

Gerhard Zweifel

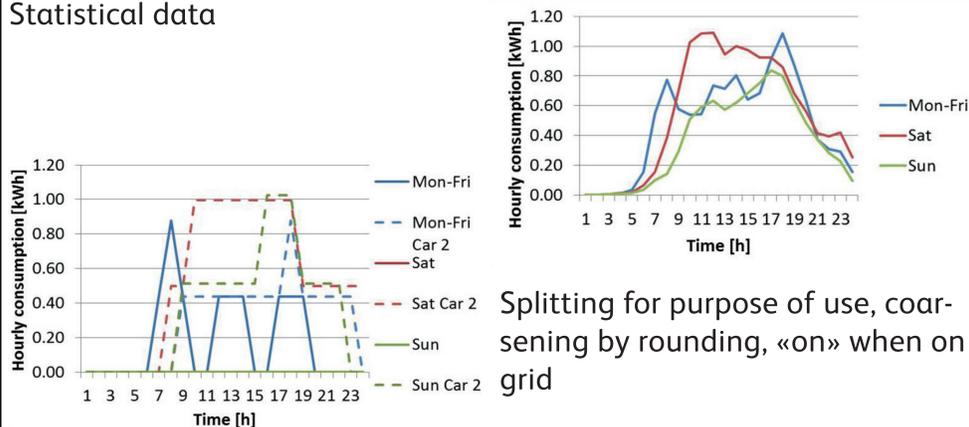
Hochschule Luzern – Technik & Architektur
Zentrum für Integrale Gebäudetechnik

Introduction

The goal was to investigate the energy supply of a residential unit including the associated individual mobility by a micro combined heat and power (CHP) system. For this purpose, a residential unit was simulated in detail, together with its mobility, i.e. the average energy consumption for the operation of automobiles to be associated with this unit, with different types of micro CHP units.

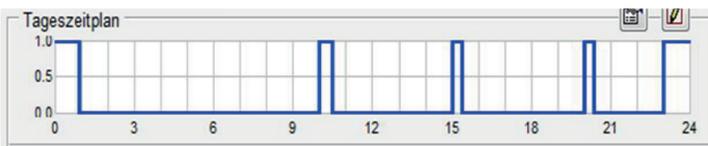
Modelling Mobility

Statistical data



Splitting for purpose of use, coarsening by rounding, «on» when on grid

Final profiles

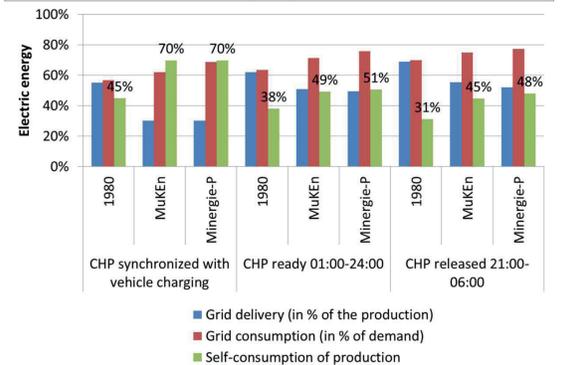
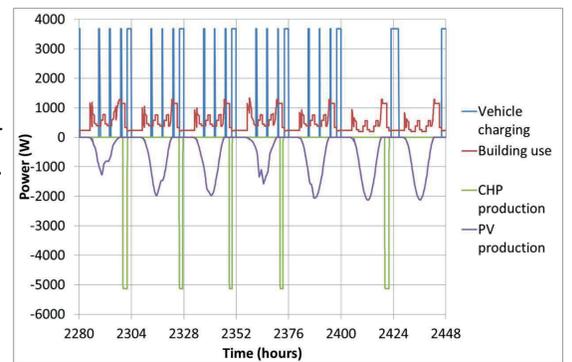


