

Contribution of the Spanish built environment to the climate change. Implication to legal frameworks

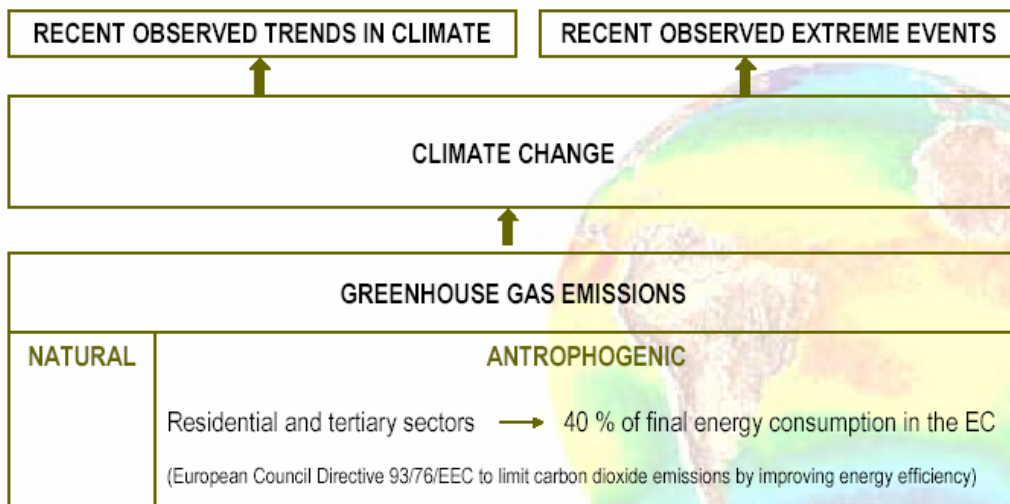
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Contribution of the Spanish built environment to the climate change. Implication to legal frameworks

INTRODUCTION



Introduction

Objective

Assessing the impact

Legal framework

Conclusions

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OBJECTIVE

To assess the impact of the Spanish built environment on climate change and the implication to legal frameworks

- Assessing the impact of the Spanish built environment on climate change
- Effectiveness gaps on the assessment of the impact of the Spanish built environment on climate change
- Legal framework
- Effectiveness gaps on current legal framework
- Conclusions and recommendations for policymakers

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ASSESSING THE IMPACT OF THE SPANISH BUILT ENVIRONMENT ON CLIMATE CHANGE

EUROPEAN UNION

Final energy consumption

471.7 Mtoe
(41.3% of the total EU-25 final energy use)

Greenhouse gas emissions

732 million tonnes of CO₂
(19.0% of the total EU-25 dioxide emissions)

