

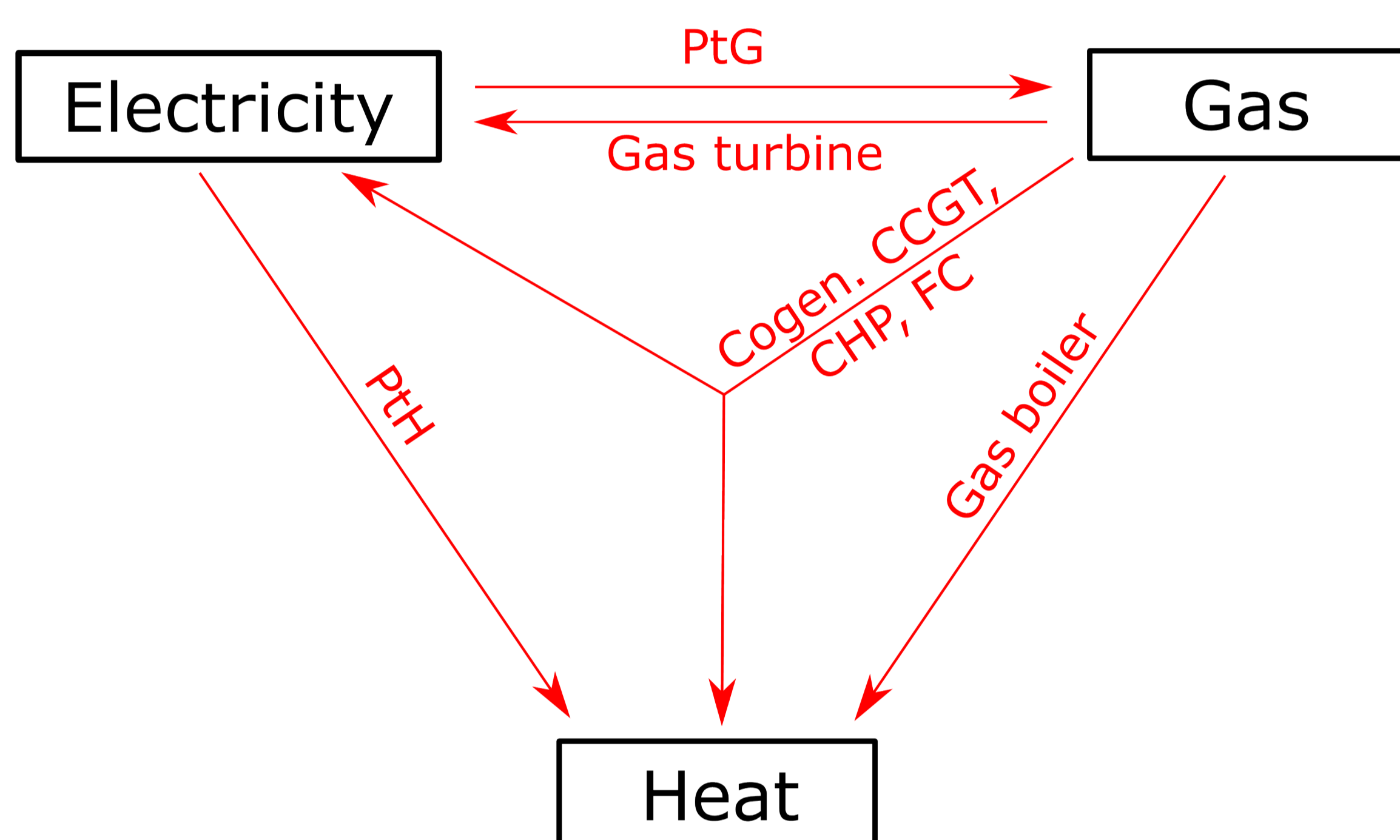
Voltage Stability Risks Caused by Dynamic Interactions in Integrated Energy Systems

Jan-Peter Heckel, Tom Steffen, Christian Becker

Hamburg University of Technology, Institute of Electrical Power and Energy Technology

Motivation

- Dynamic interactions in Integrated Energy Systems (IES): flexibility but also stability risks



- Voltage stability can be affected due to similar time constants and high power consumption.
- Voltage instabilities must be detected in time.

