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This project is supported by EEA / Norway Grants and Technology Agency of the Czech Republic under the KAPPA Program.

DEXPAND

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DEXPAND PROJECT

Name: Optimised expanders for small-scale distributed energy systems
No. project: TO01000160
Time of plan implementation of project: 1st October 2020 – 30st April 2024
Project budget: € 1,469,700
Supported by: **EEA and Norway Grants 2014-2021**
Technology Agency of the Czech Republic, Kappa Programme
(https://www.tacr.cz/en/kappa-programme/)

Number of participants/partners: 4
Czech Technical University in Prague, FME, UCEEB (academia/research institute) - Czechia
GT-Progress, s. r. o. (industry) - Czechia
NTNU Trondheim (academia) – Norway
SINTEF Energy (research institute/industry) - Norway

PROJECT FOCUSED

- **development and testing of cost-effective expanders for power generation in distributed energy systems**
- reporting expanders data and on mapping of the technologies over the power range 1–50 kW based on cost, application feasibility, and performance
  - ***Rotary vane expander*** **.**
  - **Impulse or reaction single stage axial** or radial turbines with possible *partial admission*
  - Novel impulse turbine concepts — single-wheel radial Curtis-type historically known as ***Elektra turbine***

PROJECT STRUCTURE

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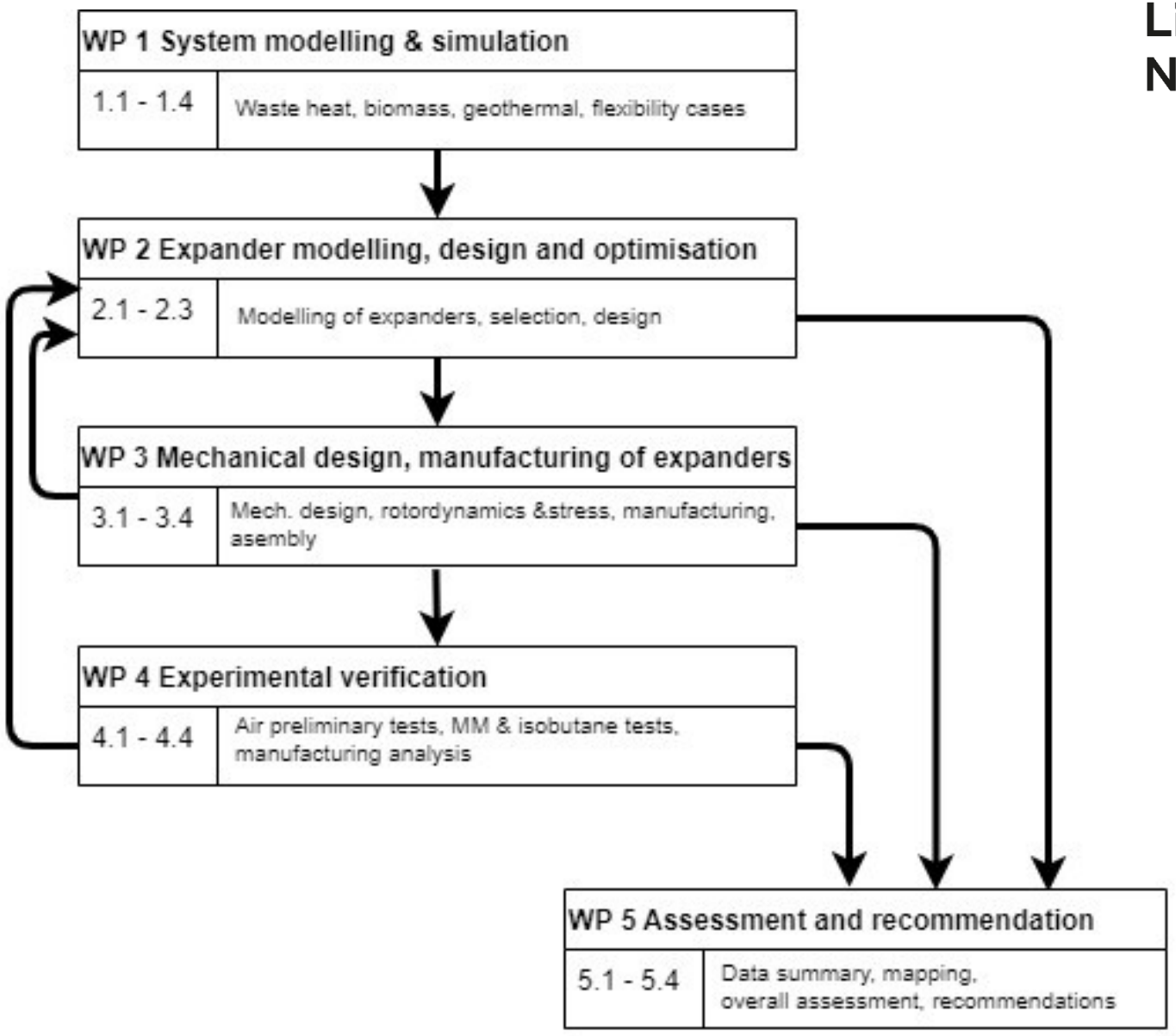

