La transició energètica i el rol de l'edificació

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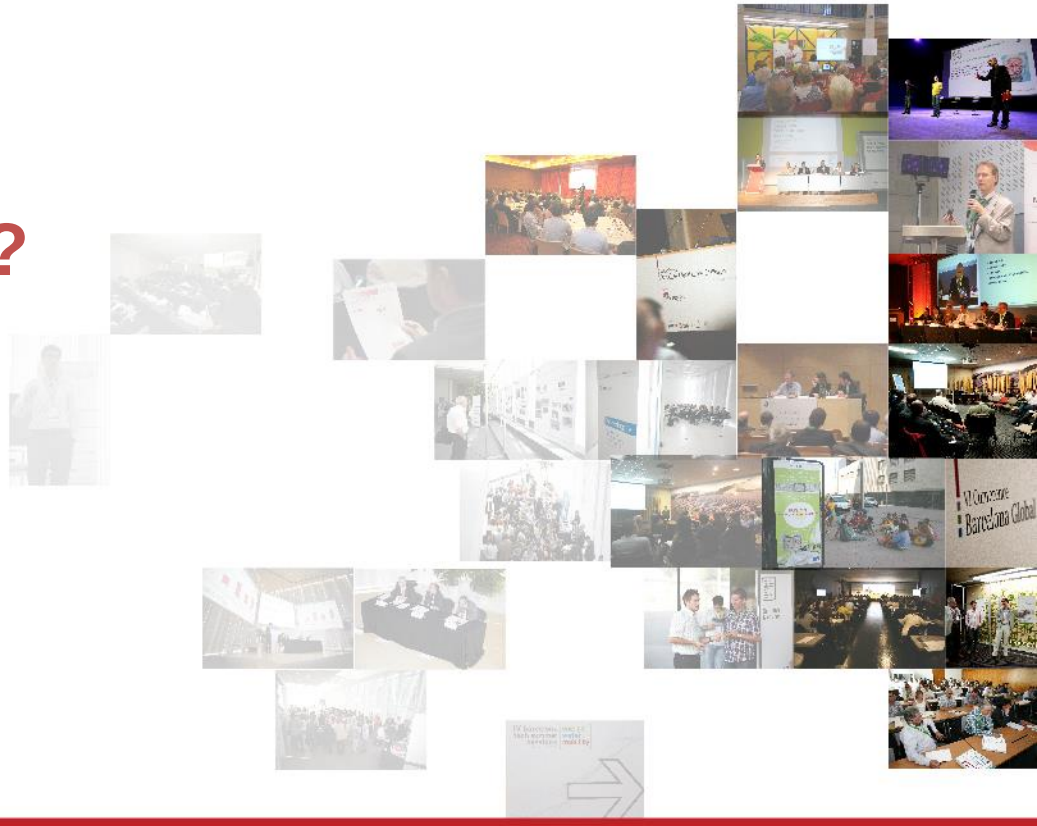
Building sector and climate change: Are we moving as quickly as we should?

Albert Cuchí, *Barcelona Tech*

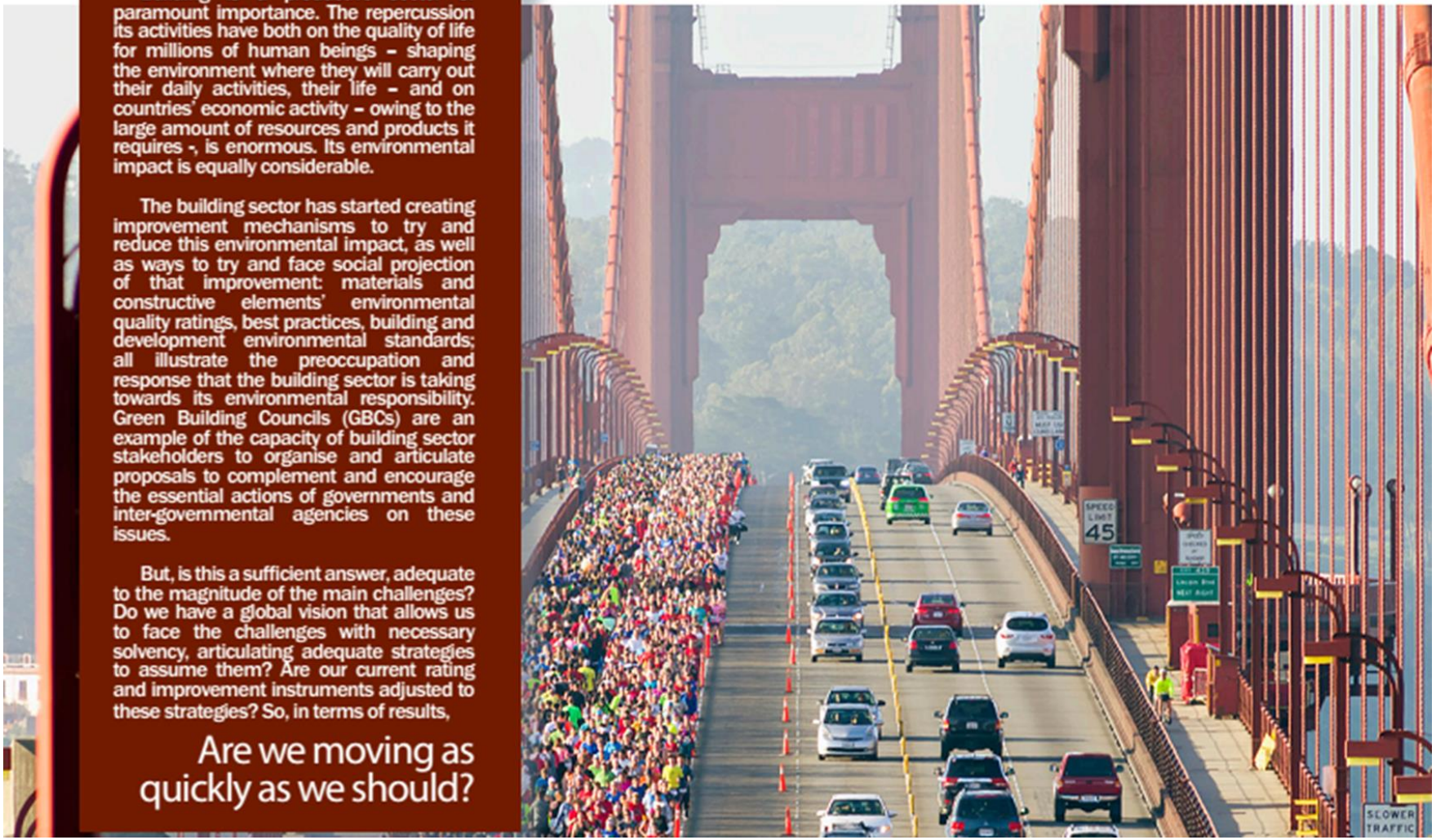


Building is a productive sector of paramount importance. The repercussion its activities have both on the quality of life for millions of human beings – shaping the environment where they will carry out their daily activities, their life – and on countries' economic activity – owing to the large amount of resources and products it requires -, is enormous. Its environmental impact is equally considerable.

The building sector has started creating improvement mechanisms to try and reduce this environmental impact, as well as ways to try and face social projection of that improvement: materials and constructive elements' environmental quality ratings, best practices, building and development environmental standards; all illustrate the preoccupation and response that the building sector is taking towards its environmental responsibility. Green Building Councils (GBCs) are an example of the capacity of building sector stakeholders to organise and articulate proposals to complement and encourage the essential actions of governments and inter-governmental agencies on these issues.

But, is this a sufficient answer, adequate to the magnitude of the main challenges? Do we have a global vision that allows us to face the challenges with necessary solvency, articulating adequate strategies to assume them? Are our current rating and improvement instruments adjusted to these strategies? So, in terms of results,

Are we moving as quickly as we should?

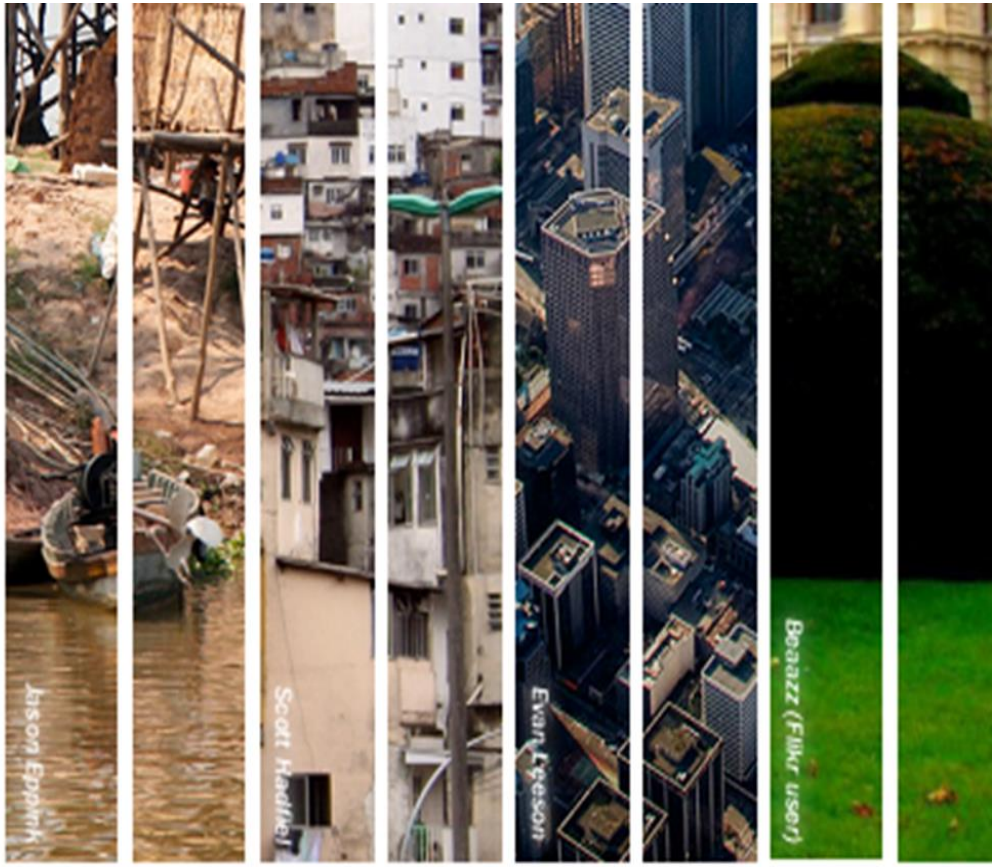


The building sector addresses the social demand for habitability in different socio-economic, cultural and environmental contexts … does it really solve it?

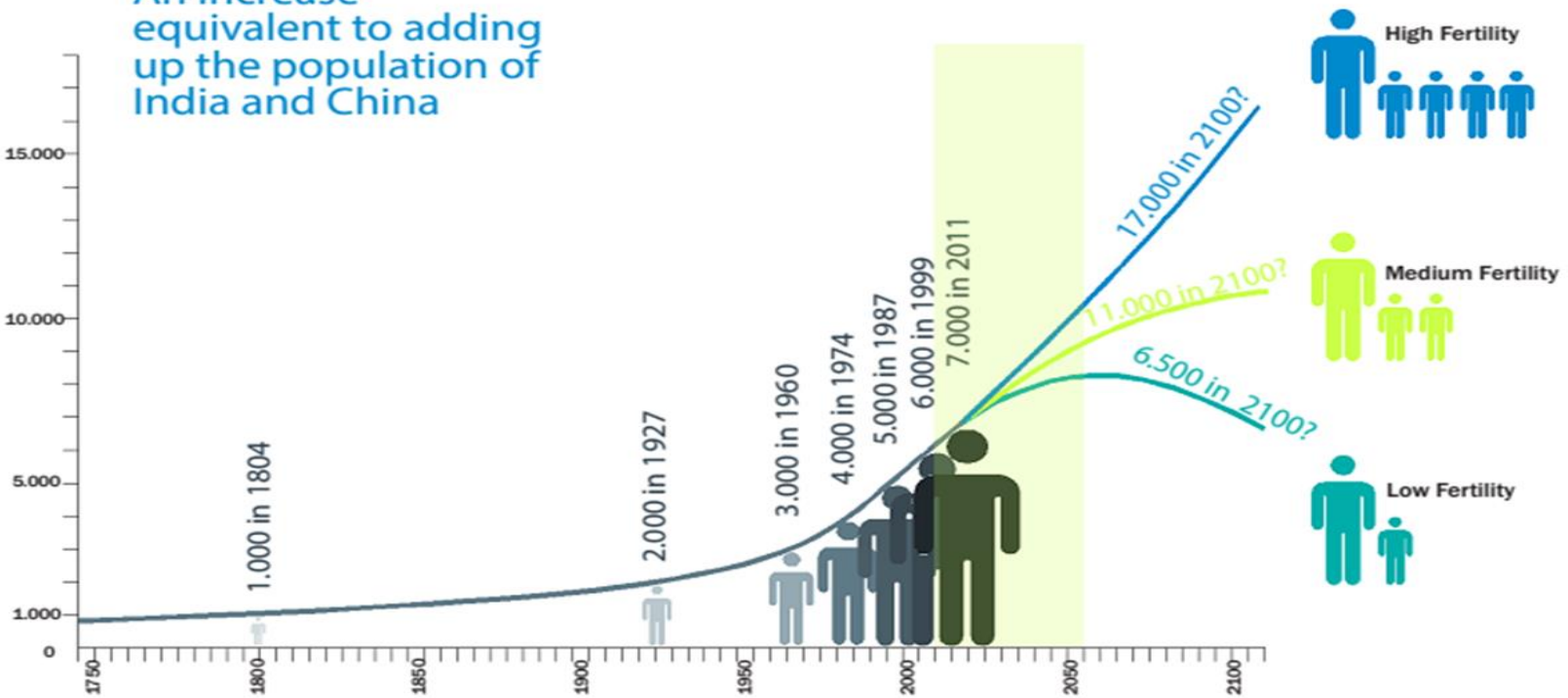
world population growth, an important decisive challenge

the conditions where this growth will happen– in which countries, which regions – and in what economic and social conditions

environmental limitations which will determine the reply that the sector gives to these challenges



In less than 40 years (2013-2050), world population will grow from 7,200 to 9,600 million inhabitants. An increase equivalent to adding up the population of India and China

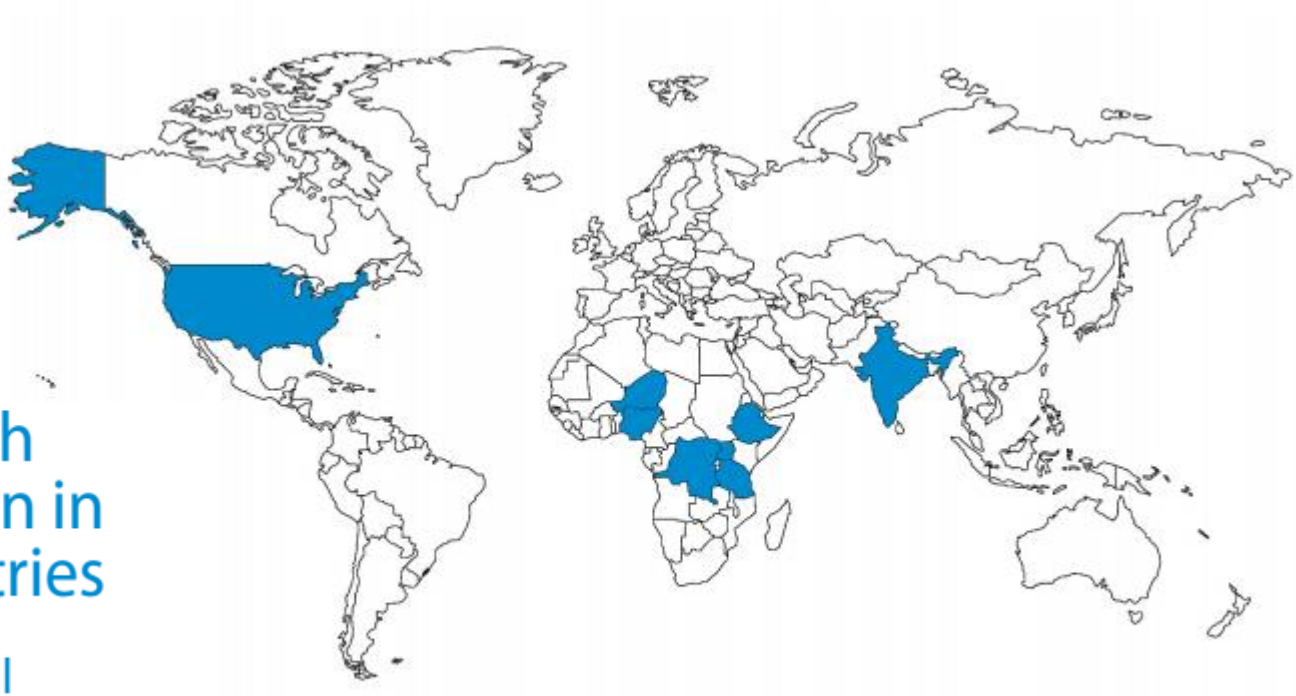


Evolution of world population (World, 1750-2100)

Units: Millions of people
Sources: Elaborated with Report authors on the base of DESA (1999); DESA (2013)

Population growth is going to happen in developing countries

Developing countries will contribute nearly the total population increase.



50% of world population increment will happen in 8 countries

With an increase in income

Half of the global population will have a higher per capita income than current income in OECD countries.

Population, proportion of urban population and per capita income (World and regions, 2000-2050)

		2000	2010	2020	2030	2040	2050	
OECD	Population	1.156.140	1.242.081	1.312.416	1.366.554	1.402.974	1.425.357	(a)
	% Urban	75,6%	79,4%	82,1%	84,2%	85,9%	87,4%	
	GDP per capita	24.775	33.320	39.913	46.850	55.158	64.944	(b)
BRICS	Population	2.688.804	2.955.727	3.192.417	3.344.075	3.418.353	3.420.449	(a)
	% Urban	38,0%	45,3%	52,0%*	57,2%	61,4%	65,6%	
	GDP per capita	2.692	6.719	11.929	17.726	25.851	34.957	(b)
RoW	Population	2.282.756	2.718.376	3.211.916	3.714.309	4.217.360	4.705.139	(a)
	% Urban	42,4%	45,8%	49,4%	53,4%	57,7%	62,1%	
	GDP per capita	2.914	4.816	6.495	7.775	9.612	12.417	(b)
World	Population	6.127.700	6.916.183	7.716.749	8.424.937	9.038.687	9.550.945	(a)
	% Urban	46,7%	51,6%*	56,0%	59,9%	63,5%	67,2%	
	GDP per capita	6.918	10.608	14.293	17.922	22.711	28.264	(b)

Units: (a) Thousand people. (b) Gross domestic product based on purchasing-power-parity (PPP) per capita GDP. Current international dollar

Notes: Medium fertility population projectiont *Urban population is bigger that rura population

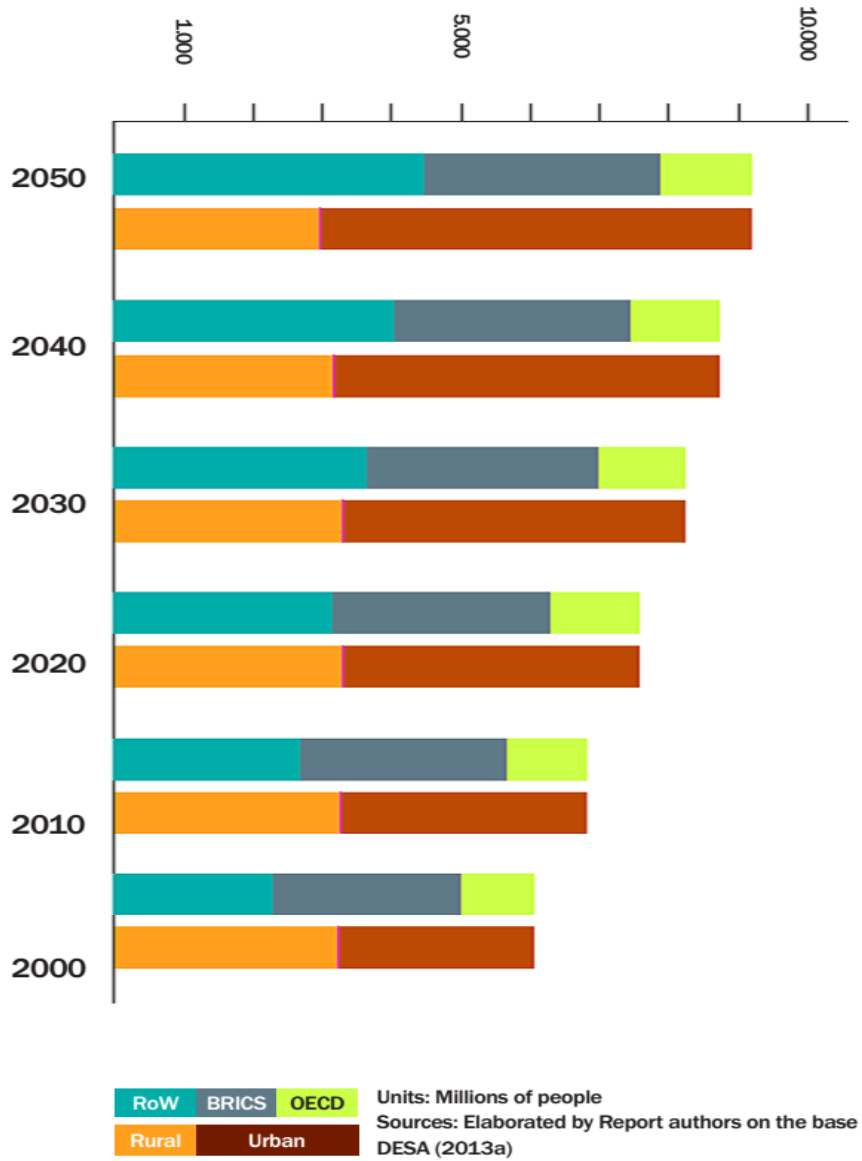
Sources: Elaborated by Report authors on the base of IEA (2013a); DESA (2012a); DESA (2013); IMF (2013)

And in cities

The whole population increase will happen in cities.

