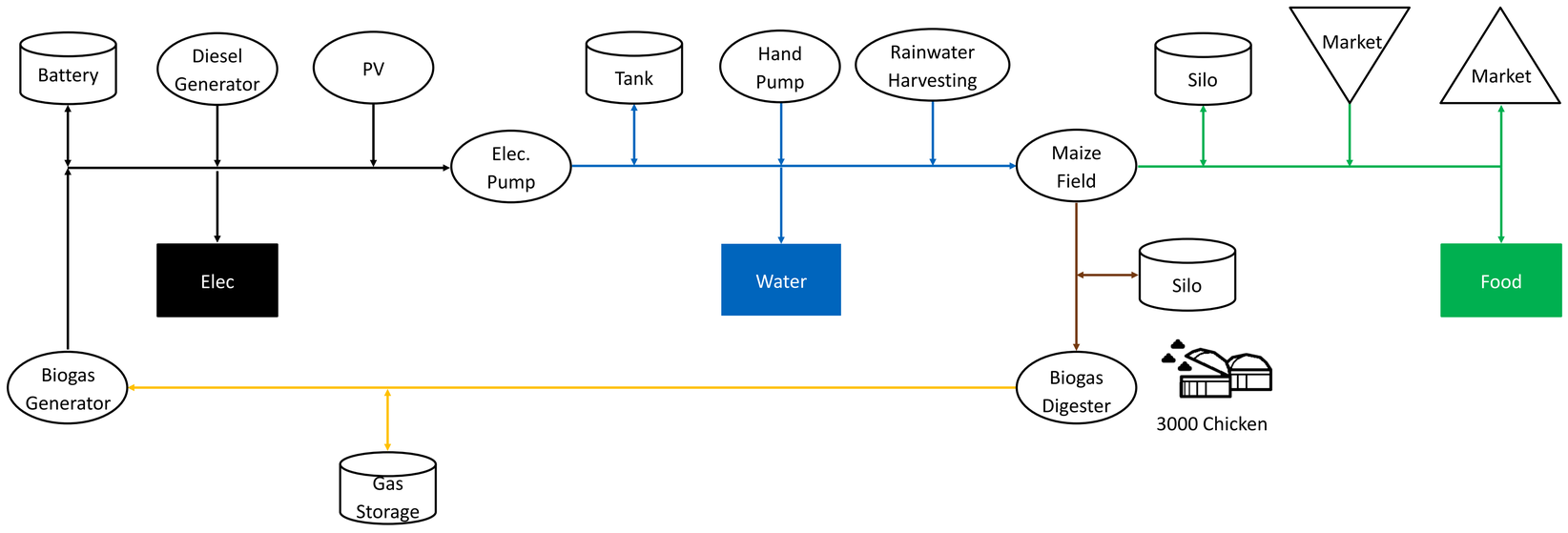
Chair of Renewable and Sustainable Energy Systems
Department of Electrical and Computer Engineering
Technical University of Munich

150 Jahre culture of excellence

Least-cost modeling of a decentralized Energy-Water-Food system in Kpori, rural Ghana

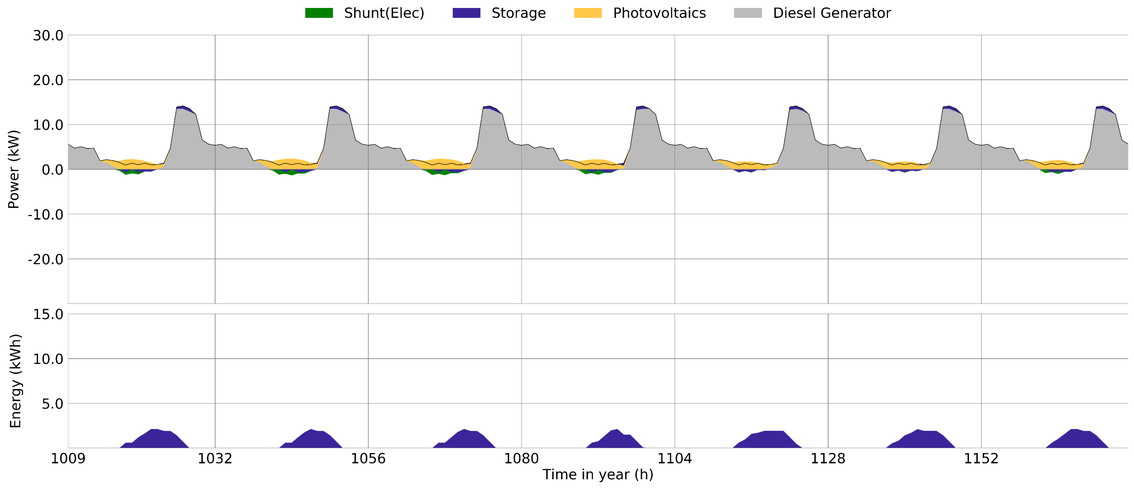
<u>Research aim: Identification of least-cost design for Energy-Water-Food system in Kpori, a case study village in rural Ghana</u>

