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Value of thermostatic loads in future low-carbon Great Britain system

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The research area of the proposed talk concerns the efficient and secure operation of the future low-carbon power system, where alternative sources of control and flexibility will progressively replace the traditional providers of ancillary services i.e., conventional generators. Various options are engaged in this challenge and suit the innovative concept of Smart Grid. Specifically, the talk investigates the potential of demand side response support by means of thermostatically controlled loads (TCLs). The proposed methodology aims to quantify the impact that a population of thermostatically controlled loads (e.g. refrigerators, heat pumps etc.) has on the commitment and dispatch of a future power system characterized by a large penetration of renewable energy sources (e.g. wind) that are variable and intermittent. Thanks to their relative insensitivity to temperature fluctuations, thermostatic loads would be able to provide frequency response services and other forms of system services, such as energy arbitrage and congestion relief. These actions in turn enhance the power system operation and support the strict compliance with system security standards. Case studies focus on the system operation cost and CO_2 emissions reductions for a) different future network scenarios, b) different frequency response requirements, c) changes of thermostatic loads' parameters (e.g. coefficient of performance, thermal insulation etc.).

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Advanced thermodynamic power cycles for utilising low-enthalpy heat sources

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It is estimated that about 20 to 50% of industrial energy input in the world is discharged as waste heat in the form of hot exhaust gases, cooling water and heat lost from hot equipment surfaces and products. The energy intensive industrial sectors include iron and steel, aluminium, cement, ceramics, glass, oil refinery, food industry and so on. Most of these waste heat sources are in the category low-enthalpy heat with a temperature less than 250^0C. In addition, renewable energy, such as solar thermal and geothermal energy, is another major source of a low-temperature heat. For instance, the sustainable technical potential for Europe is estimated as 350 TWh/yr. It is also estimated that 70% of the global geothermal resource is at temperatures of 100-130°C. Therefore, utilising these low-enthalpy heat sources becomes attractive and can potentially make a significant contribution to carbon reduction and energy security. In this talk, several thermodynamic power cycles that are suitable for power generation from low-enthalpy heat sources will be analysed, and their new developments will be discussed.

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