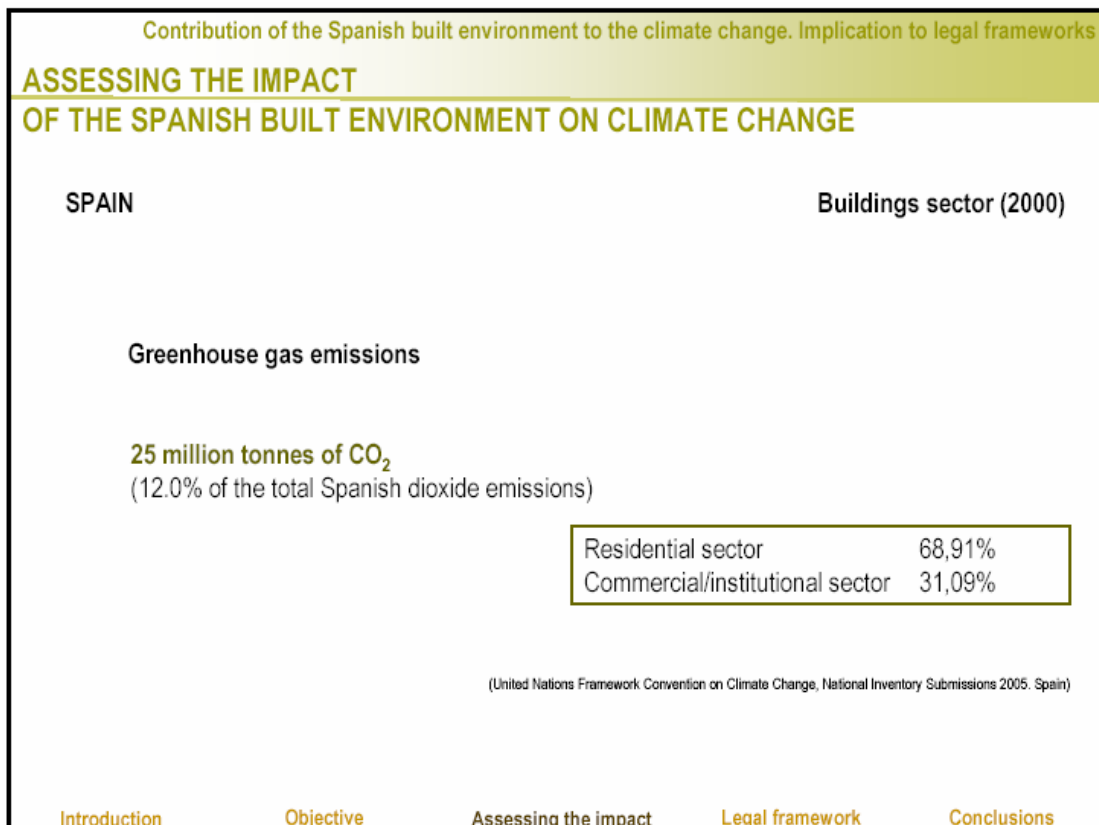
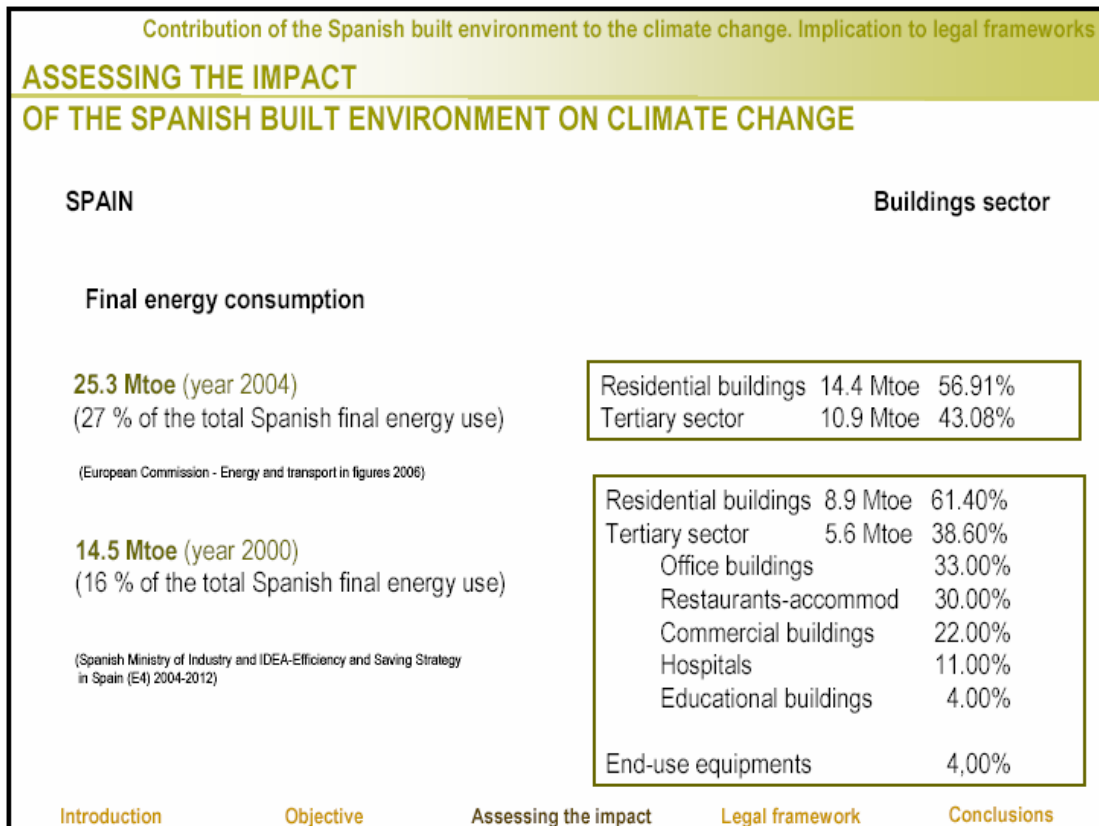
Buildings sector (2004)

Residential buildings	172.1 Mtoe	36.46%
Tertiary sector	299.7 Mtoe	63.53%

Residential buildings	470 million tn	64.20%
Tertiary sector	262 million tn	35.80%

(European Commission - Energy and transport in figures 2006)

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ASSESSING THE IMPACT OF THE SPANISH BUILT ENVIRONMENT ON CLIMATE CHANGE

CATALONIA **Residential sector (2005)**

Final energy consumption

2,16 Mtoe
(average energy consumption in a dwelling 7600 kWh/year.)

