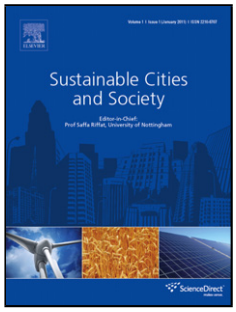

Title: Increasing flexibility of Finnish energy systems - A review of potential technologies and means

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Increasing flexibility of Finnish energy systems - A review of potential technologies and means

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Highlights

- Flexibility considerations extended to other sectors but electricity only.
- A review of enablers and means to increase flexibility of Finnish energy systems.
- The role of energy markets from flexibility perspective is assessed.

Abstract

It is apparent that future energy systems need increased flexibility for example due to wider adoption of variable renewable production, general transition towards decarbonization, and bidirectional energy grids. When several energy sectors are considered holistically, the possible flexibility measures increase. This paper reviews potential means to increase flexibility of Finnish energy systems by comprehensively regarding both electricity and thermal systems. After introducing renewable energy data from Finland, the authors discuss how flexibility is defined. Then, several technological options to meet the increased flexibility needs are described and Finnish examples are given. These key technologies and solutions include energy storage, district heating and cooling, electric vehicles, smart meters, demand response, and ICT solutions. In addition, energy markets provide important flexibility means. Therefore, aspects related to electricity market design and heat trading are also assessed.