WP1 SYSTEM MODELLING AND SIMULATION (SINTEF, CTU, NTNU)

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The main objective within WP1 is to design three different heat-to-power conversion cycles by means of system modelling, simulation and optimisation.

The work includes defining case studies and in detail specific boundary conditions and their operating range, for three different applications with expander power output in the range of 1–50 kW.

The three case studies will be based on:

1) waste heat recovery,

2) biomass-fired micro-cogeneration

3) low-temperature geothermal heat source.

WP 2 EXPANDER MODELLING, DESIGN AND OPTIMISATION (NTNU, CTU)

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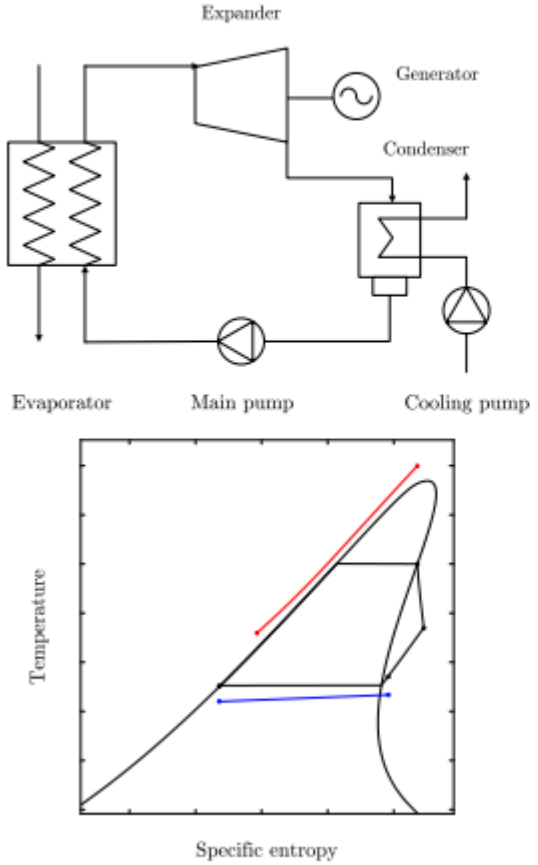
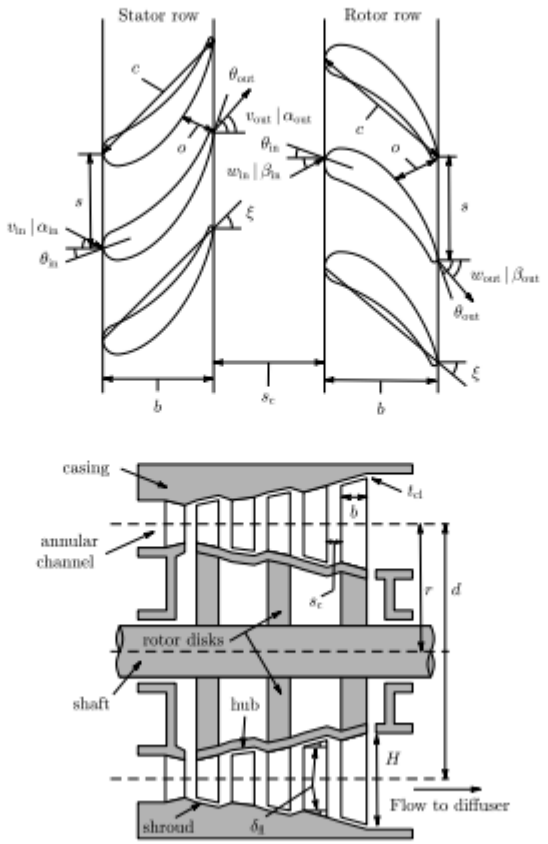
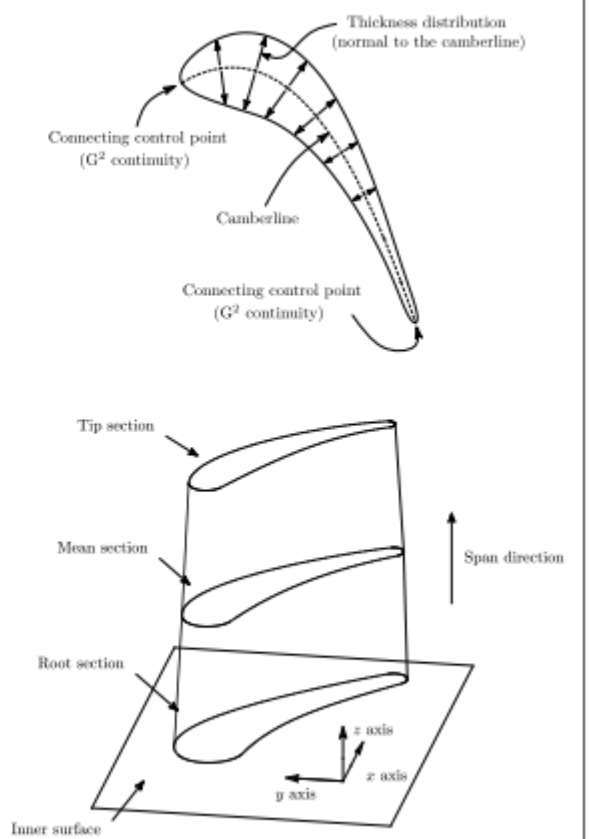
System design	Mean-line design	Aerodynamic design
		

WP 3 MECHANICAL DESIGN, MANUFACTURING OF EXPANDERS (GT PROGRESS, NTNU, SINTEF, CTU)

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The consist of 4 steps:

- Expander mechanical design
- Rotordynamics and dynamic / stress analyses
- **Manufacturing track**
- Expander assembly and commissioning

WP4 EXPERIMENTAL VERIFICATION (GT PROGRESS, NTNU, SINTEF, CTU)

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Two steps:

a) the air rig preliminary test will be employed to verify general operation and readiness of the expanders before being implemented into the experimental rigs with organic fluids.

b) the rigs with organic fluids, either MM in Czechia or isobutane in Norway

WP 5 ASSESSMENT AND RECOMMENDATION (CTU, NTNU)

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- **Cost and Feasibility Mapping**
  - cost (for several manufacturing scales)
  - reliability (service intervals) over the range of considered technologies (impulse axial, radial cantilever turbine, Curtis-like “Elektra” turbine and rotary vane expander)
  - range of power output (1-50 kW).
- **Overall assessment**
  - suitability of the specific technology and the expander size for given applications will be performed.
- **Recommendations for future.**

