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Detailed spatio-temporal modelling of renewable energy islands: the case of the island of Krk, Croatia

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Lately, many cities, as well as the islands have started a transition towards sustainable energy systems. Islands can be an excellent testing site for integrating different renewable energy solutions due to its compact size and constrained access to electricity which has to be achieved by connecting them to the mainland via underwater cables. There are many different competing scenarios for the possible energy transition of future islands, which includes decarbonization of power, heat/cooling, gas and transport sectors. Two main options include reliance on the mainland for receiving energy or satisfying most or all of the energy demand internally. Furthermore, many islands located in warm regions have good potential for solar energy generation. However, intermittent generation in combination with electrified transport sector on islands can cause local congestions in the distribution grid. In order to support the energy transition of islands located in warm regions, a detailed, technology-rich linear optimization model Calliope was used, which incorporated fine temporal and spatial resolutions. Hence, the model took into account both grid congestions due to the spatial distribution of generators and consumers, as well as a time mismatch between demand and supply of the energy. Krk Island was chosen for a case study, a relatively large island located in Croatia with low population density. Several scenarios were run in order to assess different possible energy transition pathways and special emphasis was placed on demand-response possibilities in the building and transport sectors. First results show that significant proportions of energy demand can be generated on the island itself, significantly reducing carbon emissions.