- **Linear** modeling and **least-cost** optimization with *urbs*
- Each **model scenario** allows different **processes,** starting from scenario **'Diesel+PV'** including batteries just for private power consumption up to the scenario **'+100% Renewable'**. This is a system based on PV and batteries, water pumps, maize farming and selling, as well as the generation of biogas and its conversion to electricity for small-scale agriculture



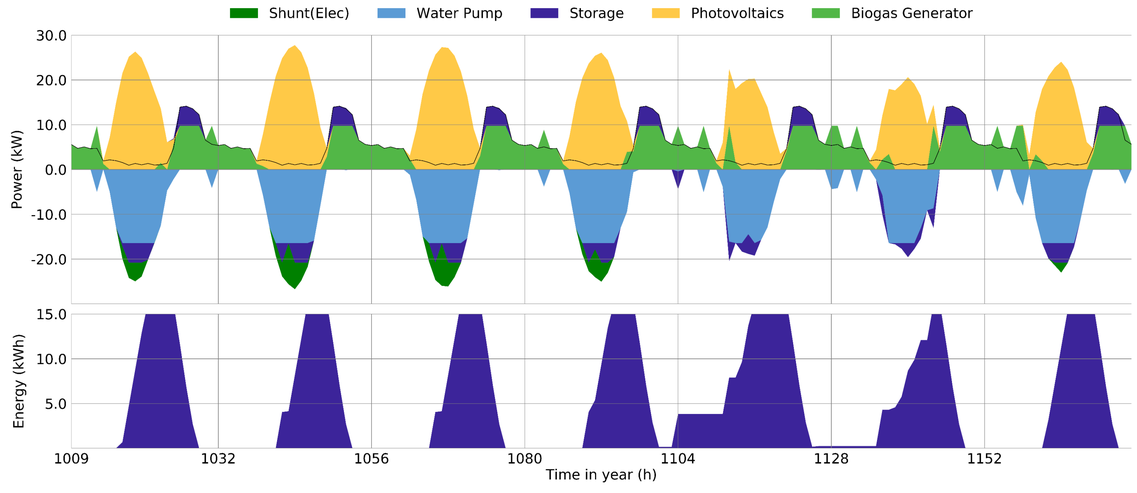
<u>Results: Example of time series for least-cost power generation and storage for one week for two different scenarios</u>

Scenario 'Diesel+PV:' system for private power consumption



Cost of electricity: **39,9 c/kWh**

Scenario '100% Renewable': system for small-scale agriculture



Cost of electricity: **20,9 c/kWh**

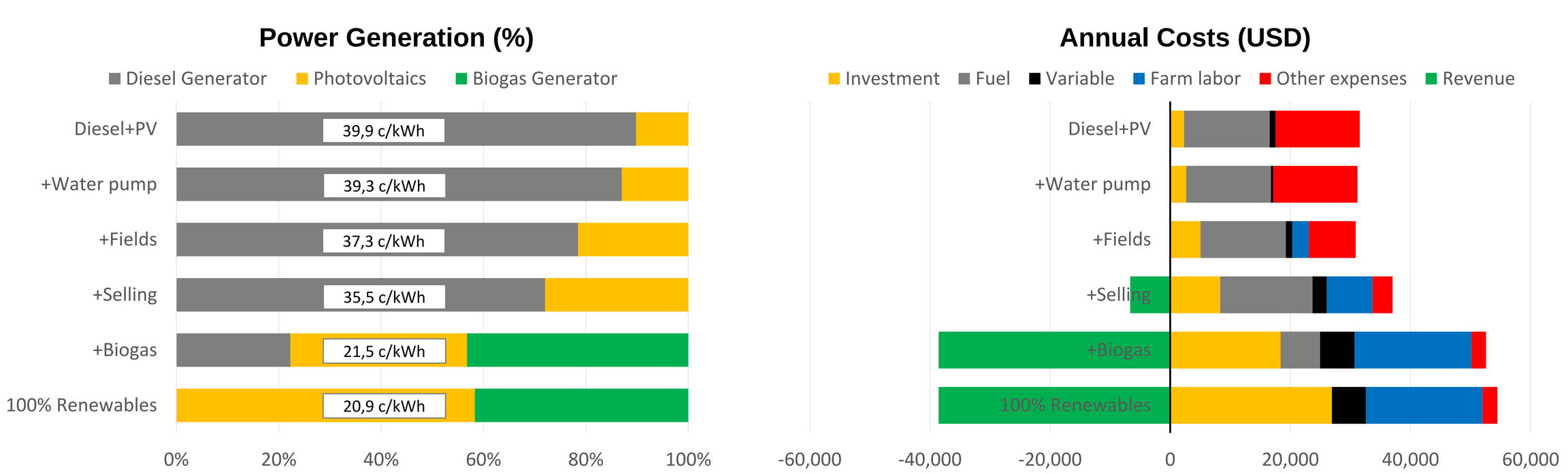
<u>Results: Optimization outputs for six sequence-built simulation scenarios</u>

Energy
- Amount of supplied energy
- Battery size
- Costs of electricity per kWh

Water
- Amount of supplied water
- Water tank size
- Water costs per unit m^3

Food
- Amount of supplied food
- Farm size
- Food production costs per ton

Costs and job opportunities
- Total costs and revenues
- Estimation of job creation



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