



TAMPEREEN TEKNILLINEN YLIOPISTO

Heating and Storage Alternatives

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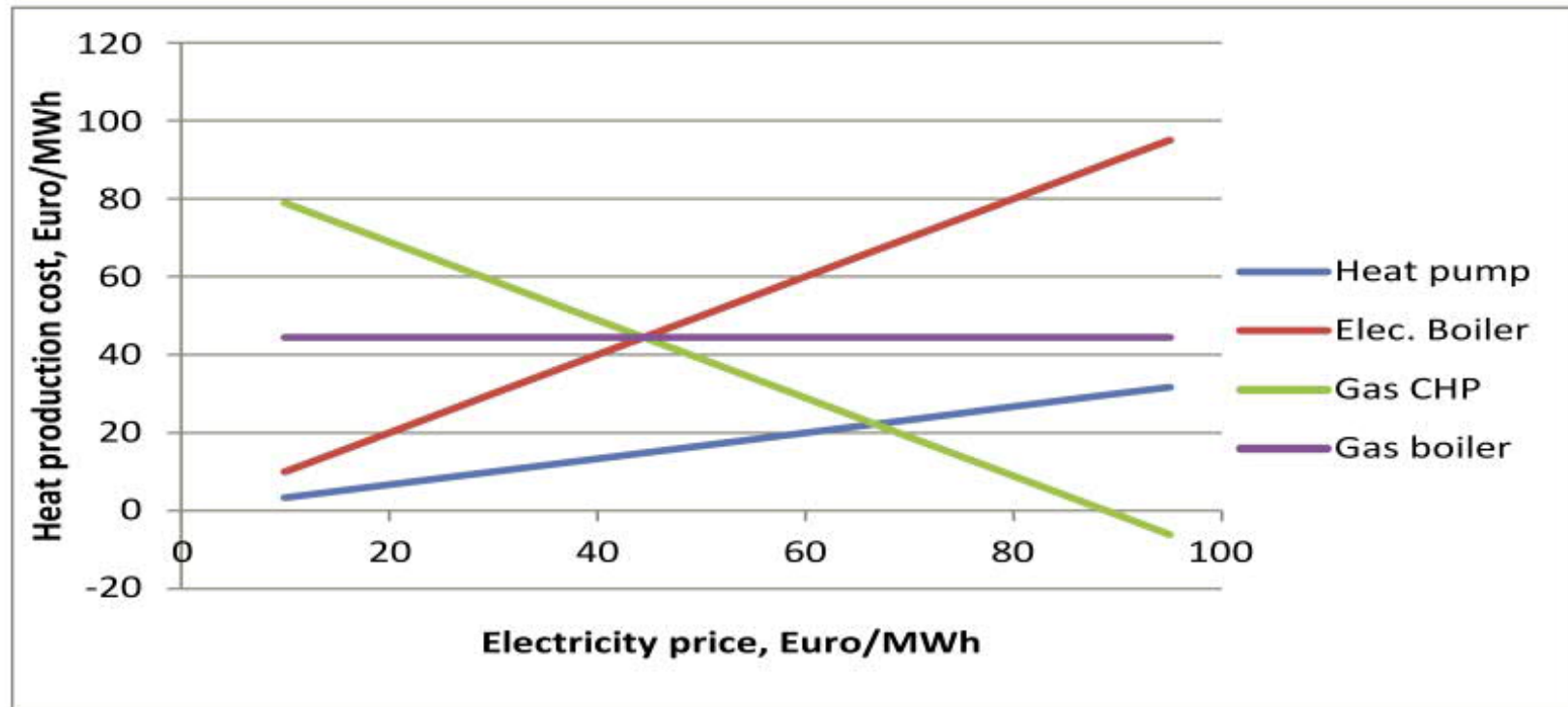
Tampereen Yliopisto/ Valmet

