Building Clustering and Active Storage for Self-Consumption Maximization

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Background and Motivation

- **Benefits of energy consumption locally**
  - Less power losses during transmission
  - Grid stabilization at peak production hours

- **Motivation**
  The increase of the local consumption of solar energy in buildings in Großschönau by aggregating them to form virtual building clusters

- **Challenges**
  - Identify which building types and combinations are well suited for clustering in order to increase the local consumption of locally produced electricity (Photovoltaic)
  - Define the optimal cluster size
  - Evaluate the gain of self consumption in case of use of additional batteries and H_2 storages

Solar Energy and Consumption Profiles

The first step of the project is to estimate the energy production potential of every local generation, in this case photovoltaic power plants. For that purpose a model to simulate the energy produced is developed. (Figure 1) Since the model uses meteorological data witch is not gathered on the exact location, there is a slight mismatch.

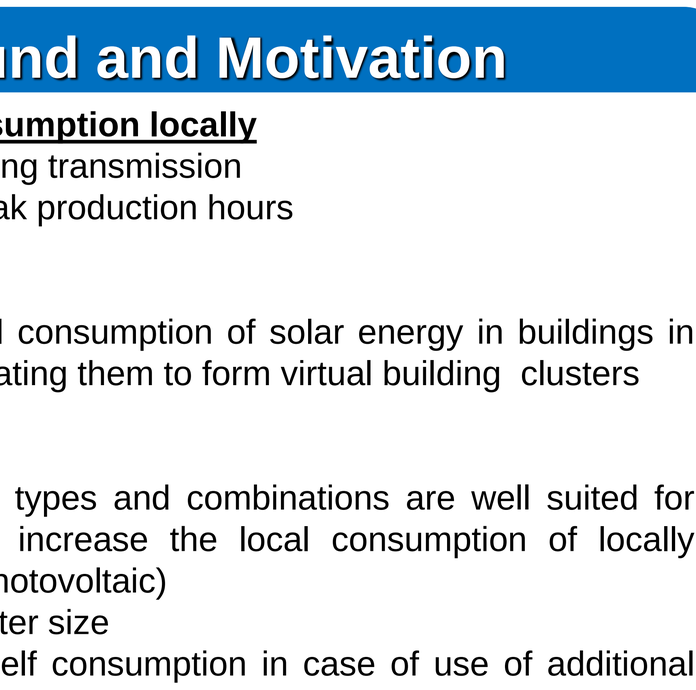

Figure 1

In Figures 1 and 2 the energy produced from a photovoltaic plant of 10 kWp is depicted and a comparison between real measurement data and simulation data is made. In Figure 1 the time step is more analytical (day level) and in Figure 2 the summarized energy of each month is depicted. The mismatch in the early months is possibly caused by snow and fog.

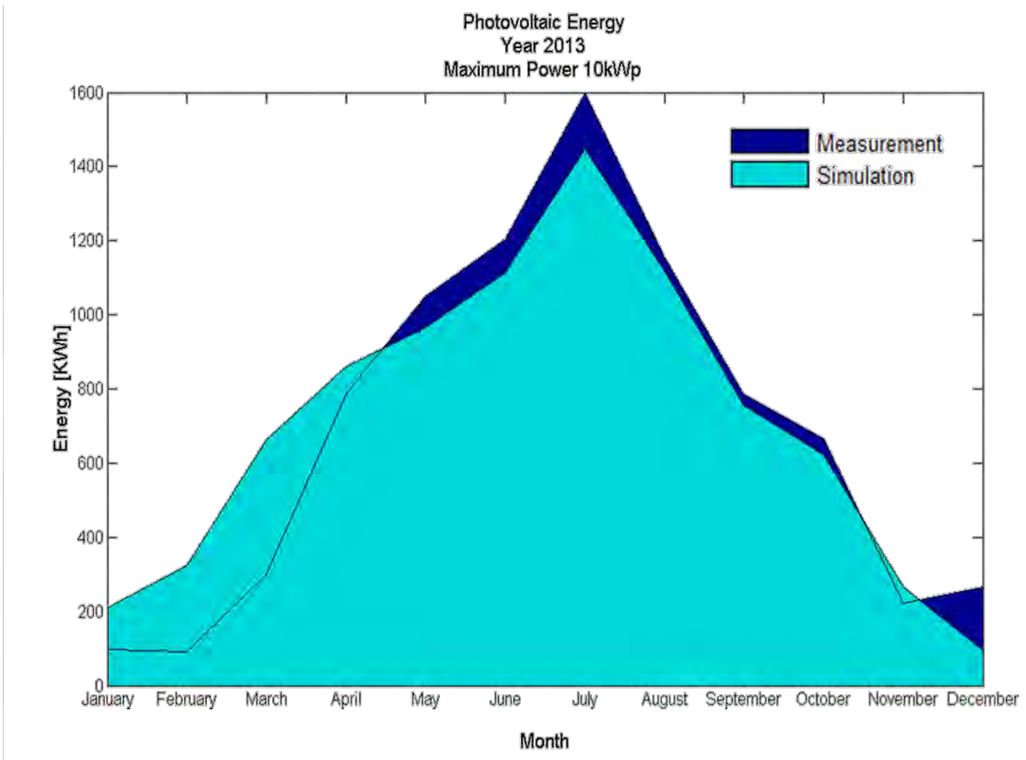

Figure 2

Since gathering real consumption data from each building in Großschönau is extremely difficult and expensive, the next step is to categorize the consumption profiles of the buildings in Großschönau, according to standard consumption profiles e.g.H0, G0, L0 .