RESULTS - PLAN

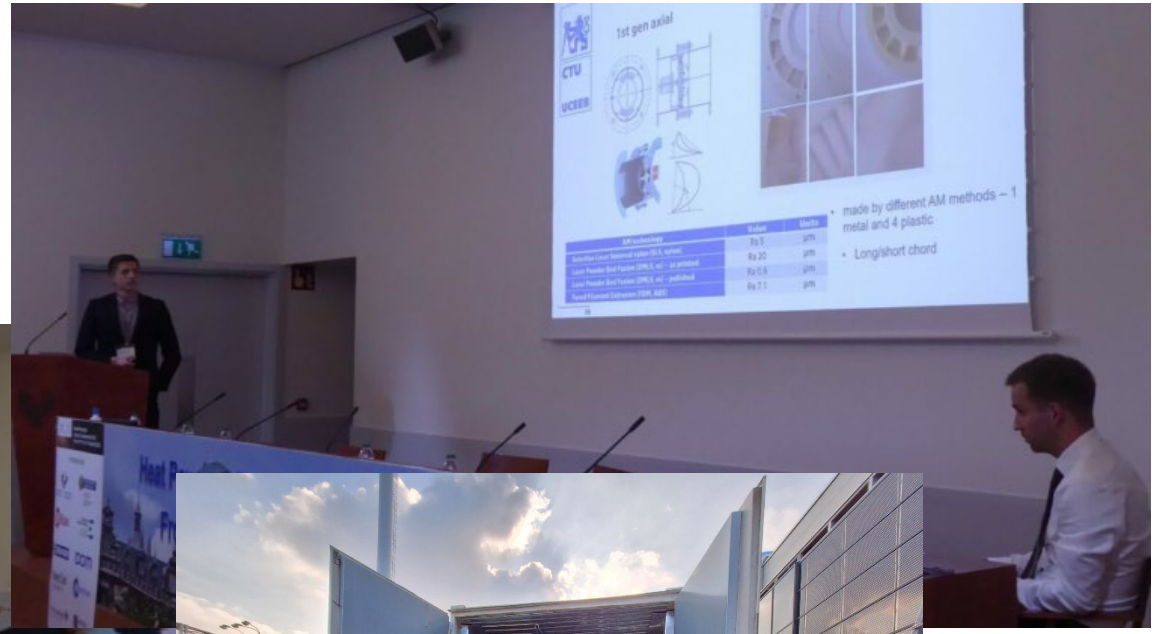
- 3 functional samples (more specific 4)
  - **Rotary vane expander for isobutane working fluid (Gfunk – functional sample) –** *exp. verified on air*
  - **Turbo-expander for isobutane working fluid (Gfunk – functional sample)**
  - **Turbo-expander for MM working fluid (Gfunk – functional sample)**
  - **“Elektra” turbine - velocity compound radial turbine for MM working fluid (Gfunk – functional sample) –** *add as a new results*

RESULTS - PLAN

- 3 others type
- Report - Summary publication of geometries, experimental data and mapping of expanders' feasibility (O – miscellaneous)
- Joint publication - Journal paper in review open-access journals
- Joint presentation at internatinal conferences

PUBLICITY

- Joint partners meetings, presentation and publications
- Publicity events
- Joint Experimental campaign



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THANK YOU FOR YOUR ATTENTION

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THE PROJECT „OPTIMISED EXPANDERS FOR SMALL-SCALE DISTRIBUTED ENERGY SYSTEMS“ BENEFITS FROM A € 1,469,700 GRANT FROM ICELAND, LIECHTENSTEIN AND NORWAY THROUGH THE EEA GRANTS AND THE TECHNOLOGY AGENCY OF THE CZECH REPUBLIC.