SATAKUNTA UNIVERSITY
OF APPLIED SCIENCES

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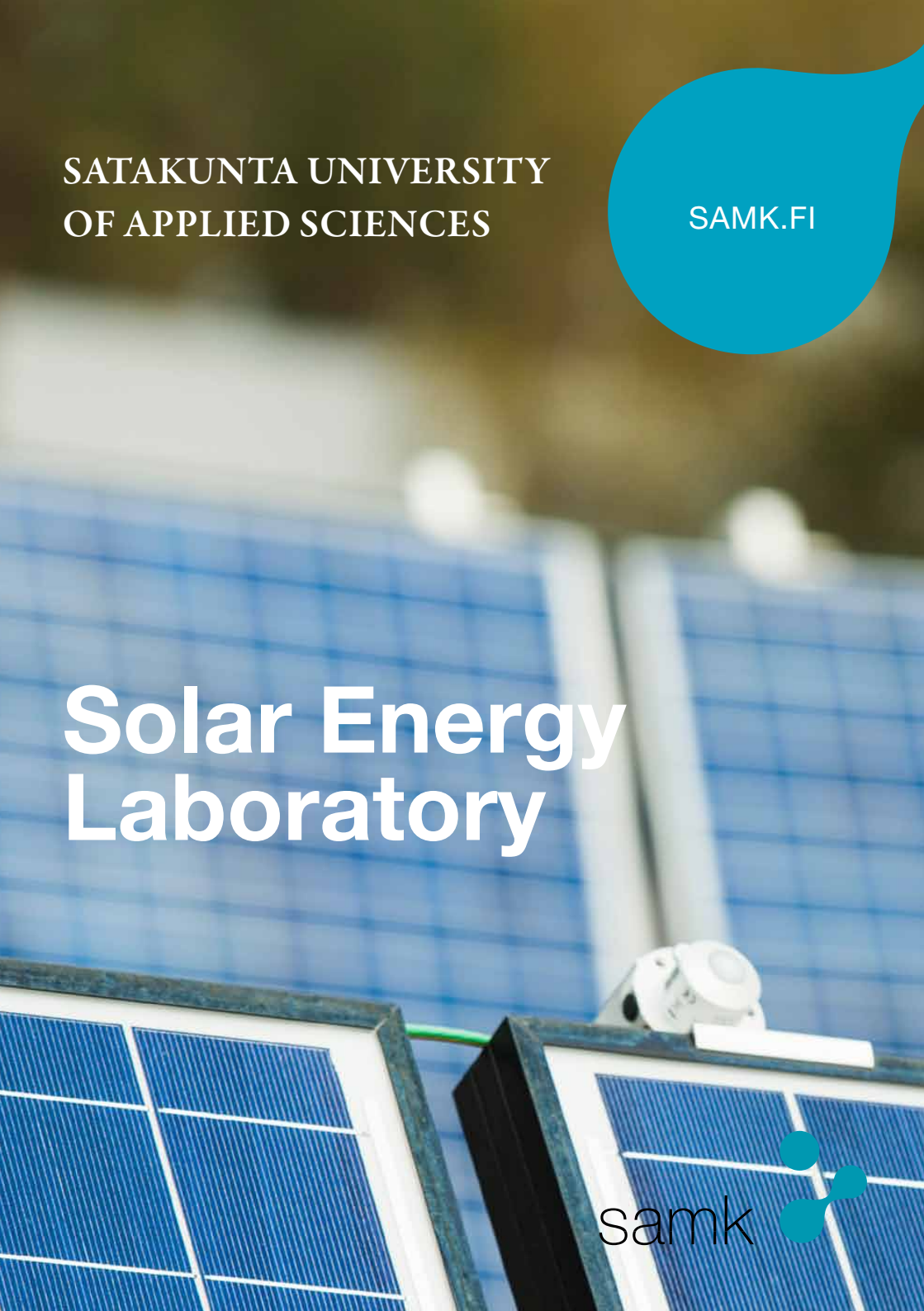
Solar Energy Laboratory



