Technische **Hochschule** Ingolstadt

Institute of
new Energy Systems

The Institute of new Energy Systems

Introduction at EUREC-College of Members
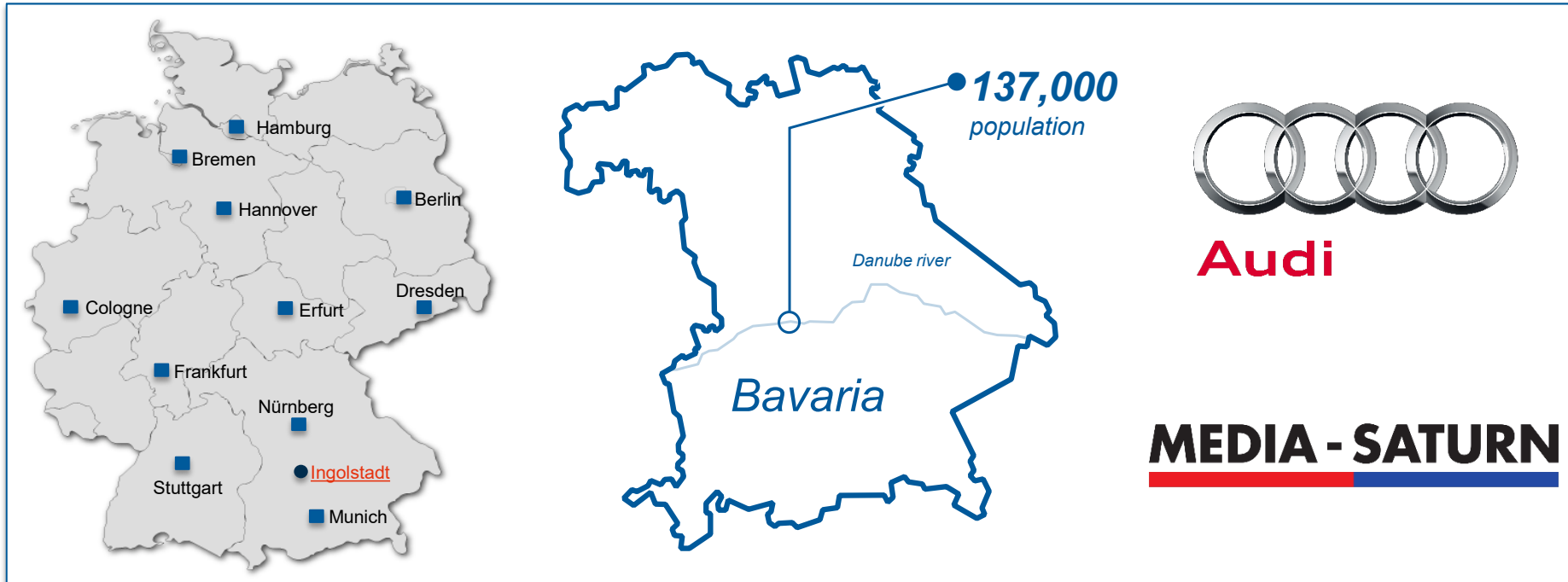
Prof. Dr.-Ing. Tobias Schrag   08.12.2021

Technische Hochschule Ingolstadt

Situated in the Heart of Bavaria with Strong Economic Environment

137,000 population

Danube river

Bavaria

Audi

MEDIA - SATURN

Source: www.facebook.com/ Ingolstadt.de

Ingolstadt

Historical old town and Site of the first Bavarian state university

Audi

€58 bn turnover
83,000 employees

Media-Saturn

€22 bn turnover
66,000 employees

Technische Hochschule Ingolstadt

Leading University of Applied Sciences

1994
Founding of the university

Focus on
Technology & Business

140
Partner universities

> 185
industry & research partners

Technische Hochschule Ingolstadt

Renewable Energy Study Programmes

Laboratory biogas plant

	Energy Systems and Renewable Energies (B. Eng.) (two Programmes*)	Renewable Energy Systems (M. Sc.)
Language	* 1) German / 2) English	English
Duration	7 Semesters	3 Semesters
Start	Summer & Winter	Winter
Fees	No semester fees	No semester fees

Sun simulator for indoor measurements

Content Example M.Sc.

