandatory energy certification of buildings (sold or rented)

Second EU building directive (« EPBD recast »)(2010)

The second EPBD directive introduced major changes (EPBD2):

- It requires EU countries to set their national energy performance standards in accordance with “cost optimal levels”.
- For **new** buildings, it requires the energy performance requirements to gradually converge to **nearly zero energy buildings (nZEB)**, so that by 2021 all new buildings are nZEB (2019 for public buildings).
- EPBD 2 also introduced new changes for **existing** buildings:
 - ✓ Elimination of the 1000 m² threshold → minimum energy performance requirements for all existing buildings undergoing major renovation (i.e. 25% of building surface or value)
 - ✓ Requirements on building elements (roof, wall, etc.) for renovation if technically, functionally and economically feasible.

Increasing regulation for renovation: Energy Efficiency Directive (EED) (2012)

- To enhance nZEB renovation the **Energy Efficiency Directive (EED)** requires EU countries to further elaborate **long-term plans to support deep renovation of the existing building stock** (Article 4).
- EED (Article 5) is also relevant for boosting the nZEB renovation by providing the leader's example of the public sector which has to increase the renovation rate of buildings owned and occupied by central governments to 3%/yr.

1. Potential energy savings
2. EU legislation
- ▶ **3. Cost optimality concept**

Cost optimality concept

According to the EPBD directive EU countries have to “assure that minimum energy performance requirements for buildings or building units are set with a view to achieving *cost-optimal levels*”

- Cost-optimal levels ask for higher initial investment costs ; however, this initial cost is amortized over time thanks to energy savings → cost optimality looks at the global costs discounted over a 30 years period.
- For that purpose, the European Commission established a reference methodological framework to be used by EU countries for calculating cost optimal levels of minimum energy performance requirements for new and existing buildings and building elements.
- The methodology specifies how to define the performance and cost of energy efficiency solutions and how to identifying cost-optimal levels for selected reference buildings with the aim of
“the energy performance level which leads to the lowest cost during the estimated economic lifecycle”

Cost optimality: example of Entranze cost curves

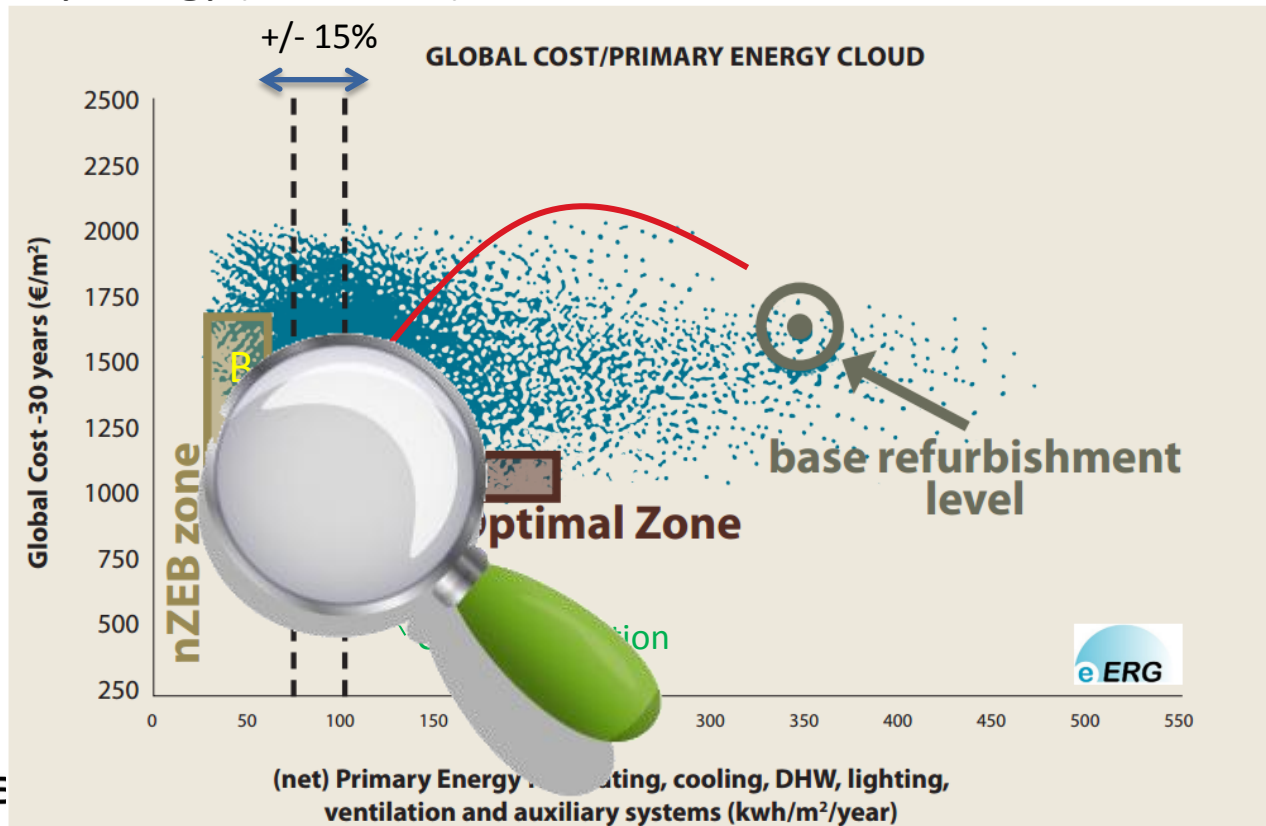
- The Entranze project identified and analyzed cost-optimal configurations of technological renovation options for the main climatic zones (12) in 9 countries of Europe, taking into account their global cost* and expected savings.
- The objective of the Entranze project was to support policy making by providing the required data, analysis and guidelines to accelerate deep renovation, with an effective penetration of nearly Zero-Energy Buildings (nZEB) and renewable heating and cooling.
- For each building type, cost energy clouds, representing global cost versus net primary energy demand for a large variety of renovation options (were displayed and assessed, so as to identify renovation packages leading to cost-optimal levels (and nZEB levels).
- 34 options considered for the building envelope and 34 for heating/cooling equipment, i.e. up to 30 000 combinations or points.

