INTERNATIONAL LITHOSPHERE PROGRAM

HUN REN | Institute of Earth Physics and Space Science

The Why and the How of the Rybach Research Center for Renewable Geo-energy

Sierd Cloetingh

Research.
Innovation.
Impact.

HUN-REN Hungarian Research Network

Utrecht University

Objectives

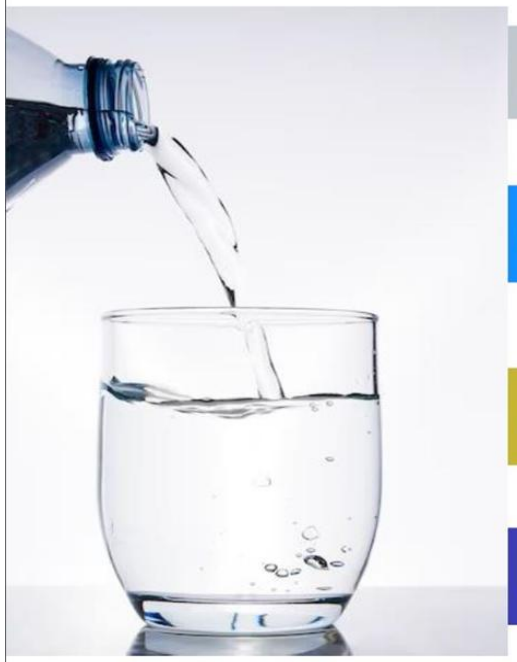
1) to consolidate the **high-impact research** activity;

2) to foster a student-centered intellectually stimulating environment for **advanced training**;

3) to explore further **collaborations with industry** to promote knowledge transfer.

