

Thermally Modified Pine BOARDS - an environmental comparison of Portuguese and Spanish case studies

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Background

- ▶ Thermal modification is a well-known process to improve wood properties by using heat in a low oxygen environment
- ▶ Several commercial processes
 - ▶ Thermowood
 - ▶ Plato wood
 - ▶ Perdure
 - ▶ Etc..
- ▶ Companies producing modified wood by heat treatment in Iberian Peninsula(at the moment):
 - ▶ two companies in Portugal
 - ▶ one company in Spain

Objective

Compare the environmental profile of thermally modified pine boards for exterior decks or cladding produced by a Portuguese and a Spanish company in 2014.

Methodology

- ▶ LCA procedure described in ISO 14040/44 series of standards was used.
- ▶ The method used for Impact Assessment was EPD2013 V1.01.
- ▶ LCA was performed with the aid of SimaPro 8.1.0.60 software.

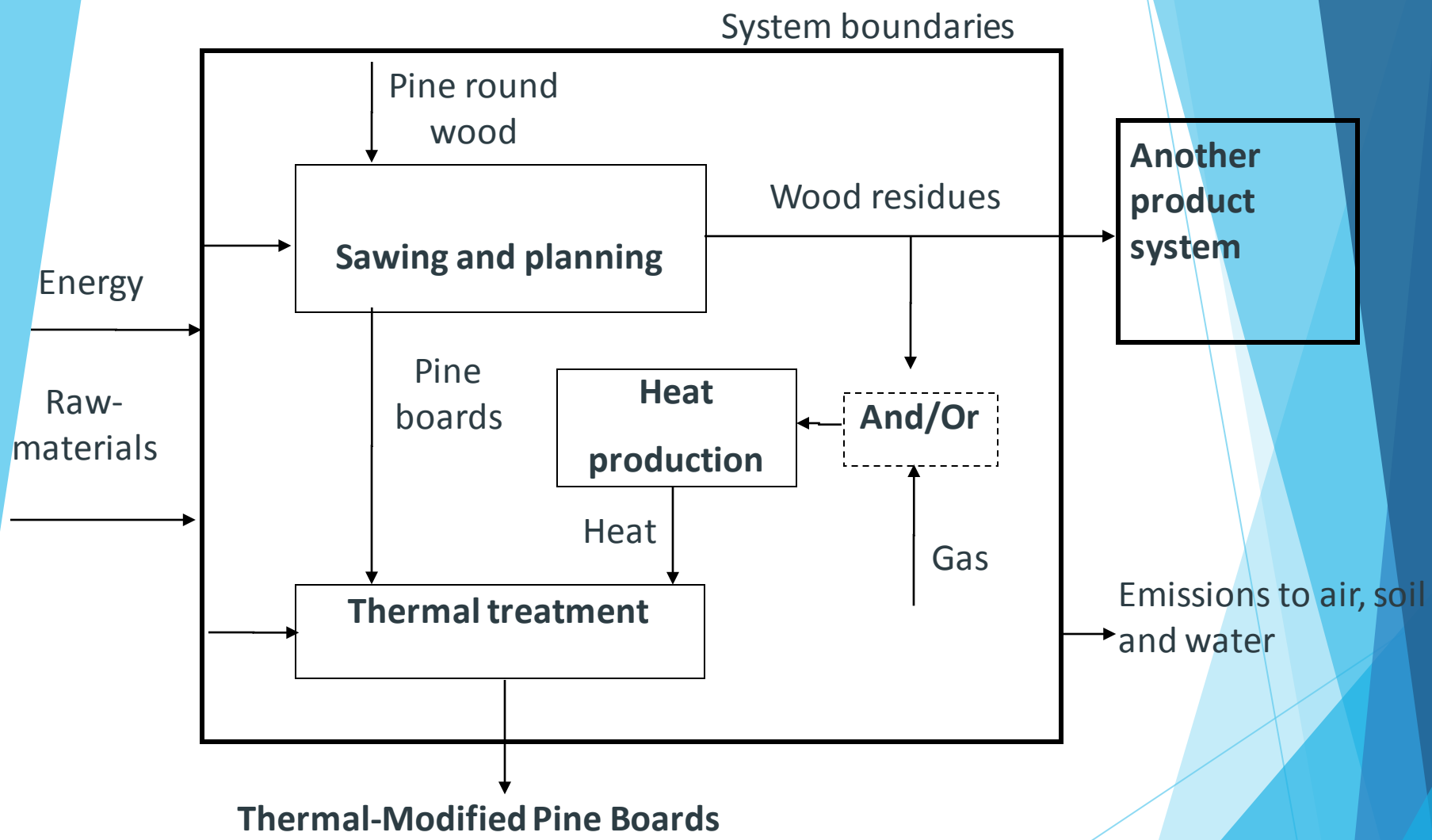
Goal Definition and Scoping

Declared unit

1 m³ of thermally modified pine boards

The thermo-treatment used was Thermo I (intense treatment)

System boundaries (cradle to gate)



Allocation - based on economic value of co-products

Inventory data

Datasets for production of 1 m³ of Portuguese thermally treated maritime pine boards

Process	Inputs		Outputs	
Forest			Pine round wood	2.09 m ³
Sawing and planing	Round wood (maritime pine)	2.09 m ³	Wood boards	1.09 m ³
	Electricity	21.8 KWh	Wood residues (out)	0.592 m ³
	Transport of round wood	52 t.Km	Wood residues (inside heat production)	0.408 m ³
Thermal treatment	Wood boards	1.09 m ³	Thermally modified pine boards	1 m ³