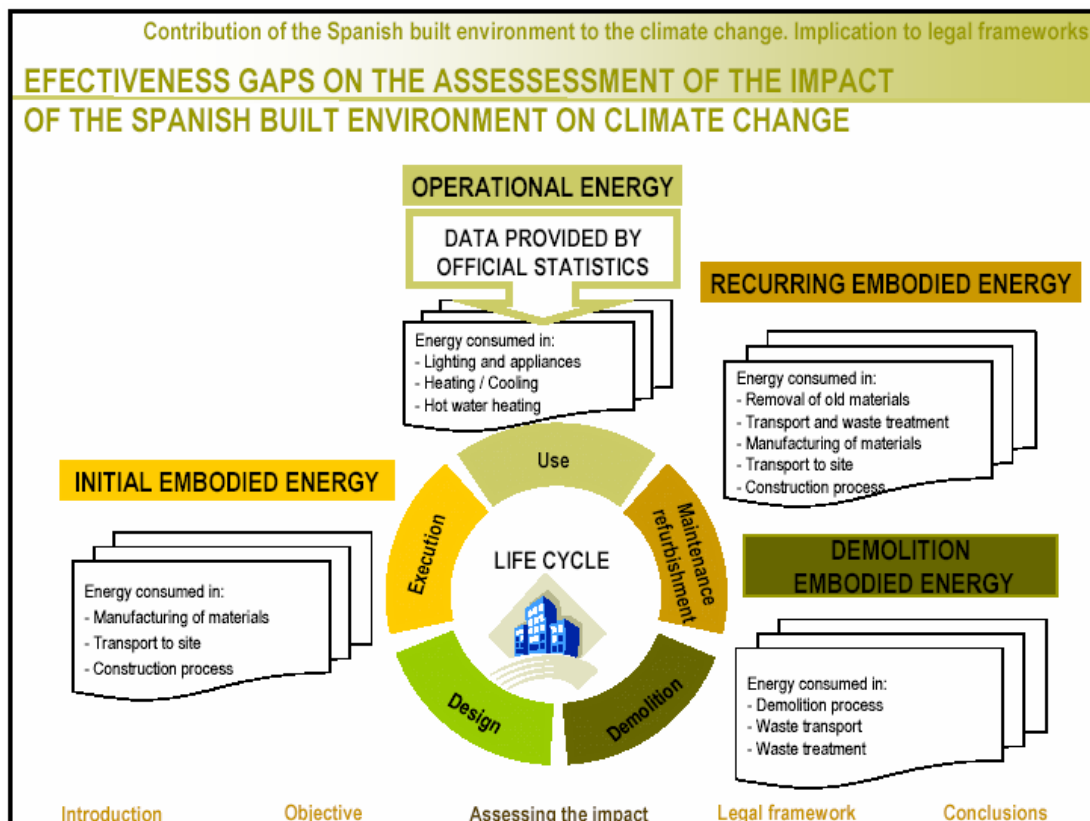
Heating	33%
End-use equipments	33%
Water heating	26%

Greenhouse gas emissions

4.2 million tonnes of CO₂
(average greenhouse gas emissions in a dwelling: 1290 Kg of CO₂/year)

(Generalitat de Catalunya. La contribució de l'habitatge a Catalunya a la reducció d'emissions de gasos amb efecte hivernacle, 2006).