Vision for a Dynamic, Collaborative, Impactful and Efficient Research Network

HUN-REN
Hungarian Research Network



Empowering scientists

Nurturing collaboration

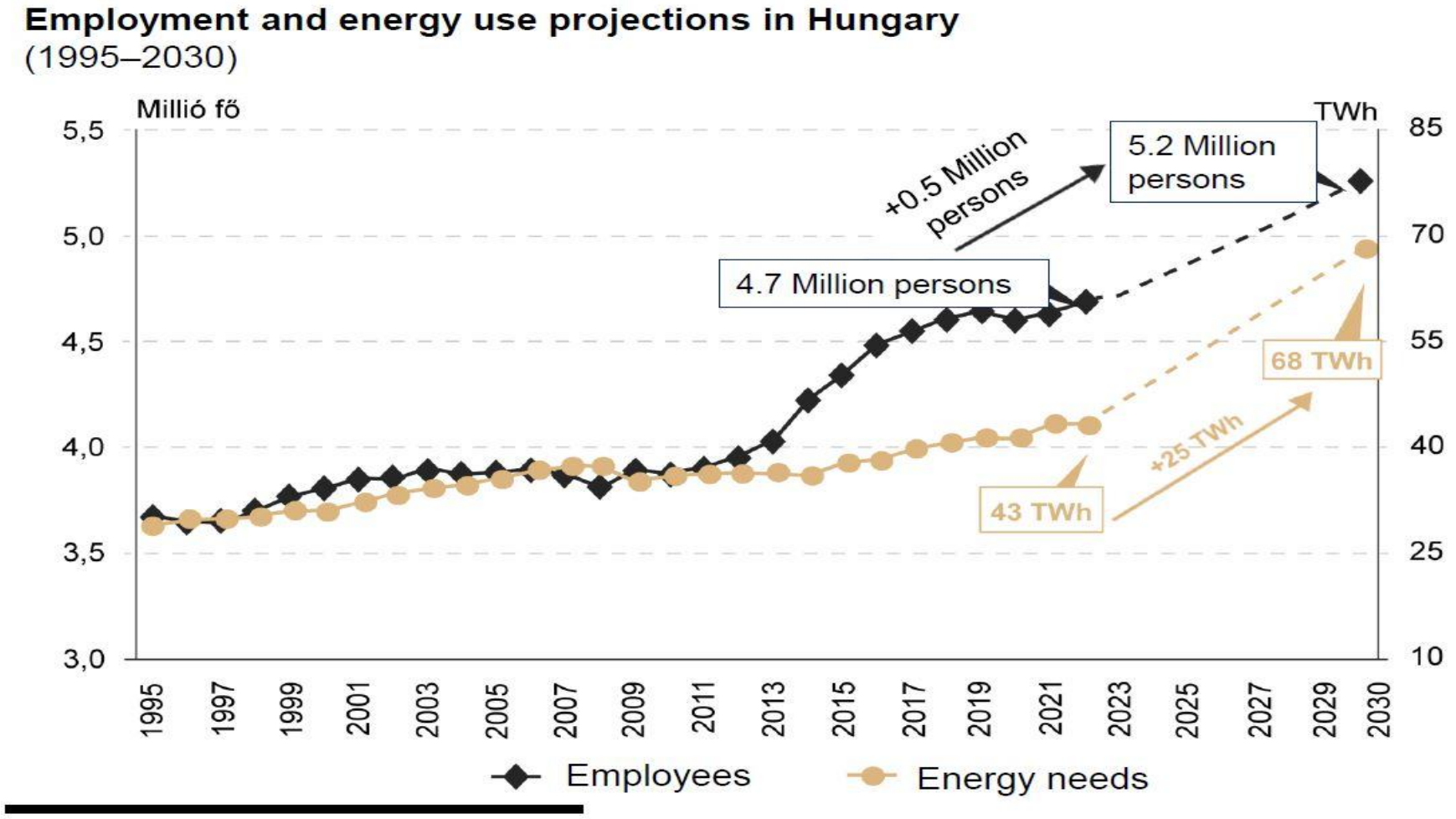
Accelerating impact

Fostering world-class research and innovation

Courtesy Roland Jakab (2023)

Opportunities

-energy transition and Earth resources
-climate, geo-environment, geo-hazards
-near-Earth space research, solar-terrestrial interactions



Courtesy László György (2023)

Opportunities

Focusing domestic RDI resources: 3+1 focus areas

1.Digital transformation on economy and society

- Artificial intelligence, big data and network analysis
- Autonomous vehicles
- Quantum technology

2.Healthy living

- Biotechnology and pharmaceutical research
- Major diseases (cancer, neurological, cardiovascular, viruses)
- Life preservation and health maintenance

3. Green transition

- Energy production
- Agricultural technologies
- Climate change and water management technologies

+1 Safety and security

- Dual use technologies
- Cyber and border security
- Space exploration and space activities

Courtesy László Bódis (2023) Ministry of Culture and Innovation

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ACADEMIA EUROPAEA
BUDAPEST HUB

TOPO EUROPE

sponsored by HUN-REN and Academia Europaea Budapest Hub

Conveners:

Sierd Cloetingh (HUN-REN EPSS, UU)

Katalin Solymosi (AE Budapest Hub, YAE, ELTE)

INTERDISCIPLINARY WORKSHOP ON EARTH, ENVIRONMENT AND HEALTHY LIVING | 24-25 APRIL, 2025

PIETRO STERNAI

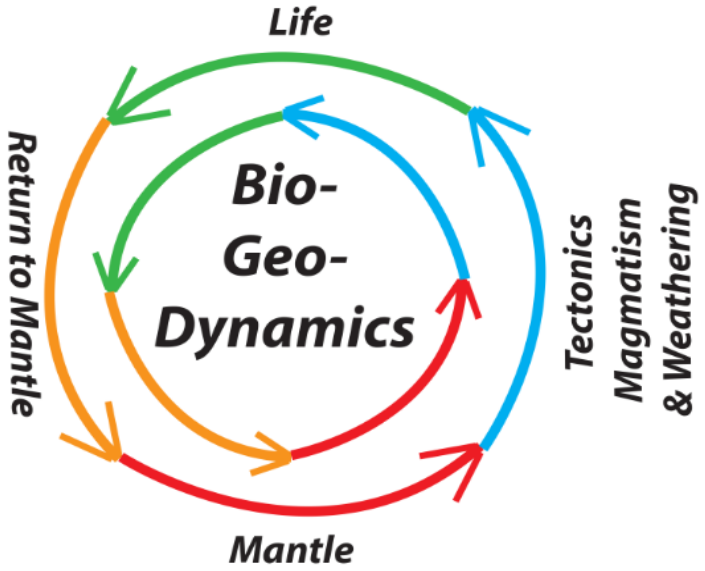
Associate Professor,
University of Milano-Bicocca

„Interdisciplinary discussions on carbon cycling and landscape evolution? We bridge Earth sciences and environmental sciences."