Building Clustering

In order to maximize the consumption of the energy locally produced, buildings with suitable consumption profiles are planned to be clustered together, as shown in Figure 3.

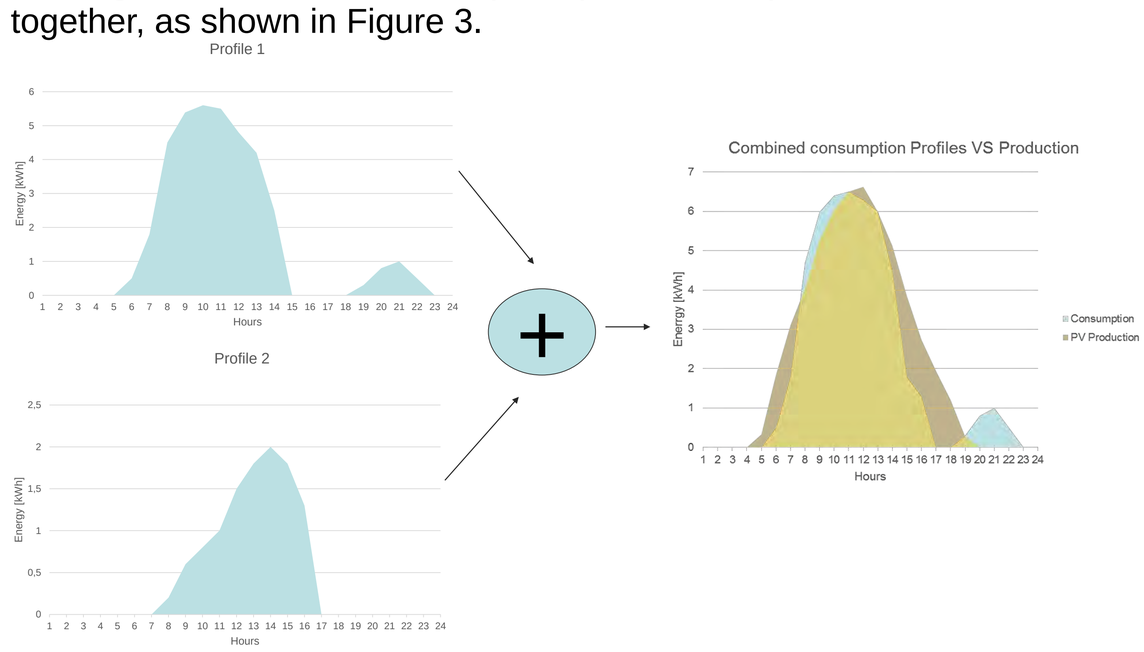

Figure 3

As depicted in Figure 3, by clustering buildings we can match the production profile with the combined consumption profile. Since it is not possible to have a perfect match, in the case of remaining produced energy, storages can be used. In this way, the energy will not flow to the grid, but it will be stored and consumed in the short or long future, again locally.

Storage Appliances and Load Shifting

The energy that can not be consumed (Figure 4) is first shifted via Demand Side Management (DSM) and then directed to a storage system. This system combines a traditional battery storage and a H_2 - storage.

In detail, the following concept is simulated, in the following sequence:

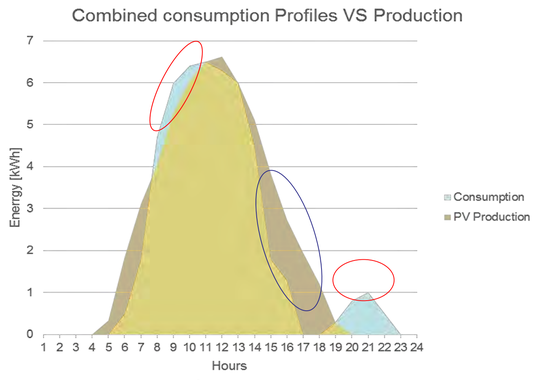

Figure 4

a) If more energy is produced by the PV than can be consumed:
   i. Energy is stored in the battery storage, until the battery is full, then
   ii. Energy is stored in the H_2 storage, until the H_2 storage is full, then
   iii. The rest of the energy is fed into the grid

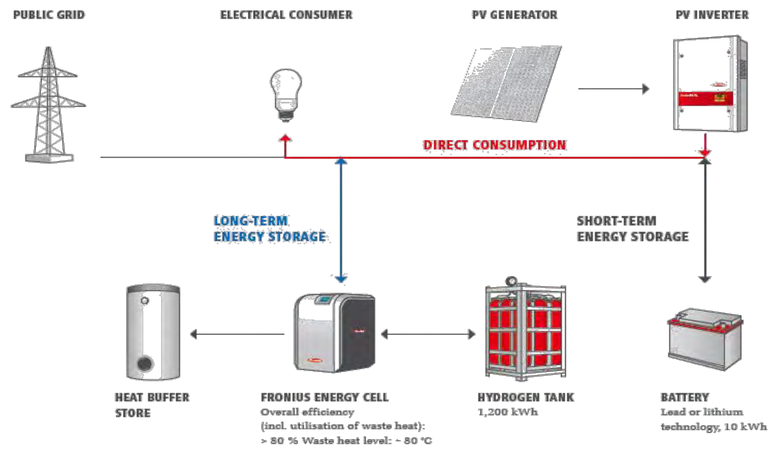

Figure 5 (source Fronius)

b) If less energy is produced by the PV than needed (Figure 5):
   i. The DSM potential of the building is used
   ii. Energy from the battery storage is used
   iii. Energy from the H_2 storage is used
   iv. Energy from the grid is used