Content

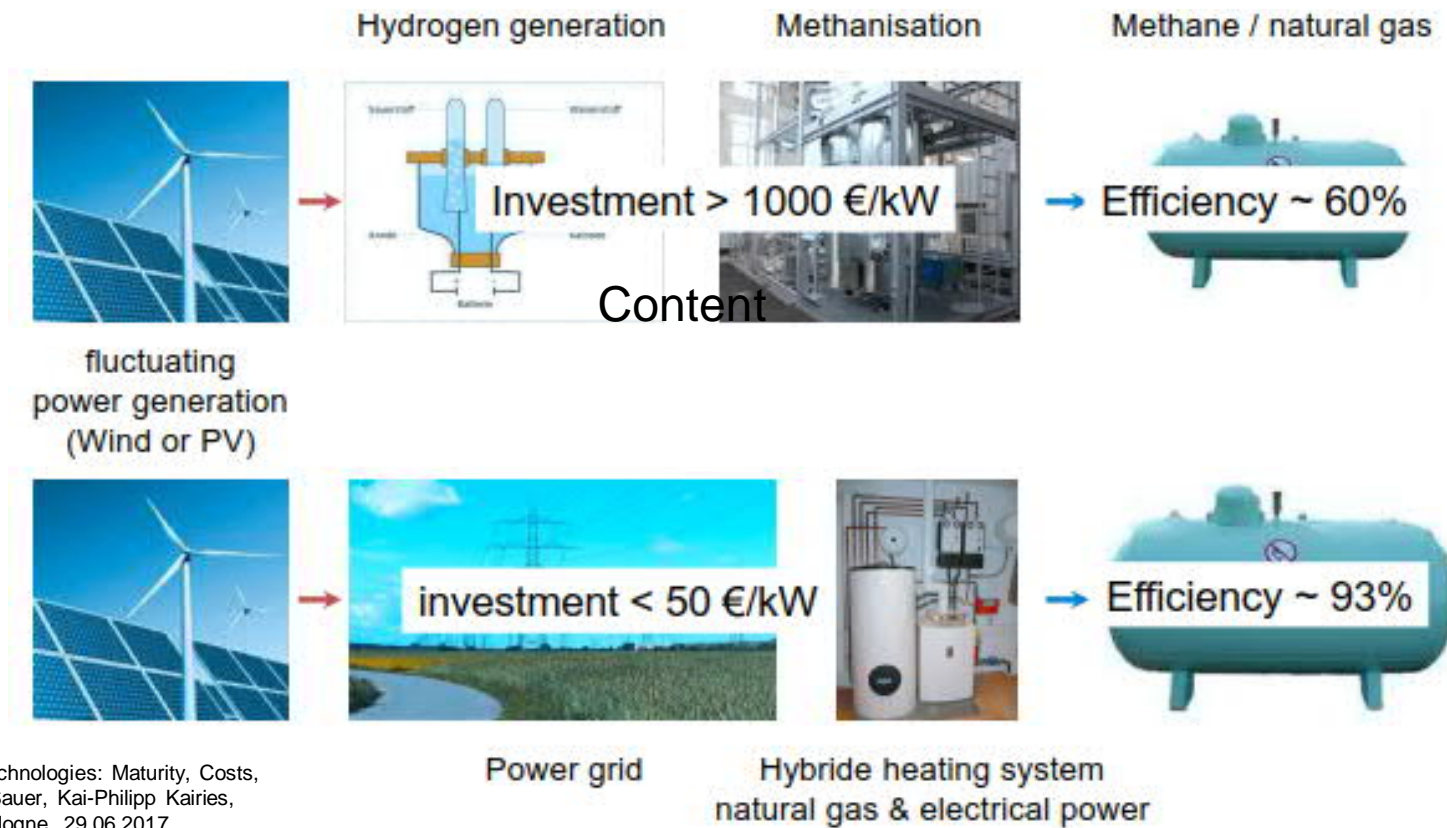
- Some background from literature review
- Constraints of the proposal
- Research issues
- Results
- Conclusion



