In this project, we would like to demonstrate that electrical appliances like dish washers and washing machines only provide limited flexibility for DSM.

In all studies, we consider the following technologies:

* Heating equipment:
  + Combined heat and power (CHP)
  + Heat pump (HP)
  + Electrical heater (EH)
  + Boiler (B)
  + Thermal energy storage (TES)
* Electrical appliances:
  + Photovoltaics (PV)
  + Battery (Bat)
  + Dish washer (DW)
  + Washing machine (WM)

In a first approach, grids (thermal or electrical) between houses are not considered. Further, only relatively small buildings are investigated, which means that the following combinations of heating equipment are allowed (TES is always installed):

1. Bivalent systems:
   1. CHP, B
   2. HP, EH
2. Monovalent system:
   1. B

Concerning the electrical appliances, DW and WM are always installed. For each simulation, two cases have to be investigated – DW and WM are solely electrically powered or are also connected to the TES unit. PV and Battery are optional.

In order to limit the amount of simulations, the dimensioning is fixed. In a bivalent system, CHP units are designed to reach 5000 full load hours and HPs cover 95 % of the heating demand. The residual heat is supplied by either the boiler or the electrical heater. The design of TES, battery and PV directly results from the other heating systems and the building’s size.

As some sort of sensitivity analysis, the building could be varied (e.g. small, medium sized and large). Further, the DW and WM cycle could be varied (e.g. eco and normal mode). Also, dynamic and static electricity tariffs could be investigated.

Overall, the following combinations are possible:

|  |
| --- |
| Table 1: Investigated combinations |
| |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Set up | CHP | HP | EH | B | TES | PV | Battery | DW | WM | | 1 | X |  |  | X | X |  |  | X | X | | 2 | X |  |  | X | X | X |  | X | X | | 3 | X |  |  | X | X |  | X | X | X | | 4 | X |  |  | X | X | X | X | X | X | | 5 |  | X | X |  | X |  |  | X | X | | 6 |  | X | X |  | X | X |  | X | X | | 7 |  | X | X |  | X | X | X | X | X | | 8 |  |  |  | X | X |  |  | X | X | | 9 |  |  |  | X | X | X |  | X | X | | 10 |  |  |  | X | X |  | X | X | X | | 11 |  |  |  | X | X | X | X | X | X | |

Required Inputs:

* Thermal load curves (space heating and domestic hot water):
  + Small building
  + Medium sized building
  + Large building
* Electrical load curve
  + Small building
  + Medium sized building
  + Large building
* DW and WM:
  + Cycles (eco and normal mode)
  + Load curve (rate at which the device is filled)
  + Entirely electrically powered or connected to TES
* Electricity tariffs:
  + Dynamic (EEX prices)
  + Static