Interview with Neus Puy Marimon, Forest Science and Technology Centre of Catalonia (CTFC), Head of Programme of Bioeconomy, Health and Governance. Neus is part of Work Package 4 (WP4) of the PYSOLO project, which focuses on the agricultural and forest biomass identification and supply chain analysis.

PYSOLO – Making Use of Concentrated Solar Power for Biomass Pyrolysis

PYSOLO (PYrolysis of biomass by concentrated SOLar pOwer) offers a solution for both decarbonisation and defossilisation by preparing the ground for a fully renewable process combining concentrated solar power and biomass pyrolysis. Thanks to the use of solar heat in the pyrolysis process, the production of valuable products bio-oil, biochar and pyrogas can be maximised and the associated CO_2 emission minimised. This offers both economic and environmental benefits compared to conventional pyrolysis.

Please shortly describe the CTFC's role in PYSOLO

At the CTFC we are leading the identification and assessment of biomass sources suitable for the PYSOLO pyrolysis technology. Our goal is to select biomasses that meet technological, sustainability, and accessibility criteria. We have identified five types of forest and agricultural biomass with potential for large-scale deployment: residual agricultural biomass from olive and grape crops, and forest biomass including pine, oak, and other species. To quantify biomass availability, we have applied remote sensing-derived products integrating data on solar power (direct normal irradiation) and road network accessibility. Our main aim is to pinpoint optimal locations in southern Europe (Spain, Italy, and Greece) for establishing solar-powered biorefinery plants, ensuring that they are strategically placed based on biomass supply, solar energy, and infrastructure, thus pinpointing the optimal conditions for implementing the PYSOLO technology.

How did you identify suitable biomass for the pyrolysis process, which ones did you choose and why?

In the case of forest biomass, we applied several restrictions related to topography, fragile soils, fragmented forest ecosystems, and protected areas. After identifying the effective forest biomass, we incorporated additional variables such as forest growth (net primary productivity) and road proximity, along with forest cover and slope, which had already been used as constraints to define the suitable forest biomass. Thus, all these variables were included in a multi-criteria analysis to define a suitability index ranging from 0 to 1. The suitability index values were then combined with DNI and road network data in a simulated annealing algorithm, which determined the optimal locations for

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storing and processing forest biomass. Once these locations were identified, the suitable forest biomass was quantified within a radius of a maximum 100 km to collect the forest biomass and classify it into three main groups: pine, oak, and other species. Pines and oaks were chosen for their abundance in Mediterranean ecosystems. Similarly, residual agricultural biomass was quantified using land cover maps of grape and olive crops, integrating regional and provincial yield data (kg/ha). These two crops were selected due to the significant presence of vineyards and olive groves in the Mediterranean region.

Why were forest biomass and agricultural residues selected as the primary biomass instead of other options (e.g. algae, or organic waste)?

On the one hand, southern European countries are covered by extensive forest areas: 37% in Spain, 32% in Italy, and 29% in Greece. This demonstrates the high potential of forest biomass to supply solar-powered biorefinery plants. On the other hand, agricultural residues are also highly abundant in Mediterranean countries, particularly from fruit trees. For the PYSOLO project, we focused on two types of residues, although other tree crops, such as sweet, dry, and citrus fruits also showed significant potential. The main criteria for selecting these agricultural residues were based on three key factors: i) extensive cultivated areas (ha), ii) yield (kg/ha/year), and iii) suitability of the residue for the pyrolysis. While other biomass options may also be attractive, the geographical characteristics of the study area give vineyards, and olive crops a clear advantage over alternative sources. The selection of these two agricultural residues was thoroughly discussed within the consortium, and a consensus was reached among the leading experts in our partnership.

Forest biomass extraction in the Pyrenee – Image: CTFC

PYSOLO

What are the key forest management practices during the biomass extraction?

In forest management, it is crucial to determine the amount of biomass that can be harvested without compromising the integrity of the ecosystem. To ensure sustainability, biomass extraction must be gradual and aligned with environmental, growth rate, and landscape criteria. Multifunctional sustainable forest management goes beyond biomass production—it also prioritizes biodiversity conservation, soil and water protection, and climate change adaptation. The overarching goal is to foster productive yet resilient forest landscapes. Additionally, in Mediterranean regions, forest management plays a vital role in reducing fuel loads which significantly contributes to mitigating the risk of extreme wildfires.

How will you ensure that the selected biomass will be available in the long term?

Fruit crop and forest biomass yields are critical for ensuring the long-term sustainability of solar-powered biorefinery plants. In agriculture, crops such as vineyards and olives are well established, with well-known data on yields and residual biomass proportions. In contrast, assessing forest biomass availability is more complex due to its variability, sensitivity to climate change, competing uses (e.g., paper, fuelwood), and the lack of accurate country-level biomass yield maps. To overcome this limitation and provide a reliable indicator of biomass availability for continuous supply to biorefinery plants, we incorporated net primary production into our multi-criteria analysis to prioritize areas with faster vegetation growth. Looking ahead, future studies will also consider incorporating other biomass uses to further refine supply estimates and support strategic planning for the deployment of solar-powered biorefinery plants.