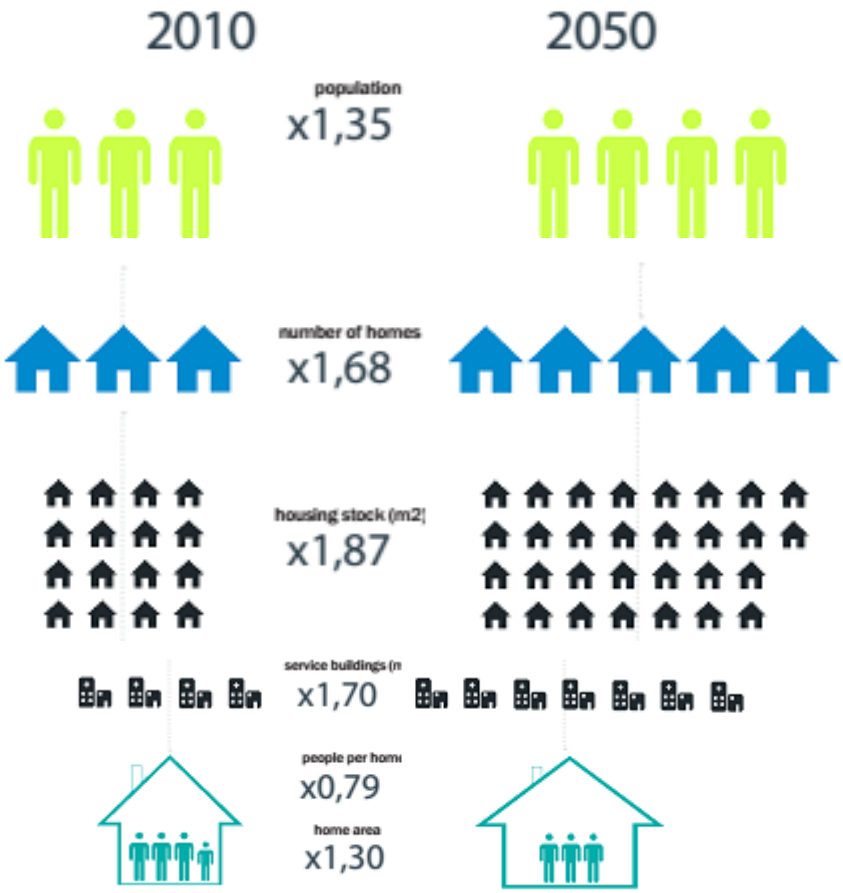
More than half of the global population already lives in cities. But future growth will almost exclusively happen in urban environments: by 2050, there will be more people living in cities than there were living on the whole planet at the beginning of this century.

Evolution of population 2000-2050
(World and regions/ Urban and rural)



Growing population demands habitability: new homes and non-residential buildings

… in renewed social and productive conditions, and supported by acceptable social models



An increase in population will mean going from nearly 1,900 million homes in 2010 to nearly 3,200 million in 2050.

This new habitability is expected to produce homes with less dwellers.

Evolution of habitability demand (World and regions, 2010 and 2050)

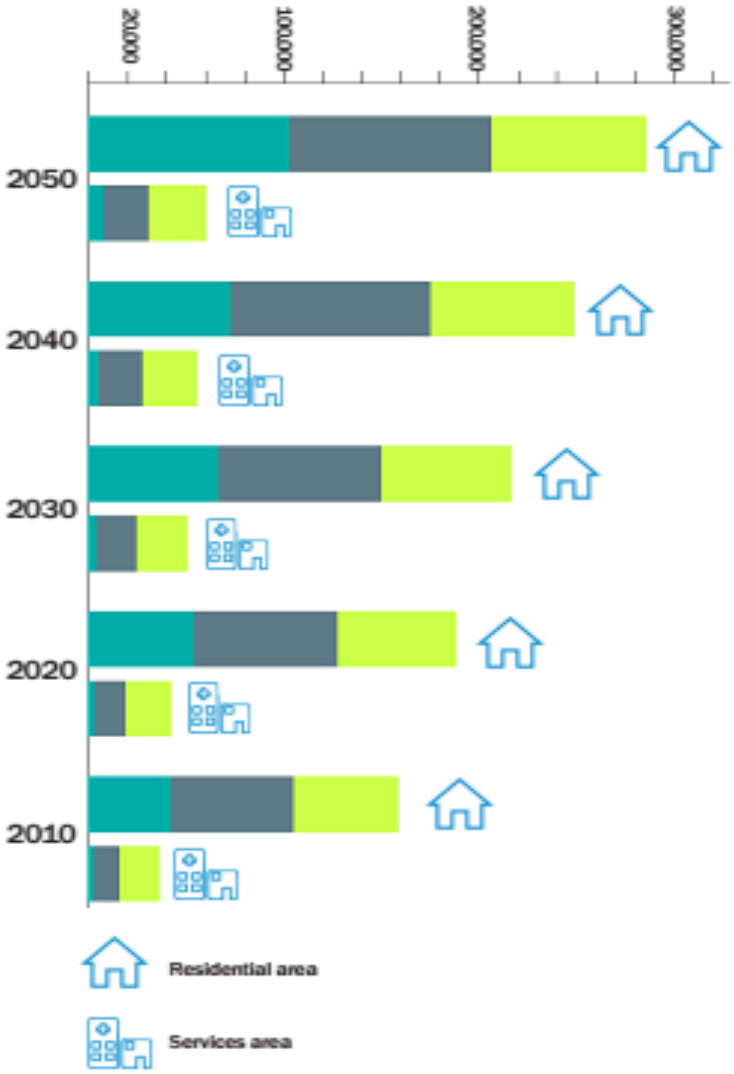
		Building sector 2010	Building sector 2050 6DS		Residential sub-sector 2010	Residential sub-sector 2050 6DS	Services sub-sector 2010	Services sub-sector 2050 6DS	
OECD	Households	474	608	Area	54.526	80.627	20.910	30.560	(a)
	Persons per household	2,6	2,3	Area/per	44,3	57,6	17,0	21,8	(b)
BRICS	Households	757	1.146	Area	62.928	104.035	13.399	24.006	(a)
	Persons per household	3,8	3,0	Area/per	21,7	30,7	4,6	7,1	(b)
RoW	Households	655	1.405	Area	43.081	103.721	3.324	7.948	(a)
	Persons per household	4,4	3,3	Area/per	15,0	22,3	1,2	1,7	(b)
World	Households	1.886	3.159	Area	160.535	288.383	37.633	62.514	(a)
	Persons per household	3,7	3,0	Area/per	22,9	30,5	5,4	6,6	(b)

Units: (2013a) Household units; million m2. (b) Persons/household; m2/person

Note: 6DS and 2DS are different scenarios defined by IEA
Elaborated by Report authors on the base of IEA (2013a)

World regions clasification

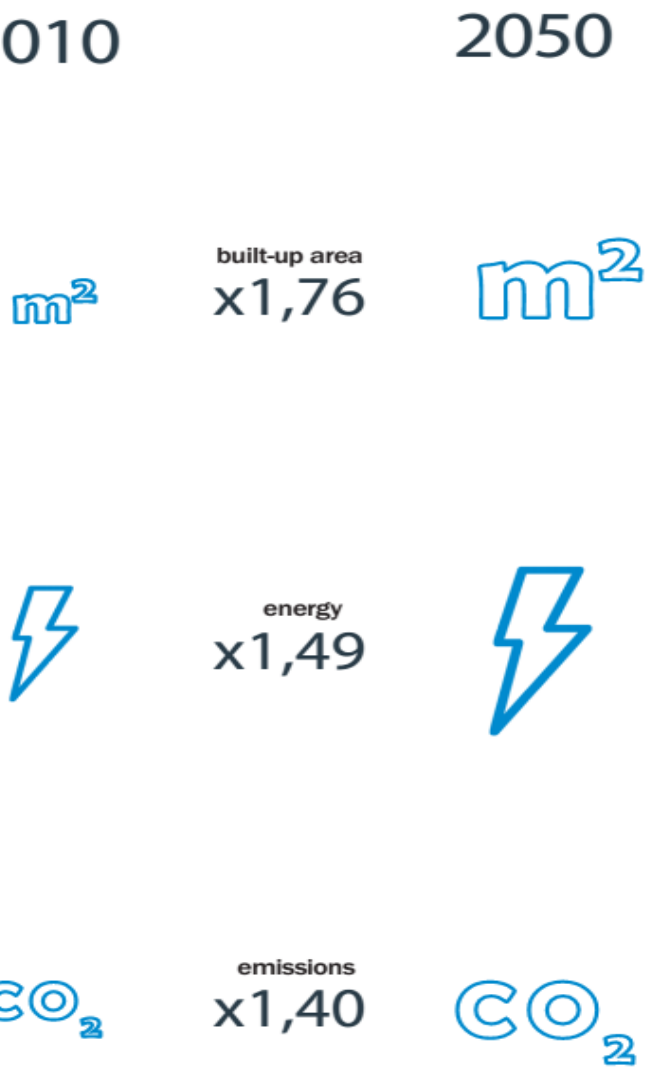
Evolution of the residential and services area (World and regions, 2010-2050)



Units: Millon m2
Sources: Elaborated by Report authors on the base of IEA (2013)

In order to create and maintain this habitability, the building sector's need for resources will swell dramatically

New resources will be needed to construct the buildings that will, in turn, satisfy the need for habitability.



Energy consumption in buildings would increase by 50% between 2010 and 2050, and 80% of this increase would occur in non OECD nations. In these countries, even though approximately 70% of this increase would be related to housing, energy consumed in service buildings could treble.

CO2 emissions connected to such an increase in energy consumption would entail reaching 40% more GHG emissions during building use.

Building sector final energy consumption evolution (World and regions, 2010 and 2050)

		Building sector		Residential sub-sector		Services sub-sector	
		2010	2050 6DS	2010	2050 6DS	2010	2050 6DS
OECD	Final energy	51,3	62,4	30,7	35,2	20,6	27,2
BRICS	Final energy	34,0	53,7	28,4	37,7	5,6	15,9
RoW	Final energy	31,7	57,3	27,6	46,0	4,1	11,4
World	Final energy	116,9	173,4	86,8	118,9	30,2	54,5

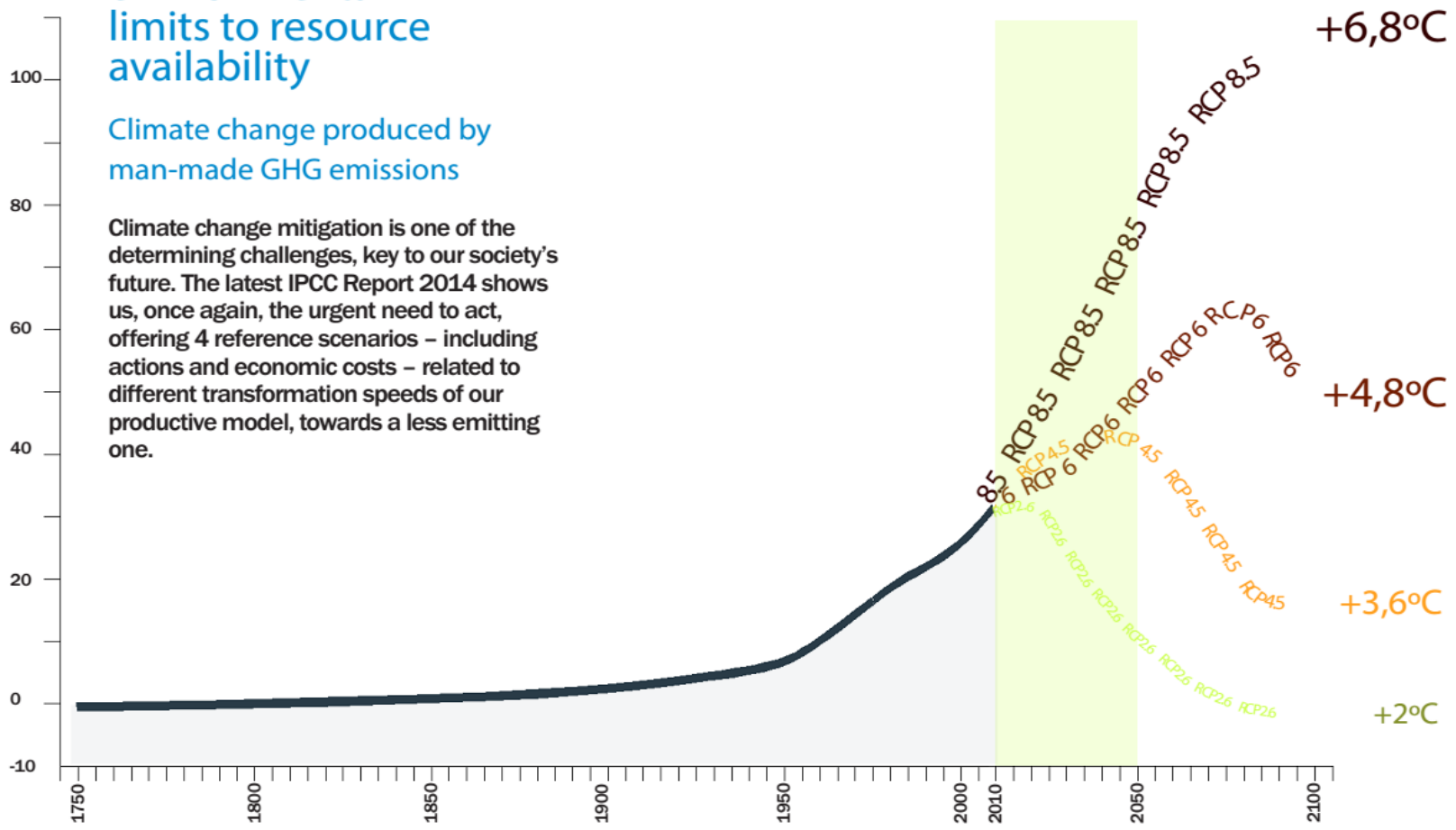
Units: EJ/year
Note: 6DS and 2DS are different scenarios defined by IEA
Sources: Elaborated by Report authors on the base of IEA (2013a)

But today there are strong global environmental limits to resource availability

Climate change produced by man-made GHG emissions

Climate change mitigation is one of the determining challenges, key to our society's future. The latest IPCC Report 2014 shows us, once again, the urgent need to act, offering 4 reference scenarios – including actions and economic costs – related to different transformation speeds of our productive model, towards a less emitting one.

Evolution of annual world CO2 emissions (World, 1750-2100)



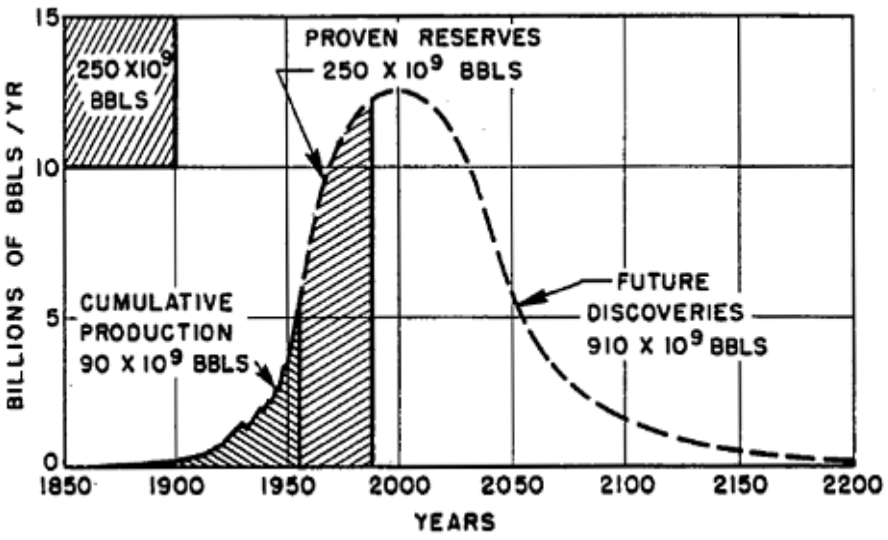
RCP 8.5, RCP 6, RCP 4.5 y RCP 2.6 are different scenarios defined by IPCC
Units: GtCO2/year
Sources: Elaborated by Report authors on the base of CDIAC (2010); IPCC (2014)

And also important local limitations: water, land, biodiversity

Decreasing availability of energy resources

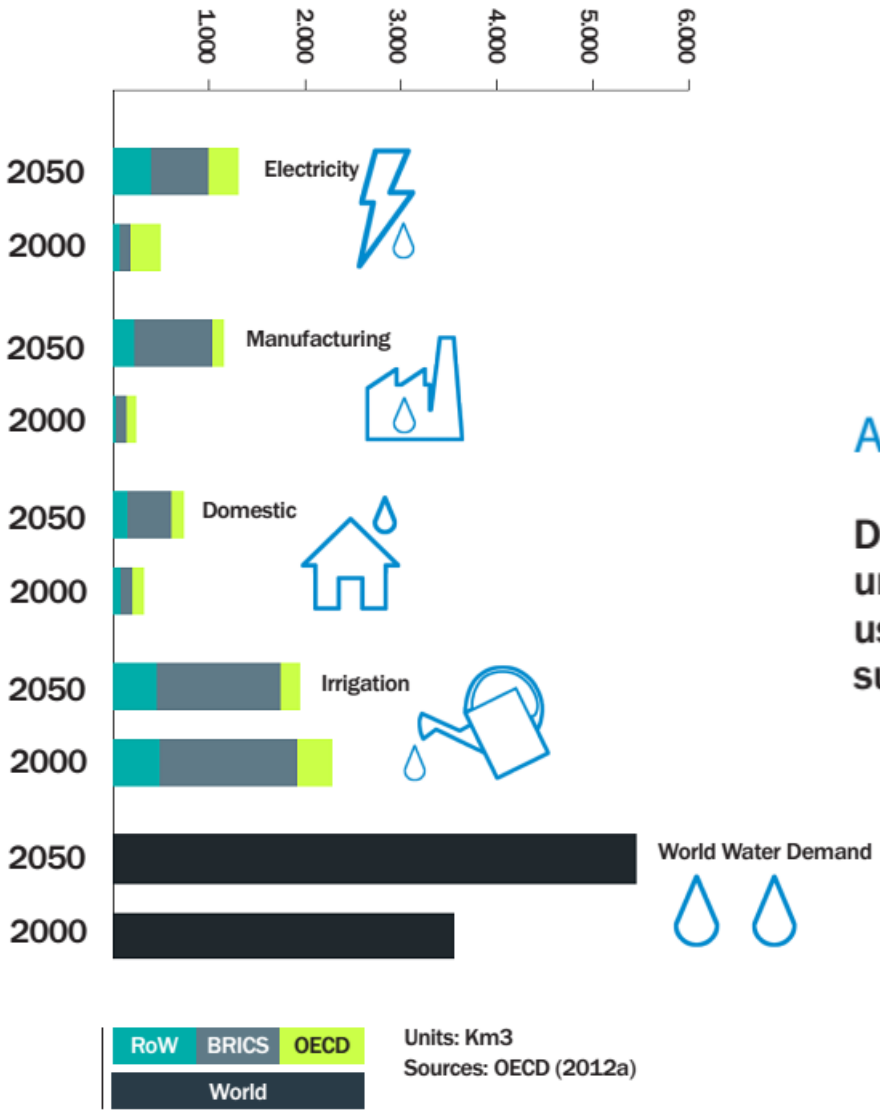
Concurrently with the climate crisis, we are also suffering a deep crisis centred on the availability of energy resources, key elements in the development of our industrial model.