HUN-REN Hungarian Research Network | HUN REN | MTA HUNGARIAN ACADEMY OF SCIENCES

Bio-Geodynamics

TARAS GERYA
ETH Zürich



REINHARD HÜTTL
EEI, Berlin

Sustainability, Soil protection, Nature conservation

BERNHARD NOVOTNY
OMV Vienna

Use geothermal energy to warm 20,000 households in the Austrian capital

The New York Times

Austria, a Longtime Buyer of Russian Gas, Tries to Break the Habit

OMV, a multinational energy company based in Vienna, has shifted to other options, including increasing its own output of natural gas, drilling for oil and experimenting with geothermal energy.

European Academies

easac

Science Advisory Council

Security of Sustainable Energy Supplies

EASAC policy report 47

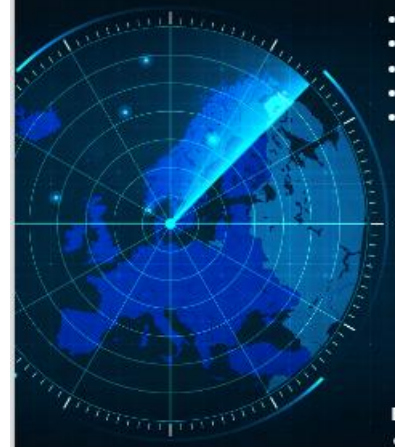
April 2025

ISBN 978-3-7001-9738-6
This report can be found at
www.easac.eu

Science Advice for the Benefit of Europe

No Security without Energy Security

Key Energy Security Threats



- Geopolitical disruption
- Increase of physical and cyberattacks
- Interruption of fuel and technology supply chains
- Volatile prices and growing energy poverty
- Escalating climate costs
- Lack of system flexibility

Old Thinking:
Import to Europe

98% 2022	98% 2022	45% 2022	45% 2024
Rare Earth Elements (REEs)	**Crude oil and petroleum products**	**Gas from Russia**	**LNG from the USA**
Source: European Commission	Source: European Commission	Source: European Commission	Source: European LNG-Tracker

New Thinking:
Invest in Europe

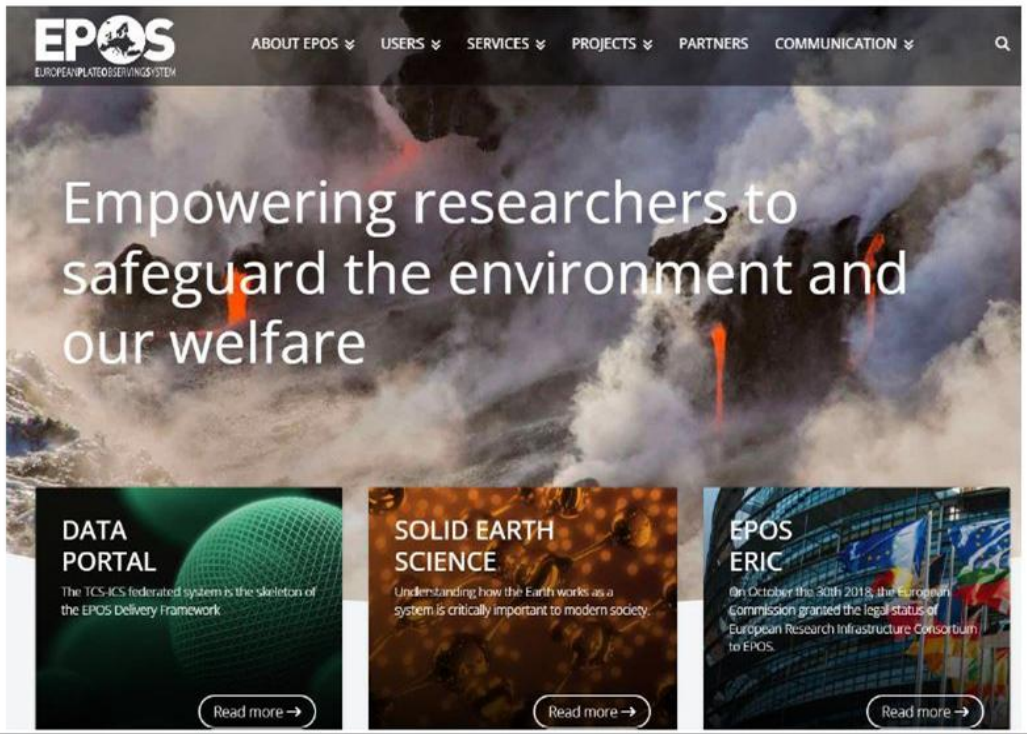
- Put energy efficiency first with circular economy
- Transition away from fossil fuels
- Enhance cyber and physical security
- Incentivise flexibility and market integration
- Produce fuels and technologies in Europe
- Prioritise decentralised systems
- Empower communities with a fair transition
- Diversify suppliers