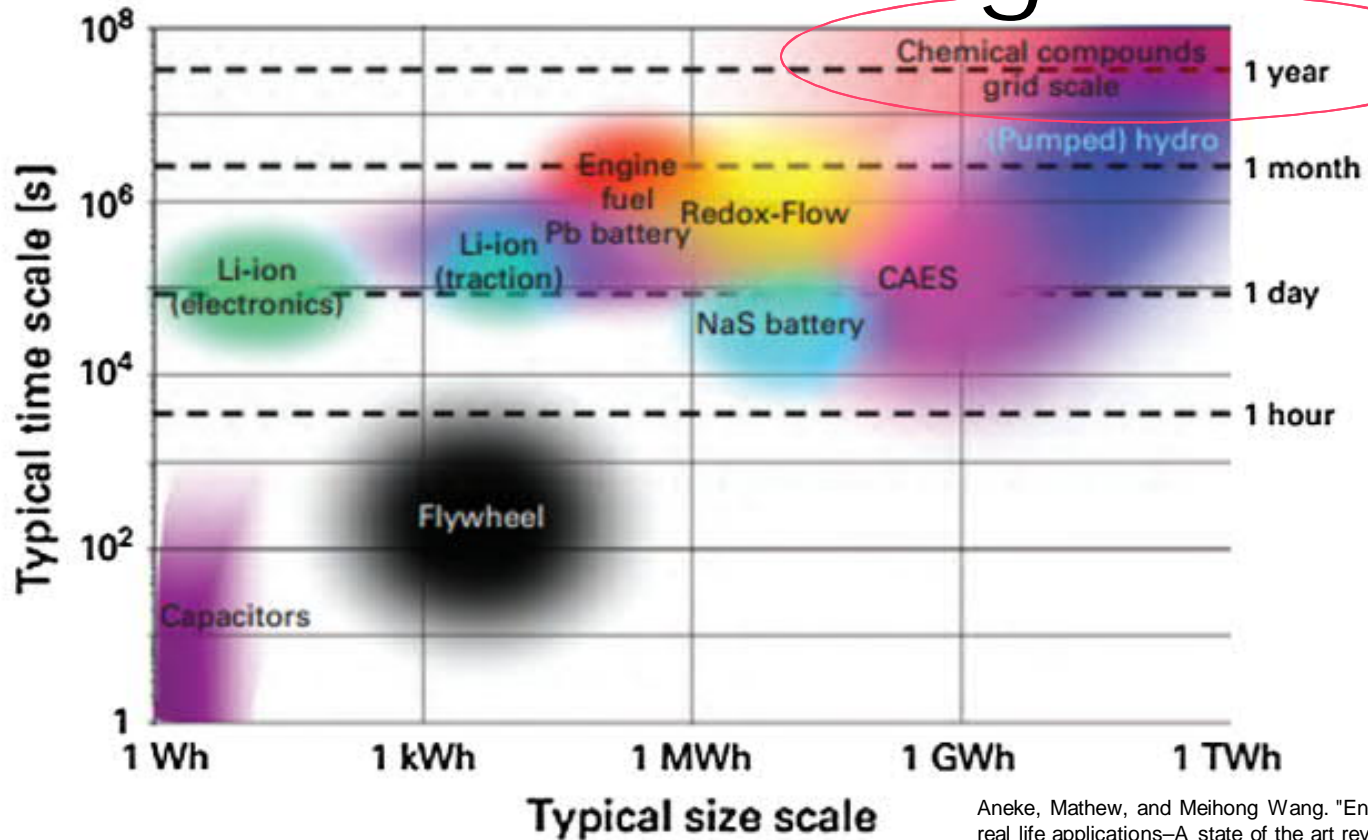
Price of heat and electricity



Comparison of PtG and PtH



Overview to Storages



Aneke, Mathew, and Meihong Wang. "Energy storage technologies and real life applications—A state of the art review." *Applied Energy* 179 (2016): 350-377. 9.1.2019 5





Technical solution

1. CHP maximization with large heat storage
2. Electrical storage with PtL fuels (else where)



Rational behind the solution

- Heat pumps are not feasible
 - Investment is high, Do not support flexibility
- Solar heating is not feasible
 - Heat demand and availability do not match
- Some potential in the electrical domestic heating (DR)
- Waste incineration not feasible due to small amount
- Biogas has also limited potential



Research issues

- Future trend of electricity price (control)
- Calculation scenarios for biomass fired CHP
 - Publication submitted (some results shown)
 - Lack of heat capacity in DH network/ industry
- Technology of seasonal storages → research proposal



Selected results

- Scenarios
 - Present system with 20.7 MW of installed wind
 - Balanced system with 85 MW of wind power and 15 MW of solar power
 - High wind system with 170 MW of wind and 15 MW of solar power



Conclusion

- Heat pumps, solar heating not feasible
- CHP can compensate electricity system to some extent
- Fuel price and investment are the most important parameters in feasibility
- Seasonal storage in research proposal