Oil, which today comprises more than one third of primary energy consumed by Humanity, has reached its peak production. Therefore, its availability is decreasing progressively, as M. King Hubbert predicted in the 1950s announcing "peak oil" at the turn of the century.



Evolution of crude-oil production according to Hubbert (World, 1850-2200)

And also important local limitations: water, land, biodiversity



Evolution of world water demand (World and regions, 2000 and 2050)

And building brings important local impacts

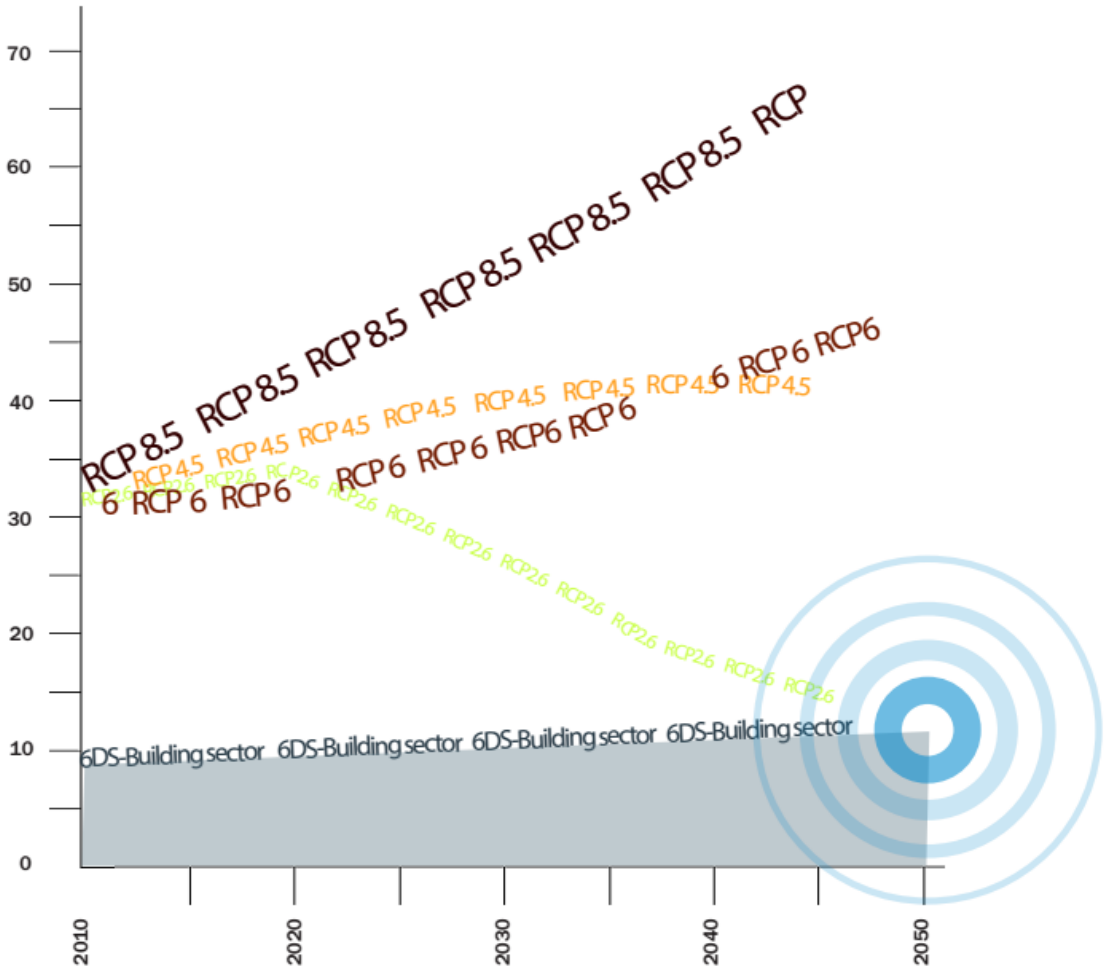
Demand for materials, construction processes, and urbanisation and local demand for resources to be used in buildings, result in important alterations to surrounding landscape, resources and ecosystems.

Following current tendencies, by 2050 the building sector alone will be responsible for all the global emissions that the 2ºC increase scenario allows.

It is impossible to reach desirable climate change scenarios with the current building sector

If, by 2050, building energy demand is satisfied following current tendencies, marked by the building sector's present situation, this sector will produce all the GHG global emissions that the IPCC report considers would result in the 2°C increase scenario in average Earth temperature since pre-industrial times.

Evolution of annual global and building sector CO2 emissions (World, 2010-2050)



6DS and 2DS are different scenarios defined by IEA
Units: GtCO2/year
Sources: Elaborated by Report authors on the base of IEA (2013a); IPCC (2014)

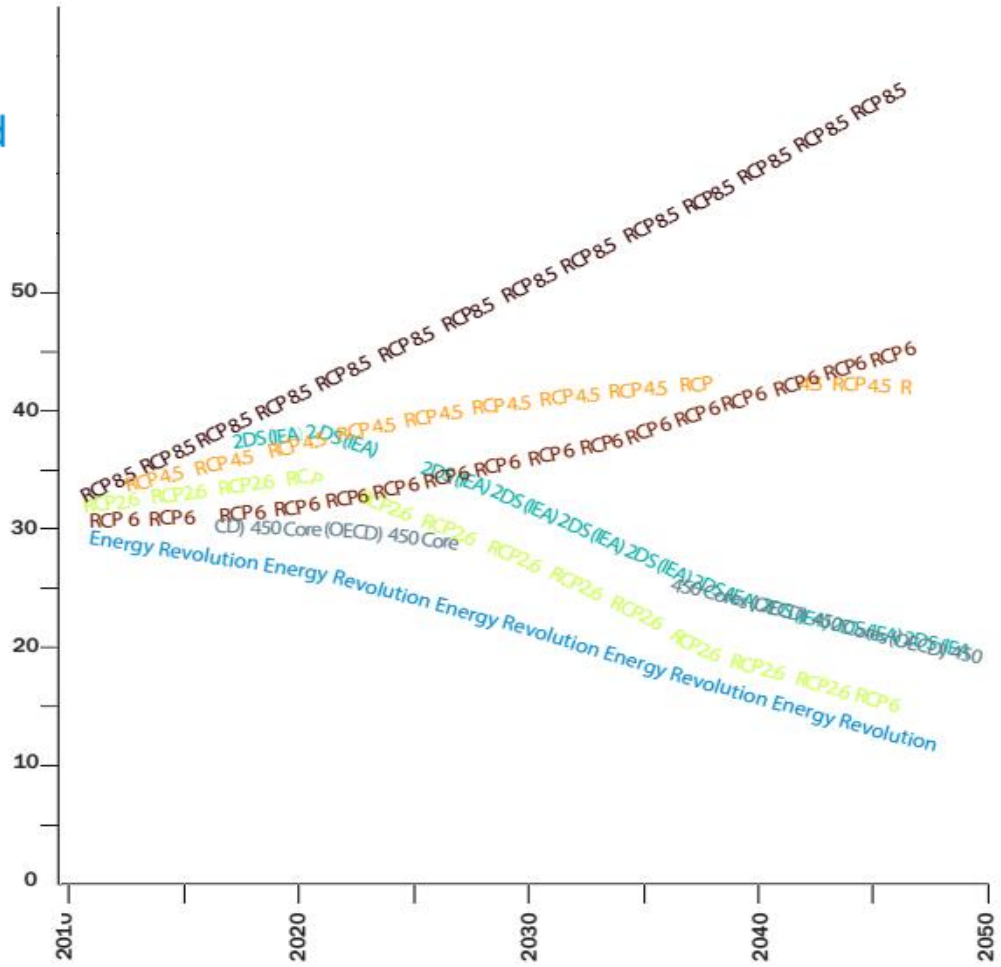
There are global plans to reach desirable reduced emission scenarios

Several institutions have action plans that would allow society to reach the IPCC 2ºC temperature increase scenario

		Global mean temperature	CO2-eq concentration	Radiative forcing
IPCC. AR5	RCP 8.5	6,8	1.370	8,5
	RCP 6	4,8	860	6,0
	RCP 4.5	3,6	650	4,5
	RCP 2.6	2,1	455	2,6
IEA. ETP 2014	6DS	6,0	1.100	
	4DS	4,0	710	
	2DS	2,0	450	
IEA. WEO 2013	Current policy scenario	5,3	950	
	New policy scenario	3,6	660	
	450 scenario	2,0	450	
OECD Environmental Outlook to 2050	Baseline scenario	3,7-5,6	1.000,0	
	450 Core scenario	2,0	450,0	
Greenpeace. E[R]	Reference scenario	6,0	1.000,0	
	Energy [R]evolution Scenario	2,0		
Units:	EJ/year			
Sources:	Elaborated by Report authors on the base of Greenpeace (2010); OECD (2012); IEA (2013b); IEA (2014a); IPCC (2014)			

Comparative chart between different international organisations' scenarios

Evolution of global annual CO2 emissions according to different international organisations (World, 2010-2050)



Units: GtCO2/year
Sources: Elaborated by Report authors on the base of Greenpeace (2010); OECD (2012a); IEA (2014a); IPCC (2014)

By means of two main strategies:

energy efficiency

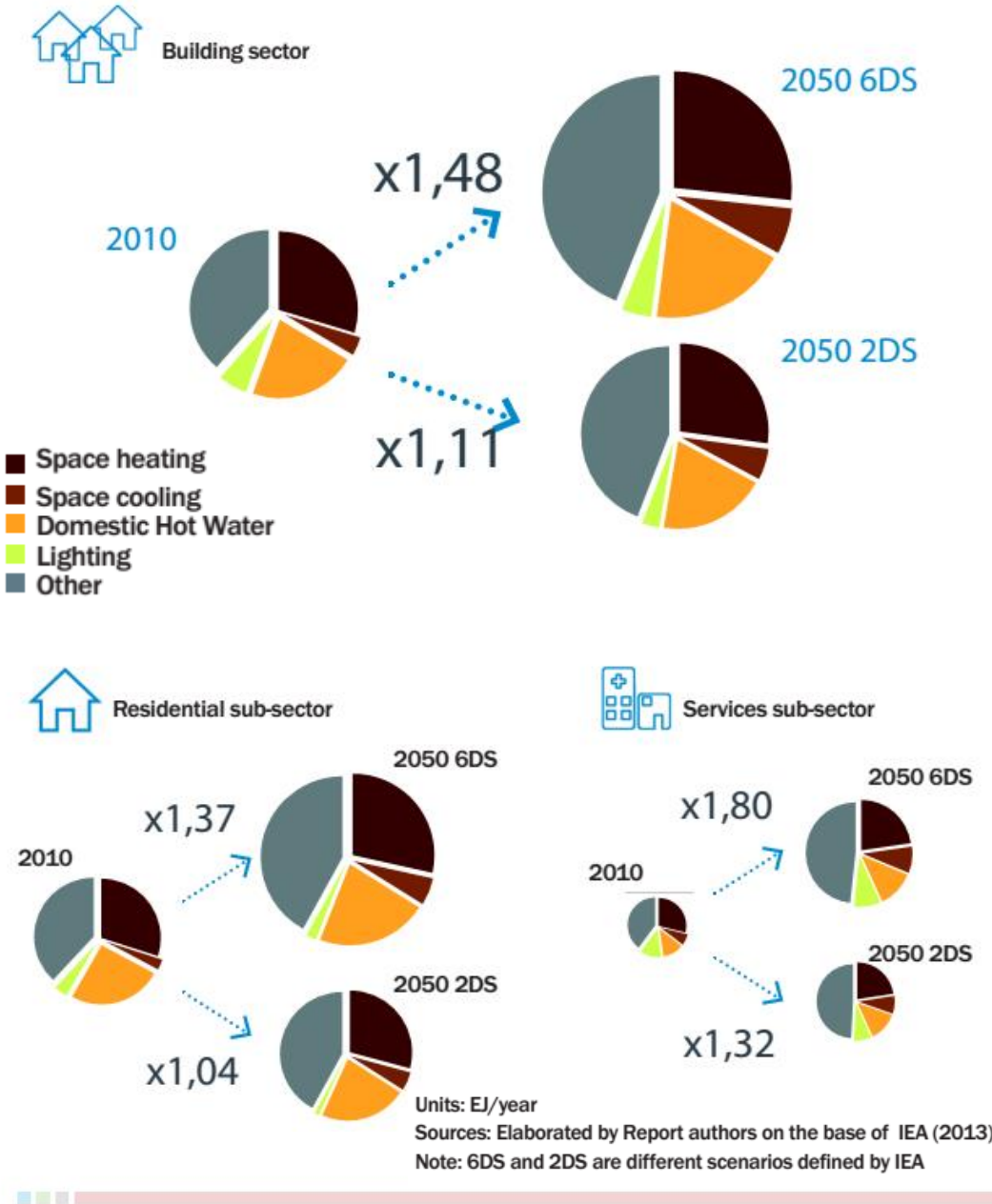
As the main energy resource of the change towards the new model. Improving efficiency in the use of energy in all sectors is possible if we use the technologies currently available, as well as by increasing efficiency on all scales.

a change in our energy sources

Decarbonising our current energy "diet", abandoning fuels – from coal to natural gas – that pollute more than renewables and redirecting the energy production towards these– which must reach at least 50% of energy production between 2010 and 2050 – and other non-emitting sources, should allow important achievements, such as reducing electric production related emissions from 600 grsCO2/ kWh in 2009 to less than 60 grsCO2/kWh in 2050.

The building sector must cooperate towards global transformation by reducing its environmental demands down to a minimum increase of a bare 11%

Energy demand should be cut down as much as possible in order to face new habitability requirements



Changing energy sources

It is necessary to boost the use of energy from renewable sources to satisfy the building sector's demand

Improving energy efficiency

It is also necessary to increase energy efficiency in all the energy usages of the building

Evolution of final energy consumption in the building sector according to sources (World, 2010 and 2050)

	Building sector			Residencial sub-sector			Services sub-sector		
	2010	2050 6DS	2050 2DS	2010	2050 6DS	2050 2DS	2010	2050 6DS	2050 2DS
Fossil fuels	43,0	56,8	31,9	29,9		21,4	13,1		10,5
Oil	4,4	2,7	0,5	3,3		0,1	1,1		0,4
Coal	13,1	14,0	4,1	8,8		2,8	4,3		1,3
Natural gas	25,5	40,1	27,3	17,7		18,5	7,8		8,9
Electricity and commercial heat	38,4	73,8	62,2	22,2		39,0	16,3		23,3
Electricity	32,7	66,4	55,5	17,8		34,0	14,9		21,6
Commercial heat	5,7	7,5	6,7	4,3		5,0	1,4		1,7
Renewables	35,4	42,8	36,0	34,6		30,0	0,8		6,1
Total	116,9	173,4	130,1	86,7	118,9	90,4	30,2	54,5	39,9

Units: EJ/year

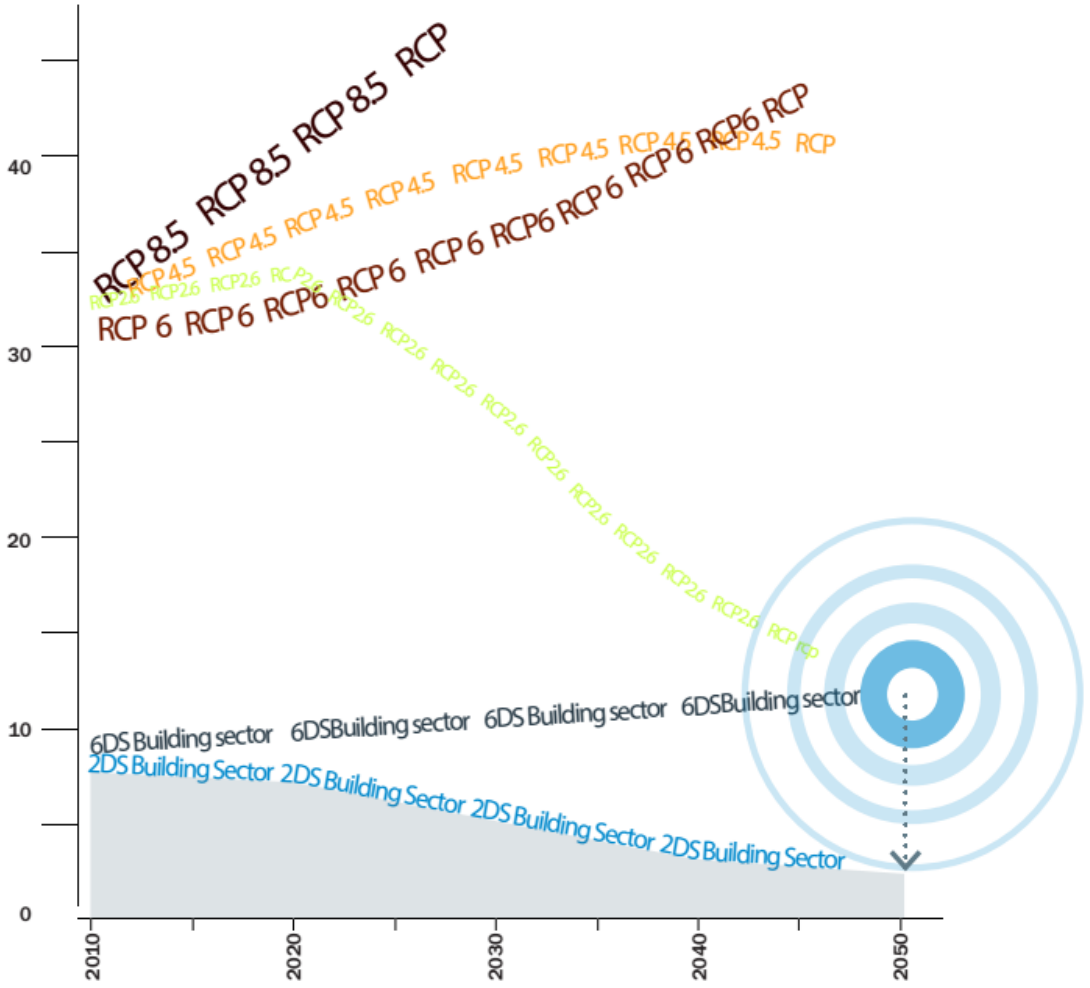
Sources: Elaborated by Report authors from IEA (2013a); IEA (2014a)

In 2050, building sector emissions could be brought down to 23% of the emissions that the 2ºC increase scenario predicts for that year

The building sector must reduce its emissions' share significantly

Emissions derived from energy use in buildings could be reduced to reach less than the current (2010) 26% of total annual global emissions, thus contributing to climate change mitigation, based on low temperature increase scenarios.