* Global costs: discounted capital costs, annual maintenance costs, operating energy costs (depending on energy price forecasts), over a period of 30 years (subtracting final value).

Entranze cost/energy cloud with target zones

For 4 building types, corresponding to “badly insulated” (i.e. built in the 50 or 60’s) houses, apartments, offices and schools, the main outcome consists of the identification of the different renovation strategies, corresponding to:

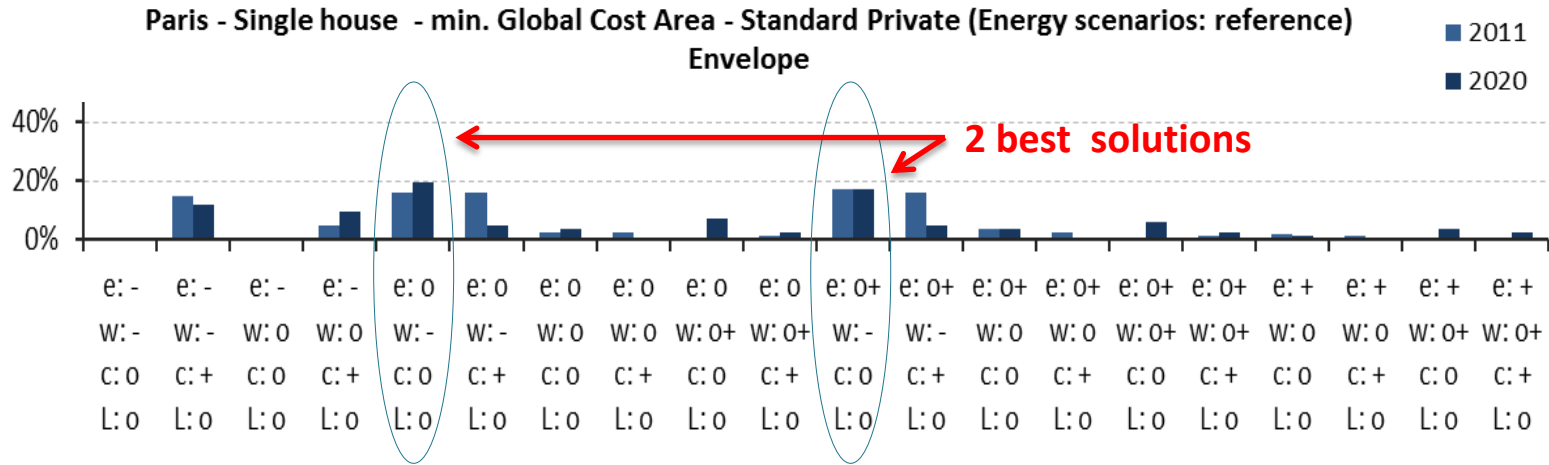
- A- minimum global cost (cost-optimal zone), or
- B-minimum primary energy (nZEB zone)



