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"EDIFICIOS DE CONSUMO DE ENERGÍA CASI NULO COMO CLAVE PARA COMBATIR EL CAMBIO CLIMÁTICO

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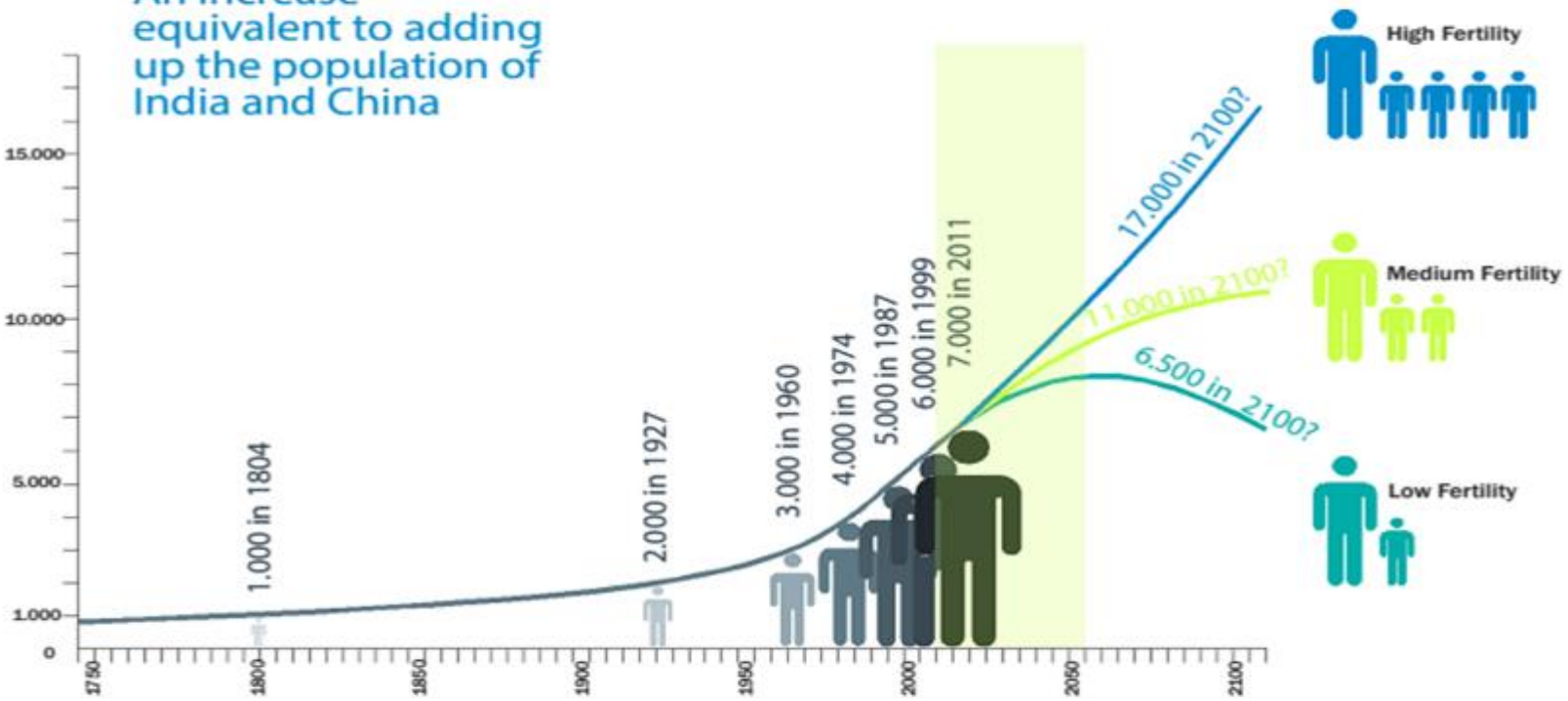
The building sector addresses the social demand for habitability in different socio-economic, cultural and environmental contexts … does it really solve it?

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

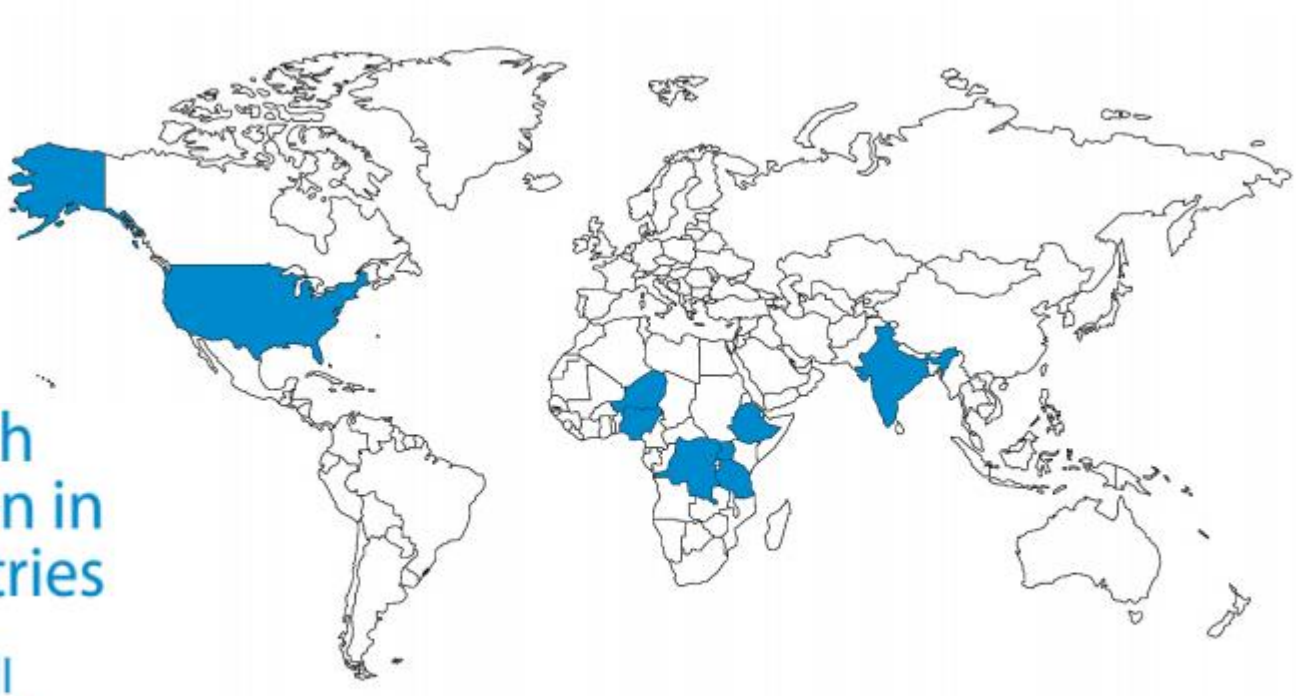


Evolution of world population (World, 1750-2100)