Evolution of annual global and building sector CO2 emissions in different scenarios (World, 2010-2050)

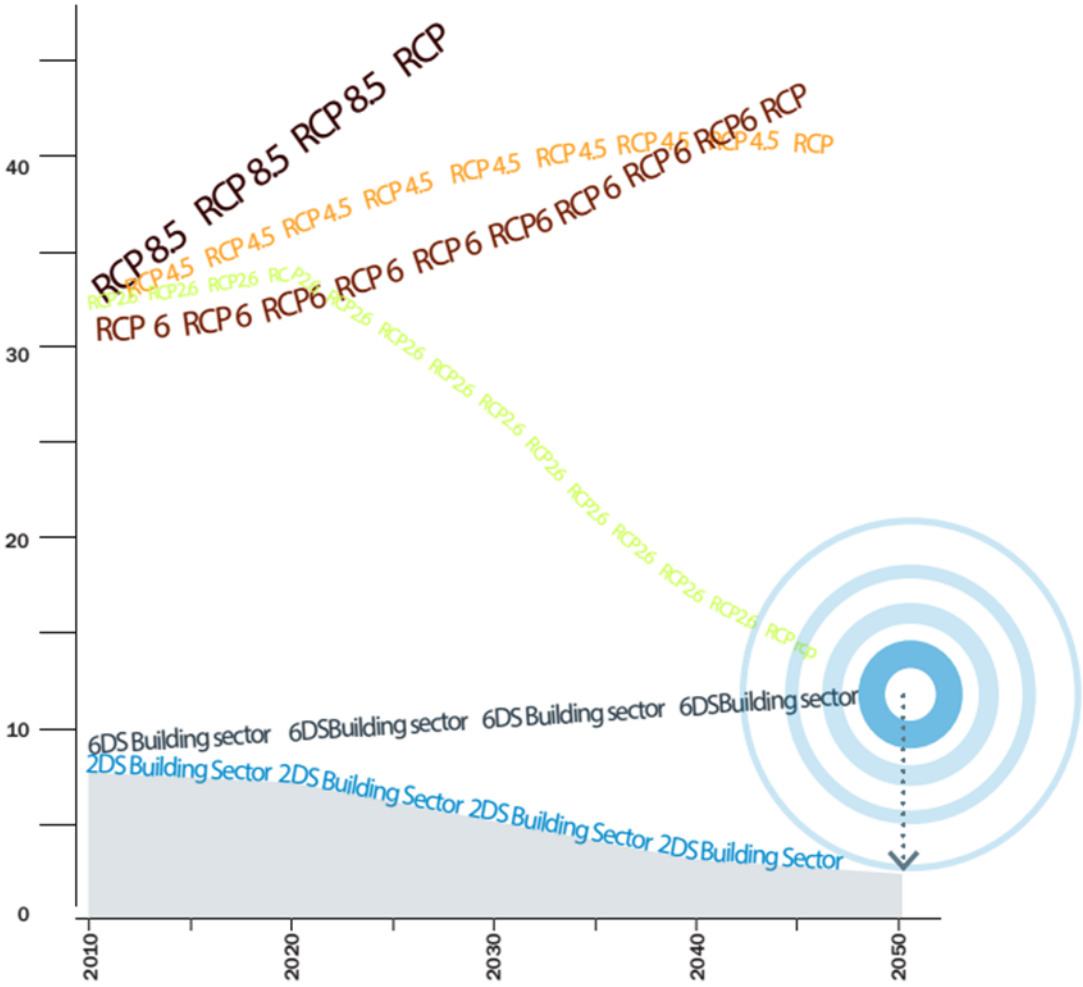


Units: GtCO2/year
Sources: : Elaborated by Report authors on the base of IEA (2013a); IPCC (2014)
Note: 6DS and 2DS are different scenarios defined by IEA. RCP is a scenario defined by the IPCC report

But environmental targets must be redefined continuously…

Some doubts and discussions over certain aspects, which must be taken into account when considering scenarios and their future evolution, persist.

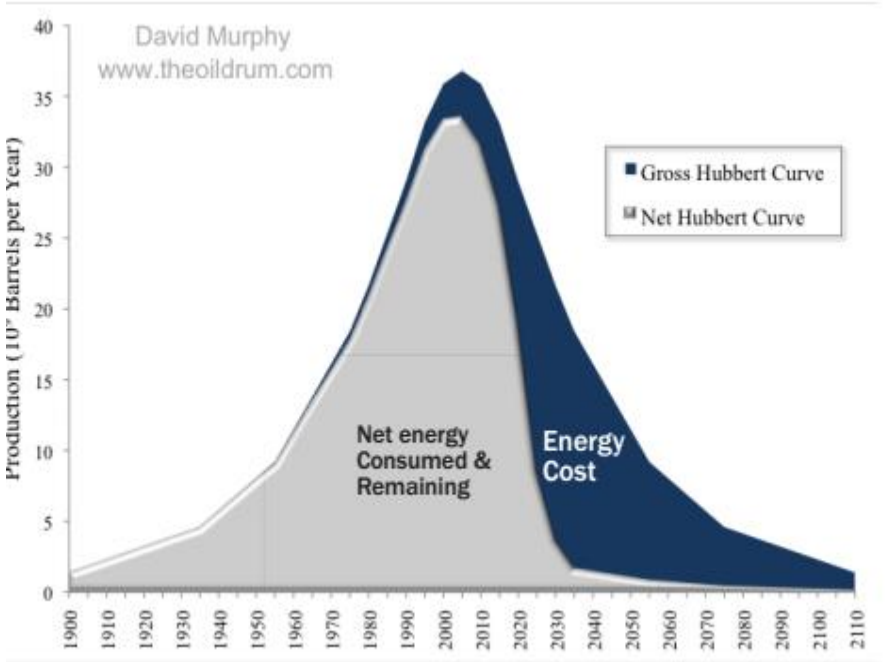
Evolution of annual global and building sector CO2 emissions in different scenarios (World, 2010-2050)



Units: GtCO2/year
Sources: : Elaborated by Report authors on the base of IEA (2013a); IPCC (2014)
Note: 6DS and 2DS are different scenarios defined by IEA. RCP is a scenario defined by the IPCC report

The EROI (Energy Return On Investment) rate may condition, in a determining way, the energy model change

Just as "peak-oil" reflects the need to increase the quantity of fuel destined to obtain each new barrel of the existing reserves, creating new renewable infrastructures entails destining some of that "growingly scarce" energy to build them and waiting some years until their production returns that energy. This could lead us to an insurmountable "energy-trap" hampering a change in the energy model if we don't act soon.



Evolution of production of crude-oil according to Hubbert and according to Murphy (World, 1900-2100); Murphy, D (2009)

Nuclear dependency

Some of these scenarios – such as those presented by the IEA, frequently used as a reference for this report – propose multiplying the nuclear energy production capacity by 2,5 between 2010 and 2050. There is an important debate regarding the role that this energy source should have in a post-carbon energy model, owing both to operation risks and hazardous waste generation.

Evolution of world primary energy consumption according to sources and scenarios from IEA and Greenpeace (World, 2007, 2010 and2050)

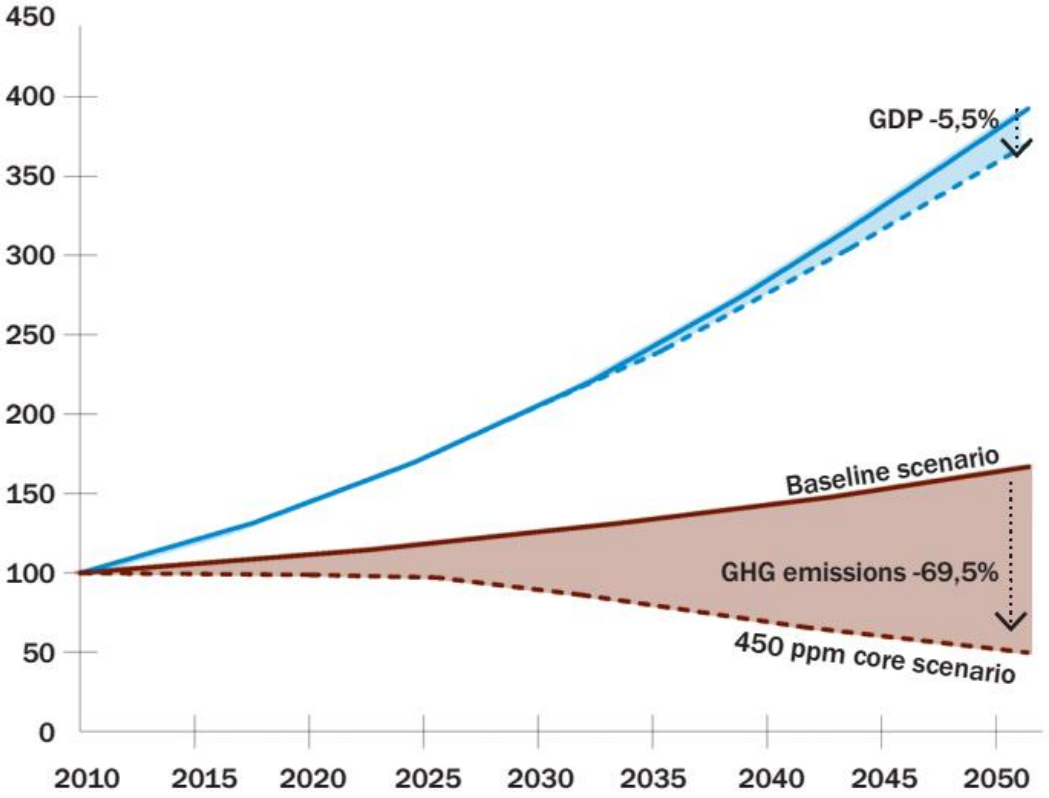
	IEA				Greenpeace			
	2010	%	2050	%	2007	%	2050	%
World			2DS				E[R]	
Fossil fuels	429,7	81%	294,3	43%	396,7	81%	190,8	31%
Oil	170,1	32%	110,0	16%	155,9	32%	81,8	13%
Coal	148,1	28%	72,9	11%	135,9	28%	37,6	6%
Natural gas	111,5	21%	111,4	16%	104,8	21%	71,4	12%
Nuclear	28,8	5%	74,0	11%	29,7	6%	0,0	0%
Renewables	70,3	13%	312,3	46%	63,9	13%	428,4	69%
Hydro	12,1	2%	25,9	4%	11,1	2%	90,9	15%
Biomass and waste	53,4	10%	163,8	24%	49,8	10%	18,2	3%
Other renewables	4,8	1%	122,6	18%	3,0	1%	159,6	26%
Wind					0,6		30,5	
Solar					0,4		76,5	
Geothermal					2,0		50,1	
Ocean Energy					0,0		2,4	
Total	528,8	100%	680,6	100%	490,2	100%	619,1	100%

Units: EJ/year
Sources: Elaborated by Report authors on the base of IEA (2012a); IEA (2014a); Greenpeace

GDP evolution related to its energy support

Most reference studies decouple GDP evolution from a change in the energy model, considering that it will vary very little for all the different climatic change mitigation scenarios. It is also possible that in the end this will not work exactly this way, with a much less homogeneous distribution between regions.

Evolution of world CO2 emissions in two scenarios and economic mitigation costs (World, 2010-2050)



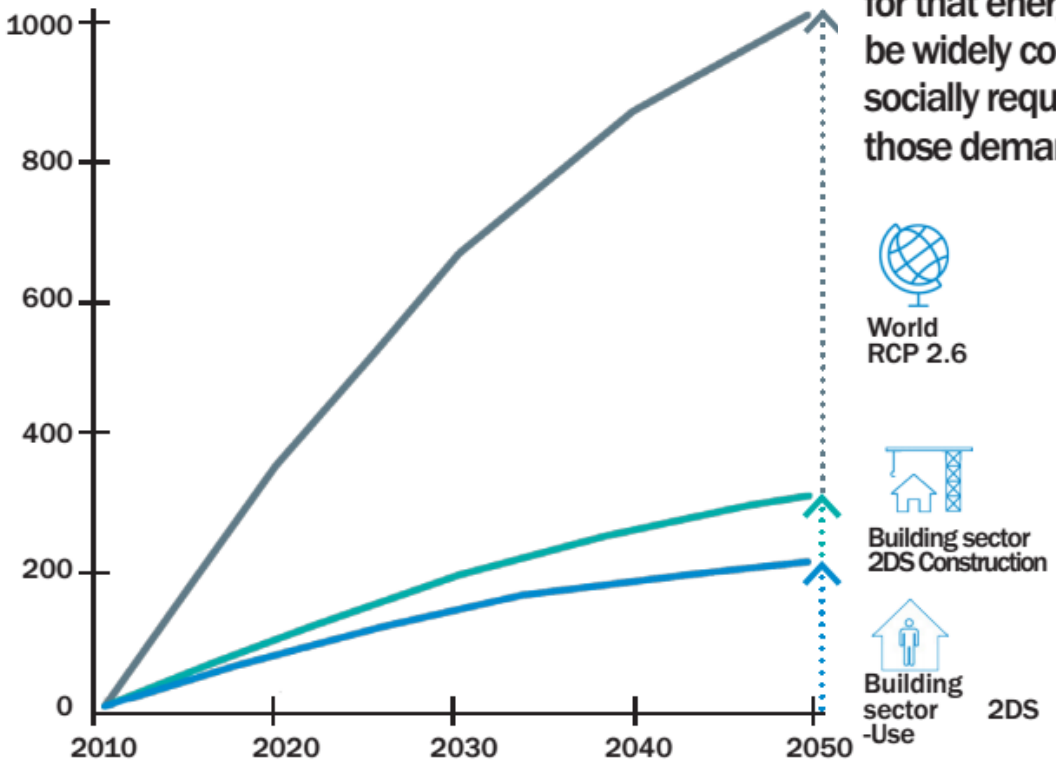
Units: Index 2010 = 1
Sources: OECD (2012a)

Embodied energy in construction materials

The building sector does not only demand energy to be used in buildings holding social activities. Manufacturing materials with which buildings are constructed implies using energy and generating emissions, amounting to a significant quantity.

Even though, usually, the industrial sector is made responsible for that energy and those emissions, the building sector must be widely considered as the sector that produces and maintains socially required habitability and, as a consequence, cannot avoid those demands in its future strategies

Evolution of cumulative world CO2 emissions and in the building sector, use and construction phases (World, 2012-2050)



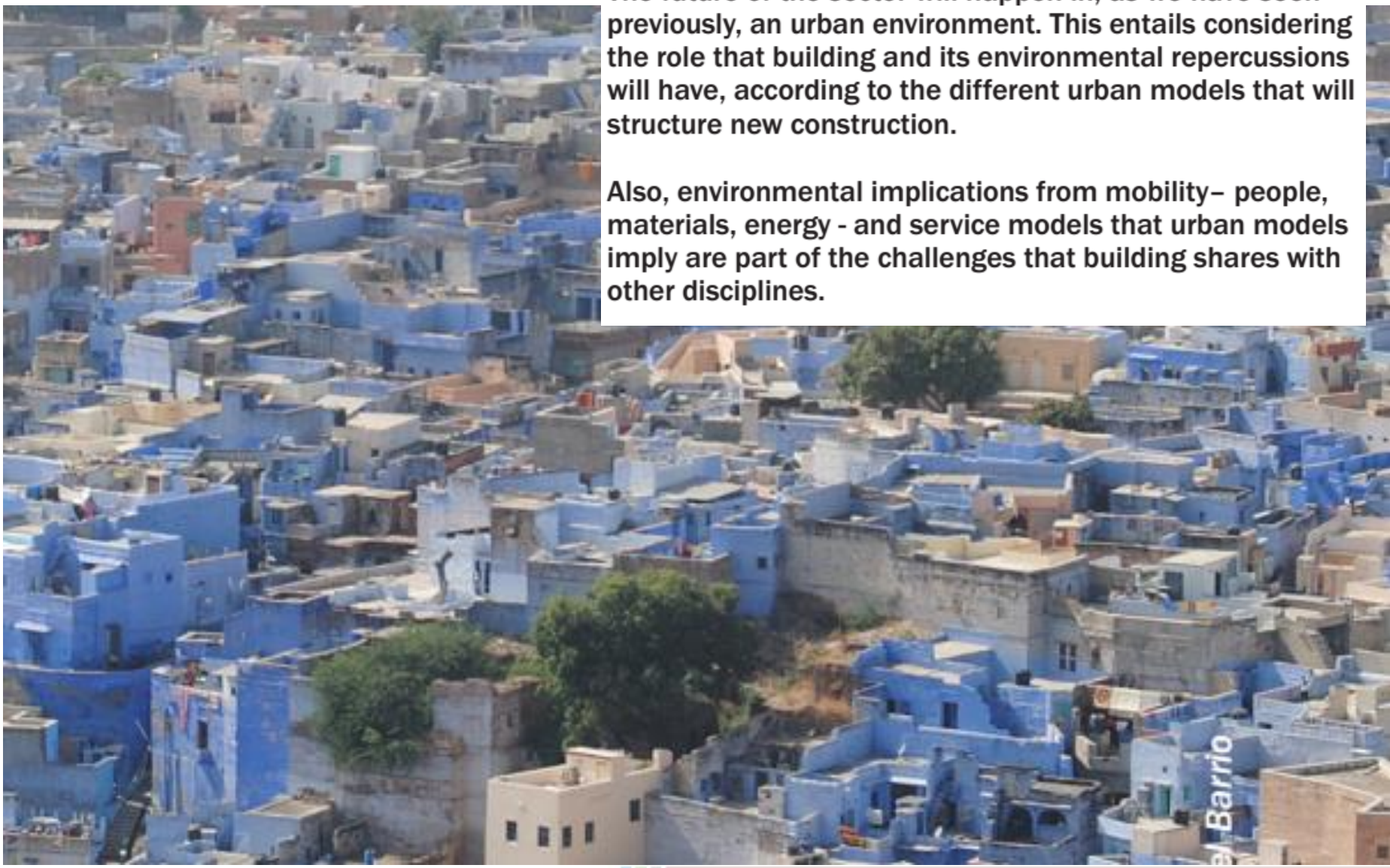
Units: GtCO2

Sources: Elaborated by Report authors on the base of GBCe (2010); IEA (2013a); IPCC (2014)

A definitely urban sector

The future of the sector will happen in, as we have seen previously, an urban environment. This entails considering the role that building and its environmental repercussions will have, according to the different urban models that will structure new construction.

Also, environmental implications from mobility– people, materials, energy - and service models that urban models imply are part of the challenges that building shares with other disciplines.



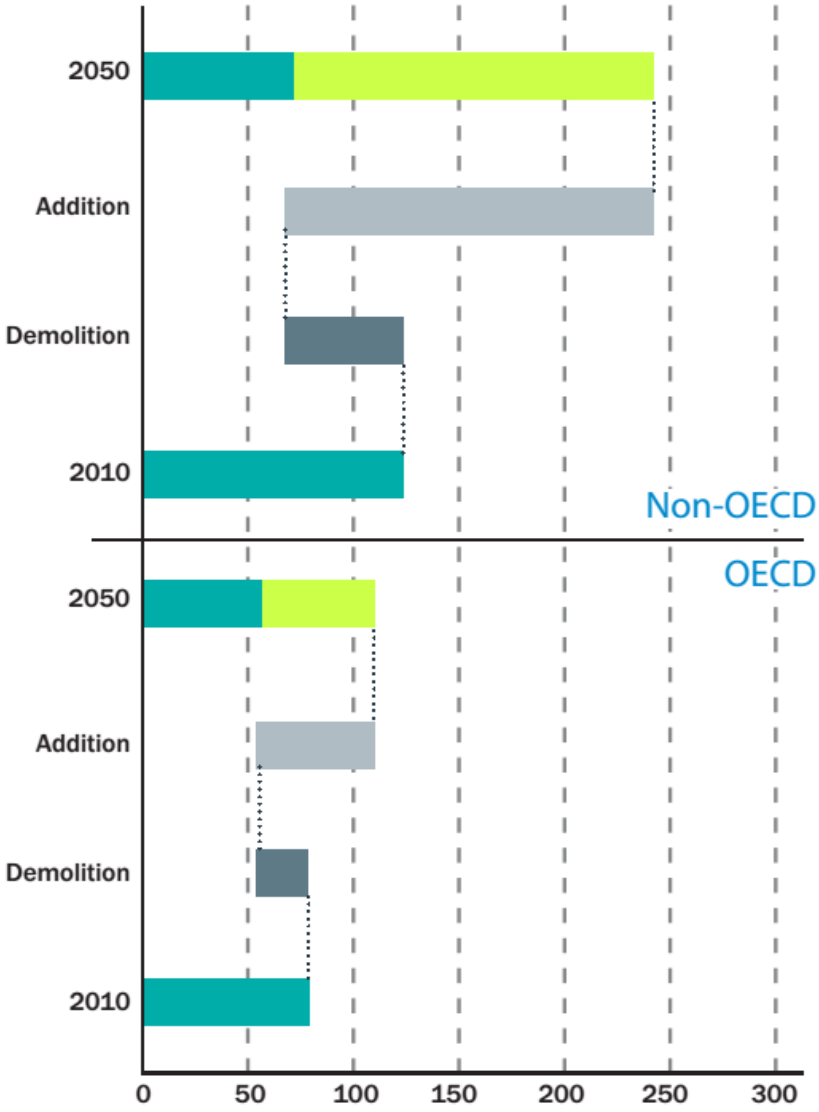
The building sector has different tasks in different regions

Population growth is basically supported by non OECD countries, while hardly growing at all in most of the wealthiest countries. Furthermore, the largest growth, proportionally, of GDP will happen in BRIC countries.