Entranze cost/energy cloud: case of a single family house in Paris

Distribution of optimal solutions for building envelopes

Paris - Single house - min. Global Cost Area - Standard Private (Energy scenarios: reference)
Envelope



BUILDING TECHNOLOGY	PARAMETERS	UNIT	VARIANT	VALUE
External Wall	U	W/m ² K	e:o	0,32
Roof	U	W/m ² K		0,22
Basement	U	W/m ² K		0,57
External Wall	U	W/m ² K	e:o+	0,23
Roof	U	W/m ² K		0,17
Basement	U	W/m ² K		0,33

BUILDING TECHNOLOGY	PARAMETERS	UNIT	VARIANT	VALUE
Window Air permeability	U *	W/m ² K	w:o	2,60
	Solar Trasm.	-		0,62
	Visible Trasm	-		0,65
	air infiltration	1/h		0,61

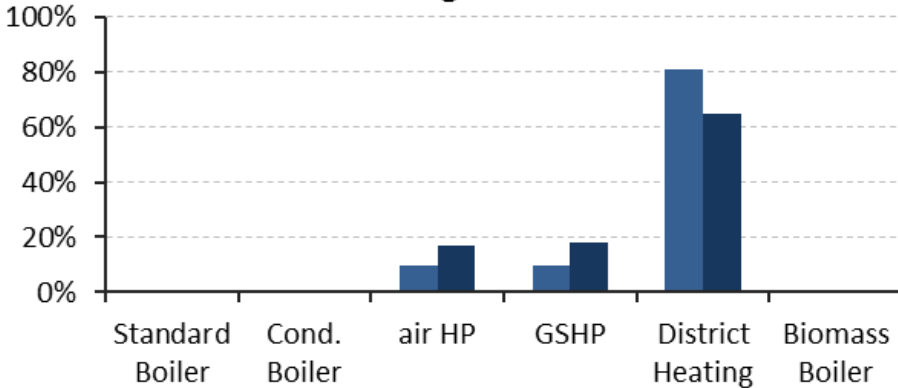
BUILDING TECHNOLOGY	PARAMETERS	UNIT	VARIANT	VALUE
Solar shading	-	-	c:o L:o	-
Night-Cooling	h ⁻¹	1/h		0
Lighting Load	power **	W/m ²		3,50
Lighting Control	-	-		

Entranze cost/energy cloud: single family house in Paris

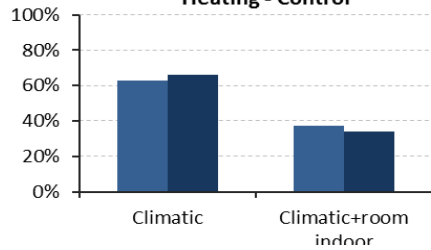
Distribution of heating optimal solutions