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

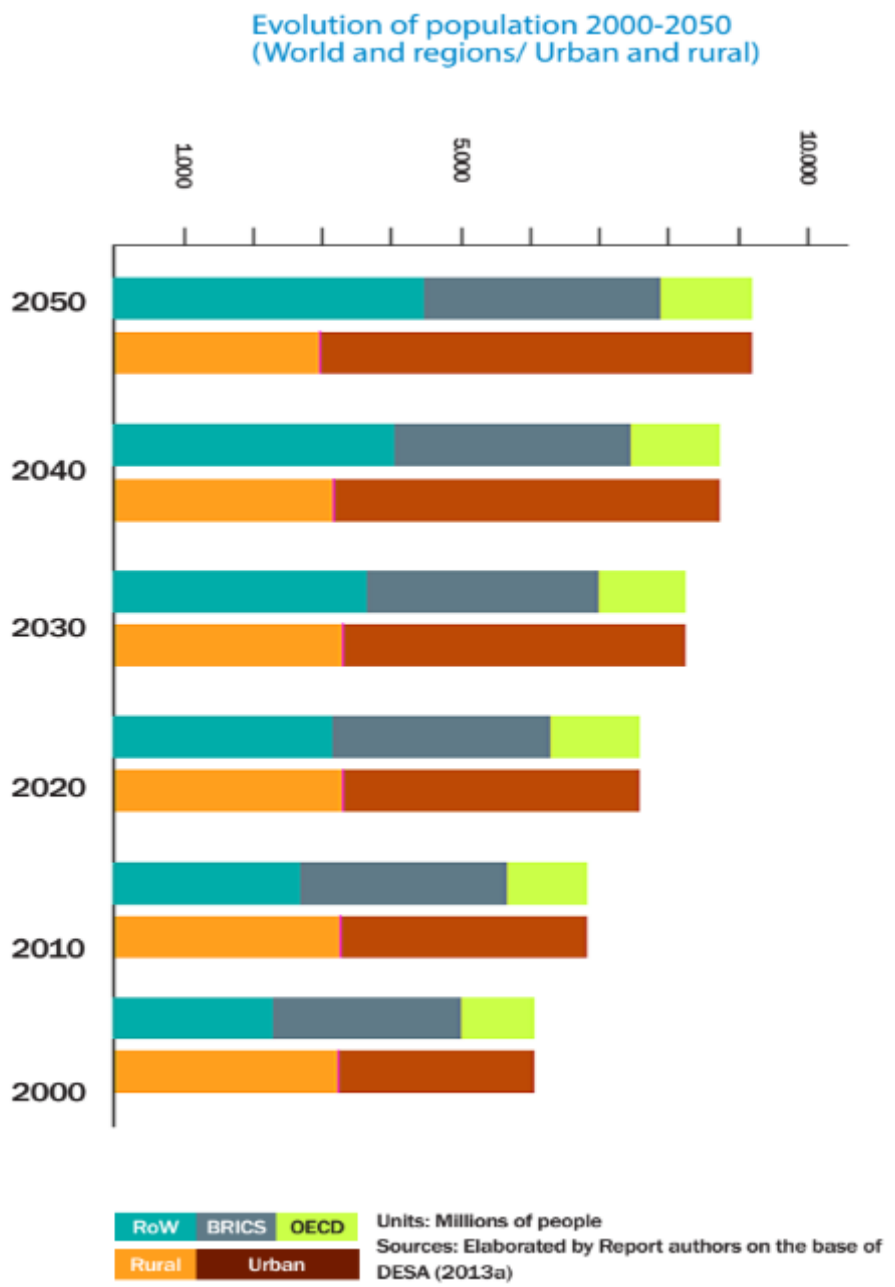
Notes: Medium fertility population projectiont *Urban population is bigger that rura population

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

And in cities

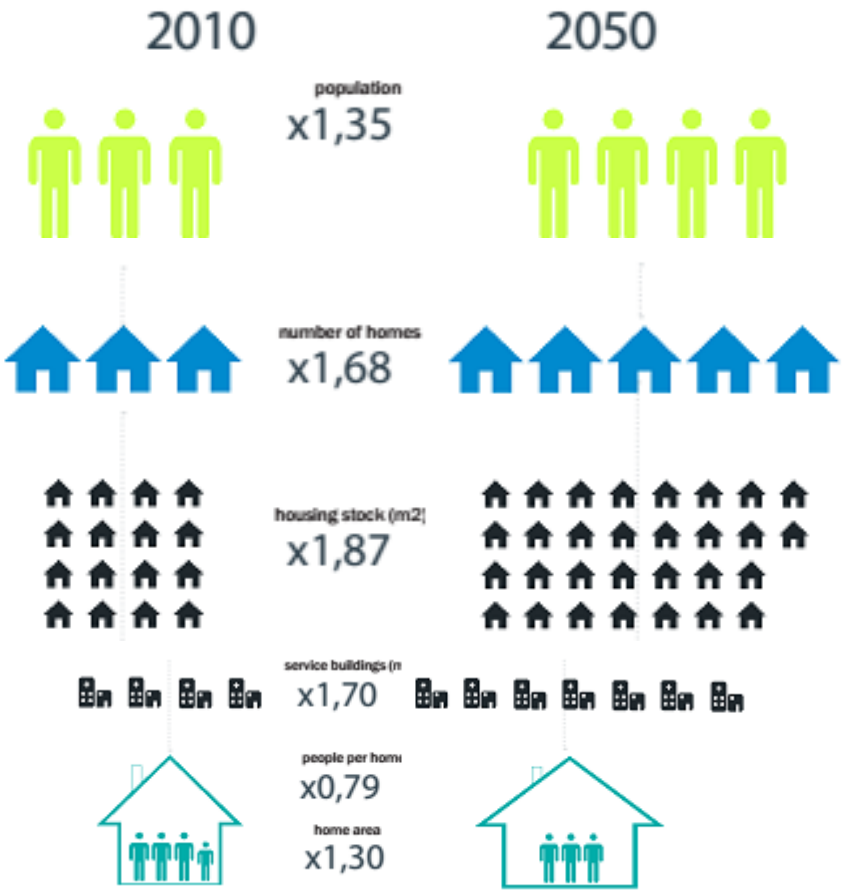
The whole population increase will happen in cities.

More than half of the global population already lives in cities. But future growth will almosts 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.



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.

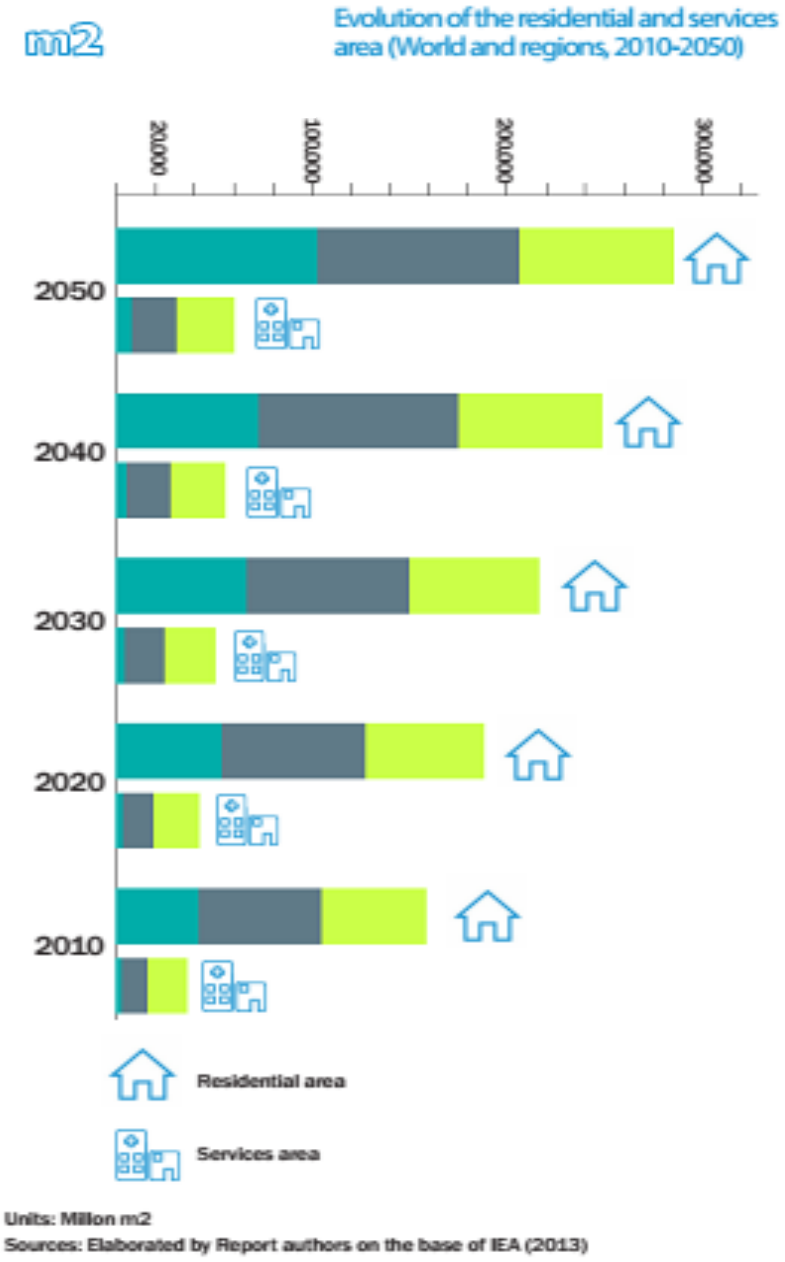
This new habitability is expected to produce homes with less dwellers.