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EFFECTIVENESS GAPS ON THE ASSESSEMENT OF THE IMPACT OF THE SPANISH BUILT ENVIRONMENT ON CLIMATE CHANGE

Results from three single-unit dwelling located in Sweden with a lifespan of 50 years [Adalberth, 1997b]:

Manufacturing energy use during construction phase	3.00 GJ/m ²	10.07%
Energy use for construction materials transportation during the construction phase	0.13 GJ/m ²	< 1%
Energy use during the erection of the building	0.24 GJ/m ²	< 1%
Manufacturing energy use during renovation phase	1.30 GJ/m ²	4.36%
Energy use for construction materials transportation during the renovation phase	Negligible	-
Energy use during the occupation	0.50 GJ/m ² ·year	83.95%
Energy use during the demolition of the building	0.04 GJ/m ²	< 1%
Energy use for waste transportation during the demolition phase	0.08 GJ/m ²	< 1%

Embodied energy ≈ 16.00%

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EFFECTIVENESS GAPS ON THE ASSESSEMENT OF THE IMPACT OF THE SPANISH BUILT ENVIRONMENT ON CLIMATE CHANGE

Results from 24 buildings located in Australia with a lifespan of 50 years [Pullen, 2000]:

Initial manufacturing energy	5.90 GJ/m ²	9.73%
Recurring manufacturing energy	4.00 GJ/m ²	6.60%
Energy use during the erection of the building	0.23 GJ/m ²	0.38%
Energy use in on-site activities during maintenance	0.17 GJ/m ²	0.28%
Energy use during the occupation	50.30 GJ/m ²	83.00%
Energy use during the demolition of the building	-	-

Embodied energy: 17.00%

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EFFECTIVENESS GAPS ON THE ASSESSEMENT OF THE IMPACT OF THE SPANISH BUILT ENVIRONMENT ON CLIMATE CHANGE

Results from an office building located in Finland with a lifespan of 50 years [Junnila et al., 2006]:

Initial embodied energy	4.50 GJ/m ²	8.51%
Recurrent embodied energy	2.15 GJ/m ²	4.07%
Demolition embodied energy	0.18 GJ/m ²	0.34%
Energy use during the operational phase	46.00 GJ/m ²	87.07%

Embodied energy: 12.92%

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EFFECTIVENESS GAPS ON THE ASSESSEMENT OF THE IMPACT OF THE SPANISH BUILT ENVIRONMENT ON CLIMATE CHANGE

Results from an office building located in Canada with a lifespan of 50 years [Cole and Kernan, 1996]:

Initial embodied energy [GJ/m ²]	Recurring embodied energy [GJ/m ²]			Operational energy [GJ/m ² ·year]
	25 years	50 years	100 years	
With underground parking				
Wood	4.54			
Steel	5.13	2.56	6.55	14.74
Concrete	4.79			
No underground parking				
Wood	4.26			
Steel	4.86	2.52	6.32	14.44
Concrete	4.52			

Embodied energy: 12.00%÷18.00%

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LEGAL FRAMEWORK

1979	First World Climate Conference by the World Meteorological Organization
1988	Creation of the Intergovernmental Panel on Climate Change by World Meteorological Organization and the United Nations Environment Programme
1992	United Nations Framework Convention on Climate Change <div style="margin-left: 20px;">  Stabilize emissions of greenhouse gases at 1990 levels by the year 2000 </div>
1993	Council Directive 93/76/EEC to limit carbon dioxide emissions by improving energy efficiency (SAVE) <div style="margin-left: 20px;">  All Member States shall limit CO₂ emissions by improving energy efficiency in buildings (implementing energy certification programs, etc) not later than 31 December 1994. </div>

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LEGAL FRAMEWORK

1997	Kyoto Protocol <div style="margin-left: 20px;">  Reduce emissions of greenhouse gases by 5% in relation to 1990 levels between 2008 and 2012 </div>
2002	Energy Performance Building Directive <div style="margin-left: 20px;">  Methodology for calculating the energy performance of buildings Application of performance standards on new and existing buildings Certification schemes for all buildings </div>
2003	Emission Trading Scheme (Directive 2003/87/EC)
2005	Spanish National Allocation Plan (2005-2007 and 2008-2012) <div style="margin-left: 20px;">  Total quantity of CO₂ emission allowances available and how this target is divided among the various individual plants covered by the system: energy, steel, cement, glass, brick making, and paper/cardboard. </div>

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LEGAL FRAMEWORK

1997 Kyoto Protocol

↳ Reduce emissions of greenhouse gases by 5% in relation to 1990 levels between 2008 and 2012

2002 **Energy Performance Building Directive**

↳ Methodology for calculating the energy performance of buildings
Application of performance standards on new and existing buildings
Certification schemes for all buildings

2003 Emission Trading Scheme (Directive 2003/87/EC)

2005 Spanish National Allocation Plan (2005-2007 and 2008-2012)

↳ Total quantity of CO₂ emission allowances available and how this target is divided among the various individual plants covered by the system: energy, steel, cement, glass, brick making, and paper/cardboard.