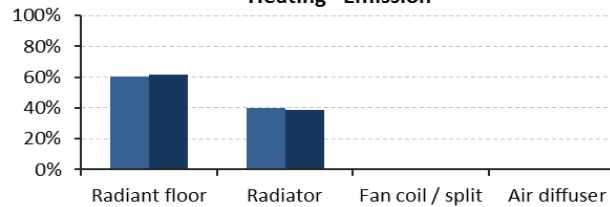
Heating - Generation



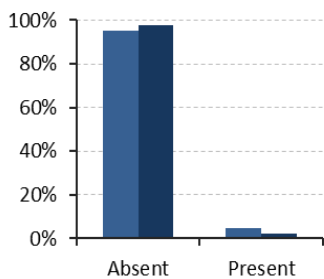
Heating - Control



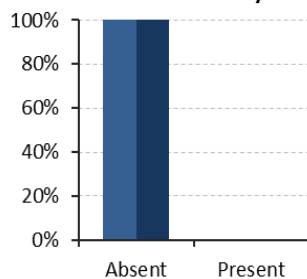
Heating - Emission



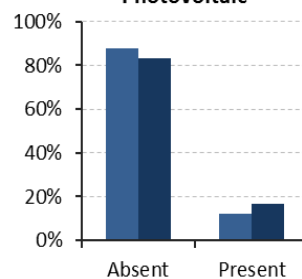
Mech. Ventilation



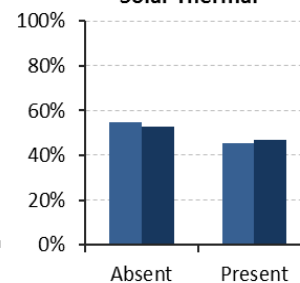
Heat Recovery



Photovoltaic



Solar Thermal



As a summary: overcome high initial investment costs

Due to Directives' requirements (e.g. cost optimality), renovations may ask for high initial investments, which represents a barrier for consumers

→ Energy efficiency measures should incentivize and help end-users:

- to select the best renovation solution (cost-optimal package)
- to overcome its high initial investment cost

How can citizens be given better access to financing or how can new ways of financing be used?



B-Innovative schemes to boost renovation

1. Financial schemes

- a. Green Deal (UK)
- b. KfW (Germany)

2. Teaching from Entranze scenarios



What is the Green Deal (GD)?

- Since 2013, the Green Deal is a retrofit scheme which allows households to get energy efficiency improvements **with little or no upfront costs**
- **Process of Green Deal (GD) Finance:**
 1. Households pay a *Green Deal Adviser* for initial assessment
 2. Then adviser provides recommendations (or package of solutions)
 3. Households then find the *Green Deal provider (GD provider)*
 4. Once a contract is signed, the provider orders a *Green Deal Installer* to carry out the agreed measures
 5. Part of the cost of the measures is financed through a loan from the GD provider and GD support schemes
 6. The loan is then repaid by way of a surcharge on the electricity bill, collected by the electricity supplier, and paid back to the GD provider
 7. The value of the monetary savings triggered by the measure installed should be greater than this surcharge (“**Green Deal golden rule**”)
 8. The loan is attached to the property itself and not to owner

Green Deal incentives

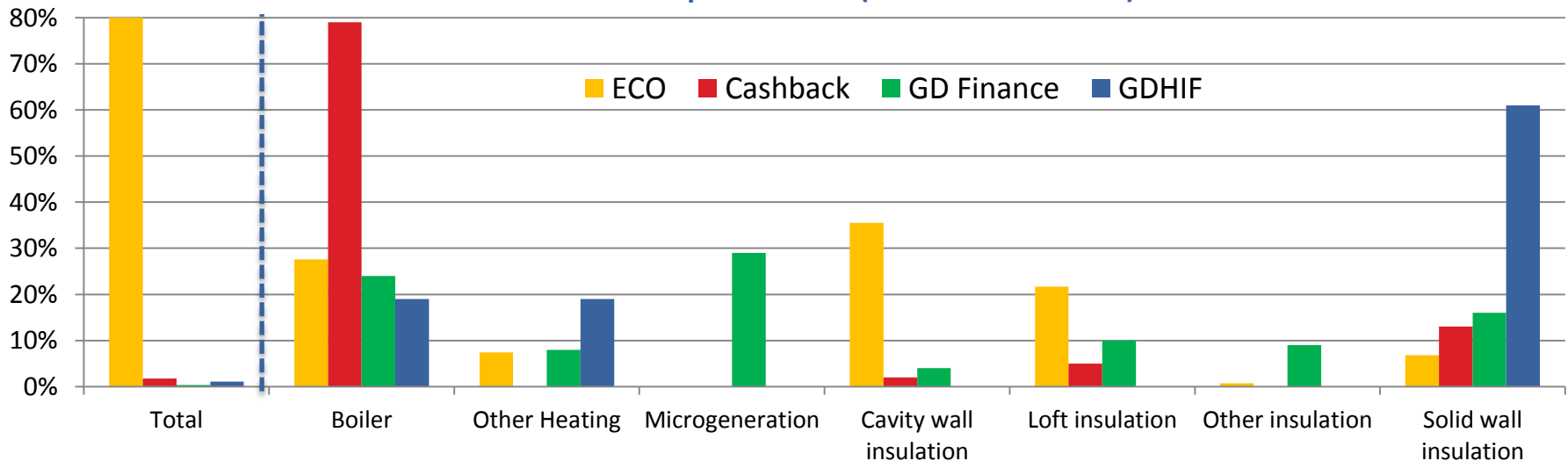
Households can co-finance measures :