This leads to different requirements in different areas of the world. In many nations, building restoration is an unavoidable strategy to reduce high energy consumption and associated emissions.

In other areas, slums are a reality that must be overcome. In 2010, more than 10% of world population lived in insalubrious neighbourhoods. And, if poverty is not surmounted, in 2030 it could affect 2,000 million people.

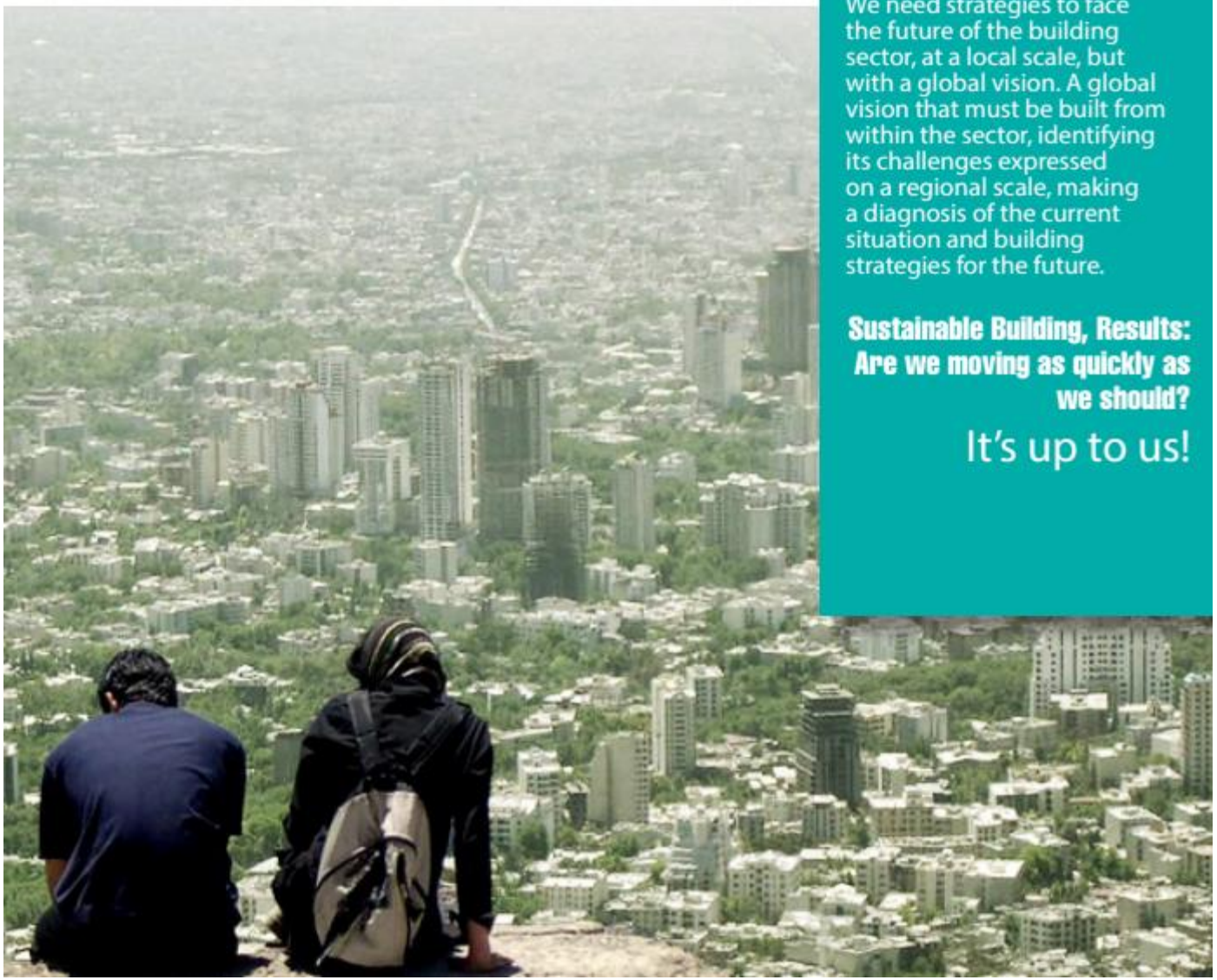
Evolution of the demolished and new construction areas in the residential sub-sector (Regions, 2010 and 2050



The building sector as a recipient of investment and generator of jobs

Covering the environmental demands of the building sector between 2010 and 2050 to reach the 2ºC increase scenario would require investing 31 trillion USD ($31*10^{12}$) – 19 for the residential sector, 12 for services – which would be recovered with energy and emission savings.

This investment would have important repercussions on jobs - different in each country or region: in developed economies, an average of 13 jobs/year per 1 million USD invested in implementing mitigation measures in building – which must be strategically considered so as to generate the highest social benefits, seeing to socioeconomic conditions in each particular region.



We need strategies to face the future of the building sector, at a local scale, but with a global vision. A global vision that must be built from within the sector, identifying its challenges expressed on a regional scale, making a diagnosis of the current situation and building strategies for the future.

Sustainable Building, Results: Are we moving as quickly as we should?

It's up to us!

A Global Vision report
is available

http://www.gbce.es/es
/estrategia

2015

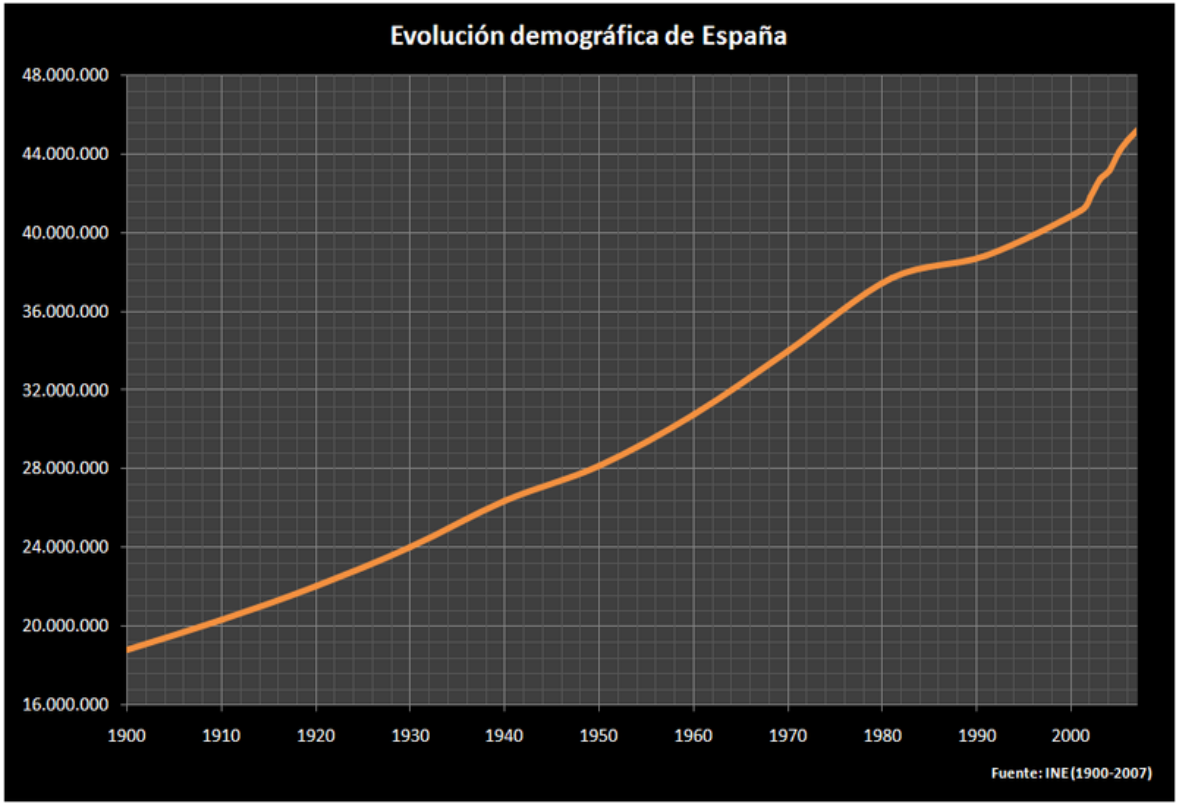
17.052 nuevos edificios de viviendas

2006

209.752 nuevos edificios de viviendas

2006-2015

-92%


Evolución demográfica de España
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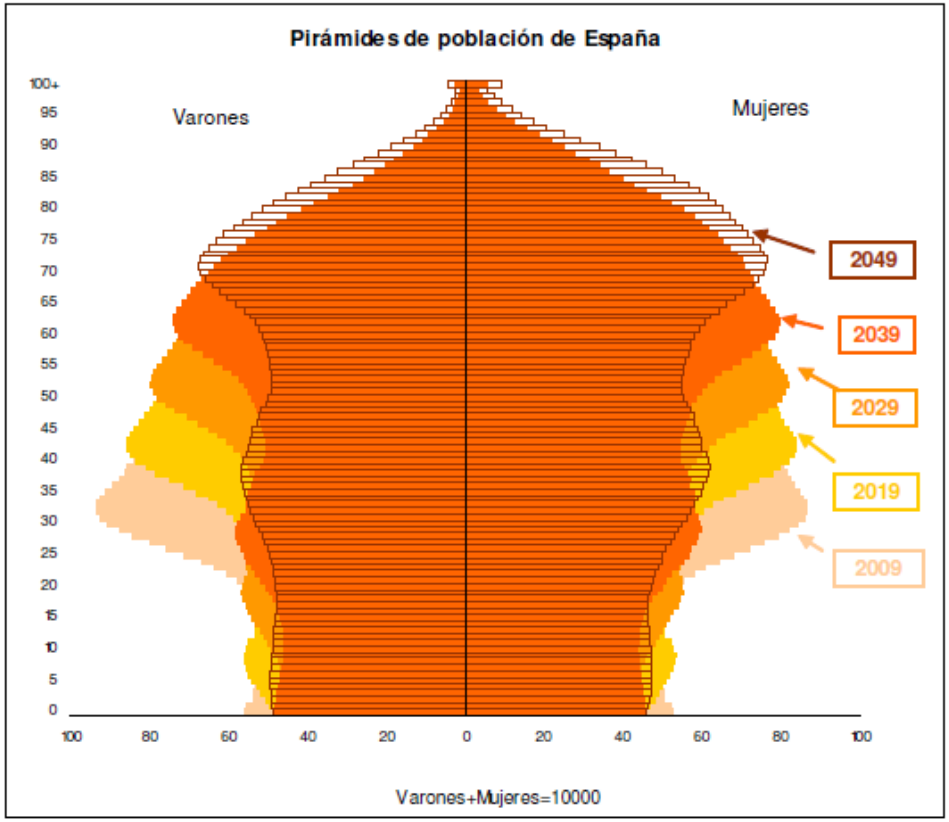
Fuente: INE (1900-2007)



Fuente: Proyección de Población a Largo Plazo


CHER ANGE EN S ENVOLANT LE BONHEUR NOUS A FUI
AMOUR ORGUEIL ESPOIR TOUT EST MORT AVEC LUI.

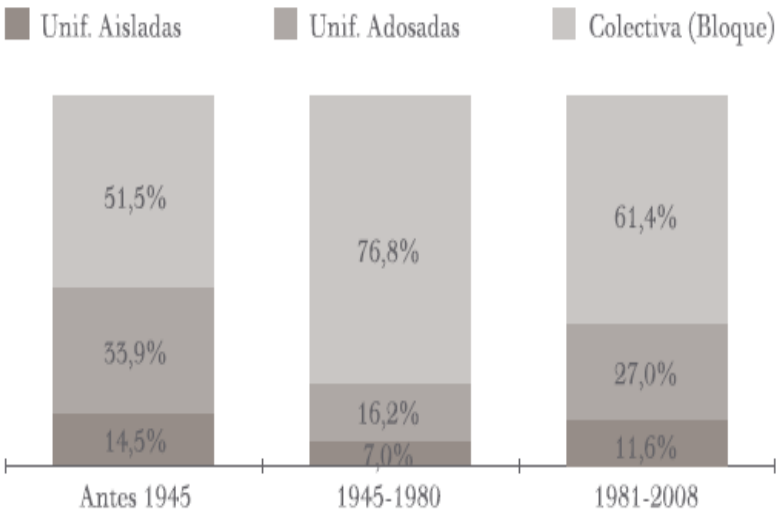
GRUPO DE TRABAJO
SOBRE REHABILITACIÓN
GTR

Coordinado por:

GBCe green building council españa

FUNDACIÓN CONAMA

La necesidad de un nuevo sector



Fuente: INE (2001). Distribución de viviendas por edad y tipo de edificio [Cuadro]. En Martin, C. (Ed.). *Potencial de ahorro energético y de reducción de emisiones de CO2 del parque residencial existente en 2020' WWF Diciembre de 2010.*

El parque de construido de vivienda

- Cerca de un **60%** del total de viviendas fueron construidos **antes de 1980**.
- De las viviendas registradas en el censo de 2001, más del **40% se encuentra en el medio rural.**
- Hay **grandes concentraciones** de vivienda en bloques con 5 o más viviendas cada uno

GRUPO DE TRABAJO
SOBRE REHABILITACIÓN
GTR

Coordinado por:
GBCe green building council españa
FUNDACIÓN CONAMA

La necesidad de un nuevo sector

La ocupación del parque construido de vivienda

- En **2008**, las viviendas principales suponían el **65%** del parque de viviendas construidas.
- En **2009**, la tenencia en régimen de propiedad suponía el **82%** del parque de viviendas principales.
- Cerca de un **30%** del parque está sobreocupado o infraocupado.

GRUPO DE TRABAJO
SOBRE REHABILITACIÓN
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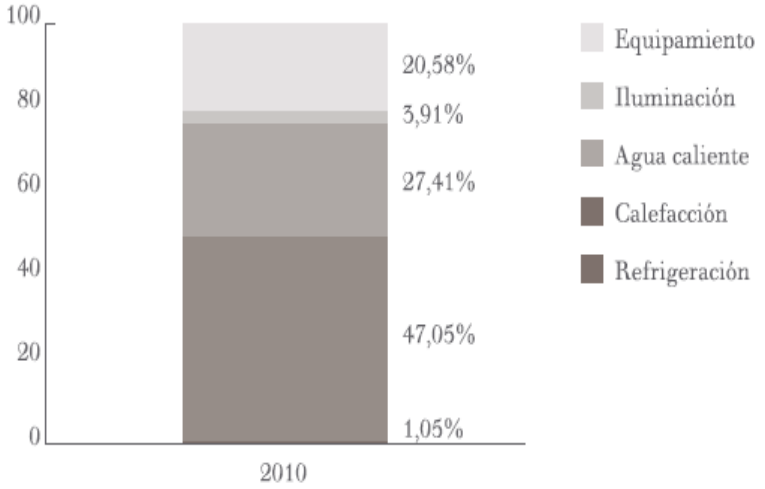
GBCe green building council españa

FUNDACIÓN CONAMA

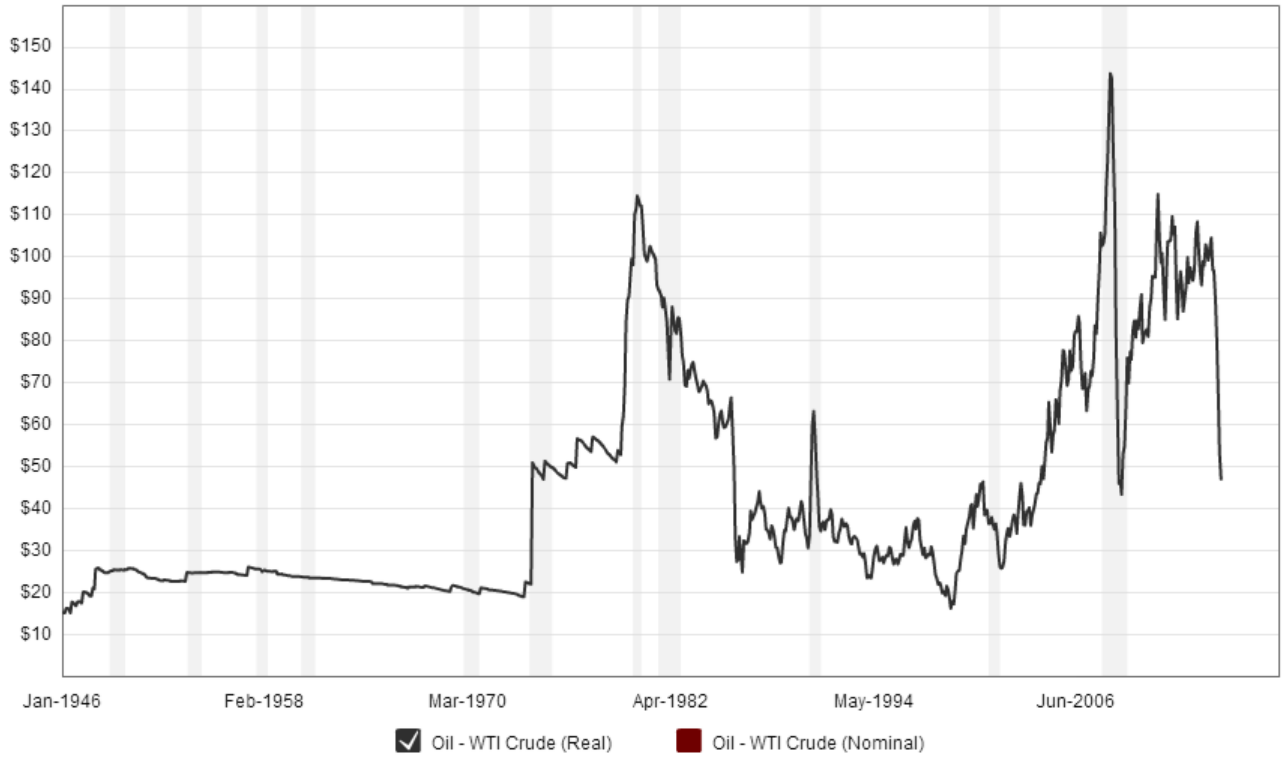
La necesidad de un nuevo sector



Fuente: IDAE. (2011). Distribución del consumo energía final Sector Edificios DOMÉSTICO (2010) [Cuadro]. En Ministerio de Industria, Turismo y Comercio España, *Plan de Acción de Ahorro y Eficiencia Energética 2011-2020.*

Los recursos utilizados en la habitabilidad

- Del uso de energía en los edificios un **65%** se produce en el sector residencial.
- En **2009**, el abastecimiento doméstico de energía supuso un coste a las familias de **15 mil millones de euros**.
- En **2007**, el **46%** de los hogares españoles usaron la electricidad para la calefacción.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Oil - WTI Crude (Real)
Oil - WTI Crude (Nominal)


