

Assessing the strategic role of Renewable Energy Communities in local energy systems: a study on the municipality of Tito in Southern Italy

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Keywords: Renewable Energy Communities, ETSAP-TIMES, local energy planning, Energy transition, Decarbonization

Abstract Renewable energy communities are a key pillar of the European strategy to promote the energy transition and combat energy poverty in Europe, with the aim of promoting self-consumption and sharing of energy from renewable sources. These communities offer a new perspective for the development of energy production and consumption models, favouring a decentralised approach that reduces dependence on unsustainable energy sources, with economic, social and environmental benefits. Renewable energy communities are well known for the technological solutions and social innovations they offer in promoting public engagement, local economic development and a fair energy transition.

In this context, modelling tools based on a multidisciplinary approach can be used to assess the potential benefits and concrete advantages of implementing renewable energy communities and to support the role of stakeholders, such as residents, companies, businesses and municipalities, as prosumers in the production and consumption of electricity. The ETSAP-TIMES model generator, based on an energy system cost optimisation approach, is one of the most widely used tools for medium-to long-term energy planning on various spatial scales. It allows for the detailed representation of local energy systems and the identification of the most effective energy strategies by integrating technological, economic, environmental and social aspects.

The work aims to model a Renewable Energy Community using the ETSAP-TIMES model generator and to analyse its role in meeting electricity demand in the energy system of the municipality of Tito, in southern Italy. The TIMES-Tito REC model was therefore implemented to analyse the effects of a Renewable Energy Community over a 30-year time horizon, with a particular focus on energy supply, local electricity production and final consumption in the residential and tertiary sectors.

The operational framework of the Renewable Energy Community was therefore implemented in accordance with the latest national regulations, taking into account both technological and economic aspects. The results were compared with the ones of a reference scenario, highlighting how the size of a Renewable Energy Community can affect the energy costs. In addition, a sensitivity analysis was carried out by varying the economic incentives (sold, shared and purchased energy tariffs) to understand the economic, social and energy benefits of creating a Renewable Energy Community in a small local area.