- By using assistance from measures such as the **Energy Company Obligation** (ECO, to fund those measures that do not meet the Golden Rule-Focus on fuel poverty).
- By using GD incentives schemes
 - From January 2013 to June 2014 **Green Deal Cashback scheme** : subsidy (cashback) depending on type of measure (e.g. US\$6000 for solid wall insulation and US\$400 for new efficient boiler);
 - Since June 2014 **Green Deal Home Improvement Fund (GDHIF)** (US\$180 million): up to US\$ 9000 subsidy for solid wall insulation and up to US\$1500 for implementing two solutions.

Green Deal: high expectations and so what?

- GD Finance only attracted a very limited number of households (3200);
- In addition it did not favor deep retrofitting, such as solid wall insulation and the number of solutions implemented is low (2.2 per household);
- ECO is supposed to fund measures that do not meet the golden rule → 35% cavity wall. But compared to previous scheme (CERT) insulation activity has decreased
- GDHIF targeted mainly solid wall insulation but collapsed immediately and was used by only 8800 households

Installed measures per scheme (Jan 2013- Oct 2014)



Source: Enerdata from DECC Domestic Green Deal and Energy Company Obligation, December 2014 report

Green Deal-conclusion

- The Green Deal finance is an innovative way to smooth upfront costs of retrofitting thanks to soft loan. But it attracted few households and implemented mainly PV installation or boiler replacements. The golden rule limits the impact on thermal insulation market (e.g. solid wall insulation).
- The Green Deal scheme is very sensitive to existing subsidies (GD Cashback + GDHIF). There is a need to fix long-term drivers and oriented incentive measures towards deep retrofit, to avoid a continual cycle of boom and bust.
- The Green Deal does not give enough incentives to implement package of solutions necessary for deep retrofitting
 - ➔ In December 2014 second release of GDHIF (US\$8 million): up to US\$1500 for installing two measures from an approved list (no more application for solid wall insulation).
- Thermal performance insulation measures should be promoted and should be an eligible condition to benefit from these schemes.

1. **Financial schemes**

a. Green Deal (UK)

▶ b. **KfW (Germany)**



2. Teaching from Entranze scenarios

KfW bank and refurbishment program

- The KfW Bank handles incentive programs on behalf of the Federal Ministry of Transport, Building and Urban Development.
- Incentives are offered by the public investment KfW bank with a strong financial backing from government. The Federal Government injects fund through KfW, dedicated credit lines are open with commercial banks to offer grants or soft loans to customers

The higher the energy efficiency, the higher the incentives

Incentives depend on the achieved level of efficiency compared to current standard for new dwelling* on the primary energy demand and heat loss values. They can be either a soft loan combined with a subsidy (“repayment bonus”) or a only a grant.

Source: Federal Ministry for Economic Affairs and Energy



	2 values (requirements)		Loans	or	Grants
	Annual primary energy demand**	Transmission-heat-loss*	interest-rate 1,00 % p.a.* + Repayment Bonus		
KfW-Efficiency House 55	55 %	70 %	17,5 %		25.0 % (Max €18,750)
KfW-Efficiency House 70	70 %	85 %	12,5 %		20.0 % (Max €15,000)
KfW-Efficiency House 85	85 %	100 %	7,5 %		15.0 % (Max €11,250)
KfW-Efficiency House 100	100 %	115 %	5,0 %		12.5 % (Max €9,375)
KfW-Efficiency House 115	115 %	130 %	2,5 %		10.0 % (Max €7,500)
KfW-Efficiency House Monument	160 %	-	2,5 %		10.0 % (Max €7,500)
Single measure			-		10.0 % (Max € 5,000)

** in % of the reference building of Energy Savings Ordinance (EnEV)

* 06.06.2012 effective interest-rate;| loan amount max. € 75,000 per housing unit for 8 KfW-EH and max. € 50,000 per housing unit for individual measures

For example: In the KfW Efficiency House 100, values cannot exceed those of the standard by more than 100%, etc. If household does not target deep retrofit (eligible for loans) it can apply to several single measures (up to a limit of €50,000) that have to comply with technical energy efficiency standards

KfW impact assessment (1/2)

- KfW approved ~US\$12 billion of commitments in 2012 (incl. construction), among which ~US\$ 1.8 billion come from Federal government
- Which in turn mobilized a total of around ~US\$ 32 billion in investment → a leverage effect of almost 20 compared to public funding
- Since 2006 ~1,8 millions housing units refurbished (around 250,000 per year), which represents 5% of the total stock.
- Average savings: 26% compared to consumption prior to refurbishment.

