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**Abstract**

**Linking the German heat and power systems: The potential of power to heat in a future energy system dominated by renewables**

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Germany aims at reducing its CO<sub>2</sub> emissions by at least 80% until 2050 (baseline: 1990). This ambitious goal requires not only major changes in the power industry, e.g. by ex-changing fossil fuel power plants by renewable energies, but also significant CO<sub>2</sub> reductions in the transport and especially in the heating sector.

Considering that today about 75% of the natural gas in Germany are used for heating purposes, the future use of 'green' electricity is a promising way to reduce green house gas emissions in this sector. We will present a most recent study conducted by VDE – ETG which assess the overall

potential of using power electricity in the heating sector. Underlying assumptions of the study: CO<sub>2</sub> emission reductions of 80% and 85% until 2050, respectively, combined with major efficiency increase; use of most economic scenario.

Main findings are:

1. Power to heat supports the integration of the fluctuating power produced by wind and solar power plants in the energy systems.
2. The technical solutions are mature and available on the market today, such as electrical driven heat pumps or direct use of electrical energy for heating purposes.
3. Also heat demand in the industry can be decarbonised using power to heat. Moreover, it allows for additional flexibility. However, some technical development is needed especially for high temperature applications and devices.
4. Power to heat is the most economic substitution of fossil fuels in the heating sector. Especially direct electrical heating systems offer fast reaction – and therefore the possibility to provide the needed balancing power – combined with lowest specific investment costs.
5. Passive storage systems such as the mass of buildings will support a power dominated operating regime and reduce the need for short term electrical storage.
6. In the -80% scenario, even long periods without or with little wind can be covered using the remaining allowance of fossil fuels (gas). Combined heat and power systems will still be present and take advantage of additional heat storage.
7. Only the high (-85%) reduction scenario requires the use of power to gas. Here, the heat supply of combined heat and power systems decreased due to the limited availability of gas.

We will present the overall approach and support our findings with the most important figures.