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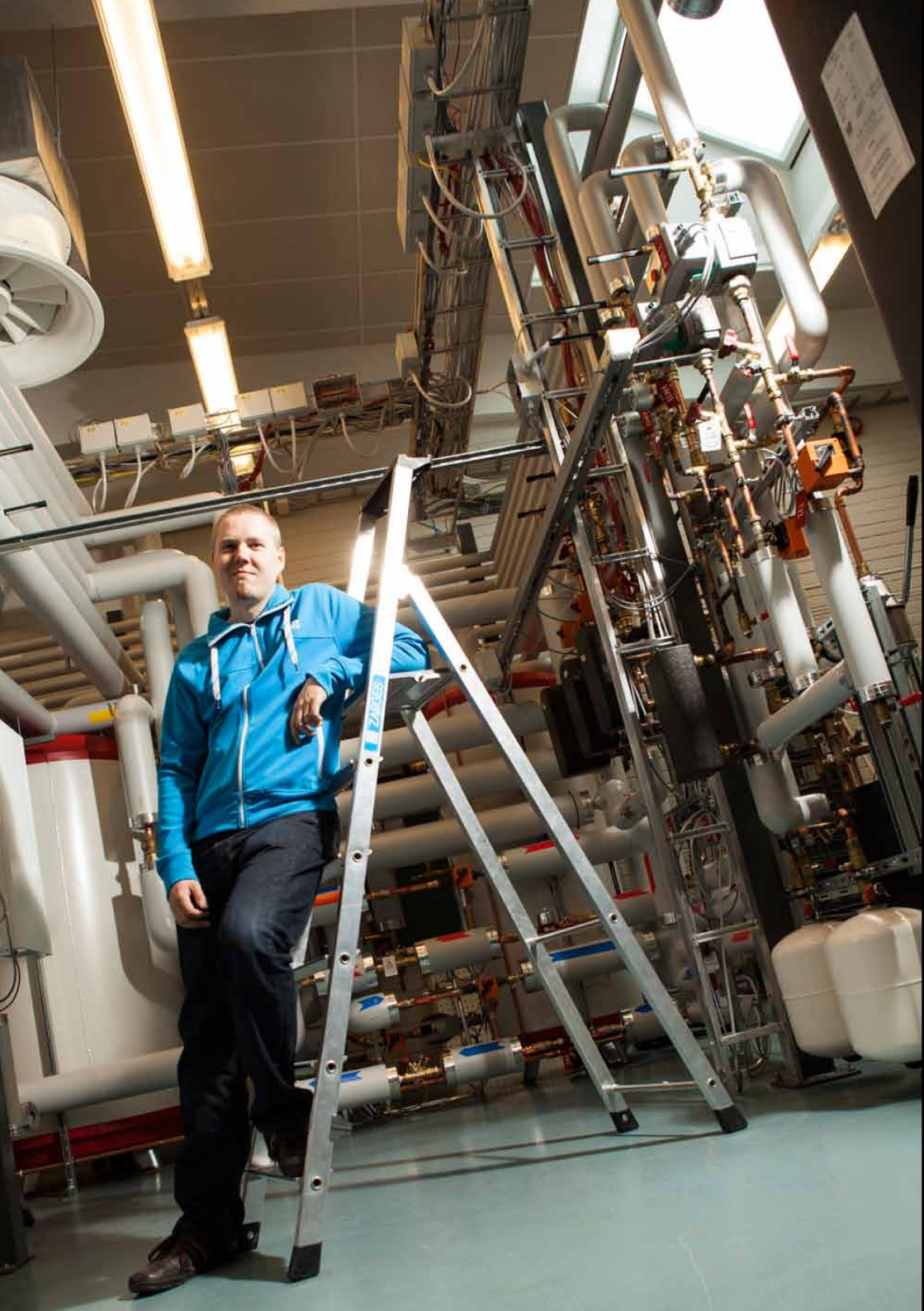


