Electricity grid tariffs as a tool for flexible energy systems: A Danish case study

Electricity grid tariffs are a lever for reinforcing the coupling of district heating systems to the electricity system and for activating flexibility from power-to-heat (P2H) technologies and storage capacities. This study assesses three tariffs that permit a flexible use of electric boilers in a representative district heating system in Denmark. A mixed integer programming model is developed to evaluate the impact of each tariff on district heating flexibility quantitatively. The tariffs are then discussed in the light of the regulatory requirements that network tariffs must comply with. We show that alternative tariffs enhance the business case for P2H technologies to run flexibly, support the replacement of fossil fuels by green electricity and lower the overall cost of supplying heat. The attributes of each tariff create significant trade-offs between simplicity of implementation, cost efficiency at the distribution-grid level and cost-recovery for distribution system operators. Ultimately, new tariffs should be designed based on the characteristics of their respective groups of users in acknowledging features such as flexibility potential, substitutability between energy sources and captivity.

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