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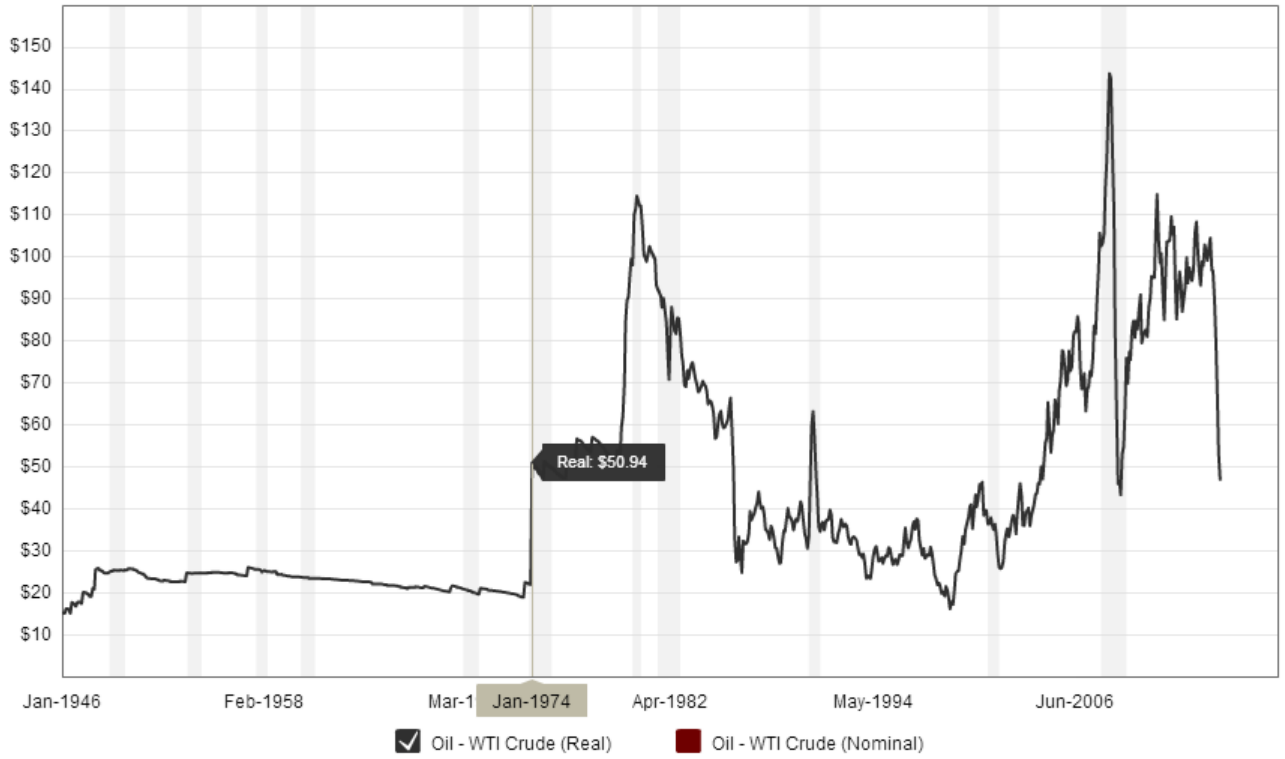
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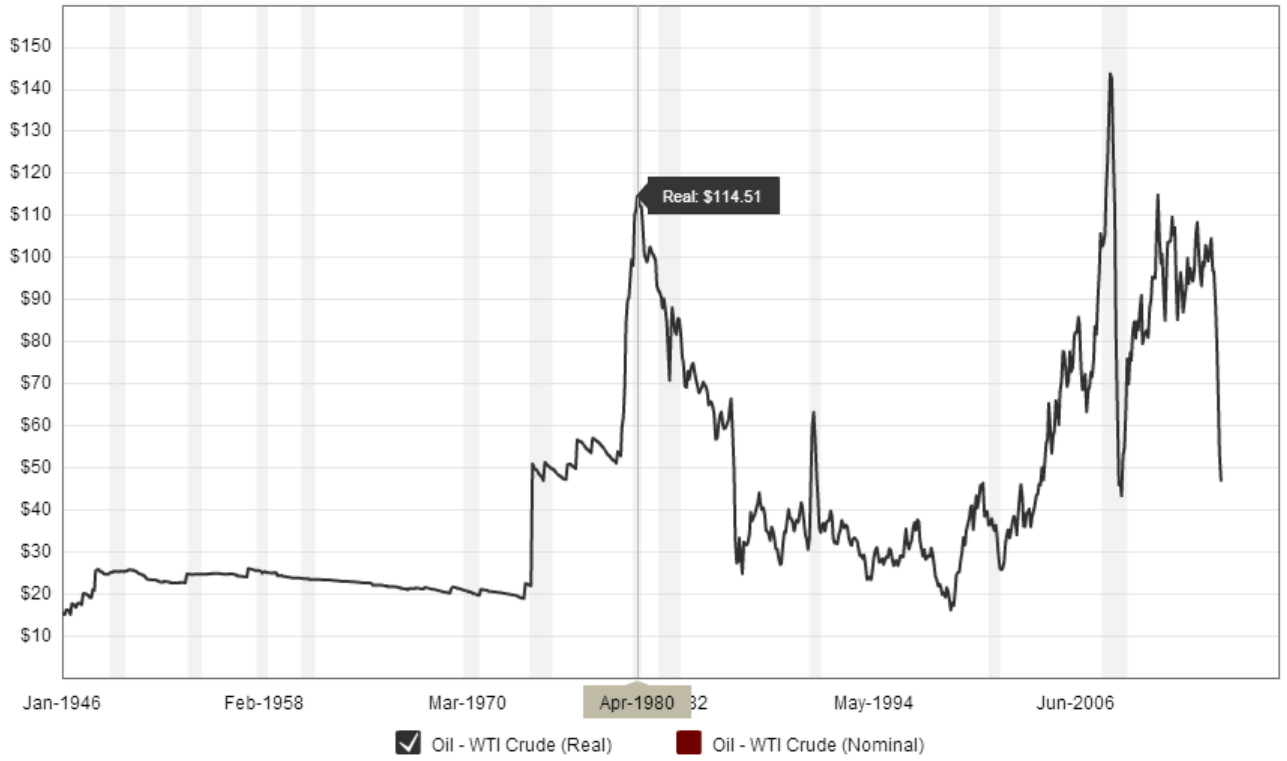
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Real: $114.51
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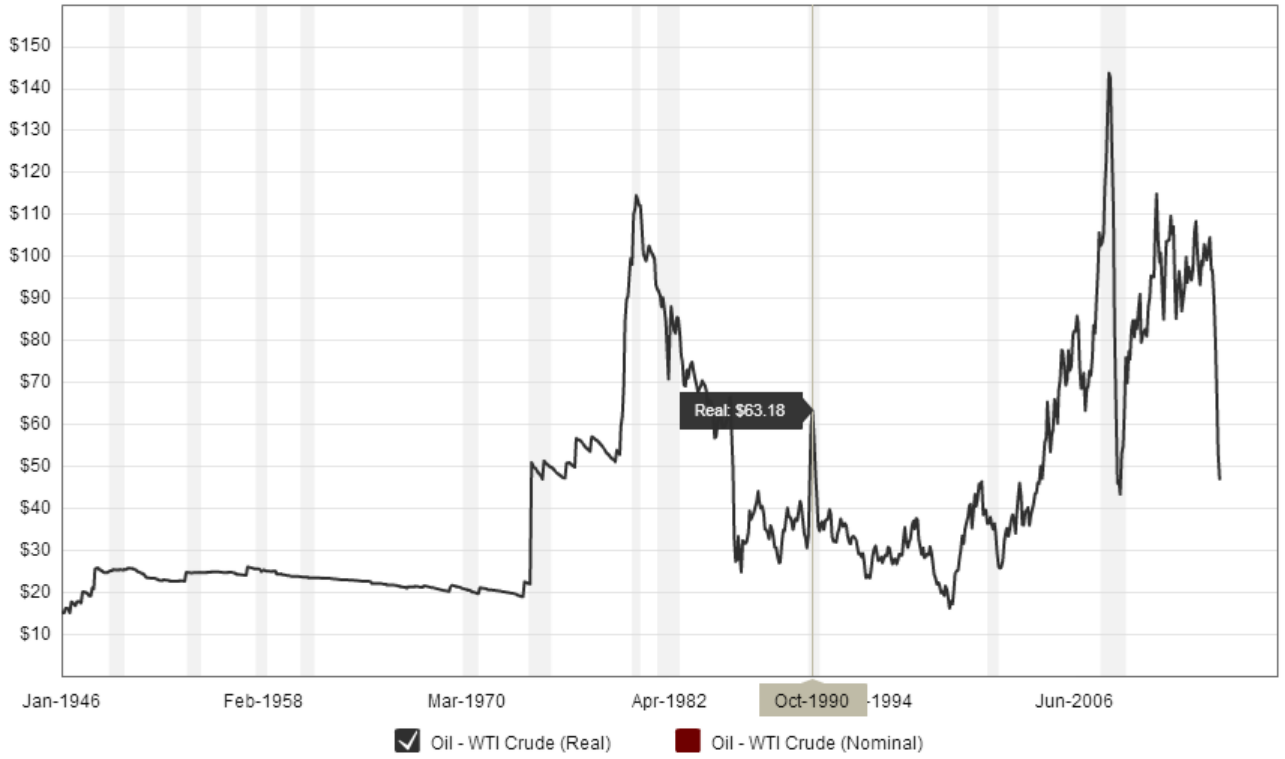
Oil - WTI Crude (Nominal)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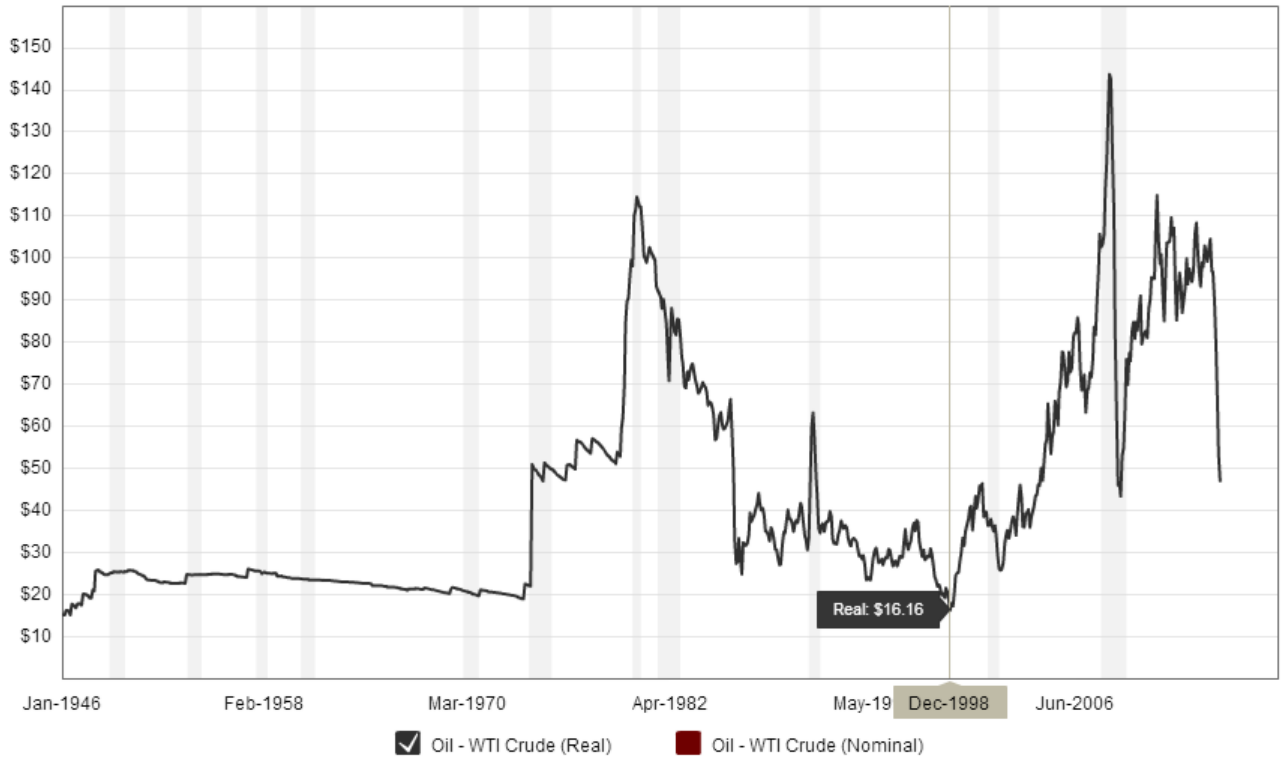
Jun-2006
Oil - WTI Crude (Real)
Oil - WTI Crude (Nominal)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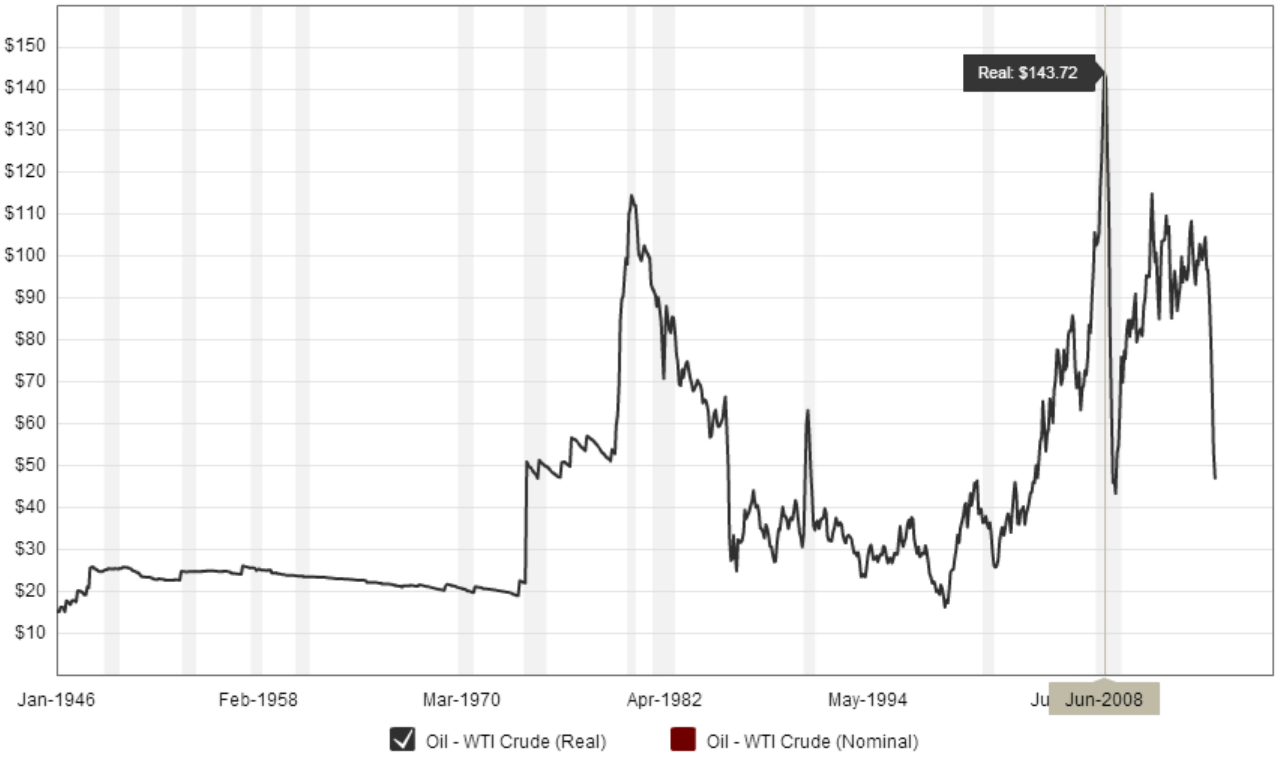
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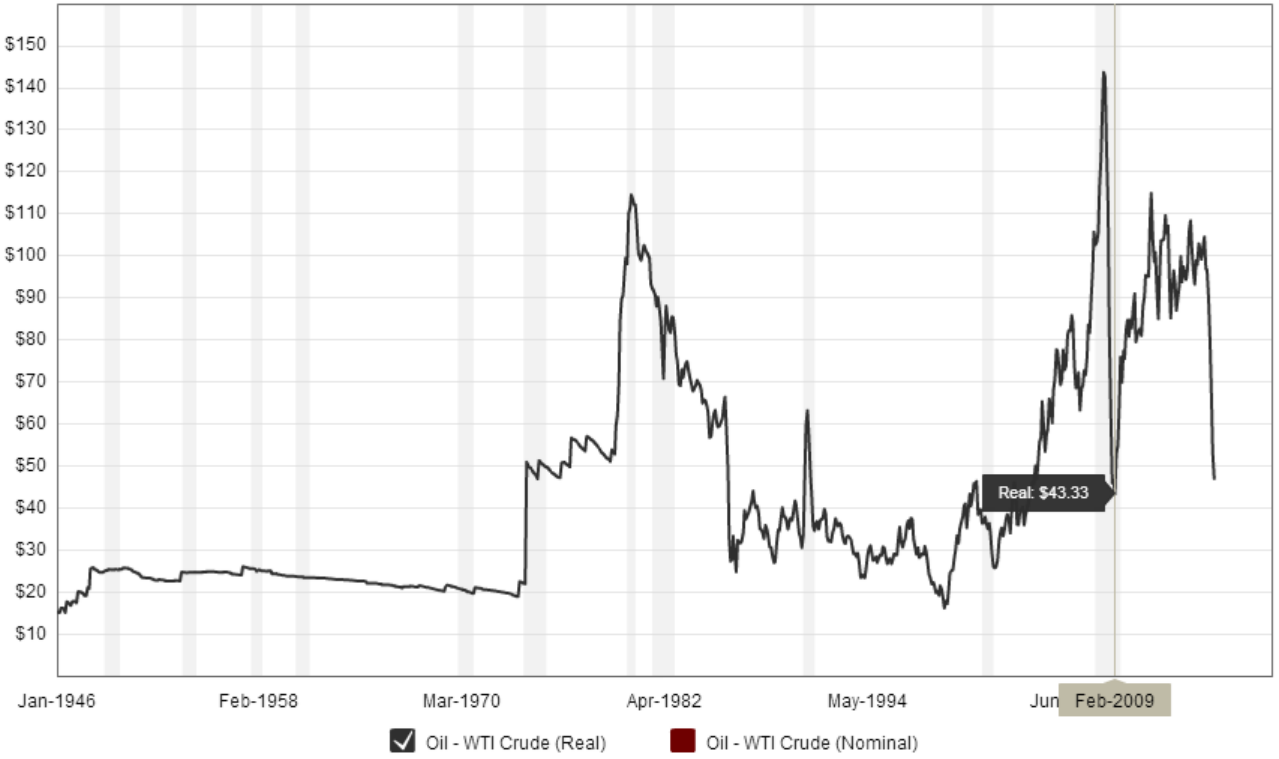
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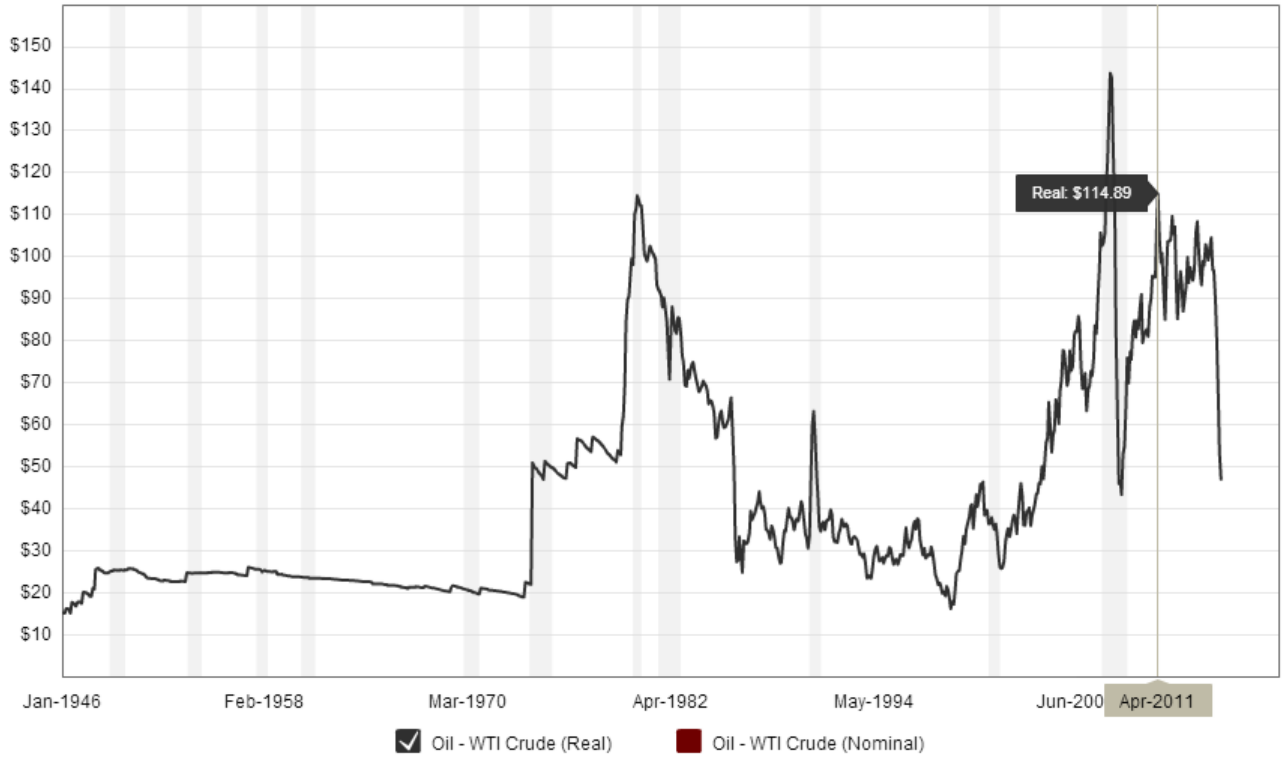
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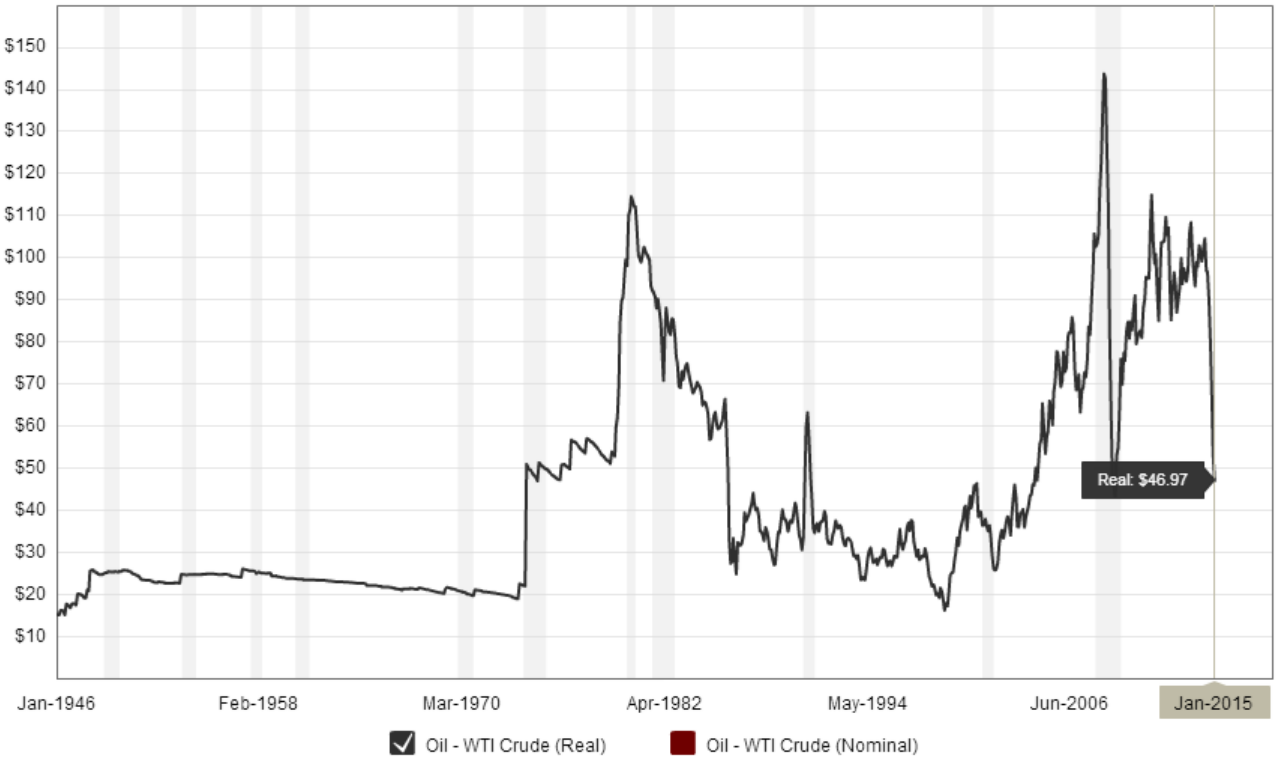
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Real: $46.97
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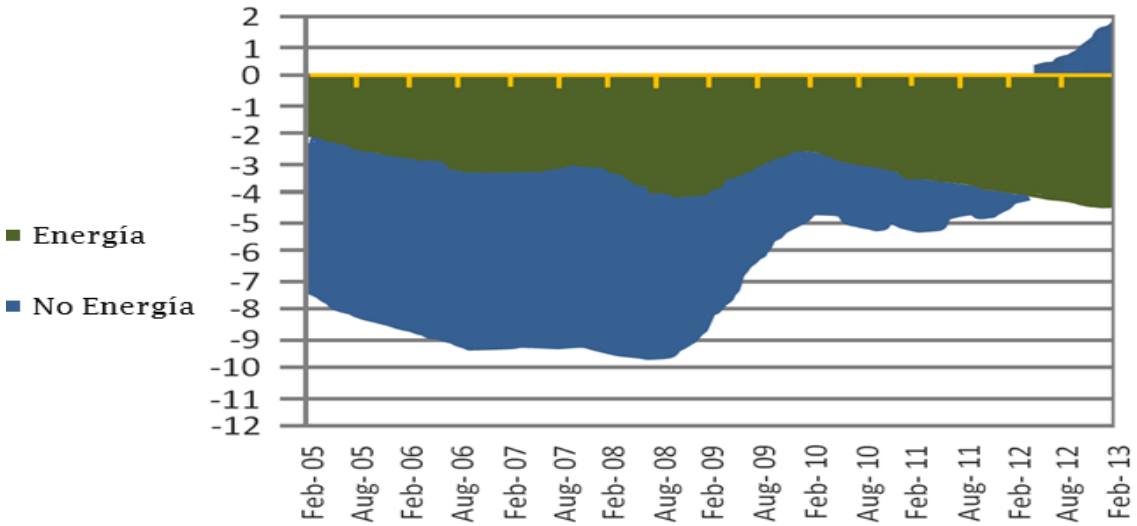
Oil - WTI Crude (Real)
Oil - WTI Crude (Nominal)

