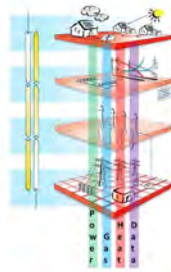


ENERGY SYSTEM INTEGRATION FACILITY



TNO innovation
for life

Proofing energy system configurations of the future. There is a need to validate and demonstrate the energy system of the future. During the energy transition it is essential to investigate the changing relations and interactions between energy infrastructures and data infrastructures to address the challenges of the transition. The HESI facility is located at EnTrance (Energy Transition Centre) in Groningen and offers an unique set of value propositions and technical services for projects that focus on hybrid energy systems.



LAYERED APPROACH. The HESI facility is equipped with state of the art energy and data infrastructures in line with the philosophy of our four layer model of energy systems. Being able to separate the physical world from the services world is a key concept that is a fundament of the HESI facility.

INTEGRATED VALUE PROPOSITIONS
Hybrid energy systems are systems where

infrastructures for power, gas and heat are combined to offer the optimal solution for energy demand. The HESI facility offers standardized facilities from connectivity to the energy infrastructures to lease of energy equipment, combined with ICT infrastructures that enable advanced control, simulation and scalability experiments. The facility is the risk reducing step before large scale deployment of innovations in energy systems. The HESI facility provides a full package of standardized services to projects that make use of the facility. These services lead to the value propositions listed below.

- **TECHNICAL ANALYSIS OF HYBRID ENERGY SYSTEMS.** Create understanding and insight about technical behavior of sustainable and hybrid energy system configurations which are variable in size and complexity.

- **VALIDATION OF CONTROL ARCHITECTURES OF ENERGY SYSTEMS.** Develop and advise on potential control mechanisms for specific



technical problems in a specific sustainable and hybrid energy system configuration.

- DYNAMIC MODELING AND SIMULATION OF ENERGY SYSTEMS. Provide a safe technical live demo and test environment in combination with a strong simulation tool to develop technical, social, economic and legal answers for practical operational and policy related challenges.

- STANDARD TECHNICAL SERVICES FOR EASY SET-UP. The HESI facility offers key services for projects. Standardized hardware project sites with default connectivity to the energy infrastructure for power, gas, heat / cold and data infrastructure will make it easy to set up the project site. State of the art equipment can be leased from the facility without burdening the project with



large investments. A unique service is the ability to implement and use sophisticated control architectures. Advanced control algorithms, dynamic simulations/emulations of networks, network components and control systems can easily be added to the project site.

EXAMPLE CASES OF THE HESI FACILITY:

COST SAVING WITH HEAT MANAGEMENT. An Energy Service Company (ESCO) sells heat to 10.000 users in a high rise community with several blocks of buildings. The challenge is to reduce costs by smarter energy management. TNO offers an advanced heat management system: Heat Matcher, although projects can decide to use a different system. The HESI facility provides a small-scale lab copy (partly physical components, partly with simulations) of the real-life situation with 2 heat pumps and software to simulate 10.000 heat pumps. The ESCO gains real experience with new heat management system and confidence for actual implementation.

COMPLEX EVOLUTION OF LOCAL HYBRID



ENERGY SYSTEM. A large city faces the challenge how to create and manage a reliable and 80% sustainable energy system in the city. The HESI facility provides grid equipment to connect power, heat and gas grid, hardware in the loop and software environments for simulation and control. The physical system is configured with power, heat and gas infrastructure and grid

connected equipment such as heat pump, PV collector, heat buffer, gas buffer, combined with a distributed system control architecture. The city gains insight how to manage a complex, integrated hybrid energy system.

LARGE SCALE DEPLOYMENT. An aggregators wishes to use a large number of devices that offer a substantial amount of flexibility, and has tested this on a small scale. The biggest challenge is to get from the basic technology trials to real life large scale deployment of products and services for energy flexibility management. The facility combines simulation, emulation and actual implementation of large number of products to determine the impact of deployment and operation in terms of reliability and manageability, thus reducing risks.

HESI FACILITY POSITIONING

The facility bridges the gap between proof of principle and the deployment of hybrid energy system technology in real life. Combined with other disciplines such as legislation, regulation and socio-economics it is a crucial environment contributing to a successful energy transition.

TNO.NL



CONTACT

René Hooiveld
 Director Sustainable Energy
 TEL: +31 (0) 88 86 62815
 rene.hooiveld@tno.nl

Visiting address HESI FACILITY
 Zernikelaan 17
 9747 AA Groningen
 The Netherlands