1st Semester

- Introductory Laboratory Course
- System Analysis and Control
- Scientific Research Seminar
- Elective course (p.e. Energy Management and Energy Efficiency)
- Energy System 1

+

2nd Semester

- Energy Policies and Economics
- Numerical Methods and Computation Simulation
- Energy System 2
- Energy System 3

+

3rd Semester

Master's Thesis

Thermal test bench

EUREC - College of Members

Institute of new Energy Systems

Overview

2001
Founding of the Institute

4
Working Fields

5
Professors

~ 35
Researchers

9
Ph.D. Graduates

17
Current Research Projects

~ €2.5 Mio.
Annual Budget

20+/a
Scientific Publications

40+
Industry Partners

Head of Institute	**Professors**				
Prof. Dr.-Ing. **Wilfried Zörner**	Dr. **Christoph Trinkl**	Prof. Dr.-Ing. **Markus Goldbrunner**	Prof. Dr.-Ing. **Uwe Holzhammer**	Prof. Dr.-Ing. **Daniel Navarro**	Prof. Dr.-Ing. **Tobias Schrag**

Institute of new Energy Systems

Working Groups

Industrial Energy Systems

Demand-oriented power supply

Intersectoral bioenergy use

Energetic process optimisation

Energy Systems Technology

Flexibilisation of the energy Systems

Smart Markets

Energy and system efficiency

Domestic Energy Systems

Sector coupling in the Buildings and quarters

Solar energy systems

Heating network systems
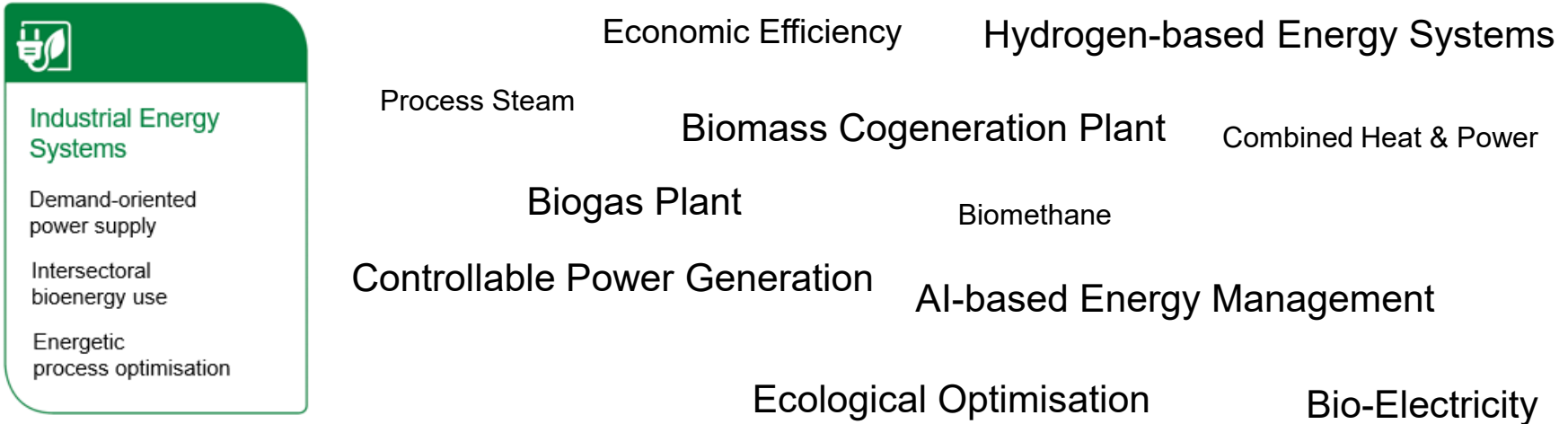
Technology Transfer & International Projects

