Application of an Up- and Downscaling-method to estimate the capability of micro gas turbines for local energy supply of residential buildings

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The Swiss national research project *MicroPolygen* is focussed on cogeneration applications for buildings, for which combined heat and power generation with an electrical power output less than 15 kW are of interest. Micro gas turbines (MGT) were analysed as a possibility for local energy supply in this power range. However, nowadays MGTs are only available down to 30 kW_{el}. To estimate the capability of MGTs with lower power output a theoretic model with the ability to simulate part load behaviour was developed. In a first step the model was calibrated based on performance data of a commercial state of the art MGT with a power output of 30 kW_{el}. In the second step the model was up scaled and compared to an existing 60 kW_{el} MGT. Finally based on these results the extrapolation to power less than 15 kW_{el} was performed.

As results of the upscale-model the manufacturer's performance data of

- the electrical efficiency as well as the generated electrical power output were reached with an average deviation maximum of 11.7 % and
- the waste heat temperatures were simulated with a relative deviation maximum of 12.5 %.

For the theoretical downscale-model it was postulated to get similar deviations as with the upscale-model. Therefore the part load behaviour of the downscale-model is assumed to be similar to that of the analysed commercial 30 and 60 kW micro gas turbines.

The downscale-model at full load was defined with

- an electrical power output of 15.2 kW,
- an electrical efficiency of 25 % and
- a waste heat temperature maximum of 252 °C.

The developed model for the estimation of the capability of micro gas turbines with electrical power output less than 15 kW should be understood as benchmark model for prospective developments in the MGT market.