Zürcher Hochschule
für Angewandte Wissenschaften

**zh
aw**

**School of
Engineering**

IEFE Institut für Energiesysteme
und Fluid-Engineering

ORC plant:

An ORC (Organic Rankine Cycle) process is a steam power cycle (Clausius-Rankine cycle) which is operated with an organic fluid. The process can be operated with less overheating in comparison to water and is therefore suitable for low temperatures. This is made possible by the positive slope of the vapor curve of the organic fluids. ORC systems convert waste heat from industrial processes into electrical energy at a temperature range of approx. 100 to 450°C with an efficiency between 10 and 15%.

The ORC facility at IEFE is used for student training as well as research and development. The waste heat source is created by heating thermal oil in an electrical heater. The temperature and flowrate of the thermal oil can be set up in a range of 110 - 145°C and max. 20 m^3/h. Heat is dissipated via a cooling circuit which uses an evaporative cooler to discharge the heat to the environment. The temperature (18 - 30°C) and flowrate (max. 10 m^3/h) of cooling water can also be adjusted. The variable heating and cooling load enable analyzing the stationary and dynamic states of the system within a wide operating range.

The installation consists of the following components:

- **Thermal oil system**
- **ORC module**
- **Cooling system**

The entire configuration of the installation as well as the measurement points are shown in the **P&ID (Piping and Instrumentation Diagram)**. The cooling system also serves the solar thermal facility, which is shown also on the P&ID. The measurement

data is collected, recorded and visualized using a National Instruments data acquisition device with LabView visualization. In addition to showing instant readings in the flow diagram, a Log(p) diagram or a T-S diagram are visualized on the monitor in real-time.
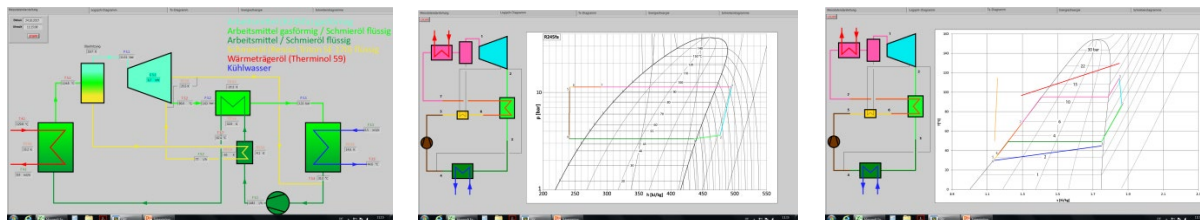
ORC module EnefCogen Green 15 PA (EnefTech):

Heat input: 175 kW (150/115°C)

Cooling output: 150 kW (25/40°C)

Electrical output: 15 kW

Working fluid: R 245fa (1,1,1,3,3-Pentafluoropropane)

Lubricant: Reniso Triton SE170 (POE)

Expander: Scroll expander SZ380-4CBA (Danfoss)

Recirculation pump: CRN 3-25 K / speed control via frequency converter

Heat exchanger: Plate heat exchanger (brazed)

Energy / exergy flow chart:

R245fa
Reniso Triton SE 170
Terminol 59
Kühlwasser
elektrische Leistung
Losses