Regional technology networks

International research cooperation

Technology transfer

Prof. T. Schrag, Institute of new Energy Systems| 08.12.2021 | Seite 6

EUREC - College of Members

InES – Fields of Research & Current Work

Working Group: Industrial Energy Systems

Industrial Energy Systems

Demand-oriented power supply

Intersectoral bioenergy use

Energetic process optimisation

Economic Efficiency

Hydrogen-based Energy Systems

Process Steam

Biomass Cogeneration Plant

Combined Heat & Power

Biogas Plant

Biomethane

Controllable Power Generation

AI-based Energy Management

Ecological Optimisation

Bio-Electricity

| Research Projects (selected)	
Process integration of a trickle bed reactor for the biological methanation of hydrogen in pressurized water scrubbing-based biomethane production (Hy2Biomethane)	2021
Development of technical solutions and business models based on AI-based digital electricity meters to increase resource efficiency in agriculture (FarmErgy)	2021
Direct methanation for flexible operation of small and medium scale biogas powerplants (FlexBiomethane)	2020
Repowering measures regarding future tasks of biogas plants (REzAB)	2018
Repowering of existing biogas plants	2017

InES – Fields of Research & Current Work

Project Example: FarmErgy

Project Overview:

Duration	10/ 2021 – 12/2023
Funded by	rentenbank
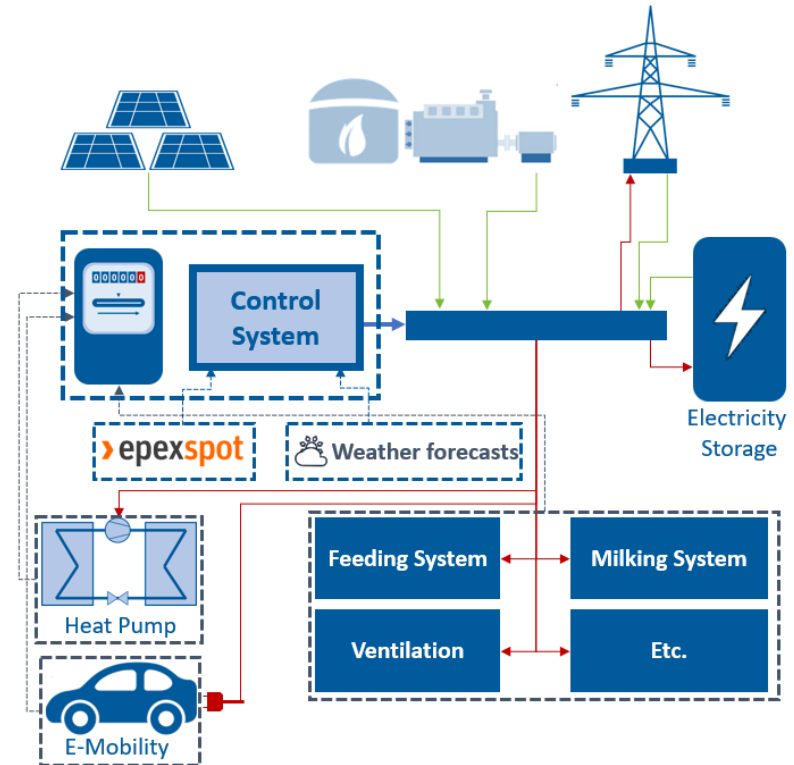
Challenges:

- Development of intelligent real-time data disaggregation algorithm for dairy farms and pig fattening farms.
- Use of complex consumption pattern-recognition algorithms to assign load profiles to individual connected devices
- Integration of a control concept to efficiently regulate the energy flow in and out of the agricultural enterprise.