Solar energy laboratory

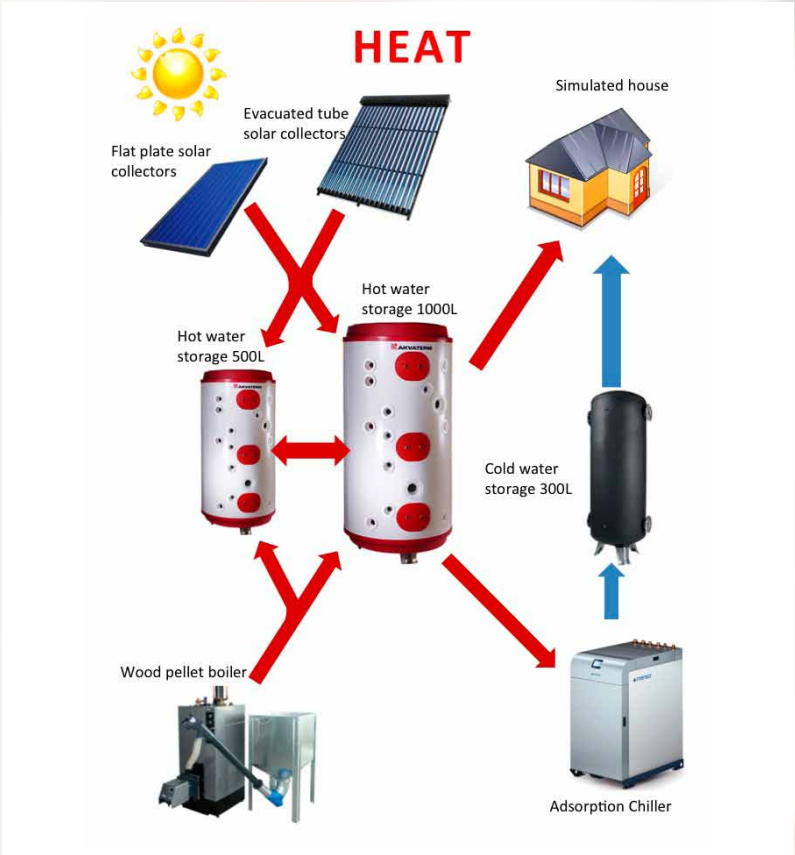
Solar energy laboratory at Satakunta University of Applied Sciences is equipped with versatile research equipment for renewable energies. The laboratory is used for research on producing and storing heat, electricity and cold. Support for the development of a measurement and control system is a key role of the laboratory.

Two separate solar collector groups are formed by using flat plate and evacuated tube collectors. These are the most commonly used technologies in Finland. Produced heat is stored in three hot water storages (1000, 500 and 30 liters). A wood pellet boiler is installed in the laboratory to simulate hybrid energy systems and to produce additional heat to the hot water collectors when necessary. Different bio-energy materials can be tested with the boiler and their flue gas emissions can be measured. The laboratory is equipped for later expansions of renewable energy systems.

An adsorption chiller uses hot water for cooling. The cooling process is based on the evaporation of water, which takes heat from its surroundings. Cold water is stored in 300 liter cold water storage, from where it can be used in air conditioning.

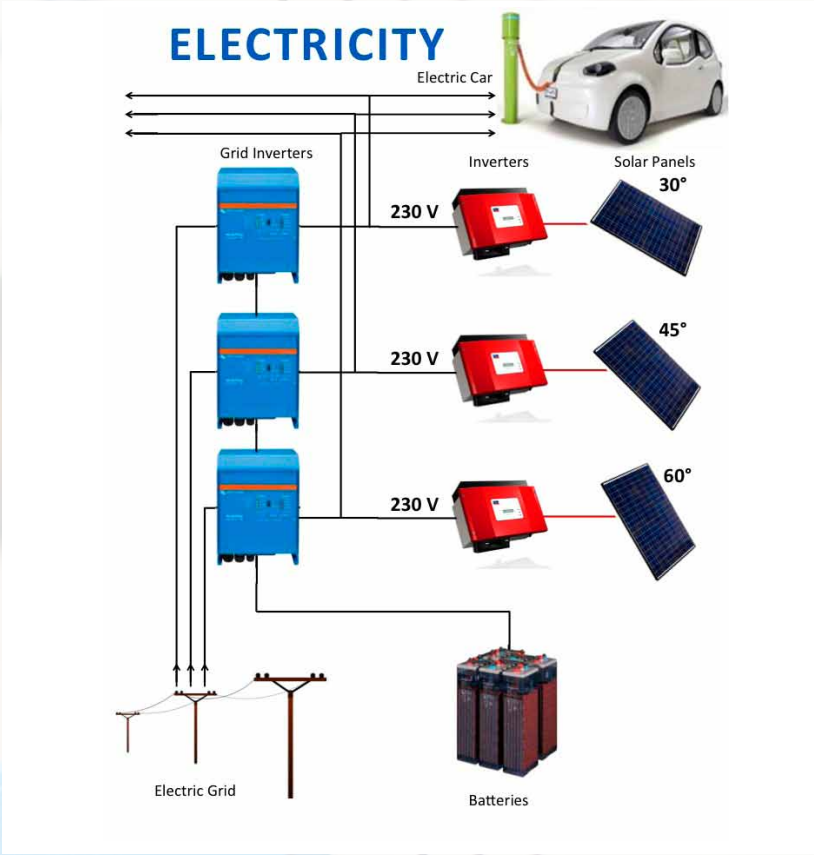
Photovoltaic system consists of 18 solar panels that are used to do research for example on how the angles effect on the production rates at different seasons. In addition to this, the system has a solar tracker which automatically directs the panel towards the sun. Produced electricity is used in the laboratory and excess production is stored in the 20 kWh battery bank.