KfW impact assessment (2/2)

- 82% of households applied for single measures ;
- Household can apply to several single measures (on average between 4 to 5 measures per household) ;
- As a result large majority (70%) of households received grants (rather than preferential loans);
- Deep thermal solutions are largely implemented in case of package of measures;
- Still insulation solutions are implemented in the majority of single measures.

Occurrence of measures according to renovation solution

	Insulation	Glazing	Heating	Solar water heater
Single measures	55%	58%	60%	14%
Other (packages)	98%	93%	79%	38%

Source: Enerdata analysis from IWU & Fraunhofer-Monitoring kfw « energieeffizient sanieren » program

KfW refurbishment program-conclusion

- KfW bank: simpler access to capital and makes loans attractive to borrowers = credit guarantees provided by the state (attractiveness, low risk, etc.)
- Financial scheme under energy efficiency conditions (loan or grant)
- If customers do not target deep retrofit of their building, KfW offers promotional loans for single measures.
- But grants are strictly preferred than loans.
- In more than 50% of cases insulation, glazing and heating solutions are installed.
- On average 26% of energy savings

- to which extent? And until when?
- ➔ Early January 2015, 5% increase in repayment bonuses for all KfW Efficiency House standards

Comparative table: Green Deal vs KfW

Green Deal	KfW
Loans attached to the property	
Loans vary according to GD provider (problem of competition) Interest rates ~6% to 8% (up to 25 years)	Loan/grant fixed according to energy efficiency standards Interest rate ~1% (up to 30 years)
Golden rule but no condition on deep renovation solutions	The higher the energy efficiency the higher the promotional incentive
<p>→ High preference to grants in both schemes</p> <p>Loan programs are not efficient to decrease upfront cost of deep retrofits ?</p>	
?	Average saving of 26%
Single measures implemented	Package of measures implemented
No public budget (good leverage effect but no guarantee) except for incentive schemes (GDHIF)-grants up to US\$9000	Depend on public budget but good leverage effect credit guarantees provided by the state And grants up to US\$22000

Cost optimality: KfW is better than Green Deal scheme (higher savings at lower costs)