Table 2 Evolution of habitability demand (World and regions, 2010 and 2050)

		sector			Residential sub-sector		Services sub-sector		
			2050 6DS		2010	2050 6DS	2010	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)



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

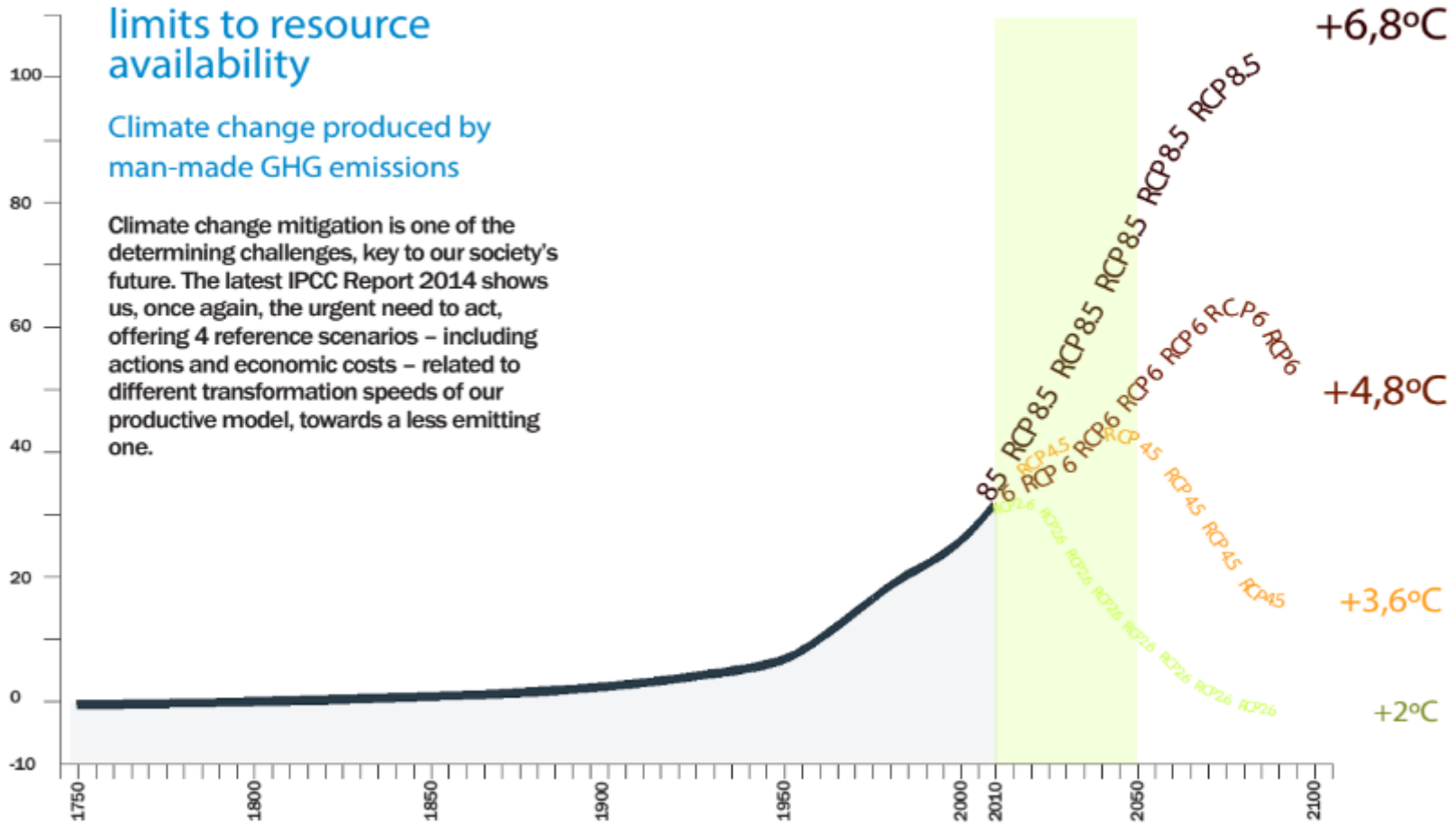
Units: EJ/year
Note: 6DS and 2DS are different scenarios defined by IEA
Sources: Elaborated by Report authors on the base of IEA (2013a)

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

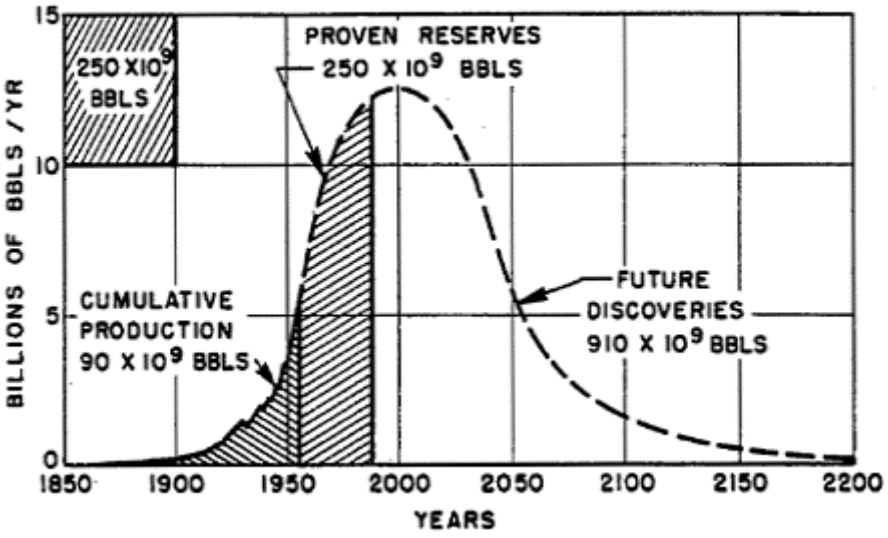
Sources: Elaborated by Report authors on the base of CDIAC (2010); IPCC (2014)