	Electricity	72.33 KWh	Water	0.109 m ³ (steam)
	Heat from gas (propane)	925 MJ (19.97 Kg)		
	Heat from wood residues	3454 MJ (0.408 m ³)		
	Water	0.109 m ³		

Inventory data

Datasets for production of 1 m³ of Spanish thermally treated maritime pine boards

Process	Inputs		Outputs	
Forest			Pine round wood	1.86 m ³
Sawing and planing	Round wood (maritime pine)	1.86 m ³	Wood boards	1.09 m ³
	Electricity	28.28 KWh	Wood residues (out)	0.77 m ³
	Transport of pine round wood	35 t.Km		
Thermal treatment	Wood boards	1.09 m ³	Thermally modified pine boards	1 m ³
	Rope	0.02 Kg	Water	0.004 m ³
	Electricity	24 KWh	Rope	0.02 Kg
	Heat from natural gas	1465 MJ		
	Transport of wood boards	22 t.Km		
	Water	0.004 m ³		

Inventory data

Datasets for the background systems - assumptions made

Process	Equivalent process	Data source
Portuguese		
Pine round wood production	Round wood, softwood, under bark, EMC=70% at forest road/PT U (adapted)	Ferreira and Domingos (2012)
Electricity production	Electricity, low voltage, at grid/PT U (adapted for EDP 2014 conditions)	Ecoinvent
Heat production from gas	Heat from nat. Gas FAL	Franklin USA 98
Transport	Transport, lorry >16t, fleet average/RER U	ecoinvent
Heat production from wood	Wood chips, from industry, pine, burned in furnace 300KW/CH U (adapted)	ecoinvent
Spanish		
Pine round wood production	Round wood, softwoo, under bark, EMC=70% at forest road/RER U (adapted)	ecoinvent
Electricity production	Electricity, low voltage, at grid/ES U (adapted for ENDESA 2014 conditions)	ecoinvent
Heat from gas production	Heat from nat. Gas FAL	Franklin USA 98
Transport	Transport, lorry >16t, fleet average/RER U	ecoinvent

