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THE CONVERTE PROJECT: BIOMASS POTENTIAL FOR ENERGY

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ABSTRACT
Climate change caused by the excessive use of non-renewable resources as a means of supporting the current society demands is forcing the development of circular economy models and social, economic and environmental balanced solutions. In Portugal, in recent decades, important progresses have been made on waste resources management practices in line with the objectives and directives of the European Union. The urban and industrial wastes are, to a certain extent, a case of success since the effort developed has created tools for the prevention, control, recovery and recycling of a considerable percentage of the generated amounts. However, this effort has not yet reached its full potential, and there are still diverse underexplored issues, such as a systematic assessment of the waste biomass suitability for specific energy conversion technologies, and the promotion of non-food-competing energy crops on marginal lands. CONVERTE will identify and quantify the different waste biomass types generated in the Portuguese continental territory, and shall develop a biomass-driven energy matrix that correlates the biomass types with eight technological value chains for heat, power and/or advanced biofuels as main products. This is expected to impact positively on the national energy security and to reduce the overall Portuguese greenhouse gas (GHG) emissions, namely in the transport sector, contributing to increase the country sustainability score.

Keywords: Residual biomass; Energy vectors; Advanced biofuels; Electricity and heat; Sustainability.

INTRODUCTION
Portugal and the EU signed the long-term policy challenge of the United Nations (IPCC, COP21), according to which, until 2050, only global reductions of emissions around 50%, planned in the long-term, will restore humankind in a compatible way with the objective of limiting the increase in global average temperature to a maximum of 2 °C, over the pre-industrial average. The EU established the Climate and Energy Framework for the year 2030 which sets a key target of reducing emissions by at least 40% compared to 1990's levels (with reductions in sectors covered by the 43% EU Emissions Trading System (ETS) compared to 2005 and 30% in other sectors), as well as a target of at least a 27% share for renewable energy.

According to the review of PNAER 2020 in April 10th 2013 [1], biomass should contribute by 2020 with 93% of all Renewable Energy Sources (RES) for the heating/cooling sector and 87% for the transport sector (as biofuels). Although with a less significant contribution in the context of different RES, biomass will also contribute to the renewable electricity with 4719 GWh, corresponding to a share of 14.9%. This contribution for renewable power generation is from cogeneration plants (CHP) and dedicated power plants. According the PNAER estimates in April 2013, for 2020 it would be expected a capacity of 769 MW in the set of all of these plants. However, the economic crisis between 2008 and 2013 did delay several investments and a more realistic value of approximately 650 MW is being considered.

It is in the transport sector that biomass provides a leading role in view of technological solutions, already in operation or in demonstration phase. A detailed characterisation at the national level is required, in order to assess the biomass endogenous potential for application under a scope of decarbonisation of the transport sector.

Objectives

The CONVERTE project aims to identify objectively and to quantify the different types of endogenous biomass that can be applied in the short-medium term to economically viable technological solutions for the production of power and heat, energy vectors, and especially advanced biofuels, in compliance with all the sustainability criteria set by the European Directives, in particular the Red II Directive (2015/1513) [2].

Activities (Fig. 1)

- Identify, quantify and characterise the endogenous waste biomass generated in the Portuguese continental territory which is potentially available for energy production, namely **1.** Organic fraction of urban waste, **2.** Organic fraction of agro-industrial wastes and of wastewater treatment plants sludge, and **3.** Energy crops;
- Based on the physical and chemical analysis, create a uniform Classification Grid for the characterisation of the different waste biomass types with respect to their potential for conversion into energy;
- Identify the determinant composition parameters of each waste biomass type that influence the choice for the best route for biochemical or thermochemical conversion;
- Select case studies of waste biomass types and determine the yield and productivity of the best combinations (Waste biomass x Conversion technology) for the production of **1.** Biodiesel by transesterification, **2.** Biogas/Biomethane by anaerobic digestion, **3.** Ethanol by fermentation, **4.** Hydrogen by fermentation, **5.** Electricity and heat (CHP) by combustion, **6.** Biogas/Synthesis gas by gasification, and **7.** Bio-oils by pyrolysis or **8.** by hydrothermal liquefaction;
- Define energy potential indicators that enable the creation of an Energy Potential Score, which will be included in the Classification Grid of the waste biomass typologies for energy;
- Define sustainability indicators that enable the calculation of the Sustainability Value, which will be included in the Classification Grid of the waste biomass typologies for energy.

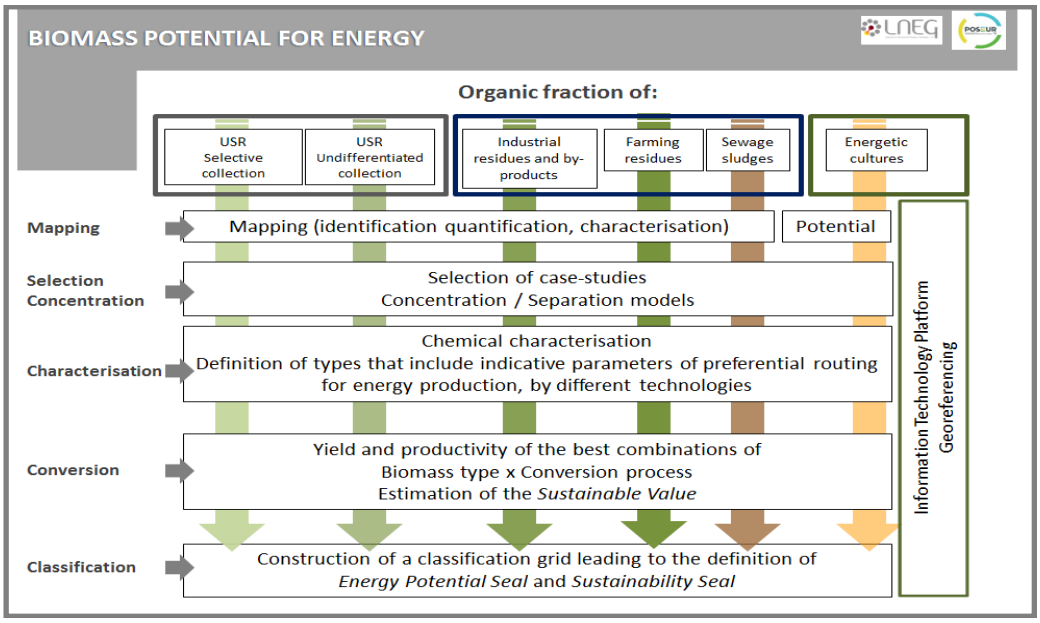

Fig. 1 - CONVERTE Flowchart

The results of CONVERTE may lead to a useful tool to reduce the complexity of the assessment and respective decision making in the process of directing the studied biomass resources for energy, which can be potentially helpful for certification and/or for future legislative production.

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