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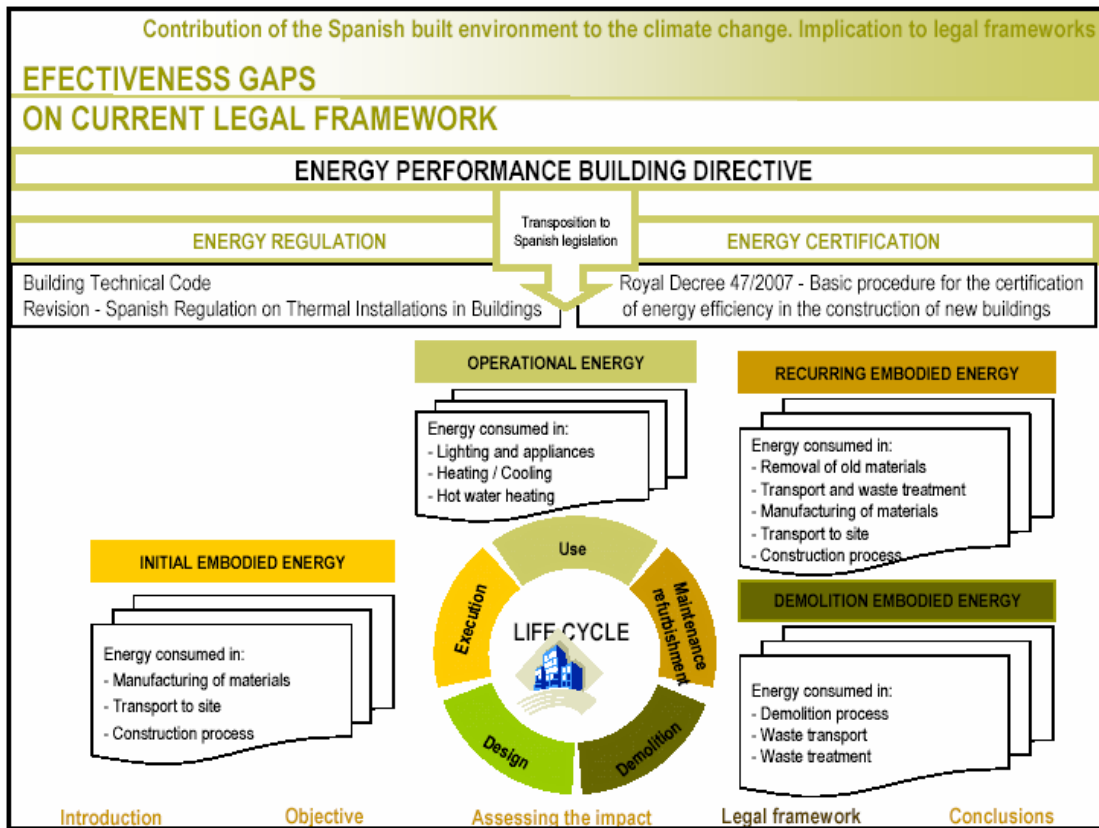
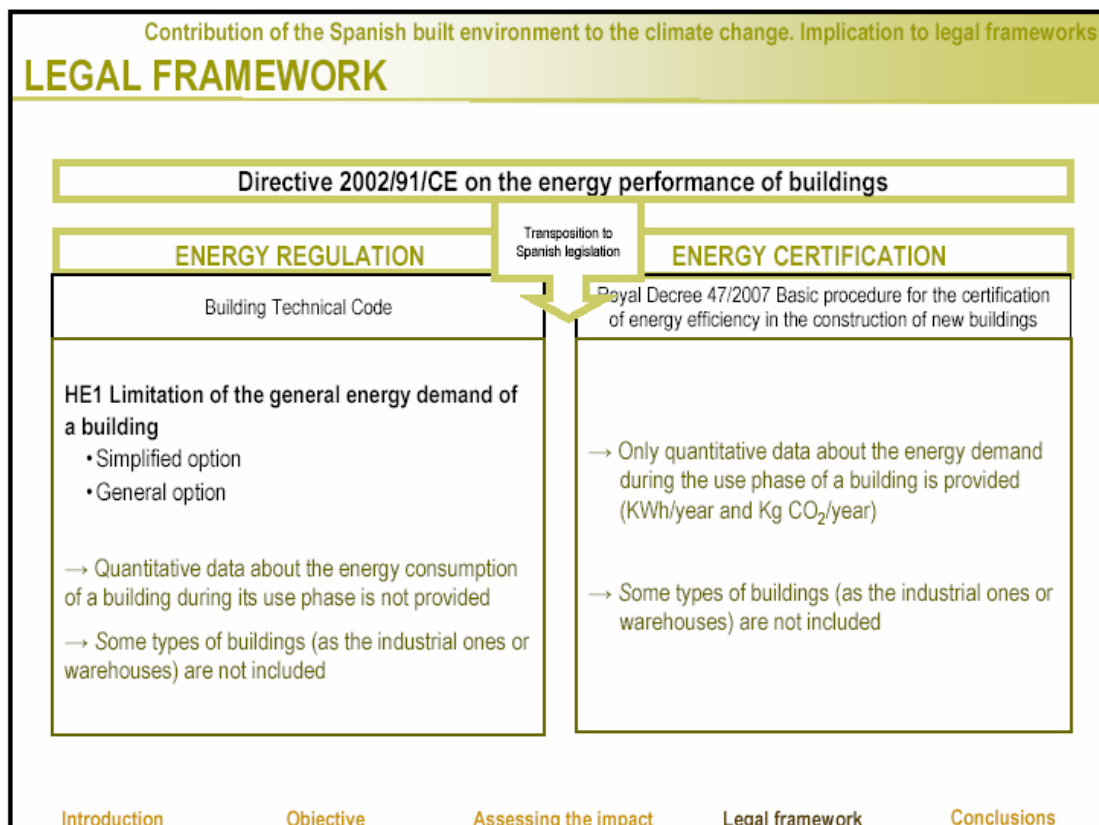
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LEGAL FRAMEWORK