More resilient systems
More value creation in Europe
Better trade balance
Fewer climate and health costs
Less energy poverty

Investments in sustainable energies are investments in Europe's energy security!

Synergy example: ESFRI

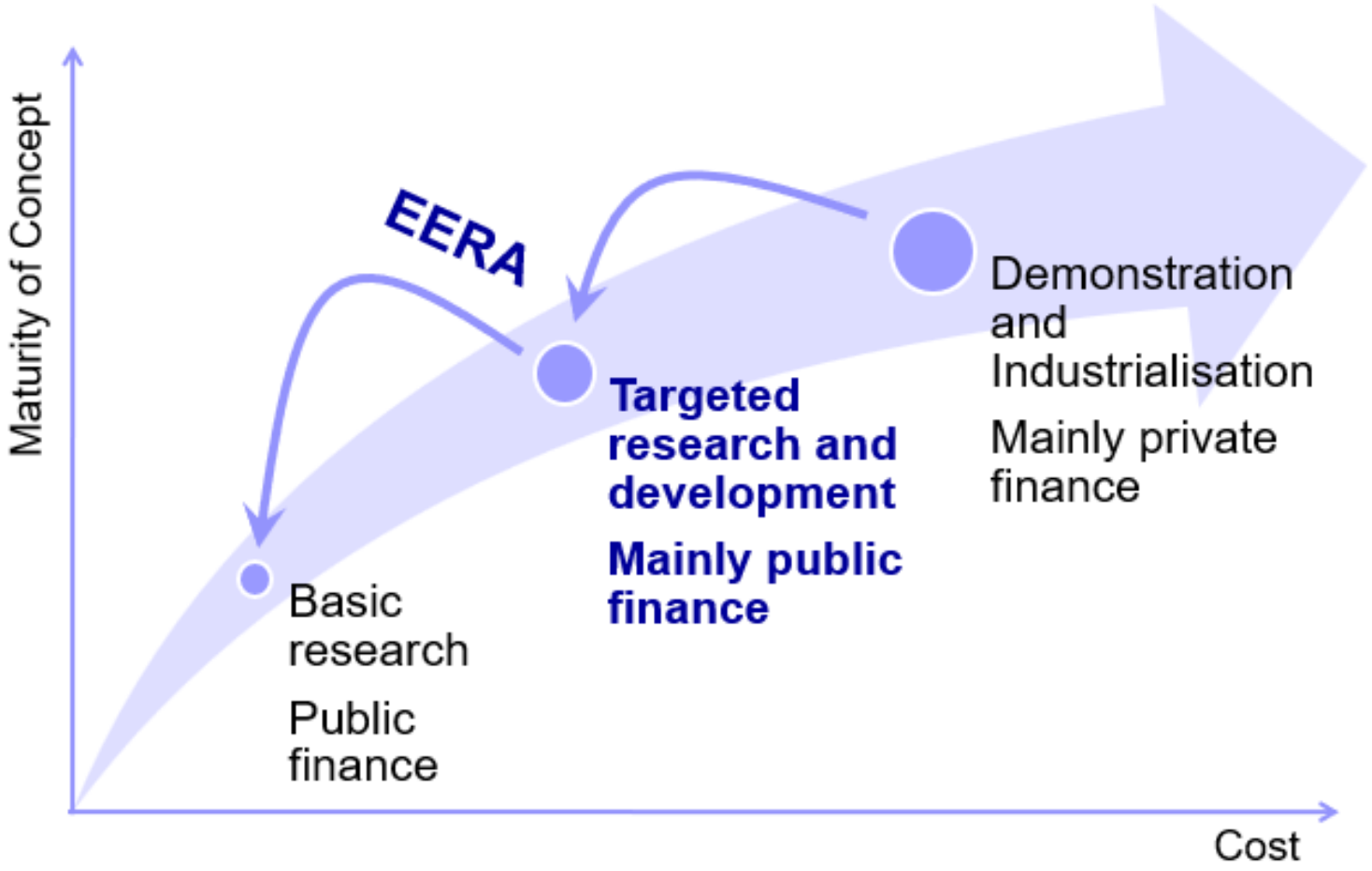
European Plate Observing System (EPOS), distributed pan-European research infrastructure, connecting earth system science with innovation in geo-environment, geohazards and geo-energy (including geothermal energy and storage of CO2 and hydrogen in geo-reservoirs)