EVOLUCIÓN DE LA DEPENDENCIA ENERGÉTICA (Metodología Eurostat)

Saldo comercial acumulado a 12 meses (En porcentaje del PIB)



Fuente: BBVA Research (2013)

En España gastamos en 2013 unos 40.000 millones de euros en pagar energía importada

13.000 millones de euros (un tercio) en edificación

Con un ahorro del 80% (todos los edificios clase A), ahorraríamos

10.000 millones de euros cada año

EL PAÍS

PORTADA | INTERNACIONAL | POLÍ

POLÍTICA

MONCLOA | FERRAZ | GÉNOVA | + PARTIDOS | CONGRESO | OPINIÓN | SUCESOS

ESTÁ PASANDO | Lucha contra la corrupción | Marchas de la Dignidad 22-M | Elpidio Silva

Rajoy anuncia el recorte de 10.000 millones en Educación y Sanidad

- El Gobierno anuncia en una nota de prensa privatizaciones y recortes, tras reunirse el presidente con los ministros afectados

FERNANDO GAREA | Madrid | 9 ABR 2012 - 18:30 CET 3207

Archivado en: Mariano Rajoy | Recortes presupuestarios | Recortes sociales | Copago sanitario | Presupuestos educación | Privatizaciones | Crisis deuda europea | PP | Gobierno de España | Gasto sanitario

6.871 2.552 109 68

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Imprimir

El presidente del Gobierno, Mariano Rajoy, ha acelerado las reformas y los recortes con su equipo económico y con los ministros afectados, y planea recortar 10.000 millones de euros, en educación y sanidad. El Ejecutivo lo ha anunciado en una nota de prensa enviada a los medios a las cinco de la tarde. Por eso, el PSOE ha pedido formalmente la comparecencia del presidente en el Congreso para explicar estos nuevos ajustes, porque considera que no es adecuada la vía del anuncio a través de un comunicado.

EL MUNDO | España

Líder mundial en español | Martes 10/04/2012. Actualizado 08:51h.

España | Mundo | Europa | Op-Blogs | Deportes | Economía | Vivienda | Cultura | Toros | Ciencia | Salud | Tecn

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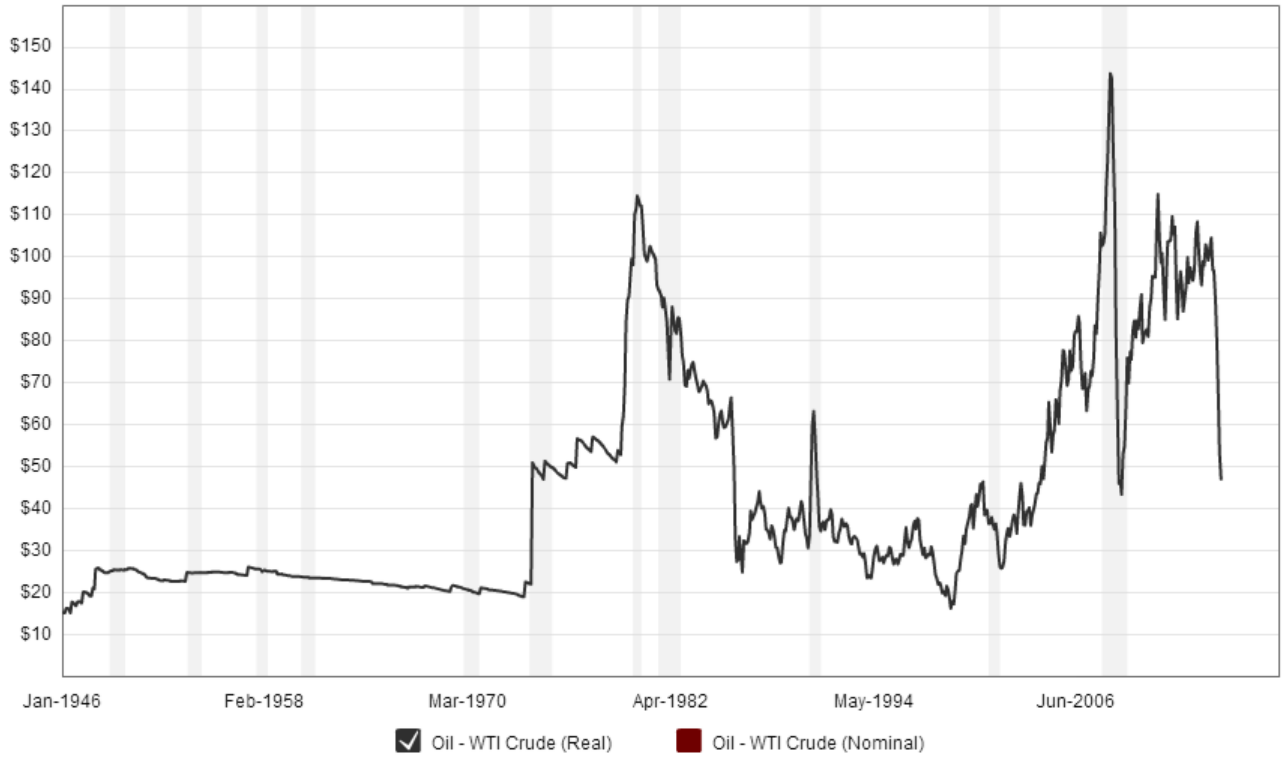
CRISIS | Según estimaciones del Partido Popular

Sanidad tendrá un recorte de 7.000 millones y Educación de 3.000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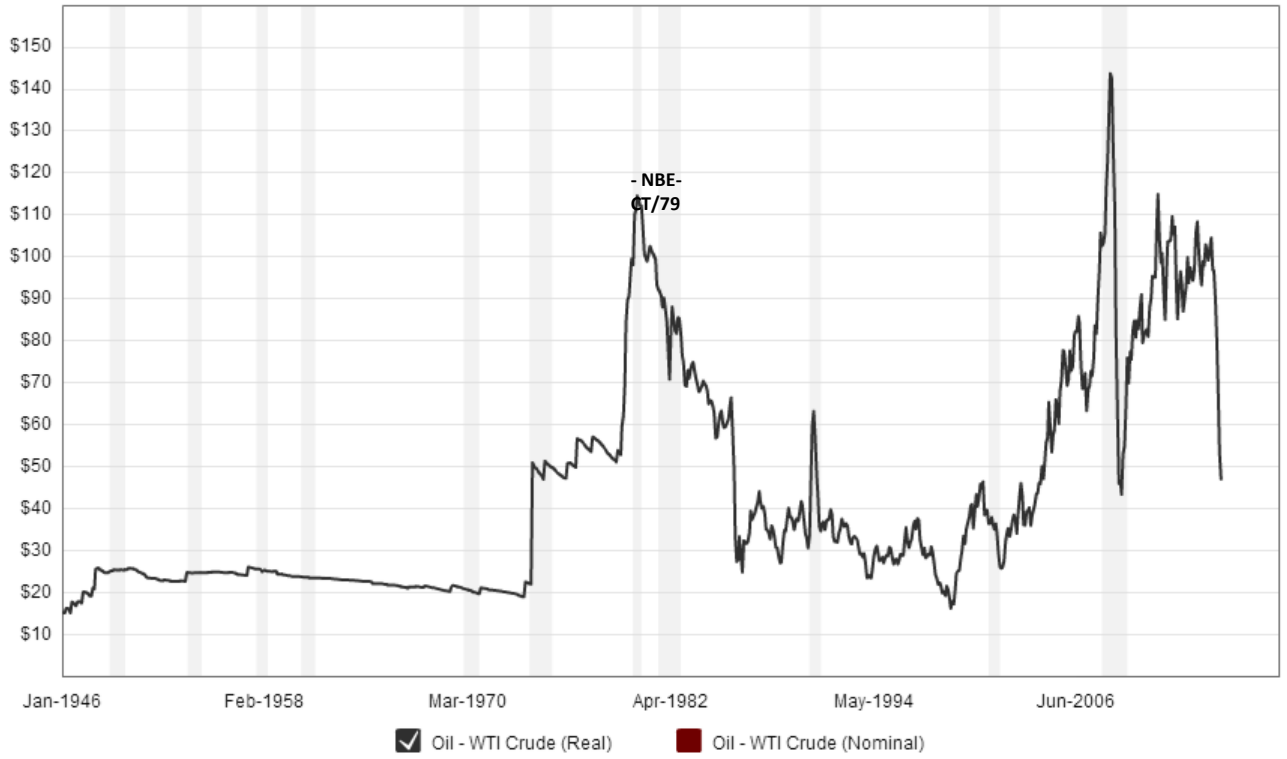
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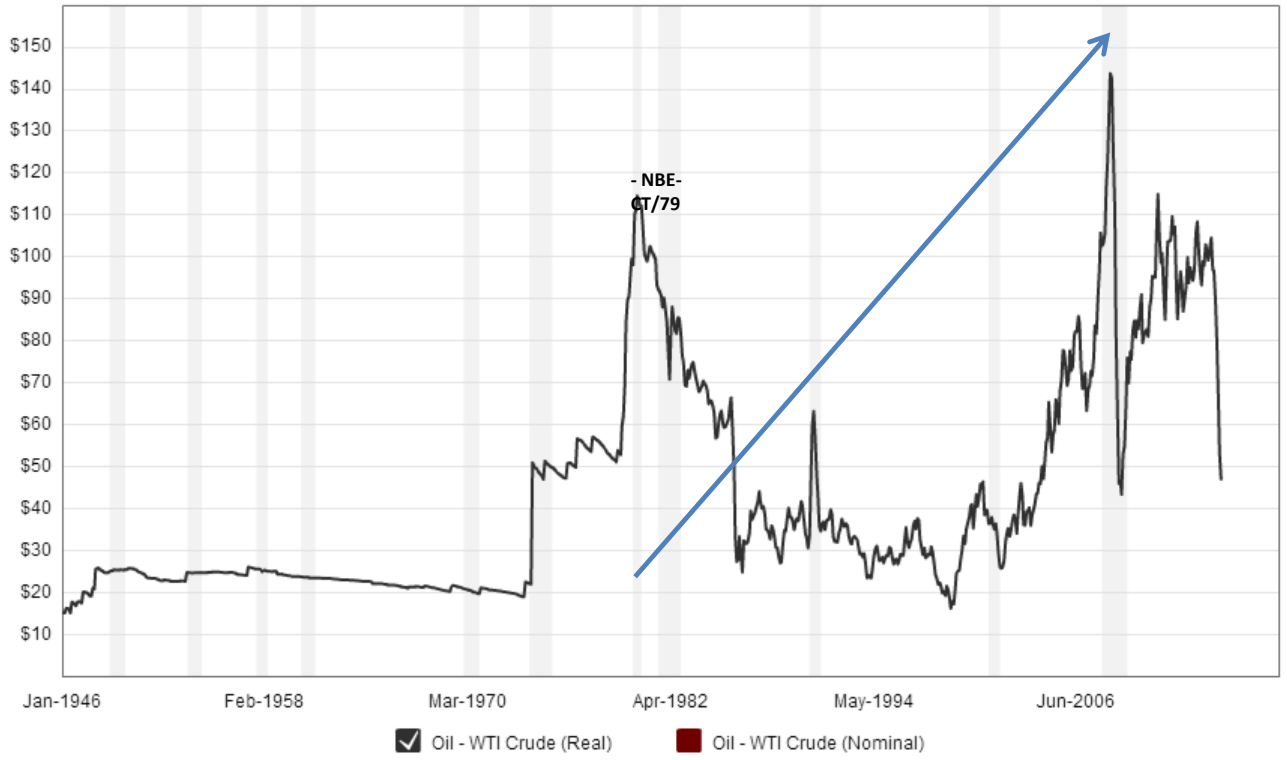
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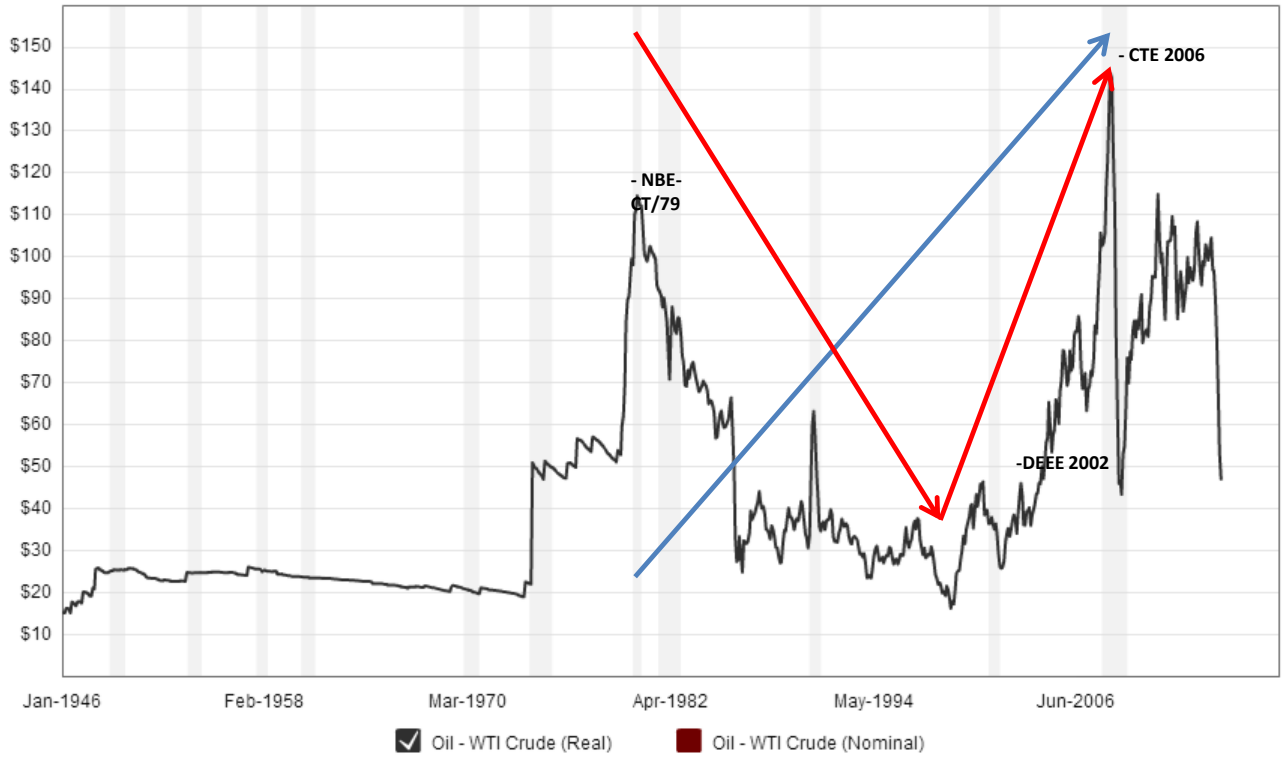
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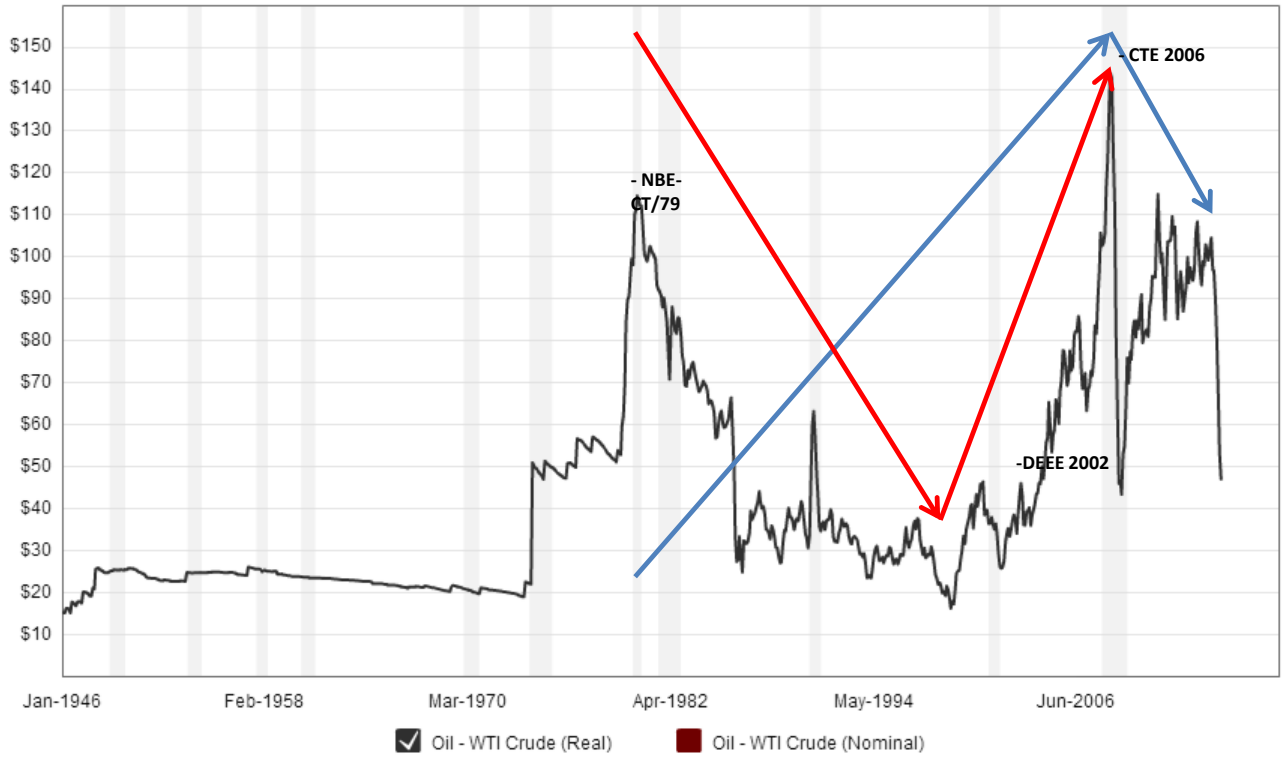
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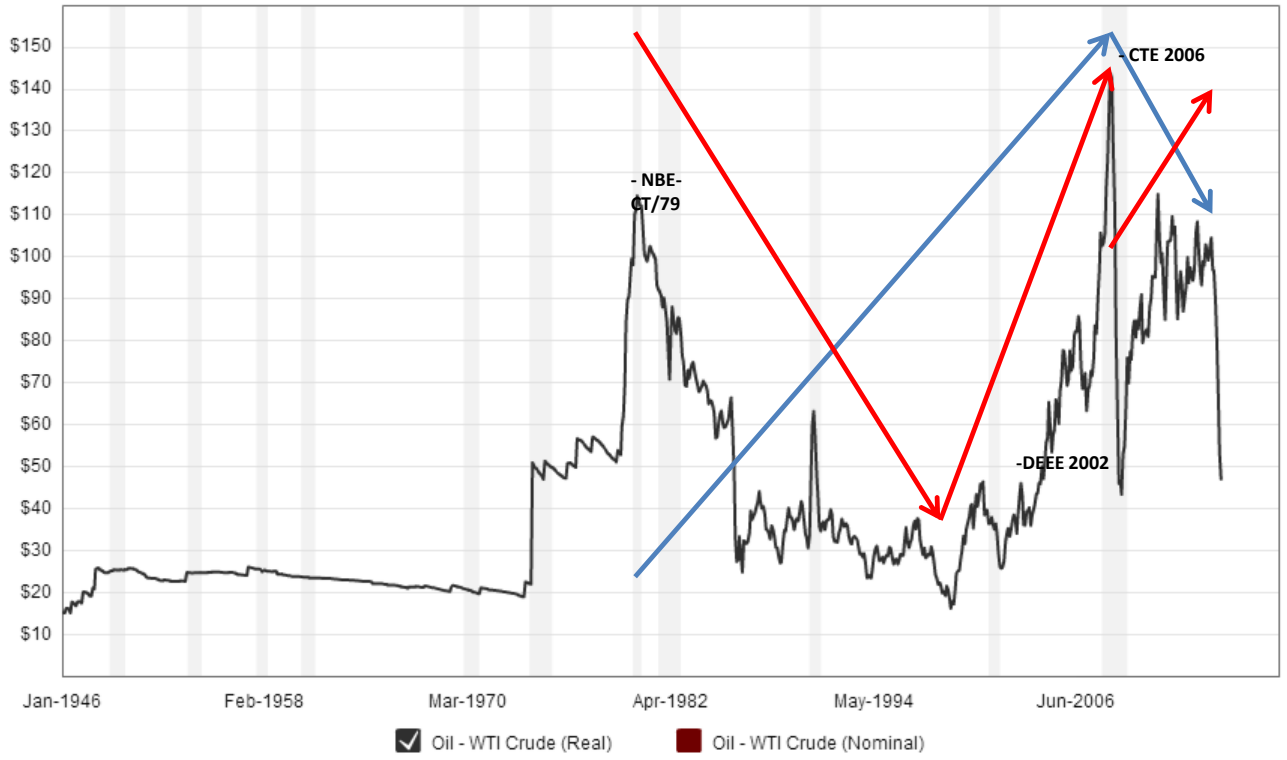
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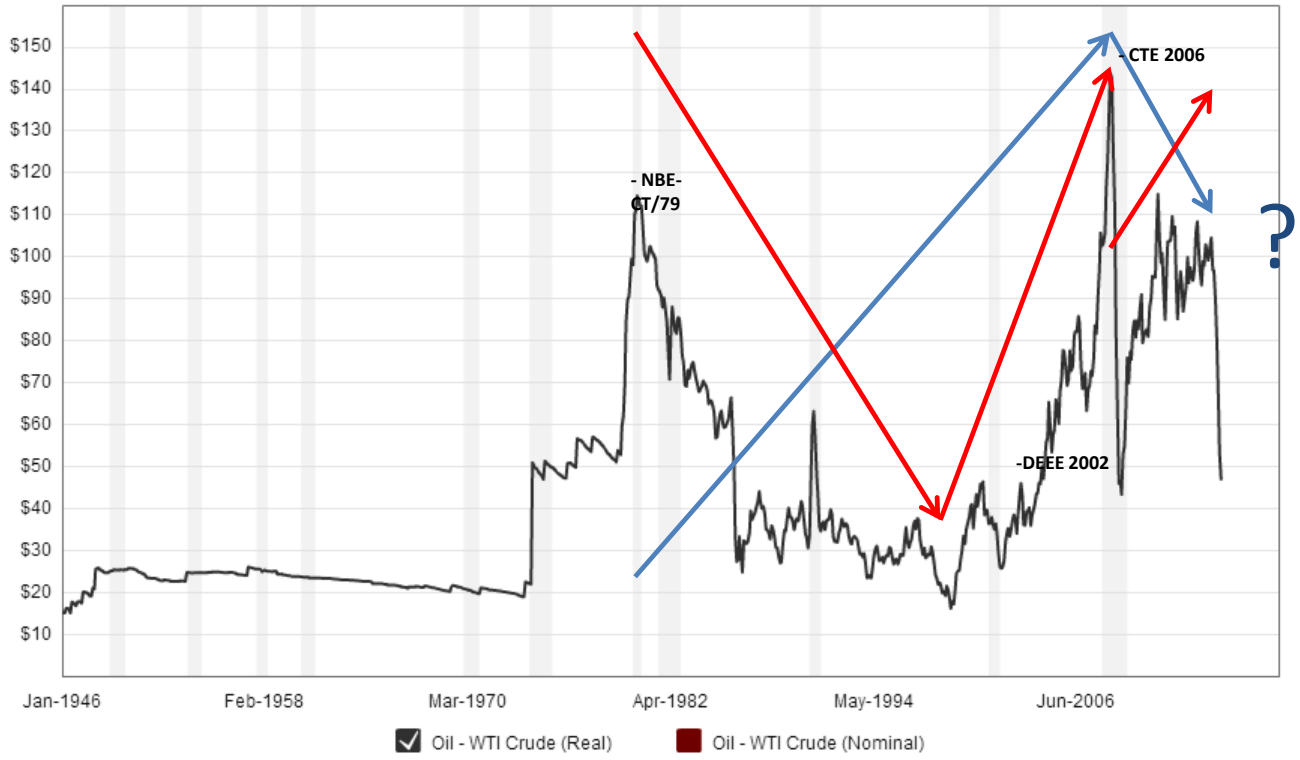
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Oil - WTI Crude (Real)
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¿QUE ES LA POBREZA ENERGETICA?