And also important local limitations: water, land, biodiversity

Decreasing availability of energy resources

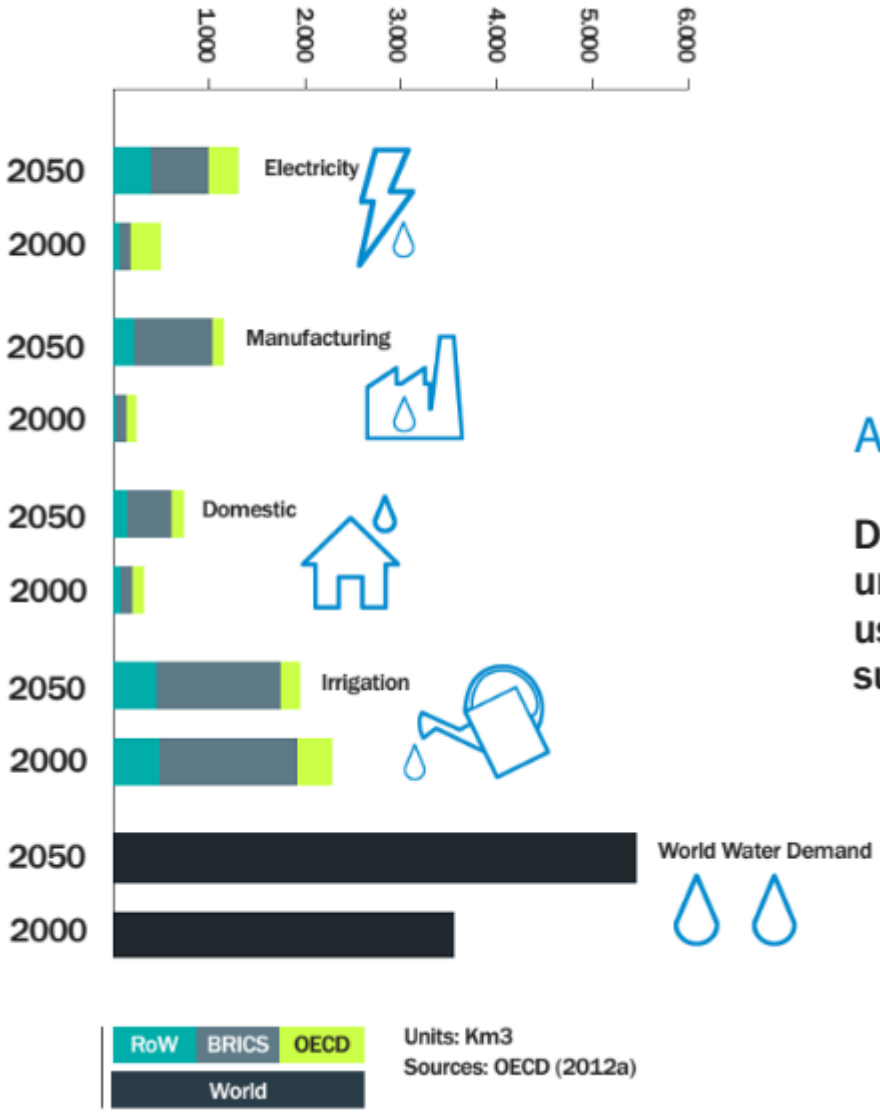
Concurrently with the climate crisis, we are also suffering a deep crisis centred on the availability of energy resources, key elements in the development of our industrial model.

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)

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



And also important local limitations: water, land, biodiversity

And building brings important local impacts

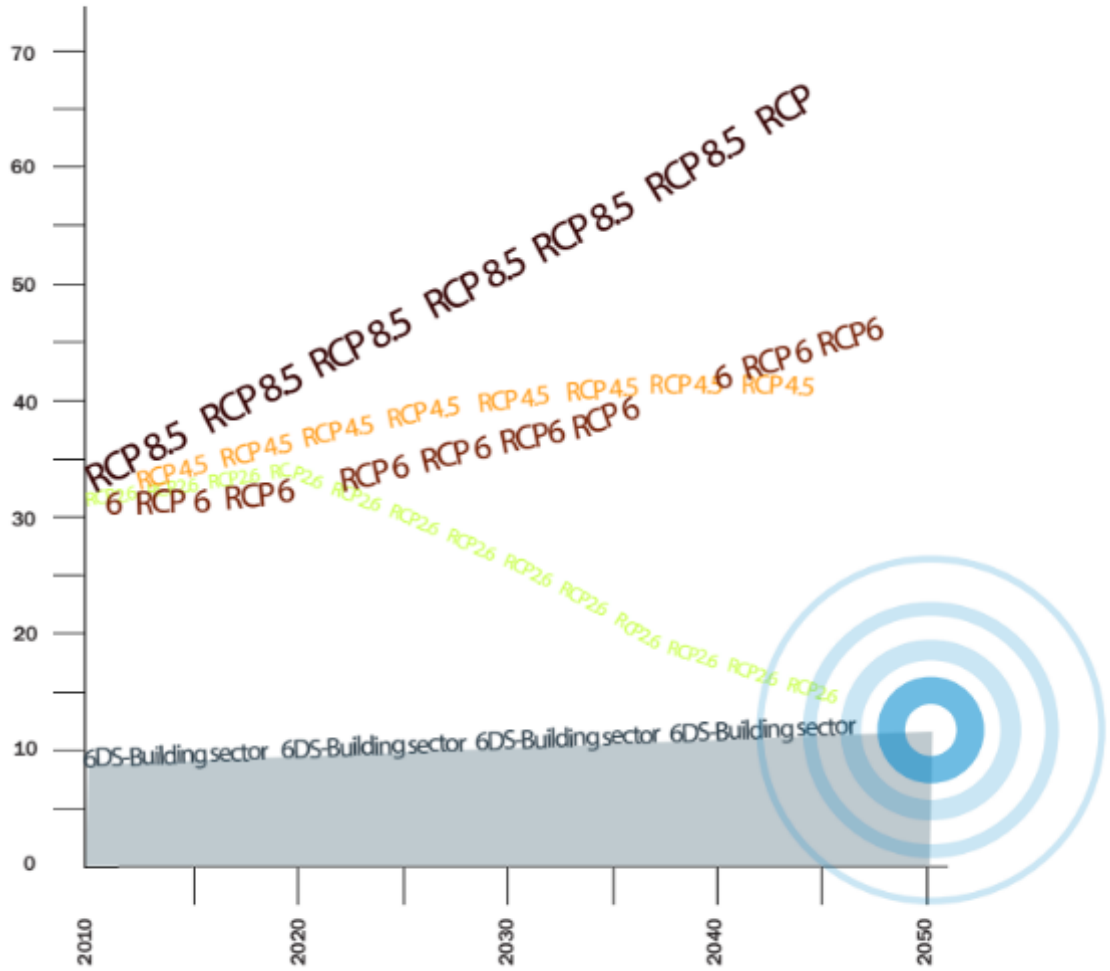
Demand for materials, construction processes, and urbanisation and local demand for resources to be used in buildings, result in important alterations to surrounding landscape, resources and ecosystems.

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

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.