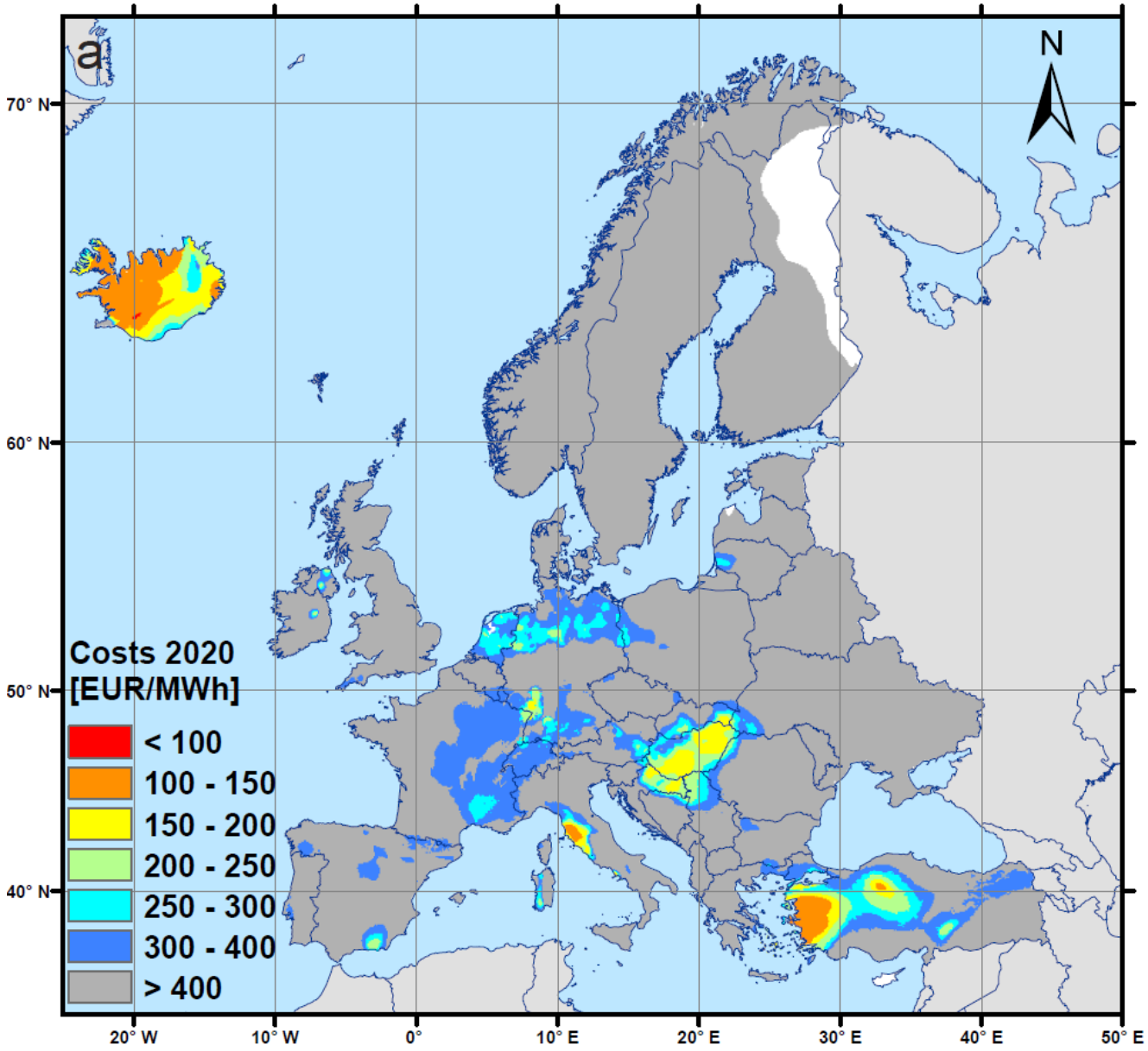
EPOS: 500 M€ EU investment in Solid Earth Research Infrastructure

