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DISTRICT HEATING AND RENEWABLE ENERGY: A SYNERGISTIC APPROACH TO ECONOMIC AND ENVIRONMENTAL BENEFITS FOR URBAN AREAS

Air pollution in cities is a significant concern, with residential heating systems being a major contributor. Many urban areas rely on individual heating units that burn fossil fuels, releasing harmful pollutants such as particulate matter nitrogen oxides into the atmosphere. These emissions degrade air quality, posing serious health risks to residents. Implementing district heating systems (DHS) with integration renewable energy sources (RES) presents a promising avenue for sustainable urban development by localizing CO2 emissions and enhancing control over environmental impact. By centralizing heating systems through DHS connections, the diversification of heat sources is facilitated, fostering increased system independence, reliability, and optimized heat production costs. This work evaluates the techno-economic rationale behind investing in district heating systems, focusing on determining the threshold at which such investments become cost-effective. This includes indicators such as MWh/km to ascertain the break-even point, alongside the calculation of the Levelized Cost of Energy. Five simulation models-Scenarios of a heating systems are developed and analysed for a designated area of the city of Ohrid (R.Macedonia), focusing on existing buildings and their energy consumption patterns. Three scenarios incorporate public facilities like schools, offices, and hospitals, while two aim for higher heat density by including residential buildings.

Levelized Cost of Heat (LCOH) and Levelized Cost of Energy (LCOE) are calculated, which are pivotal for evaluating economic viability. Simulation models of heating systems that integrate RES (such as solar thermal, heat pumps, seasonal heat storage, PV and CHP) are developed and analyzed for a designated urban area, encompassing existing buildings of varying energy efficiencies. The analyses include both administrative facilities and households as consumers. In the analysis of heating systems, several different scenarios were developed, considering various: energy sources, building energy performance classes and network densities.

District heating systems offer promising solutions for both economic and ecological challenges faced by cities. However, it is crucial to underscore the importance of evaluating technical, economic, and environmental aspects when assessing the feasibility of investments in these systems. By integrating renewable energy sources (RES) and adopting efficient heating technologies, significant opportunities for energy savings, economic benefits, and positive environmental impacts can be realized.