

SUPPORTING A CIRCULAR ECONOMY STRATEGY IN SOUTH TYROL, ITALY: INTEGRATED LIFE-CYCLE ENERGY AND GREENHOUSE GAS ANALYSIS

Antonello Durante, Eurac Research, Italy
antonello.durante@eurac.edu
Gianluca Grazieschi, Eurac Research, Italy
Samuele Zilio, Eurac Research, Italy
Valentina D'Alonzo, Eurac Research, Italy
Joana Bastos, Eurac Research, Italy

Key Words: Circular Economy, Bioeconomy, Building insulation, Spatial analysis, Greenhouse gas

The research project “Strategy for Circular Economy in the Autonomous Province of Bolzano” aimed at providing the Province of Bolzano (South Tyrol, northern Italy), with materials and tools to support the design of an integrated regional strategy for Circular Economy (CE). The project focused on synergies between the bioeconomy and the built environment, due to their local relevance and to their significant potential in the transition to a CE. In particular, the project illustrated the application of a set of analytical tools to evaluate and support the design, development and implementation of CE strategies.

In 2015, forestry and agriculture sectors were associated with about 5% of the gross domestic product (GDP) in the Province, compared to 2% in Italy (ASTAT, 2021). The project analyses illustrate how the integration of different tools can be used to estimate the potential benefits and impacts of the exchange and valorisation of co-products and waste from agriculture and forestry activities, in construction materials and products. The analyses included: (1) a spatial analysis using geographic information systems (GIS); (2) a simplified material flow analysis (MFA) of the residential building stock; and (3) a streamlined life-cycle energy and greenhouse gas (GHG) analysis comparing wood fibre and expanded polystyrene (EPS) insulation.

The spatial analysis consisted of an estimate and mapping of potentially available biomass from forestry and agricultural activities, using land-use data – namely the area of agricultural land for three types of crops (feed crops, fruit, and vineyards) – and literature-based coefficients on generation of wood-based biomass from these three types of crops. The MFA estimated annual material inputs and outputs of the residential building stock in the Province, providing a simplified characterization of raw material construction requirements and demolition waste. The evaluation considered literature-based coefficients on: renovation and demolition rates, generation of waste per renovated/demolished surface, material separation factors and composition of waste. Different scenarios were established to account for variability in the intensity of construction and demolition activities. Lastly, a streamline life-cycle energy and GHG analysis comparing wood fibre and expanded polystyrene (EPS) insulation was performed. The analysis considered a cradle-to-gate perspective and, as functional unit, the insulation of a 1 m² surface with a thermal resistance of 1 m² K/W, across a service life of 50 years, and estimated the potential primary non-renewable energy (NRE) requirements and GHG emissions, with a 100-year time horizon.

The analysis of potentially available biomass in the Province estimated and mapped an annual generation of (i) about 88 000 tons of residual biomass from agricultural activities, and (ii) about 465 000 m³ of residual biomass from forestry activities/management. Regarding construction and demolition waste, 7 000 - 12 000 tons of wood waste were estimated, which could have valuable potential if properly separated from mineral components and recovered. The LC analysis showed a potential reduction of 40-60% in NRE and 15-40% in GHG emissions, depending on the electricity mix considered (national or regional), if locally produced wood fibre insulation was used to replace EPS.

It is important to highlight that the analyses were strongly limited by data unavailability; however, they had an illustrative and awareness-raising nature and complemented a participatory approach involving a range of local stakeholders across relevant economic sectors. Moreover, the project supported the creation of a regional competence centre for circular economy, which shall further develop the knowledge and tools to enable the transition to a CE in the Province, including the creation of an online trading platform for exchange of resources.

Reference:

ASTAT - Statistic Institute of the Autonomous Province of Bolzano: Income statement of the province of Bolzano - 2010-2019 and 2020 estimate. Available on: <https://astat.provincia.bz.it/>. Accessed 20 December 2021