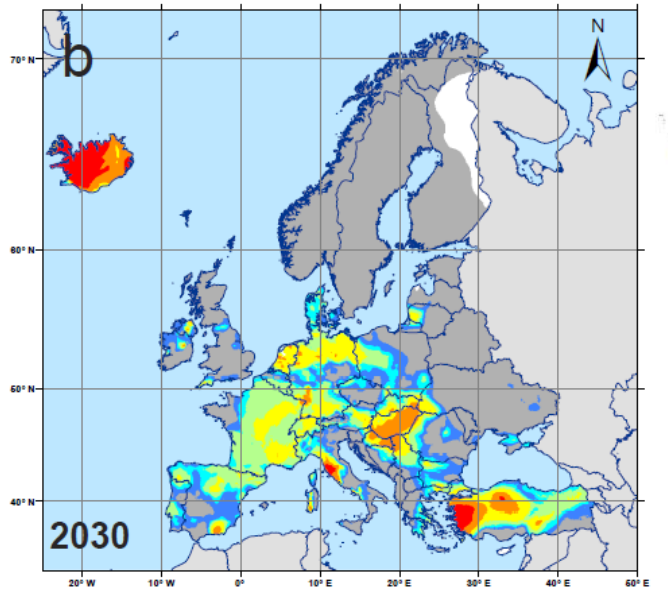
European Energy Research Alliance (EERA)