1. Financial schemes

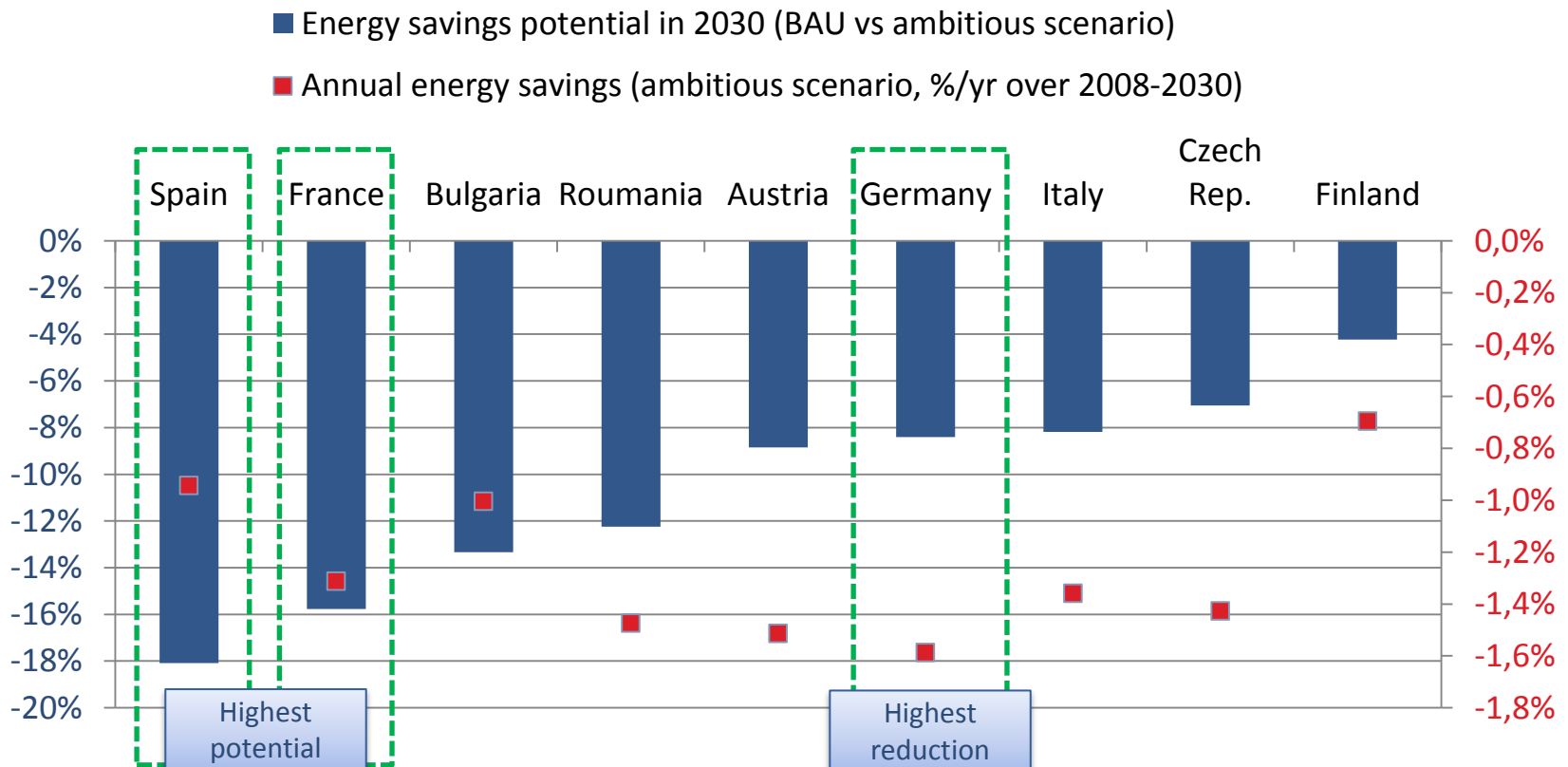
- a. Green Deal (UK)
- b. KfW (Germany)

- ▶ 2. **Teaching from Entranze scenarios**



Entranze scenarios: development of the building stock and its energy demand in the EU-28 up to 2030
 Different set of national policy packages on the refurbishment of the existing building stock have been developed. The scenarios are country specific and cannot be compared among countries. However energy savings highlight the most powerful and ambitious policy packages.

Results from Entranze scenarios in 2030



Source: Entranze, <http://www.entranze-scenario.enerdata.eu/site/> Enerdata analysis

Policy packages in selected EU countries

Spain

- Current regulatory requirements
- Increase of amount if financial instrument (from State budget)
- VAT reduction to 10% for major renovation actions
- Energy efficiency obligation
- Energy efficiency refurbishment obligation

France

- Current building code (and RT2020 in 2020)
- Current financial and fiscal measures
- Increasing awareness
- Mandatory renovation enforced at the occasion of real estate transaction for least performant buildings (EPC above D) when economically feasible.

Germany

- Current policy design
- Tightening of the building code requirements + expansion of the RES-H use obligation for existing buildings
- Enforcement and information measures to improve compliance

Source: Entranze



Conclusion and references



Conclusion

- Very high potential energy savings in building sector
- Key target in EU: existing stock
- Since a decade EU legislation is tightening norms on new and existing buildings and is tending to nearly zero energy buildings in early 2020. Cost optimality conditions are a priority for refurbishment.
- Some original initiatives launched recently:
 - In UK since 2013, the Green Deal that offers an innovative mechanism but unfortunately has poor impact for the moment on deep retrofit activity.
 - In Germany since 2009, the KfW refurbishment program offers financial support that depends on expected savings. The program benefits from Government Fund.
- ➔ Both schemes show a preference to grants compared to (soft) loans: high preference for the present and for cashback
- Entranze projections highlight that efficient package of measures include:
 - Obligation of renovation (under certain conditions)
 - Financial support (e.g. KfW refurbishment program)
 - Increase of information awareness

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- ZEBRA 2020: <http://zebra2020.eu/>



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