Opportunities and Potentials:

- High energy savings potential
- Use of bidirectional interactions with the power grid
- Creation of revenue options for farms

Partners:

Steinbacher Consult
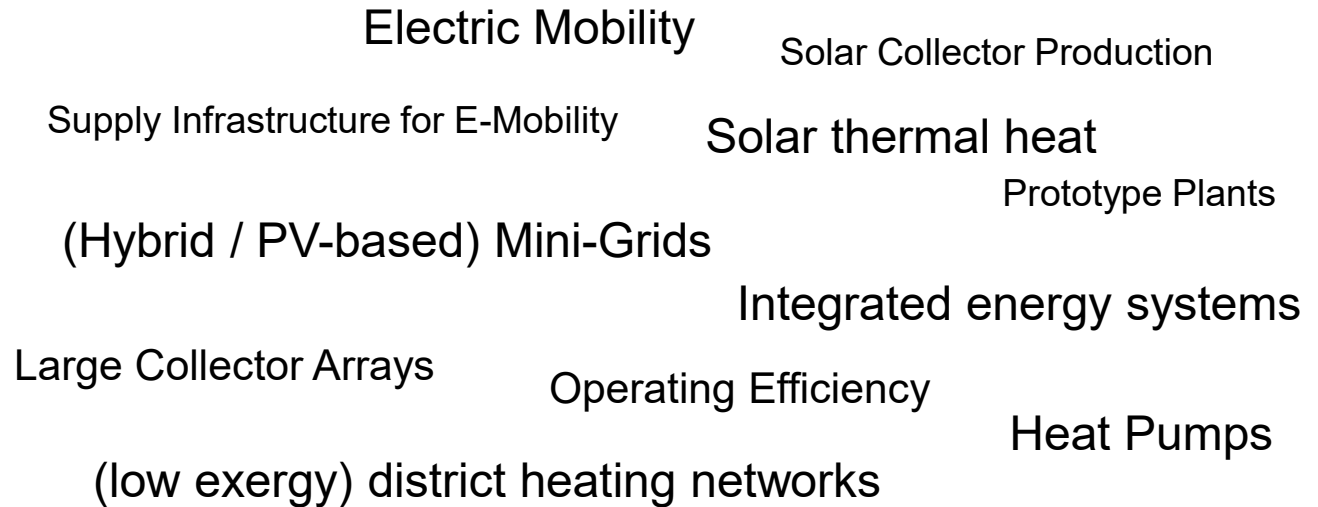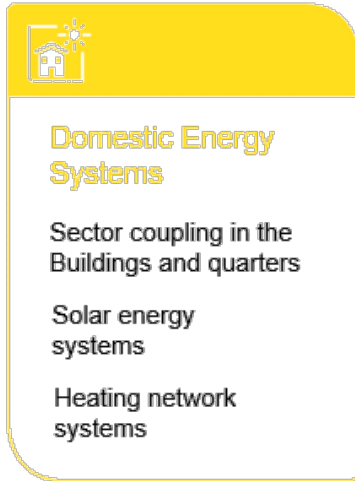... invent the future

MASCHINENRING | MR

Prof. T. Schrag, Institute of new Energy Systems| 08.12.2021 | Seite 8

EUREC - College of Members

InES – Fields of Research & Current Work

Working Group: Domestic Energy Systems

Domestic Energy Systems

Sector coupling in the Buildings and quarters

Solar energy systems

Heating network systems

Electric Mobility

Solar Collector Production

Supply Infrastructure for E-Mobility

Solar thermal heat

Prototype Plants

(Hybrid / PV-based) Mini-Grids

Integrated energy systems

Large Collector Arrays

Operating Efficiency

Heat Pumps

(low exergy) district heating networks

Research Projects (selected)	
STROM – SecToR cOupling and Micro-grids (WP 7: Decentralised energy management)	2021
Plus energy buildings – Hybrid-Hp+; Technological concepts and software	2020
OREWA - Development of a catalog of measures for the optimization and restructuring of district heating networks including the assessment of transferability, ecology and economy	2019
AUDI Smart Energy Network	2019
NATAR – Temperature-variable District Heating Network as a Provider for Operative Reserve	2017

Prof. T. Schrag, Institute of new Energy Systems| 08.12.2021 | Seite 9

EUREC - College of Members

InES – Fields of Research & Current Work

Project Example: Low-exergy district heating systems as an essentiell link to the energy system