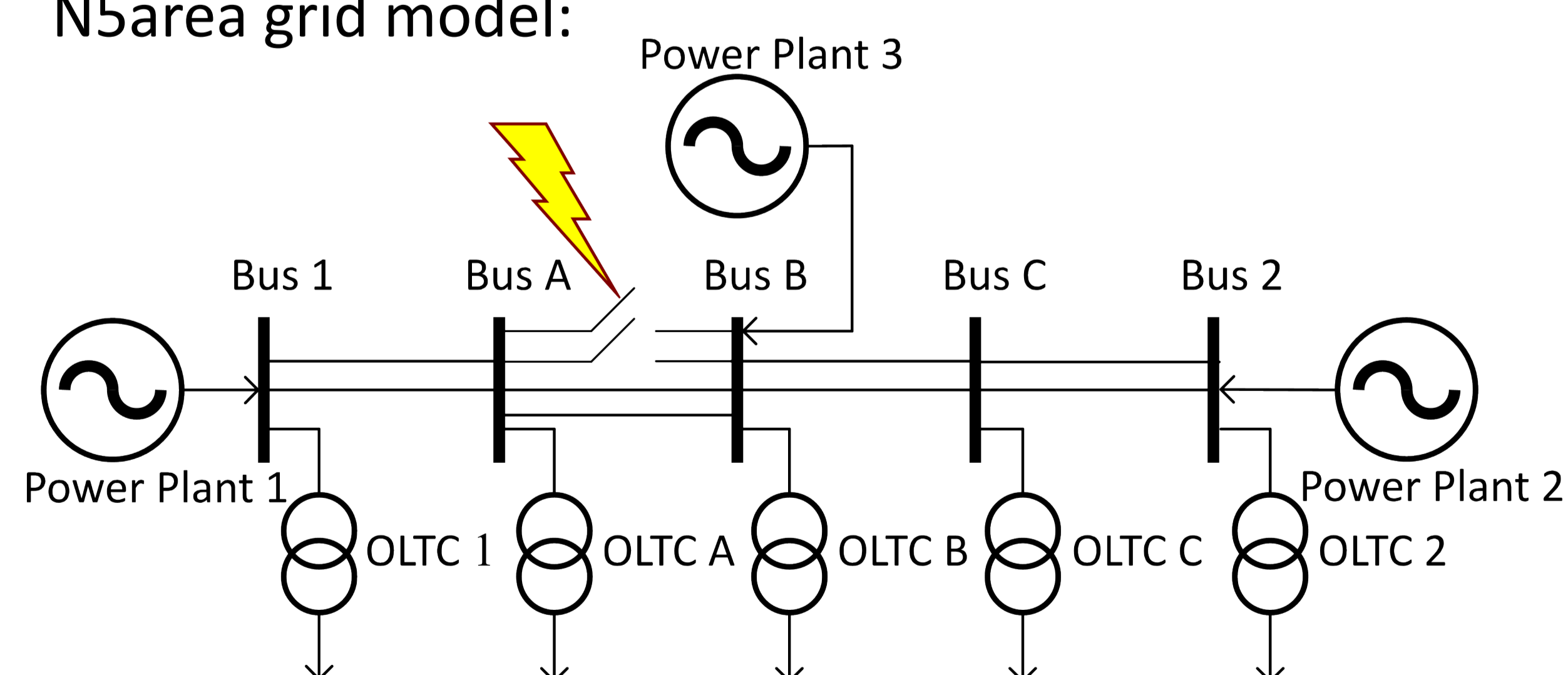
Methodology

- Dynamic system simulation using components from the