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)

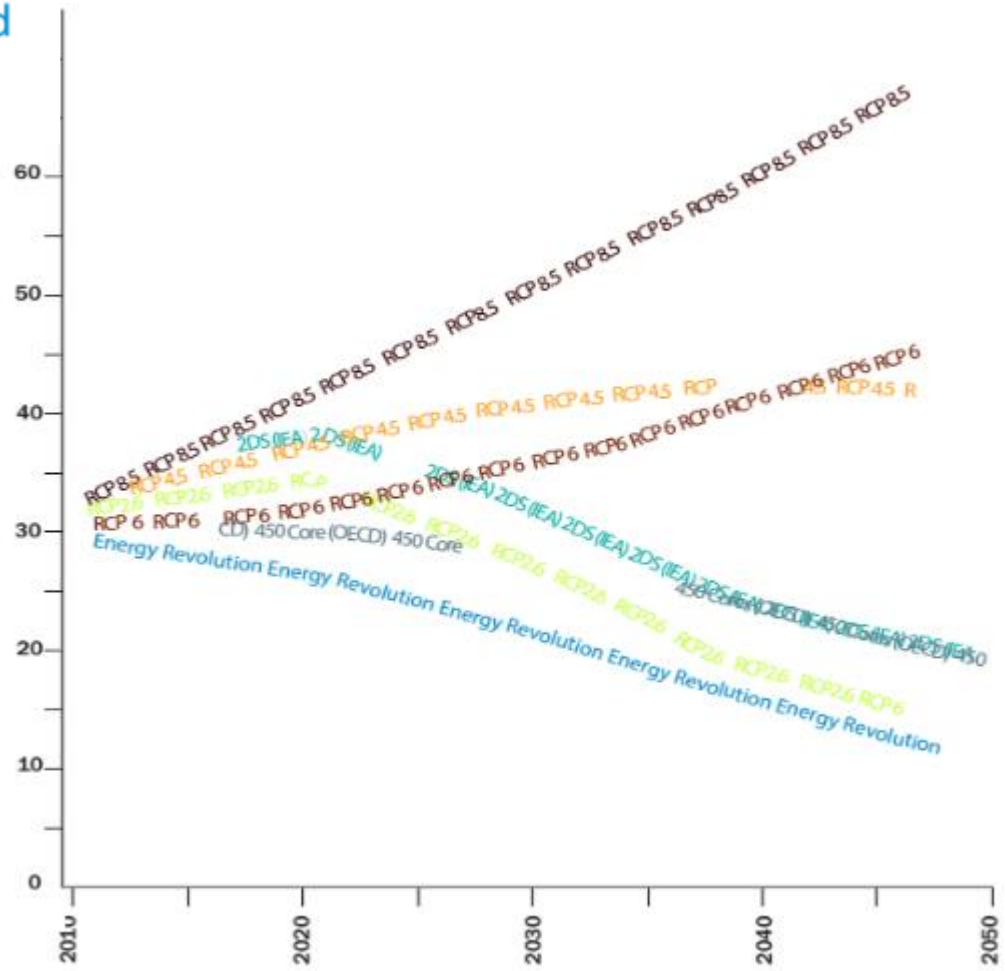
There are global plans to reach desirable reduced emission scenarios

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

Comparative chart between different international organisations' scenarios

		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)			

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

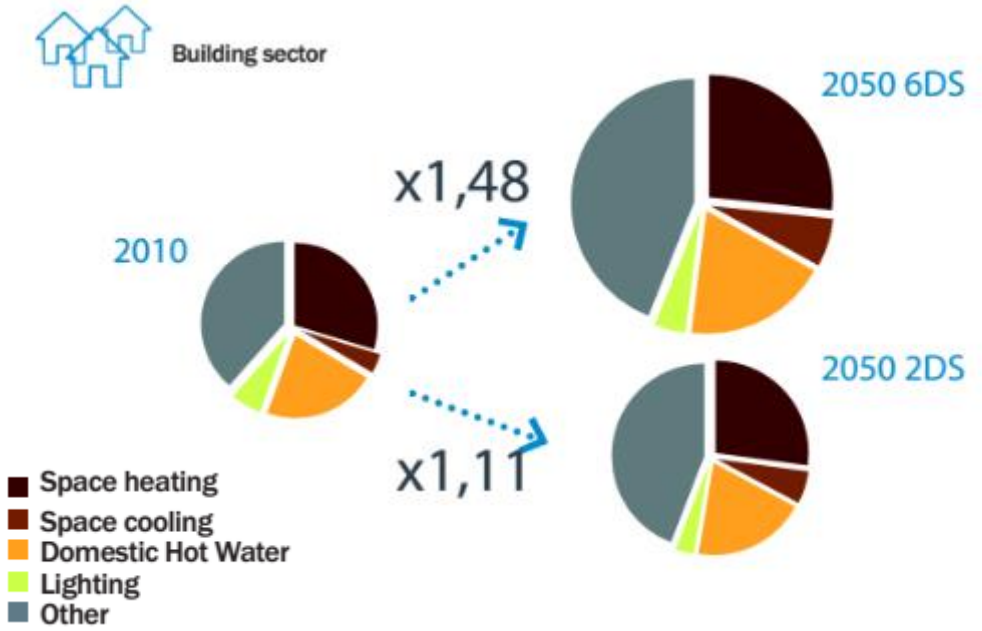
As the main energy resource of the change towards the new model. Improving efficiency in the use of energy in all sectors is possible if we use the technologies currently available, as well as by increasing efficiency on all scales.