Project Overview:

Duration   01/ 2017 – 12/2020
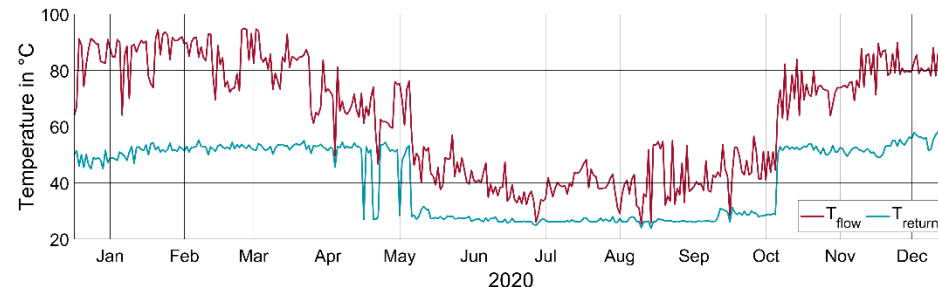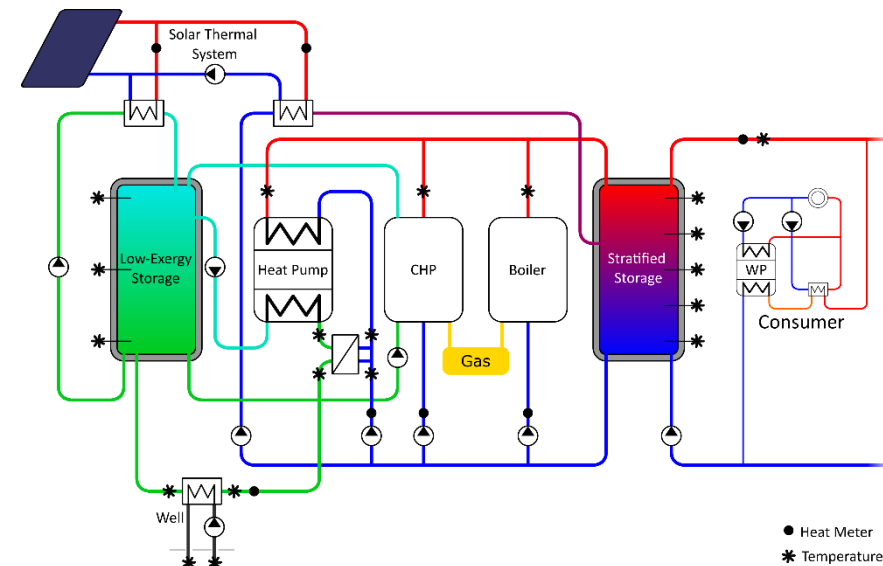
Research Questions:

- What energy savings are possible due to seasonal temperature reduction of the DHN?
- How can heating grids provide important system services for the electricity grid by sector coupling?

Methodology:

- Evaluation of measurment data & identification of optimisation potentials
- Economic and ecological evaluation of possible optimization measures
- Detailed modelling of the DHN; simulation and operational optimisation

Results:

- Proof of market/grid-serving operation
- Summer operation can be realised with a "cold" network and prior heat supply by solar thermal energy.
- Reduction of the heat losses by the DHN is possible