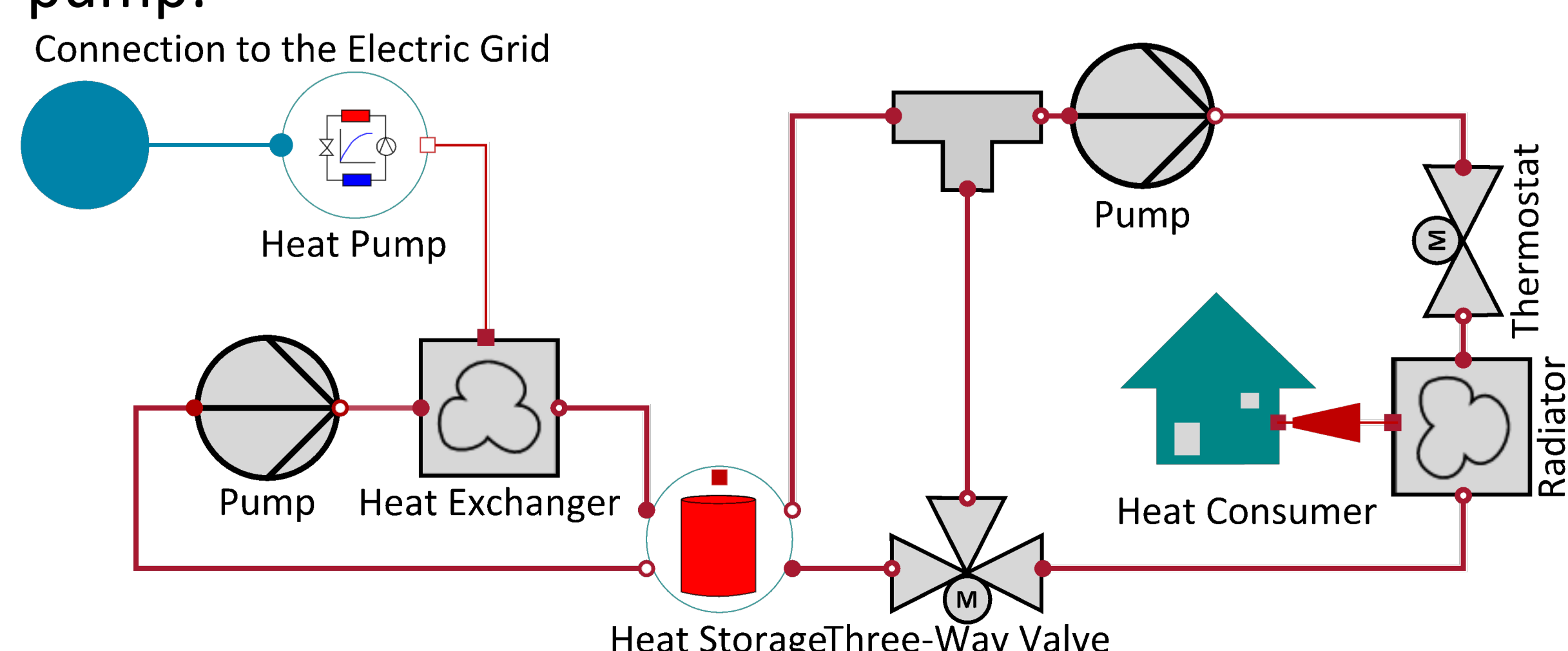


Experimental setup

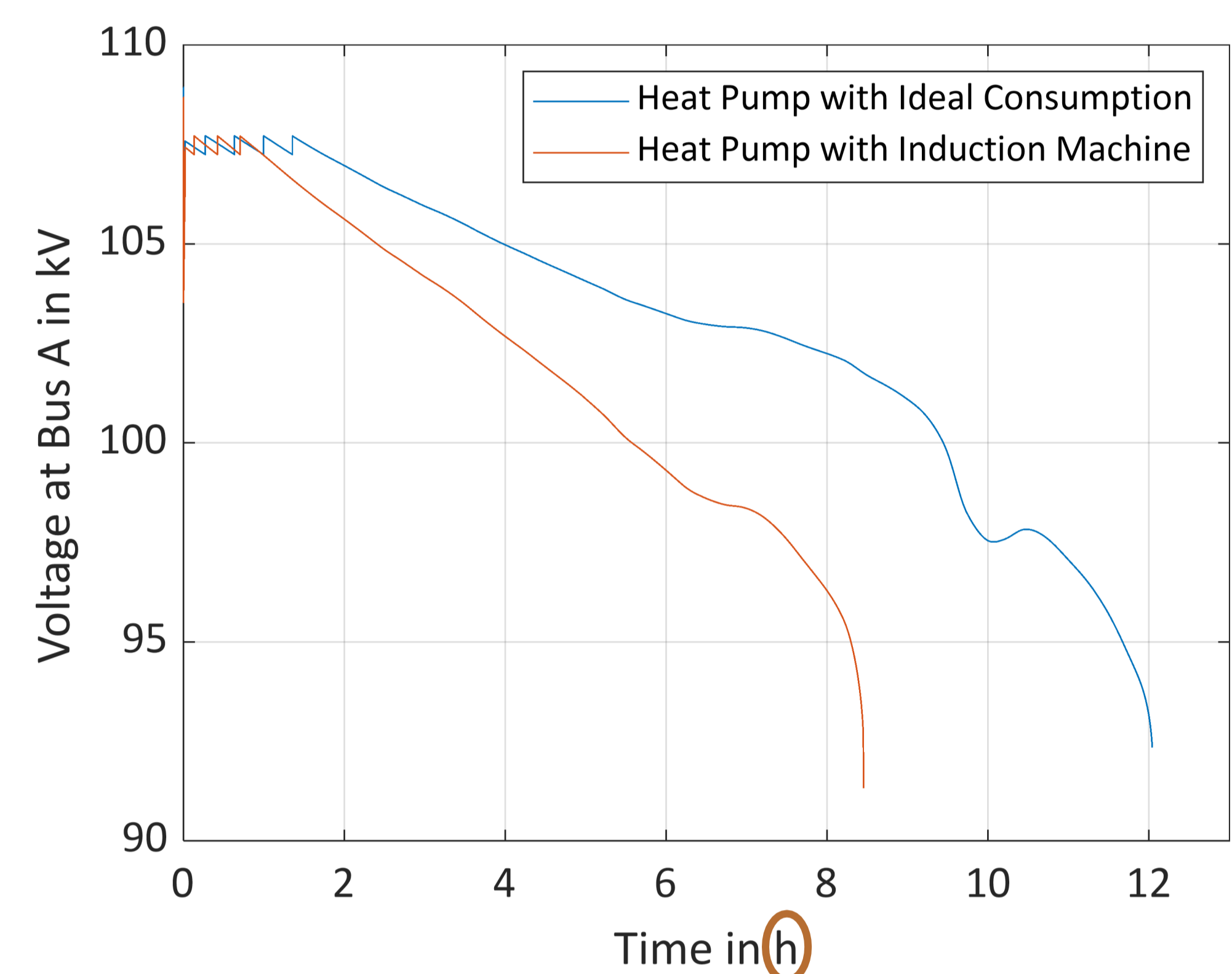
- N5area grid model:



- Different load models, for example heat circuit with heat pump:



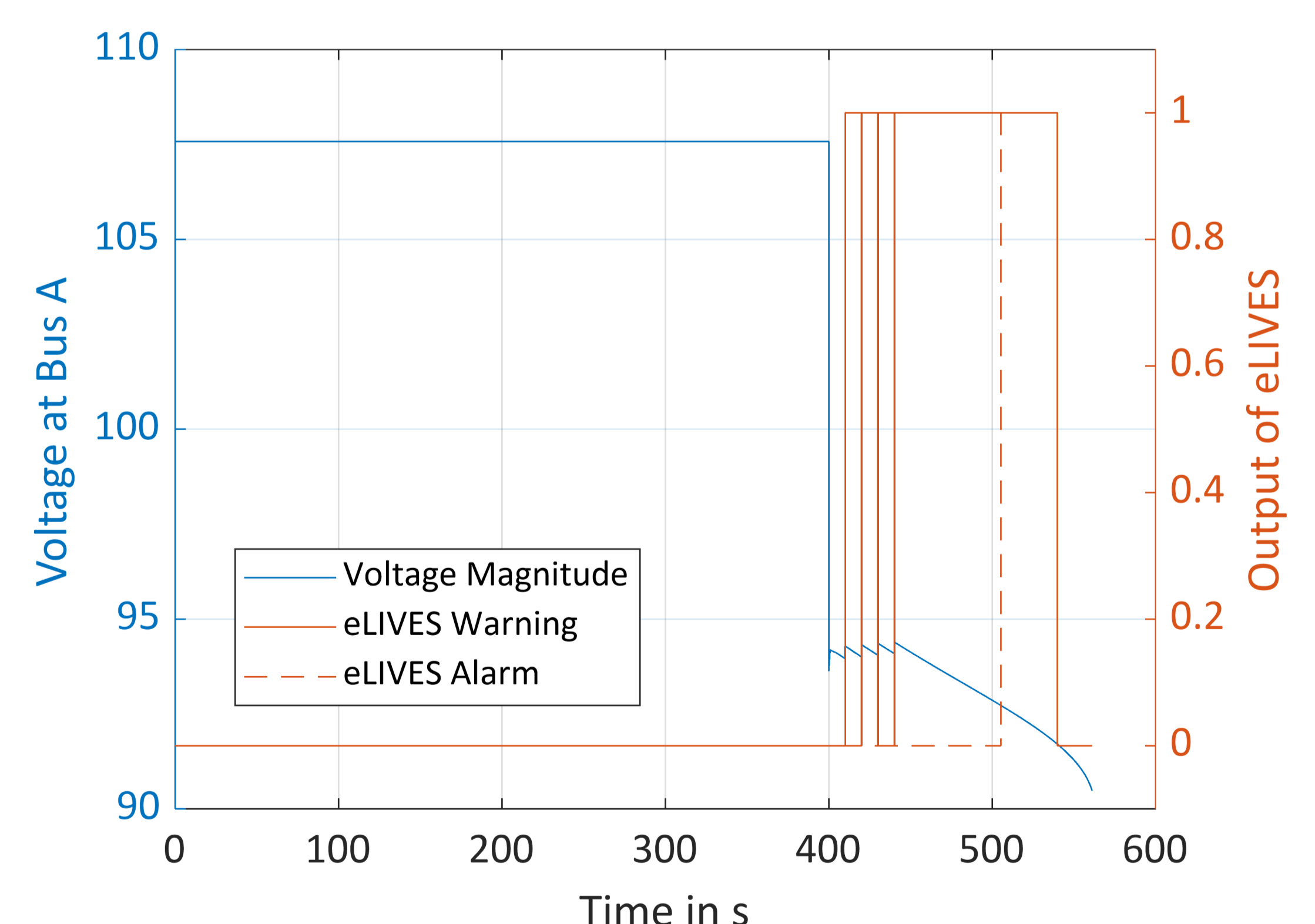
Results



Discussion

- Long-time behavior based on heat systems
- Time domain behavior of the voltage magnitude and its gradient complicate the detection of the voltage collapse.
- Do state-of-the-art detection schemes identify the voltage collapse reliably?

→ Extended-time Local Identification of Voltage Emergency Situations (eLIVES)



- Timer deactivation because of long-time behavior and increasing voltage gradient

Conclusion

- Dynamic interactions in IES are a potential risk for the voltage stability of electric grids.
- Existing voltage instability detection schemes must be adapted or new schemes developed.