LLEC investigates and evaluates energy solutions for different living conditions.

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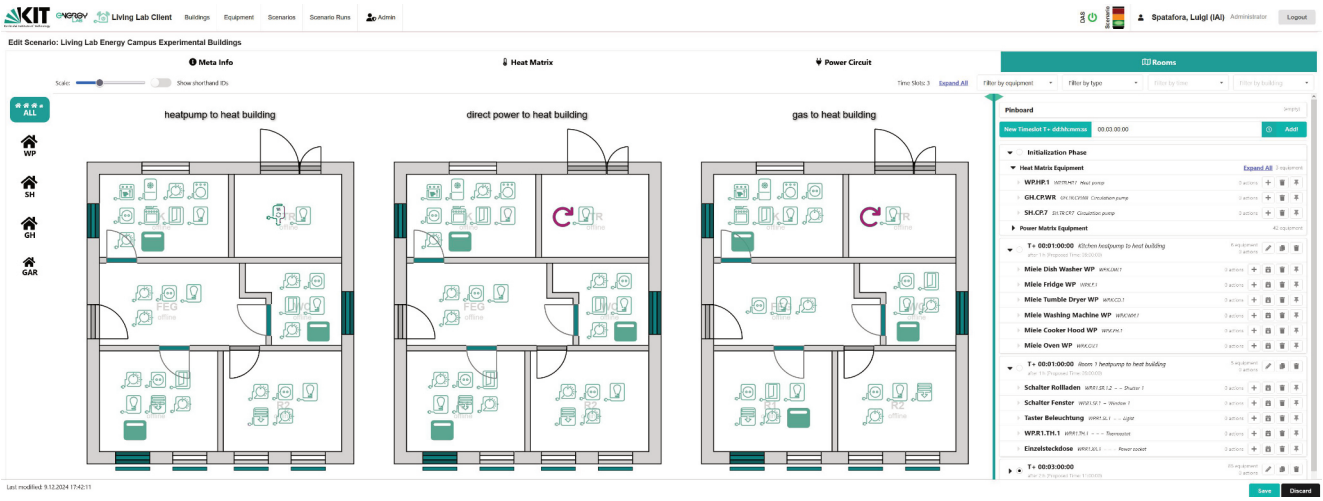
Living Lab Energy Campus

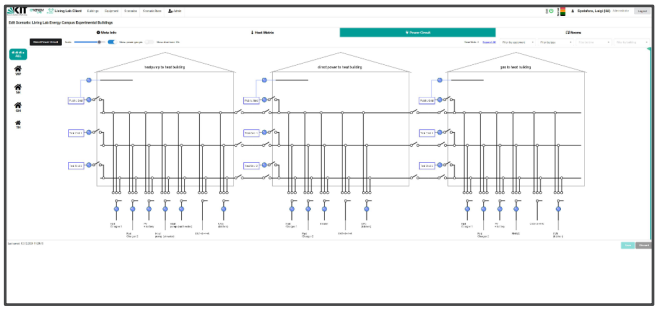
The Living Lab Energy Campus experimental buildings are three buildings in the form of single-family houses with the same architecture but different technical building equipment. The buildings are part of the research infrastructure SEnSSiCC (Smart Energy System Simulation and Control Center) of the Energy Lab and allow the execution of real experiments in the field of energy system design. Essentially, the research work is concentrated in the development of practicable energy management concepts taking into account realistic user behavior for future, sector coupled energy networks.

The special feature of the experimental buildings is the fully automated and highly flexible energy topology. The individual buildings are thus interconnected in terms of electricity, data and hydronic and function as single-family house or district. Heat pumps, fuel cells, smart instantaneous water heaters and ventilation systems for air conditioning are present for investigation. In addition, PV, solar and PVT collectors with various battery systems are installed. Electric vehicles and several charging stations are also available. In addition, one building has a DC power grid. Moreover, each component of the houses can be remotely controlled via a SCADA system.



WebClient of the SCADA System of the Experimental Buildings at the Energy Lab. Through the WebClient, any component or system of the experimental buildings can be remotely controlled. Additionally, scenarios can be planned, executed, monitored, and evaluated via the WebClient.

Living Lab Energy Campus



WebClient of the SCADA System of the Experimental Buildings at the Energy Lab. Each building has multiple microgrids. The SCADA system switches the building to the appropriate microgrid. This allows a variety of different experiments with the same building technology.

The architecturally identical buildings differ in their technical equipment in the different sectors: heat, electricity, and mobility. For example, they are equipped with various heating systems to represent a variety of different technologies. One house is heated by a heat pump, a second by electric heaters (also called direct electricity-to-heat), either by electric underfloor heating or intelligent instantaneous water heaters that use excess solar energy. The third house is supplied with heat by a fuel cell that uses natural gas and methane as chemical energy carriers. For the distribution of heat, both underfloor heating and wall radiators are installed in all three buildings. This allows a large number of existing buildings to be represented.

The buildings are equipped with a multitude of sensors to quantify the influence and interaction of the various subsystems. For example, the temperatures of the building masses, the room air at different heights, and all relevant points of heat generation are recorded. Furthermore, the heat flows introduced by the heating system are measured individually for every room. The hydraulic coupling between the buildings allows heat energy to be exchanged between them, for example, to investigate neighborhood concepts with regard to the shared use of resources. Weather influences can be precisely recorded by the local weather station.

On the electrical side, all major consumers are individually equipped with network analyzers to enable detailed measurements of consumption and voltage quality. The coupling of the buildings to the infrastructure of the Energy Lab (SESCL-Labor, insert link here) allows the buildings to be supplied via an experimental power grid, in which repeatable power grid scenarios can then be provided to investigate the reaction of the buildings to it.

Through the SCADA system, test scenarios can be easily defined, which then run automatically and can be easily monitored. The measurement data collected in this way are stored centrally in a database and are available for later evaluation.

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