Energy consumption of different buildings can be simulated by running a liquid cooler circuit with different consumption profiles. The liquid cooler circuit works also as a condenser for the waste heat from the adsorption chiller. Heat exchangers, which work as DHW consumers, use the generated heat according to the simulated building. Consumption circuit works as the ones used in a regular domestic house. Simulations of heating system and the heating coil of air conditioning are included in the consumption circuit. In addition, the circuit can be used to cool boilers and storages after test runs.



HOW IT WORKS

- 2 flat plate collectors and 2 evacuated tube collectors, total ca. 10 m2, collect heat into the solar coolant of non-freezing solution of propylene-glycol and water that circulates in the collectors. Heat is transferred from the solar coolant in to water with heat exchangers.
- Hot water is stored in 1000, 500 and 30 liter hot water storages.
- Hot water storages can be used to simulate consumption of domestic hot water of different sized families.
- Heat exchangers at the consumption side are used to simulate e.g. the space heating
- Pellet boiler works in parallel with the solar system and can be used simultaneously
- Chiller transfers hot water into cold water for air conditioning using adsorption method.



HOW IT WORKS

- 18 panels in three different installation angles feed electricity into the laboratory through inverters
- Additional power is gained from a tracker system that moves in the direction of the sun
- Excess electricity is stored in 20 kWh lithium battery
- When produced electricity isn't enough, electricity from the batteries is used
- As consumption grows, electricity from the grid is used to offset the consumption
- Grid inverters direct the use of electricity between photovoltaics, batteries and grid
- Pure renewable energy can be used to charge the electric car of the university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Equipment

Equipment	Model
Photovoltaics	
18 PV panels	Evergreen ES-A210
Data logger	Sunny WebBox
3 Inverters	SMA Sunny Boy 1200
Weather station	Vaisala WXT520
3 Pyranometers	Kipp & Zonen SP Lite2
2 Pyranometers	Kipp & Zonen CMP3
Tracker& comparison panel	Sanyo HIT-HD4
Inverters	Enecsys Micro inverter
Data logger	Enecsys Gateway
Solar thermal	
2 Flat plate collectors	EURO L20 AR
2 Evacuated tube collectors	AHP 20
Laboratory facility	
Artificial sun	
Hot water storage	AKVA Solar 1000
Hot water storage	AKVA Solar 500
Cold water storage	Akvaterm
Adsorption chiller	InvenSor LTC 09
Temperature sensors	Pt100
Water meters	E-THXKA
Flowmeters	ifm SBY 433
Pressure sensors	Sitrans P200
Valves	Belimo HRYD24 - SR
Pumps	WILO-Stratos 25/1-10 CAN PN 10
Pellet boiler	Thermia Biomatic +
Batteries	International Battery IB-B-FHE-40
PLC	Beckhoff CX5020
3 Grid inverters	Victron
Data logger	Victron Ethernet Remote

MORE INFORMATION

Petri Lähde, +358 44 710 3980, petri.lahde@samk.fi

Satakunta University of Applied Sciences
Tiedepuisto 3, FI-28600 PORI
+ 358 2 620 3000 | www.samk.fi

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Tekes

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Centre for Economic Development, Transport and the Environment

Leverage from the EU 2007–2013

European Union
European Regional Development Fund
European Social Fund