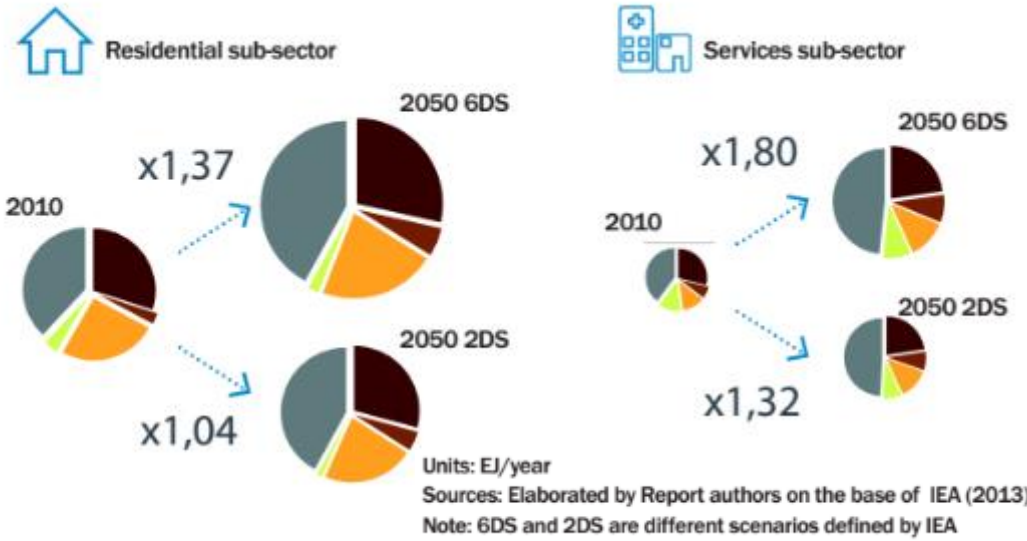
a change in our energy sources

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

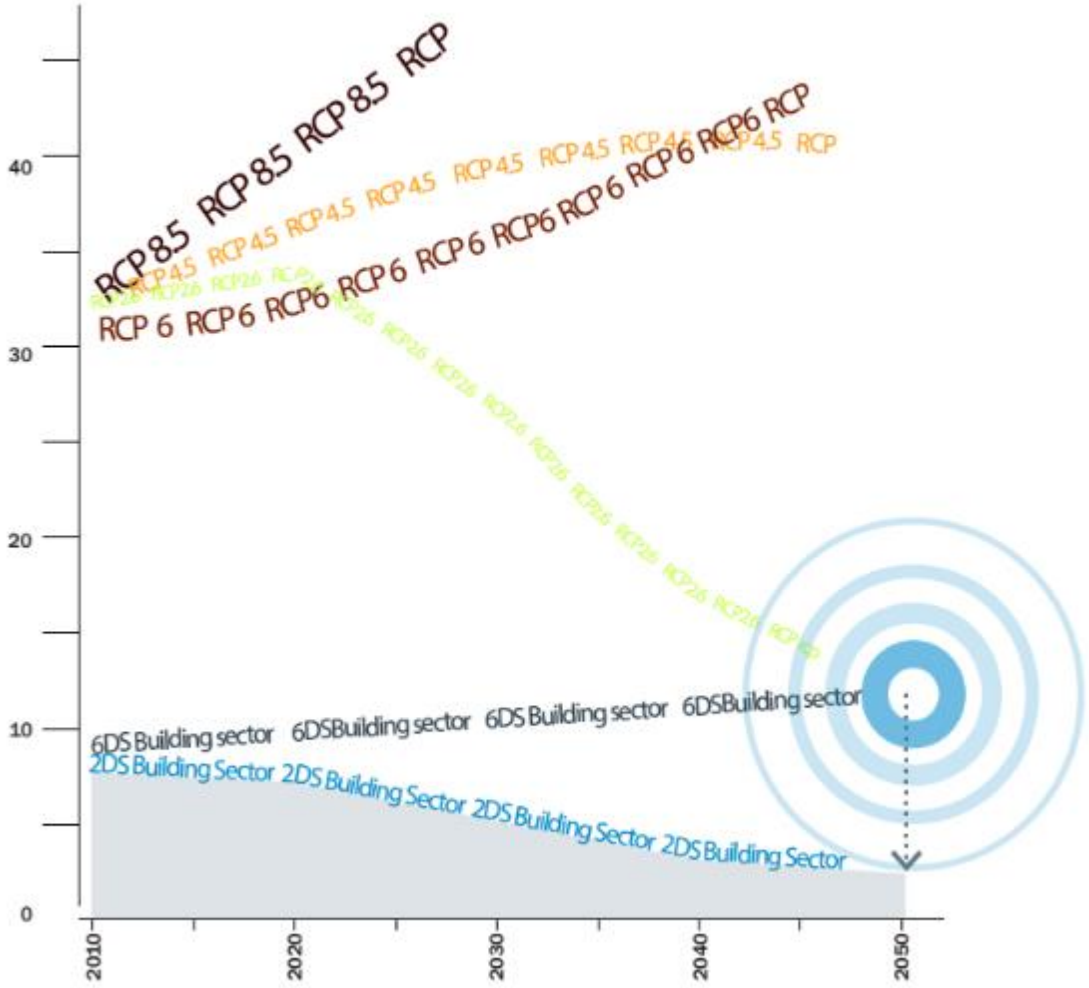
Sources: Elaborated by Report authors from IEA (2013a); IEA (2014a)

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)

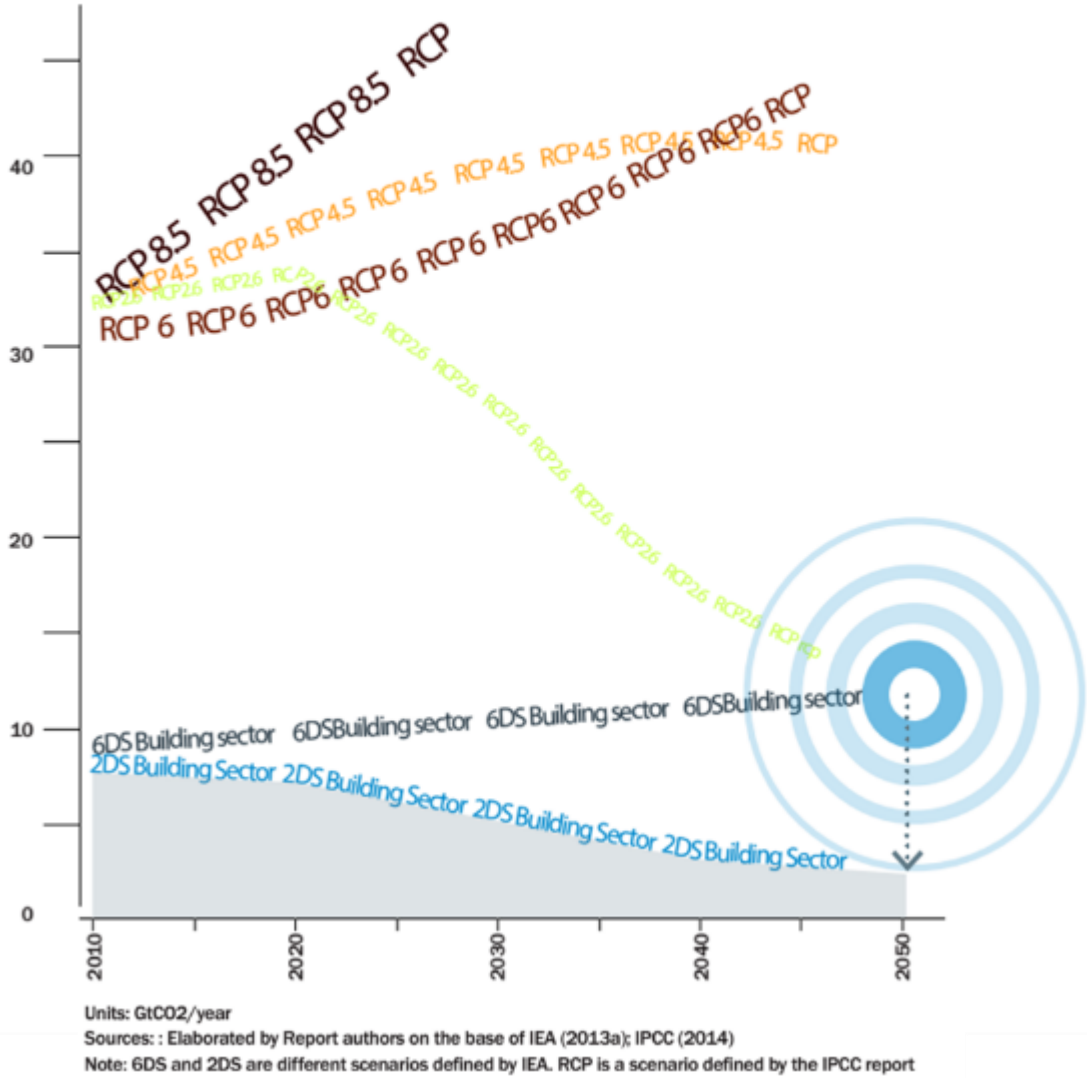


Units: GtCO2/year
Sources: : Elaborated by Report authors on the base of IEA (2013a); IPCC (2014)
Note: 6DS and 2DS are different scenarios defined by IEA. RCP is a scenario defined by the IPCC report

