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SUMMARY

To reduce the overall energy consumption of buildings in the Republic of Serbia it is vital to replace old and inefficient heating systems with more energy-efficient, environmentally friendly technologies, based as much as possible on renewable energy sources. Hence, it is necessary to perform analyses and propose solutions using modular heating and cooling systems, with special reference to using hybrid heating and cooling systems coupled with thermal energy storage. Emphasis should be placed on using local independent systems, primarily renewably energy-based, which, in existing, energy-renovated, as well as in new residential buildings, will provide energy-efficient and economically efficient heating and cooling throughout the year. As part of the *FF GreEN* project, hybrid energy systems based on renewable energies, advanced heat pumps, and thermal energy storage, will be examined. The installation of these systems will be advised only after the previous energy rehabilitation of the observed residential buildings, if necessary, to an acceptable energy class. It is considered that the specific annual energy consumption for heating, for the existing buildings with several apartments, must be reduced through energy rehabilitation measures to the values of up to 70 kWh/m^2, and in the case of newly built buildings up to 60 kWh/m^2. For existing single-family residential buildings, the specific annual energy consumption for heating must be lower than 75 kWh/m^2, and in the case of newly built buildings, lower than 65 kWh/m^2. After reducing the heat losses of buildings to a level that allows profitable installation and exploitation of RES-based systems, energy modeling of the selected relevant cases will be undertaken using modern software packages for thermomechanical calculations. A comprehensive analysis of the obtained results, along with a corrective comparison with own and literature measurement data and results, will be the basis from which further optimization and adaptation of advanced hybrid energy systems will be approached.