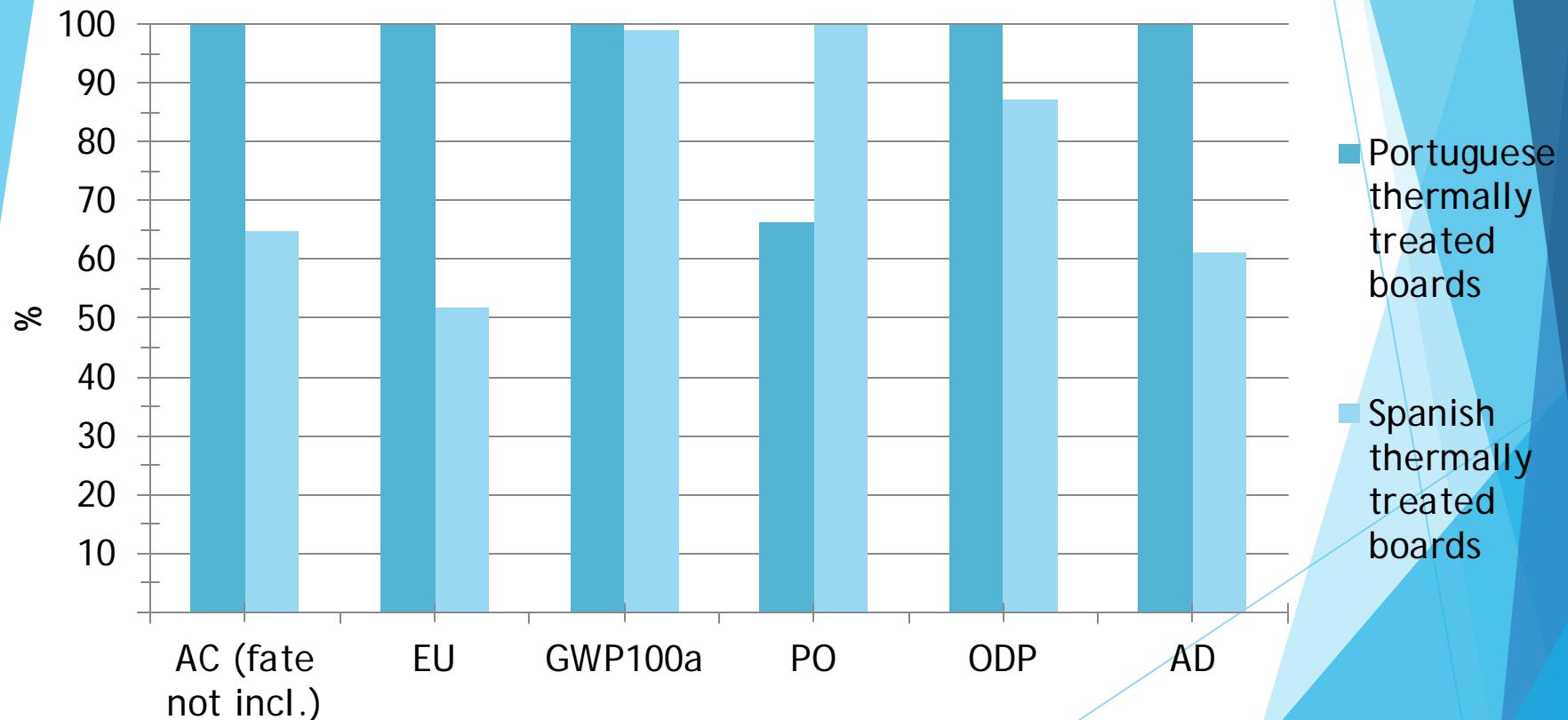
Results

Impact assessment results associated with 1 m³ of thermally modified pine boards

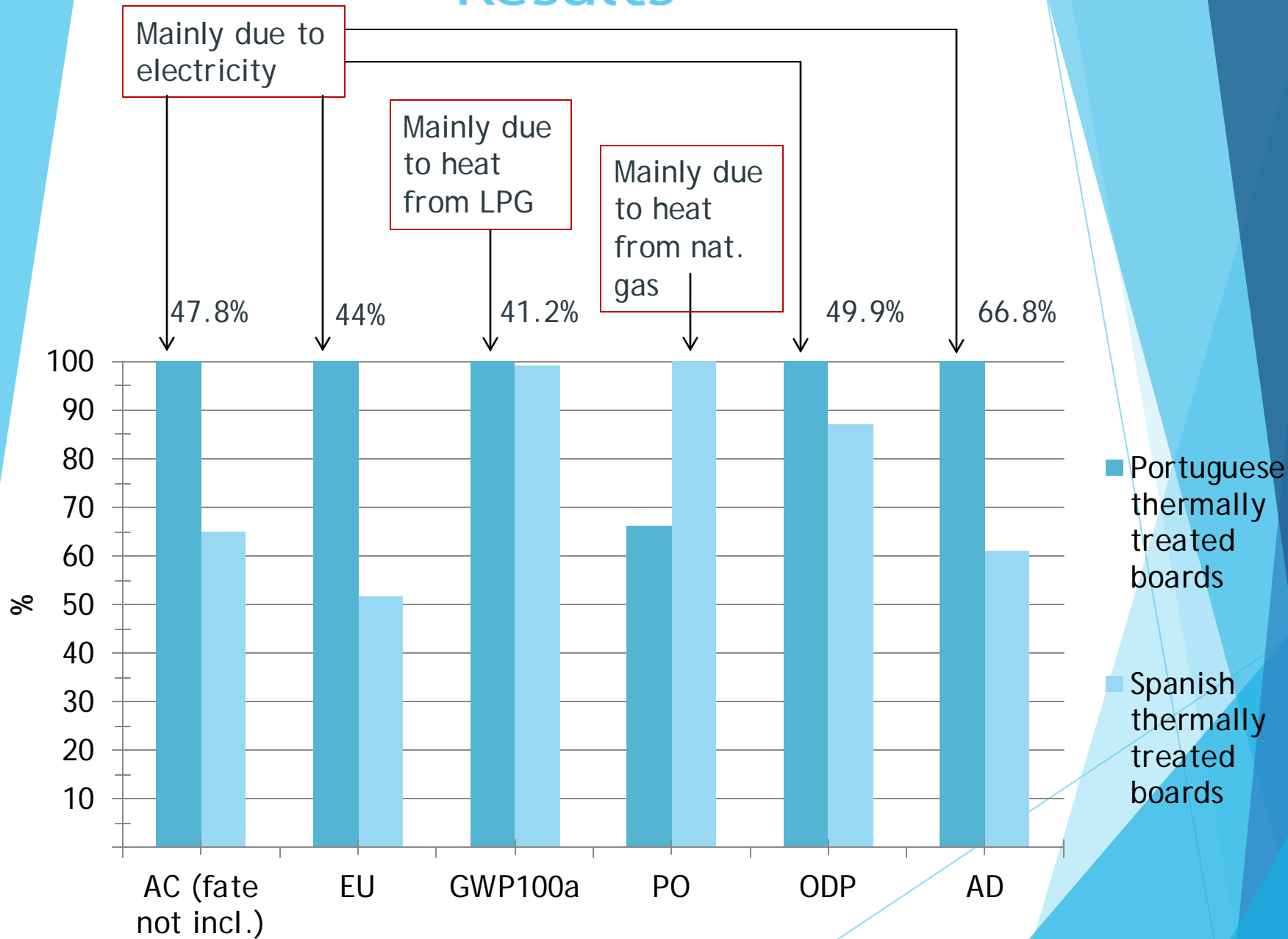
Impact category	Unit	Portuguese boards	Spanish boards
Acidification	kg SO ₂ eq	8,37E-01	5,44E-01
Eutrophication	kg PO ₄ ³⁻ eq	2,17E-01	1,12E-01
Global warming (GWP100a)	kg CO ₂ eq	1,33E+02	1,31E+02
Photochemical oxidation	kg C ₂ H ₄ eq	6,34E-02	9,55E-02
Ozone layer depletion (ODP)	kg CFC-11 eq	5,47E-06	4,77E-06
Abiotic depletion	kg Sb eq	1,21E-04	7,37E-05

Results

Comparative environmental profile 1 m³ of thermally modified pine boards



Results



Conclusions

- ▶ The contribution of Portuguese and Spanish treated boards to climate change (CC), is almost equal.
- ▶ The Spanish treated boards are better than Portuguese for acidification (65%), eutrophication (52%), ozone layer depletion (87%) and abiotic depletion (61%) and
- ▶ The Portuguese treated boards are better than Spanish for photochemical oxidant formation (66%).

Acknowledgments

FCT

Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA EDUCAÇÃO E CIÊNCIA



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DEPARTAMENTO DE DESARROLLO
ECONÓMICO Y COMPETITIVIDAD

CENTRO DE ESTUDOS EM EDUCAÇÃO, TECNOLOGIAS E SAÚDE
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UID/Multi/04016/2016



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Thank you!

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