NEUTRON

KOZANI, GREECE

Emissions domains addressed by the Pilot Activity

- Consumption of non-electricity energy for thermal uses in buildings & facilities
- Consumption of electricity generated for buildings, facilities & infrastructure

Key Focus Areas

District heating | Green Heat Module | Energy-from-waste | Digital Twin | Just transition | Agrivoltaics | Biogas | Thermal storage

Levers of Change

Democracy and participation | Governance and policy | Learning and capabilities | Social innovation | Technology/infrastructure

Description of the Pilot Activity

Kozani is undergoing a major transition from decades of lignite-based energy production to a greener future. NEUTRON tackled the technical and social complexities of this shift, using digital innovation, inclusive governance, and clean technologies to develop a flexible and resilient urban heating model—positioning Kozani as a demonstrator of just and integrated energy transformation.

Impact & Results

The Green Heat Module (GHM) was designed and tested as a thermal battery to store renewable electricity and supply the district heating system. Simulations and economic assessment showed the solution to be technically feasible and financially viable. The municipality and DEYAK (Kozani's municipal district heating company) are now considering investment in Drepano. Scenario modelling estimated GHG emission reduction of over 90,000 tonnes of CO_2e across two years of project duration from GHM operations, plus over 30,000 tonnes from biogas and thermal energy production.

Agrivoltaics studies in the Drepano area demonstrated potential to generate 7MW of solar energy while cultivating shade-tolerant crops such as aloe vera—potentially reducing emissions by around 2,800 tonnes of CO_2e (97% reduction). A Digital Twin was developed to model Kozani's heating system and test different operating scenarios, providing DEYAK and the municipality with new database and technical insights.

Innovation Highlights

The integrated renewable portfolio—combining agrivoltaics, biogas, and the Green Heat Module—demonstrates that decentralised, modular solutions tailored to local conditions can enhance resilience, reduce fossil fuel dependence, and deliver co-benefits such as crop production and waste valorisation.

Work on energy communities revealed the limits of citizen engagement when awareness and trust are low—technical feasibility alone is insufficient without parallel social mobilisation.

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