TITLE: Coordinating residential flexibility resources in socio-technical co-simulation design (CO-FLEX)

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Object under Investigation (*OuI*)

- Device-level flexibility
- Modular architecture for coordinating flexible resources

Function(s) under Investigation (*FuI*)

"The referenced specification of a function realized (operationalized) by the object under investigation"

Domain under Investigation (*DuI*):

- Electrical
- Thermal
- Environmental

Test Objectives

In this test case, the feasibility and effectiveness of co-simulation framework mosaik's Observer controller (OC) architecture in coordinating residential energy demand flexibility modelled with a socio-technical approach will be tested.
The OC architecture will serve as a backbone for the development of an aggregator model that is capable of sending DR requests tailored to the need of the network and the specificity of the user portfolio. Sensitivity analysis will be used to obtain an estimate of the potential for flexibility as technical-economic parameters (e.g., penetration of certain technologies and the characteristics of those technologies) and social parameters (e.g., consumer responsiveness to economic, environmental, and network stability signals) vary.
The simulation infrastructure will be tested against different consumer portfolio sizes to assess its scalability.

Purpose of Investigation *(PoI)*

1. To test the suitability of mosaik's Observer-controller architecture for managing and coordinating residential energy demand flexibility modelled with a socio-technical approach (characterization) test;
2. To estimate the demand flexibility potential (characterization test);
3. To assess the scalability of the proposed solution (characterization test).

System under Test (*SuT*)

In this test case, the main system consists of a set of households. Each household is equipped with a range of appliances and devices (e.g., heat pump). These households are part of the consumer portfolio of an aggregator to provide flexibility services to the grid.

Functions under Test (*FuT*)

Functions relevant to the operation of the system under test, including FuI and relevant interactions btw. OuI and SuT

Target metrics (*TM*)

Measures retrievable from SuT required to quantify each of the identified test criteria

Test criteria *(TCR)*

Formulation of criteria *for each PoI* based on properties of SuT; encompasses properties of test signals and output measures

Quality attributes *(QA)*

Threshold levels for test result quality as well as pass/fail criteria

Variability attributes *(VA)*

Identify relevant controllable or uncontrollable factors of the SuT and their required variability; refer to PoI