



# 1 PowerFlexHouse

## Actively controlled buildings as assets in intelligent power grids

The PowerFlexHouse facility at DTU Risø Campus is a collection of three individual houses, which have been equipped with sensors and controllable power and heating equipment. The Power Flex House facility is interconnected with the configurable 400 V grid and the communication platform of the SYSLAB facility.

With a peak load of 10 to 20 kW, the buildings are well-sized for parallel operation on the SYSLAB power grid. All loads can be controlled by the central building gateway which receives data and events from bus controlled wired or wireless switches and sensors.



## Applications and Operation

**TEST AGAINST STANDARDS:**  
PowerLabDK facilities are suitable for technology development related testing of electric power components and systems against a wide range of standards; including IEC and CENELEC standards.

- ▶ Demand side response studies
- ▶ Consumption and user behavior simulation
- ▶ Control strategy analyses
- ▶ Consumer impact studies
- ▶ Grid impact studies
- ▶ In terms of power, heating, ventilation and hot water supply the houses appear as islands to the rest of DTU Risø Campus buildings
- ▶ Possible parallel operation on the SYSLAB power grid
- ▶ Houses can be operated as single entities or as combined loads to the grid



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### Technical Specifications:

The following load units are automatically controllable as flexible loads and can be monitored:

PowerFlexHouse 1	PowerFlexHouse 2 (under construction)	PowerFlexHouse 3
120 m2 eight room office building	100 m2 one story domestic house	150 m2 three story domestic house
10 pcs electric space heaters (0.7-1.25 kW)	10 pcs hot water heaters (0.7-1.25 kW)	- heaters (0.6-1.4 kW)
refrigerator	refrigerator/freezer	refrigerator/freezer
2.3 kW hot water boiler	electric stove	-
5 pcs 0.75/0.99 kW cooling/heating air conditioner w/ heat pump	dish washer	dish washer
	washing machine/Dryer	washing machine/dryer
	3 kW hot water boiler	3 kW hot water boiler
1.4 kW Light installation	1.2 kW light installation	1.5 kW light installation
50 bus controlled sensor/actuator devices	50 bus controlled sensor/actuator devices	80 bus controlled sensor/actuator devices

The PowerFlexHouse facility is a platform for smart grid test activities

**Consumer impact studies:** The impact of the required service level on the load flexibility and the potential economic benefit for the consumers can be analyzed. The various controllable electrical units are controlled within given conditions according to the required service level on the one hand and the potential benefits on the other hand.

**Control strategies and portfolio coordination:** The impact on the total efficiency (in terms of cost per kWh) of various control strategies for the demand can be tested - including central management, distributed management based on simulated local price signals, the voltage levels and the common line frequency. Control dependency on measurement and requirement to connection/interfaces can be analyzed.

**Grid impact and system efficiency:** The impact on the overall system efficiency of the time step and time delay (from hours to seconds) of the synthetic price signal provided to the consumer can be analyzed - including a) fixed prices within an hour, b) new (fixed) price signals every minute and c) asynchronous local price signals defined by actual local status.