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

But environmental targets must be redefined continuously…

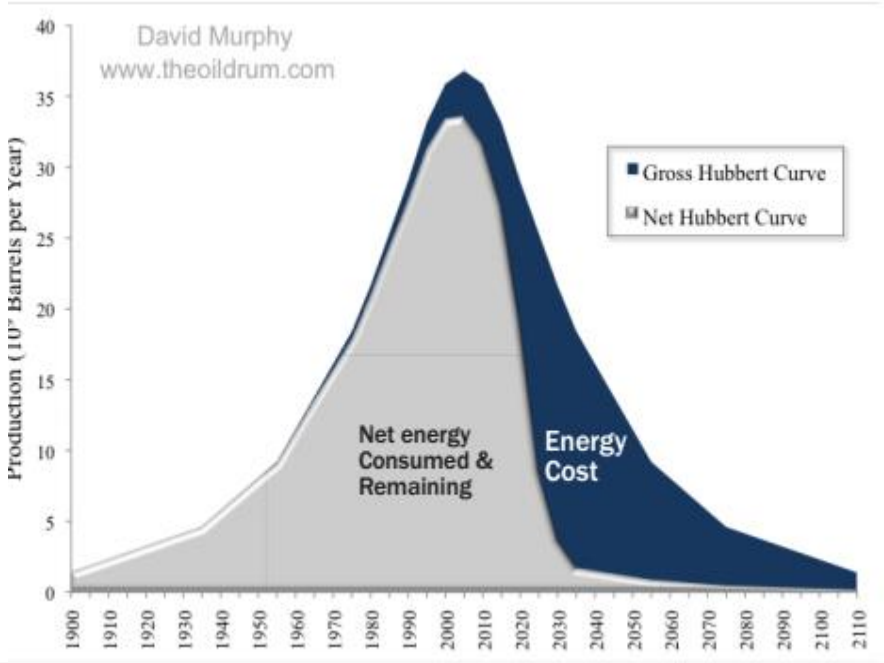
Some doubts and discussions over certain aspects, which must be taken into account when considering scenarios and their future evolution, persist.



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)

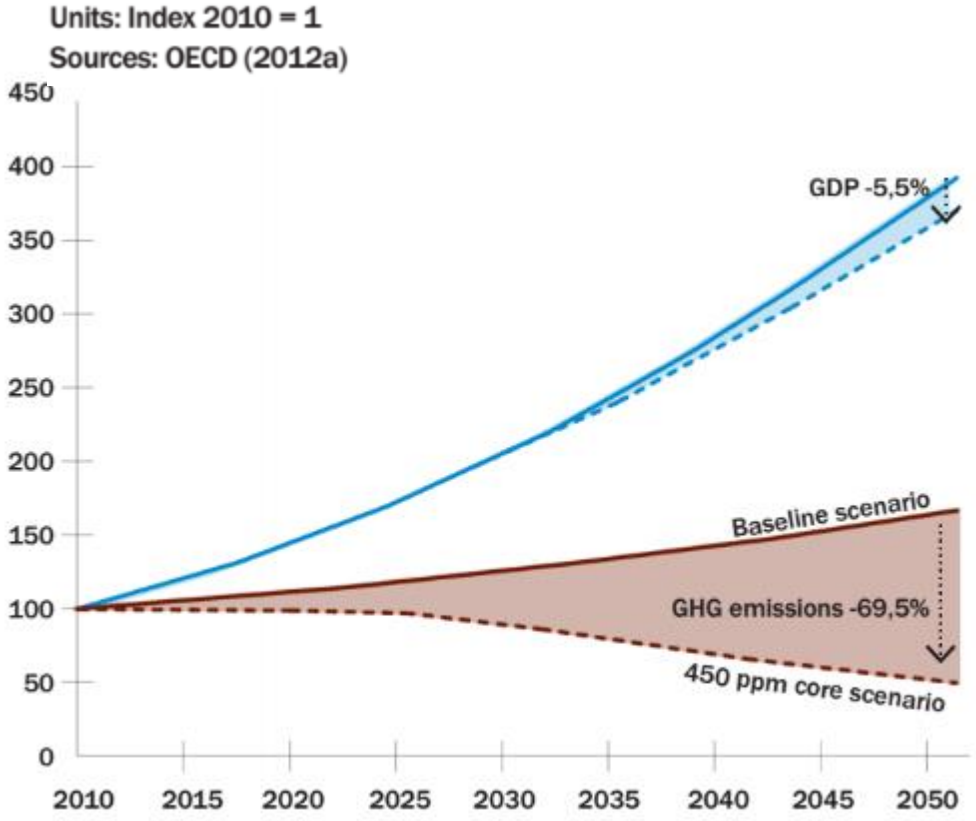
	IEA				Greenpeace			
	2010	%	2050	%	2007	%	2050	%
World			2DS				E[R]	
Fossil fuels	429,7	81%	294,3	43%	396,7	81%	190,8	31%
Oil	170,1	32%	110,0	16%	155,9	32%	81,8	13%
Coal	148,1	28%	72,9	11%	135,9	28%	37,6	6%
Natural gas	111,5	21%	111,4	16%	104,8	21%	71,4	12%
Nuclear	28,8	5%	74,0	11%	29,7	6%	0,0	0%
Renewables	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

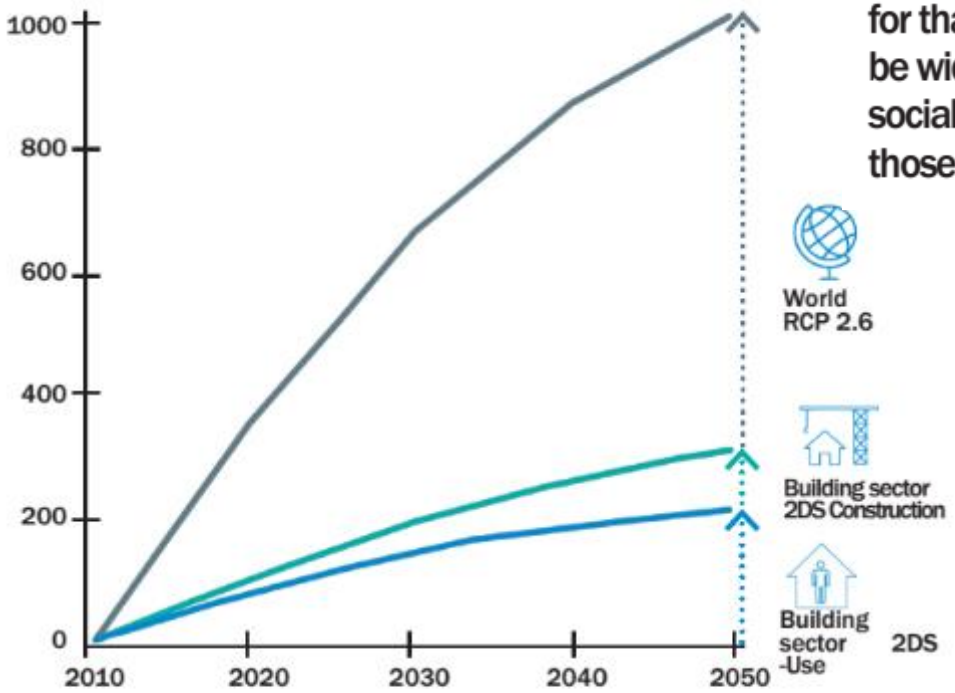
Most reference studies decouple GDP evolution from a change in the energy model, considering that it will vary very little for all the different climatic change mitigation scenarios. It is also possible that in the end this will not work exactly this way, with a much less homogeneous distribution between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

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



Embodied energy in construction materials

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)