Simulation Scenarios

System Scenarios		System components	
Building standard	Reference scenario 'conservative'	Gas boiler for space heating and DHW, automobile with fossil fuel, grid electricity	
	Reference scenario 'progressive'	Ground coupled heat pump for space heating and DHW, electric vehicle, grid electricity, with and without PV	
	Scenario 'Polyvalent energy system'	CHP plant for electricity and space heating, heat pump for DHW only, electric vehicle, grid connection, PV	
«Bestand 1980»	«MuKEn»	«Minergie-P»	3 Variants: <ul style="list-style-type: none"> • Internal combustion engine (natural gas / biogas) • Micro gas turbine (natural gas) • Stirling (natural gas / pellets)

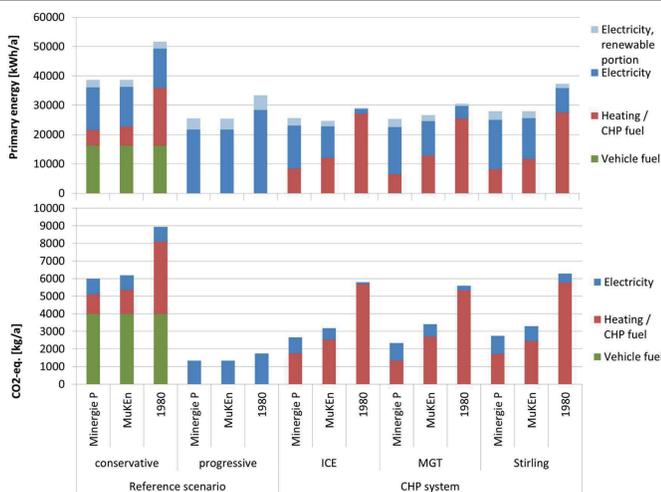
Results: Synchrony of Electricity Production and Vehicle Battery Charging

Electricity generation by CHP and PV are well complementary, but occur largely asynchronously to the demand for household and vehicle battery charging. With a synchronized release of the CHP operation, the self-coverage can be increased significantly, up to 70%. Condition: thermal storage for a daily heating/ DHW energy demand.



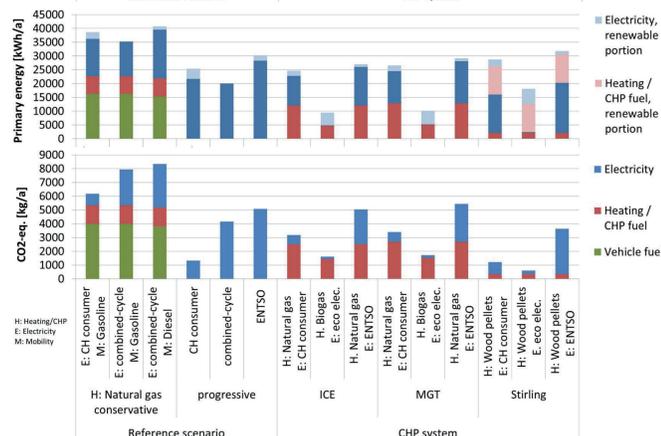
Results: Environmental Impact

Primary energy by scenario CHP equivalent to reference



CO₂ emissions by scenario: reference better

Primary energy + CO₂ emissions by energy carrier: advantages for CHP with bio fuel / eco electricity + wood pellets (for non renewable)



Conclusions

Micro-CHP in connection to electric mobility is competitive in terms of environmental impact compared to a progressive reference scenario (except for a pure greenhouse gas consideration).

References / Acknowledgements

Thanks to the co-authors of the final report from EMPA, HSLU, ZHAW and Oekozentrum:
Gaegauf C., Dorer V., Weber A., Tillenkamp F., Keller T., Struck C., Zweifel G. Gebäudeintegrierte polyvalente Energiebereitstellung. Schlussbericht, Langenbruck 2012
Also thanks to the Swiss Federal Office of Energy for funding



ibpsa.fr



BUILDING SIMULATION FOR A SUSTAINABLE WORLD
Building Simulation 2013, Chambéry, France