ENERGY PERFORMANCE BUILDING DIRECTIVE

<p>Energy efficiency requirements:</p>	<p>Building Technical Code</p>
<p>Thermal installations:</p>	<p>Revision of the current Spanish Regulation on Thermal Installations in Buildings</p>
<p>Energy certification schemes for buildings:</p>	<p>Royal Decree 47/2007 - Basic procedure for the certification of energy efficiency in the construction of new buildings</p>

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CONCLUSIONS

SPANISH BUILDINGS SECTOR	OPERATIONAL ENERGY	16% - 27% of the total final energy use 12% of total greenhouse gas emissions
	EMBODIED ENERGY	+ ≈ 18% of the total final energy consumption, depending on: <ul style="list-style-type: none"> ▪ the anticipated useful life of the building ▪ frequency of maintenance ▪ type of construction ▪ pattern of occupants' energy consumption ▪ climate

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<p>ENERGY REGULATION</p> <ul style="list-style-type: none"> ▪ Buildings sector is not included within the Spanish Emission Trading Scheme. ▪ Energy efficiency requirements are introduced at the building design stage in line with the Energy Performance Building Directive by means of the Building Technical Code, the revision of the current Spanish regulation on thermal installations in buildings and the Royal Decree on energy certification in buildings. ▪ All three instruments are only focused on the operational energy ▪ They does not cover all types of buildings
<p>ENERGY CERTIFICATION</p> <ul style="list-style-type: none"> ▪ It is only focused on the operational energy ▪ It does not cover all types of buildings
<p>REPORTING ENERGY CONSUMPTION</p> <ul style="list-style-type: none"> ▪ Embodied energy should be taken into account when reporting energy consumption because what is not assessed can not be improved

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FURTHER STEPS

DEVELOPMENT OF AN HOMOGENEOUS MODEL OF LIFE CYCLE ANALYSIS FOR THE EVALUATION OF THE ENERGY CONSUMPTION OF THE "INDUSTRIAL PLANT" SYSTEM AND ITS ASSOCIATED EMISSIONS

The model will quantify the energetic consumption of industrial buildings along all their life cycle (and their associate emissions) and it will allow the comparison of their energetic performance.

- The model will contribute to the definition of the sustainable specification in the planning phase
- This method will be also useful for all design stakeholders who would have a decision making tool in terms of environmental incidence of different project solutions.
- It will establish the basis for a future environmental certification of industrial buildings, including all the life cycle of a building