Prof. T. Schrag, Institute of new Energy Systems| 08.12.2021 | Seite 10

EUREC - College of Members

InES – Fields of Research & Current Work

Working Group: Technology Transfer and International Projects

Technology Transfer & International Projects

Regional technology networks

Technology transfer

International research cooperation

Staff mobility

Joint Applied Research

Higher Education Network

Academic Training
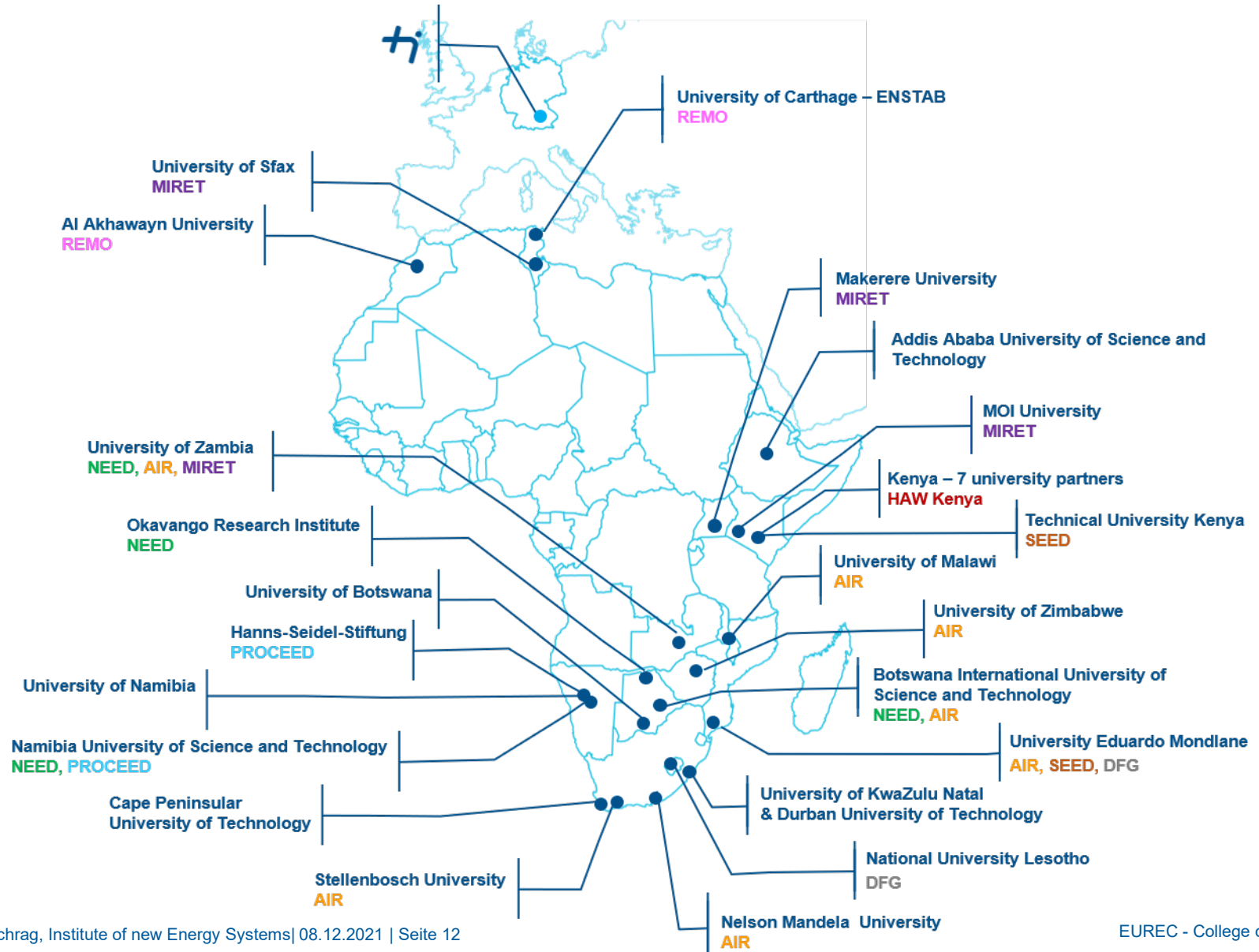
Capacity Transfer

Student exchange

Local and regional knowledge transfer

Research Projects (Selection)	
Sustainable Energy Education Districts for Informal Settlements (SEED)	2021
Rural Energy Supply of the Future (LEnZ)	2020
Renewable Energy-based E-Mobility in Higher Education (REMO)	2020
Pathway to Renewable Off-Grid Community Energy for Development (PROCEED)	2019
Network of Energy Excellence for Development (NEED)	2014