Asociación de Ciencias Ambientales ACA

Una combinación de ingresos bajos, precios de la energía doméstica en aumento y deficientes niveles de eficiencia energética en viviendas

Puede decirse que un hogar está en situación de pobreza energética cuando es incapaz de pagar una cantidad de servicios de la energía suficiente para la satisfacción de sus necesidades domésticas y/o cuando se ve obligado a destinar una parte excesiva de sus ingresos a pagar la factura energética de su vivienda.

Originalmente, la pobreza energética fue definida en el Reino Unido por Brenda Boardman a principios de la década de 1990 como la "incapacidad [para un hogar] de obtener una cantidad adecuada de servicios de la energía por el 10% de la renta disponible". Esta definición se ha vinculado posteriormente, también en el Reino Unido, a la satisfacción de un régimen térmico de la vivienda adecuado (21 ºC en la sala de estar y 18 ºC en el resto de estancias). Sin embargo, aunque la noción de pobreza energética se asocia comúnmente al uso de energía para calefacción, **otras demandas de energía (electrodomésticos, agua caliente, etc.) también deben ser tenida en cuenta**. Esto es relevante en el caso de que también se quiera incluir dentro del concepto de pobreza energética la incapacidad de un hogar de mantener la vivienda a una temperatura adecuada en verano por medio de, por ejemplo, sistemas de aire acondicionado.

	Pobreza	Pobreza Severa
Renta media Equivalente	13.523,70 €	13.523,70 €
Umbral de pobreza	8.114,22 €	4.057,11 €
Renta disponible para energía (12,3% max)	998,05 €	499,02 €

Tabla 2. Deducción de la renta disponible para energía a partir de la renta media equivalente. Elaboración propia.

Reparto consumo según I.D.A.E SPAHOUSEC				Gasto anual		Vector Energético
Uso Energético	%	kWh·any	kWh/m2	Euros año TOTAL Edificio	Euros / m2	
Equipamiento + iluminación	44,0%	1281,17	18,30	316,69 €	4,52 €/m2	Electricidad
ACS (sin aporte solar)	34,7%	1011,11	14,44	119,30 €	1,70 €/m2	Gas Natural
Calefacción	0,0%	0,00	0,00	- €	0,00 €/m2	
Refrigeración	0,0%	0,00	0,00	- €	0,00 €/m2	
Cocción	21,2%	617,72	8,82	152,69 €	2,18 €/m2	Electricidad
Totales	100%	2.910,00	41,57	588,68 €	8,41 €/m2	

Tabla 12. Estimación de consumo mínimo de usos no asociados al confort para edificios existentes. Elaboración propia

	Coste acondicionamiento (€/m²)					
	A-B	B-C	C-D	D-E	E-F	F-G
A3	0.6	1.9	3.7	5.0	11.2	12.4
A4	0.8	2.3	4.4	6.0	12.8	14.2
B3	1.0	2.5	4.8	6.8	13.7	15.1
B4	1.4	3.0	5.4	7.5	15.4	17.0
C1	1.4	2.9	5.0	7.3	14.4	16.5
C2	1.3	3.1	5.5	8.7	16.6	18.9
C3	1.8	3.7	6.6	9.5	18.8	20.7
C4	2.1	4.2	7.3	10.5	20.4	23.2
D1	2.7	4.7	7.6	10.7	20.9	24.7
D2	2.6	4.8	8.1	11.9	22.9	27.1
D3	3.0	5.5	9.0	13.0	25.1	28.6
E1	3.6	6.1	9.6	13.8	27.4	32.3

Tabla 14. Costes en/m²·a para las diferentes zonas climáticas de España. En rojo las zonas climáticas en las que los usuarios tendrían constes superiores a los 5,85/m²·a

	Coste acondicionamiento (€/m²)					
	A-B	B-C	C-D	D-E	E-F	F-G
A3	0.3	0.8	1.5	2.0	4.5	5.0
A4	0.3	0.9	1.8	2.4	5.2	5.7
B3	0.4	1.0	1.9	2.7	5.5	6.1
B4	0.6	1.2	2.2	3.0	6.2	6.8
C1	0.6	1.2	2.0	2.9	5.8	6.7
C2	0.5	1.2	2.2	3.5	6.7	7.6
C3	0.7	1.5	2.7	3.8	7.6	8.3
C4	0.8	1.7	3.0	4.2	8.2	9.4
D1	1.1	1.9	3.0	4.3	8.4	10.0
D2	1.0	1.9	3.2	4.8	9.2	10.9
D3	1.2	2.2	3.6	5.2	10.1	11.5
E1	1.5	2.5	3.9	5.6	11.0	13.0

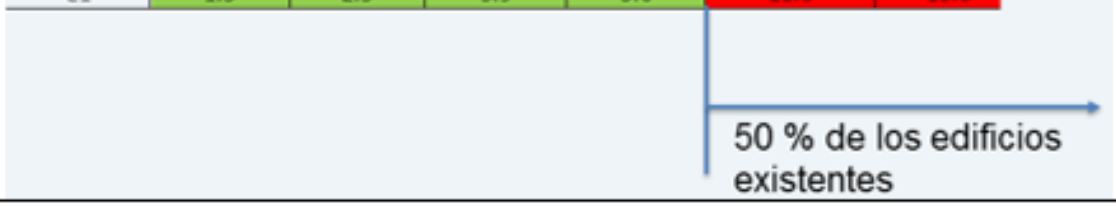


Tabla 19. Resultados obtenidos con la combinación de los 2 escenarios propuestos: reducción del factor de uso y ampliación de la banda de confort.

¿Es habitable una vivienda que puede causar daños a sus usuarios en función de su nivel de rentas y del precio de la energía?

DIRECTIVA 2010/31/UE DEL PARLAMENTO EUROPEO Y DEL CONSEJO

de 19 de mayo de 2010

relativa a la eficiencia energética de los edificios

Artículo 2

Definiciones

A efectos de la presente Directiva se entenderá por:

1) «edificio»: construcción techada con paredes en la que se emplea energía para acondicionar el ambiente interior;

2) «edificio de consumo de energía casi nulo»: edificio con un nivel de eficiencia energética muy alto, que se determinará de conformidad con el anexo I. La cantidad casi nula o muy baja de energía requerida debería estar cubierta, en muy amplia medida, por energía procedente de fuentes renovables, incluida energía procedente de fuentes renovables producida *in situ* o en el entorno;

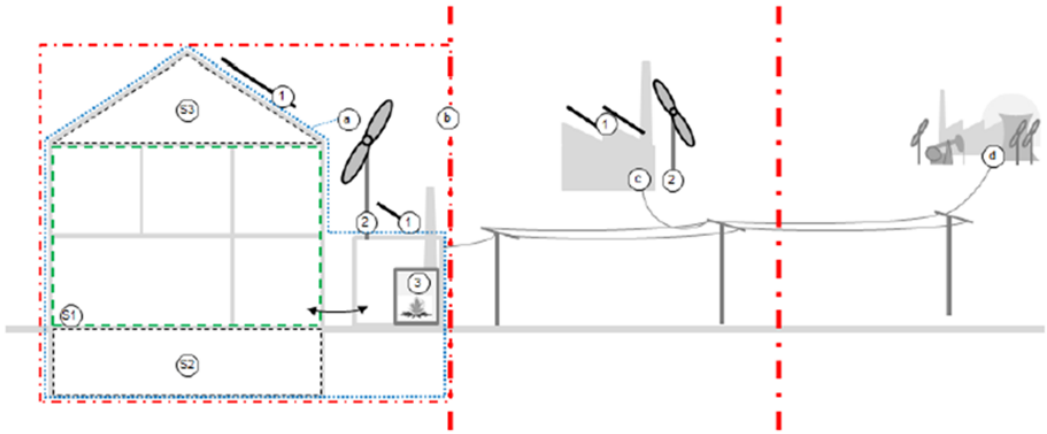
Artículo 9

Edificios de consumo de energía casi nulo

1. Los Estados miembros se asegurarán de que:

a) a más tardar el 31 de diciembre de 2020, todos los edificios nuevos sean edificios de consumo de energía casi nulo, y de que

b) después del 31 de diciembre de 2018, los edificios nuevos que estén ocupados y sean propiedad de autoridades públicas sean edificios de consumo de energía casi nulo.



Key

a	Assessment boundary (use energy balance)	S1	Thermally conditioned space	1	PV
				2	Wind
b	On-site	S2,	Space outside thermal envelope		
c	Nearby	S3	Boiler room		
d	Distant				

Figure 1 — Perimeters and assessment boundaries

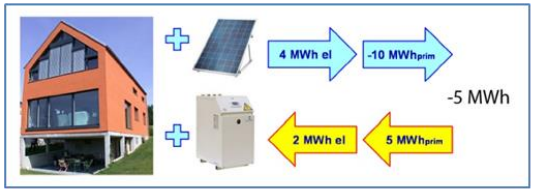
Table M.1 — Example illustrating the CEN proposal in FprEN 15603:2014 for nZEB rating

Calculation direction →			→
1st requirement	**2nd requirement**	**3rd requirement**	**Final nZEB Rating**
Build. fabric	Tech. Build. systems + related energy carrier **only nearby, distant!!**	Renewable source **on-site, nearby, distant**	Compensation by exporting **on-site, nearby, distant**
Energy needs [1)]	**Total primary energy use** $f_{P,tot}$ [2)]	**Non-renew. Prim.Energy** $f_{P,nren}$ [2)]	**Tot + nren. Prim.energy** $f_{P,nren}$, k_{exp} [3)]

Balance de energía eléctrica: debate sobre la compensación en la evaluación energética

¿Se puede compensar la energía suministrada por un portador de energía con la exportada por otro?

¿Podría tenerse en cuenta la energía exportada en exceso de la utilizada en el edificio, obteniendo así un EP negativo?



Al compensar la energía suministrada con la exportada, ¿puede hacerse como un valor total anual, o debe tenerse en cuenta la sincronicidad?

REHABILITATION WORKING GROUP (GTR)

Coordinado por:

GBCe green building council españa

FUNDACIÓN CONAMA

	2020	2030	2050
Number of Homes Reformed (2012-year)	2.200.000	5.700.000	10.000.000
(% of 2001 Primary Residential Homes)	14%	35%	62%
Aggregate Investment in Housing (€ mm)	64.000 €	160.000 €	260.000 €
Cumulative Investment only in Energy Efficiency	42.667 €	106.667 €	173.333 €
Energy Saved in Year (GW*hr*)	21.000	47.000	68.000
Cumulative Energy Savings since 2012 (GWh)	77.000	440.000	1.6700.000
CO_2 Saved in Year ('000 *Tons*)	4.600	8.300	8.600
(% Reduc. vs 2001 Residential Homes (inc. other measures)	24%	49%	82%
Cumulative CO_2 savings from 2012 ('000 Tons)	19.000	89.000	26.000
Accumulated Savings Energy and CO_2 from 2012 (€ mm)	11.000 €	81.000 €	390.000 €
Jobs Sustained (Period Average)	130.000	170.000	120.000
Subsidy Cost per Job (average over period)	13,694 €	14.144 €	n/a

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Subsidy Cost per Job (average over period)	13,694 €	14.144 €	n/a

Membres del grup de recerca que han treballat aquests temes:

- Anna Pagès Ramon
- Joaquim Arcas Abella
- Marina Casals Tres

A no oblidar:

- l'edificació és clau a nivell mundial en el canvi de model energètic
- al nostre país, un parc edificat ineficient genera costos econòmics i, sobretot, costos socials
- la rehabilitació, amb objectius energèticament ambiciosos (nZEB), és una solució i, alhora, una imperiosa necessitat