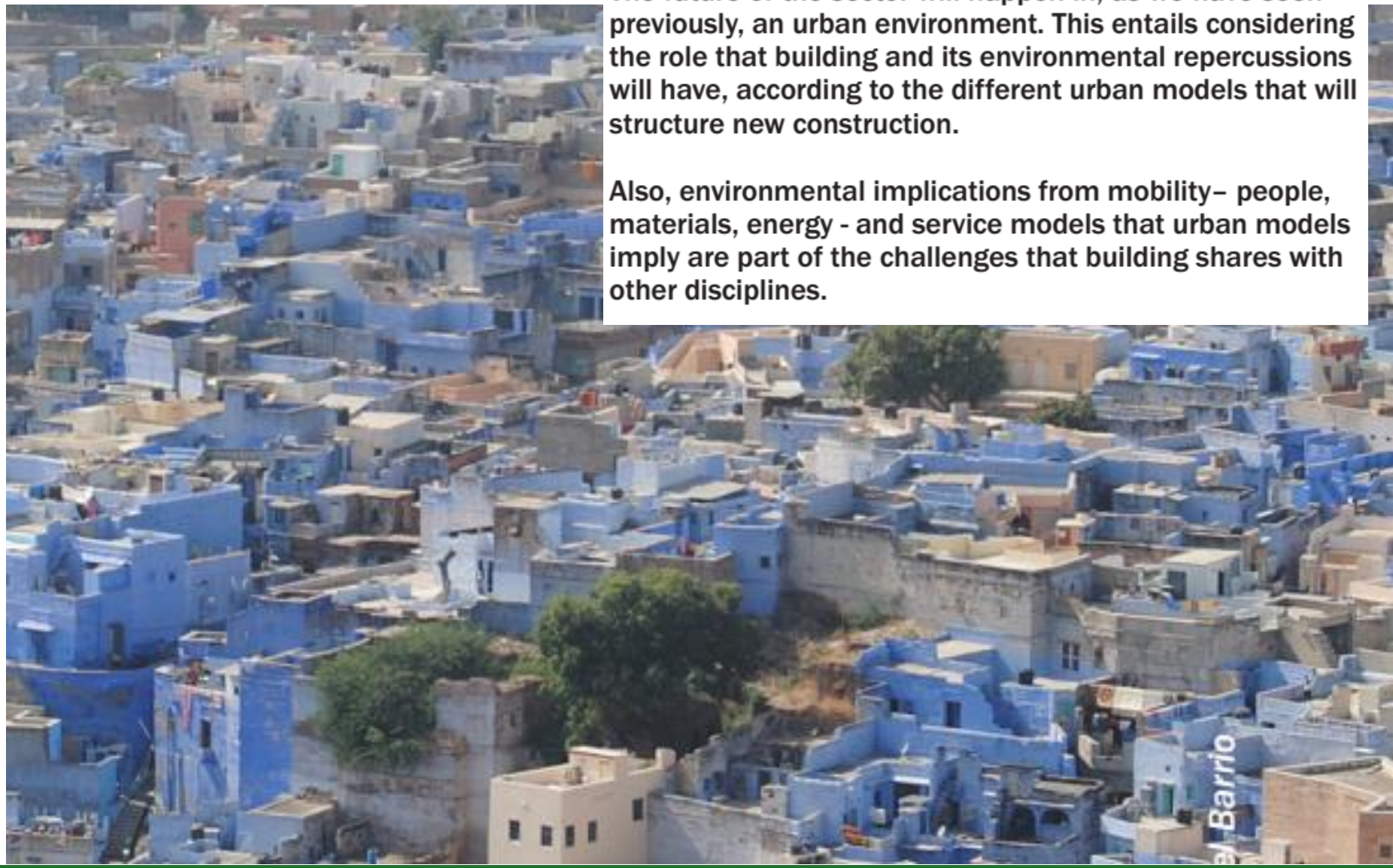
The building sector does not only demand energy to be used in buildings holding social activities. Manufacturing materials with which buildings are constructed implies using energy and generating emissions, amounting to a significant quantity.

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

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.



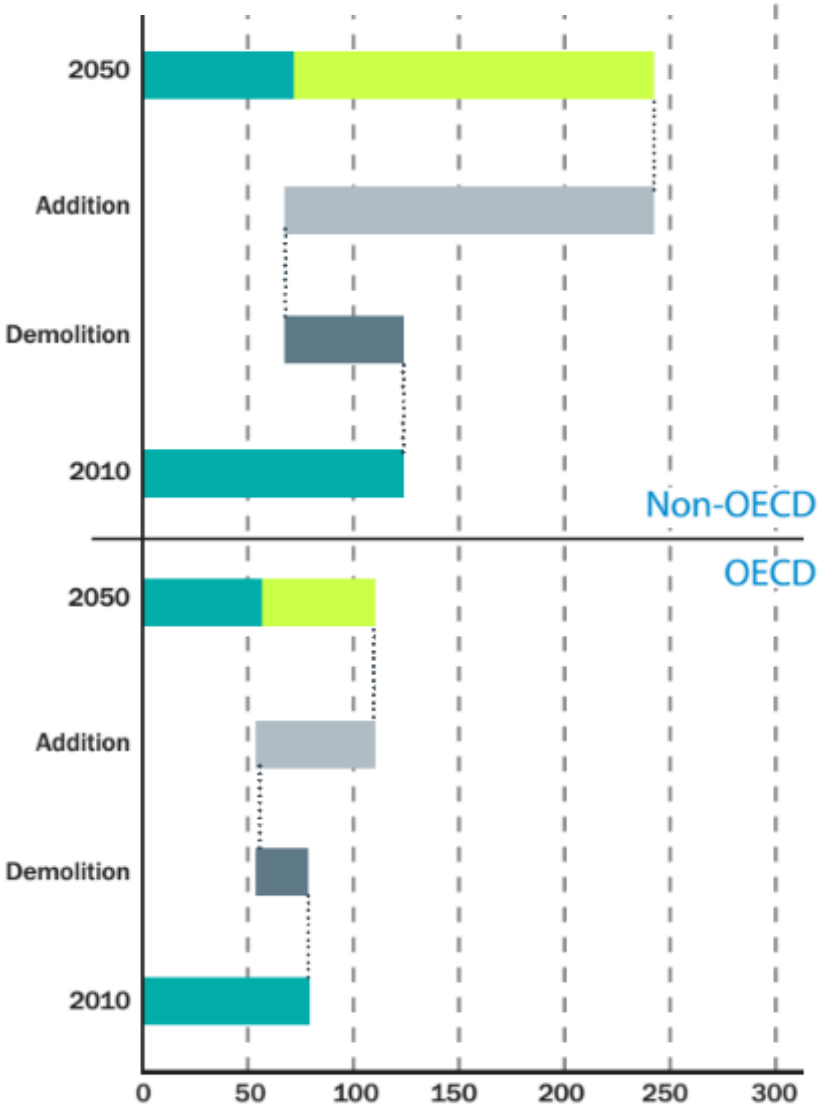
The building sector has different tasks in different regions

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



Al hilo de esta Visión Global, algunas preguntas sobre el nZEB que deberían ser resueltas:

- ¿deben considerarse la embodied energy y las emisiones implicadas en la fabricación de los materiales?

- ¿debe considerarse separadamente el estándar para edificios nuevos que para la edificación existente?

- ¿en qué forma la escala urbana debe ser contemplada en la definición del nZEB?

- ¿es posible definir el nZEB sobre un sector que supone directamente un tercio del consumo energético final del país sin afectar el conjunto del sistema energético nacional?

MUCHAS GRACIAS

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