InES – Fields of Research & Current Work

Network of Academic Research Partners in Africa

Institute of new Energy Systems

University of Carthage – ENSTAB
REMO

University of Sfax
MIRET

Al Akhawayn University
REMO

Makerere University
MIRET

Addis Ababa University of Science and Technology

MOI University
MIRET

University of Zambia
NEED, AIR, MIRET

Kenya – 7 university partners
HAW Kenya

Technical University Kenya
SEED

Okavango Research Institute
NEED

University of Malawi
AIR

University of Botswana

University of Zimbabwe
AIR

Hanns-Seidel-Stiftung
PROCEED

Botswana International University of Science and Technology
NEED, AIR

University of Namibia

Namibia University of Science and Technology
NEED, PROCEED

University Eduardo Mondlane
AIR, SEED, DFG

Cape Peninsular University of Technology

University of KwaZulu Natal & Durban University of Technology

Stellenbosch University
AIR

National University Lesotho
DFG

Nelson Mandela University
AIR

Prof. T. Schrag, Institute of new Energy Systems| 08.12.2021 | Seite 12

EUREC - College of Members

InES – EU-funded Projects

Past Project Example: NEED - Network of Energy Excellence for Development

Projekt Overview:

Duration	03/2014 – 08/2017
Funding Authority	
Funding Programme	ACP Group of States "Science & Technology II"

Project Consortia:

Coordinator	THI – InES
Partner	Botswana International University of Science and Technology
Partner	Namibia University of Science and Technology
Partner	Okavango Research Institute (Botsuana)
Partner	University of Zambia

+ 7 Industrial partners

Results

- Two model regions developed ('best practice'):
  - Simulation model of typical wetland tourist facilities
  - Technical model for sustainable energy concepts in Renewable Minigrid Dryland and Fossil-Free Wetlands
- Inter-linked policy makers, research institutes and stakeholders of the private sector to promote innovation in RET
- Enhanced academic combined with practical education in RET ('dual studies')

Prof. T. Schrag, Institute of new Energy Systems| 08.12.2021 | Seite 13

EUREC - College of Members
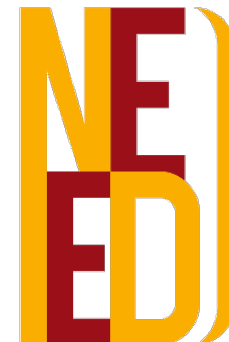
InES – EU-funded Projects

Current Projects and Future Interests

Rural Energy Supply of the Future

Projekt Overview:

Duration	04/2020 – 10/2022
Funding Agency	**European Union** European Regional Development Fund

Focus Areas	• technology transfer • combined use of biomass and solar energy • energy autonomy in rural settlements and rural areas (electricity, heat and mobility)

BIO-FIT
Biogas technology - Fit for the future through professional development and knowledge transfer through blended learning

Projekt Overview:

Duration	01/2022 – 12/2023
Funding Agency	**European Union** European Social Fund

Focus Area	• Blended learning for biogas plant operators • professional development • increased efficiency and economic viability of the Bavarian biogas plants

Prof. T. Schrag, Institute of new Energy Systems| 08.12.2021 | Seite 14

EUREC - College of Members

Contact Persons

Prof Dr.-Ing. Tobias Schrag

Phone   +49 841 - 9348 2270
Email   tobias.schrag[at]thi.de

Katharina Winterhalder, M.Sc.

International project manager

Phone   +49 841 - 9348 6424

Email   katharina.winterhalder[at]thi.de
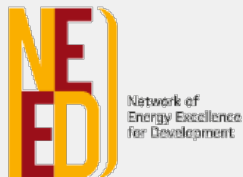

Technische **Hochschule Ingolstadt**

Institute of
new Energy Systems

Stauffenbergstr. 2a

85049 Ingolstadt

www.thi.de/go/energy

Our Project Websites:

www.need-project.org

https://www.waerme-wohnen.org/

https://www.laendliche-energieversorgung.de/

www.bmbf-client.de/projekte/OekoFlussPlan

www.bmbf-client.de/projekte/proceed