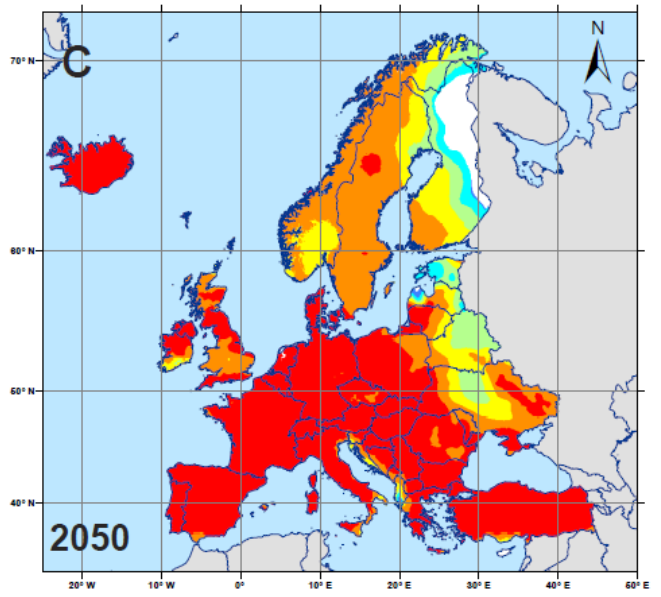
Nonlinear innovation



Geothermal energy potential of Europe





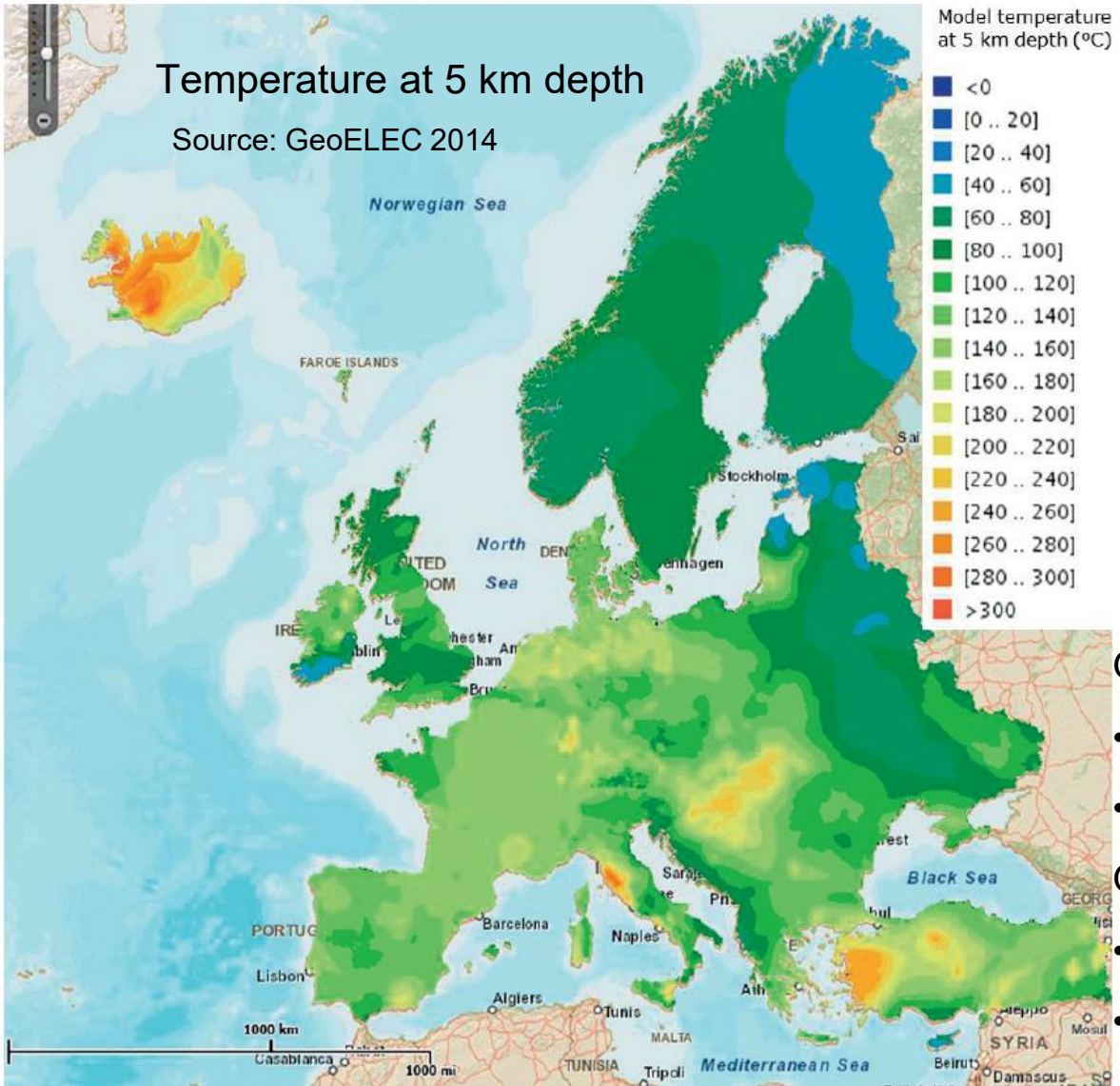


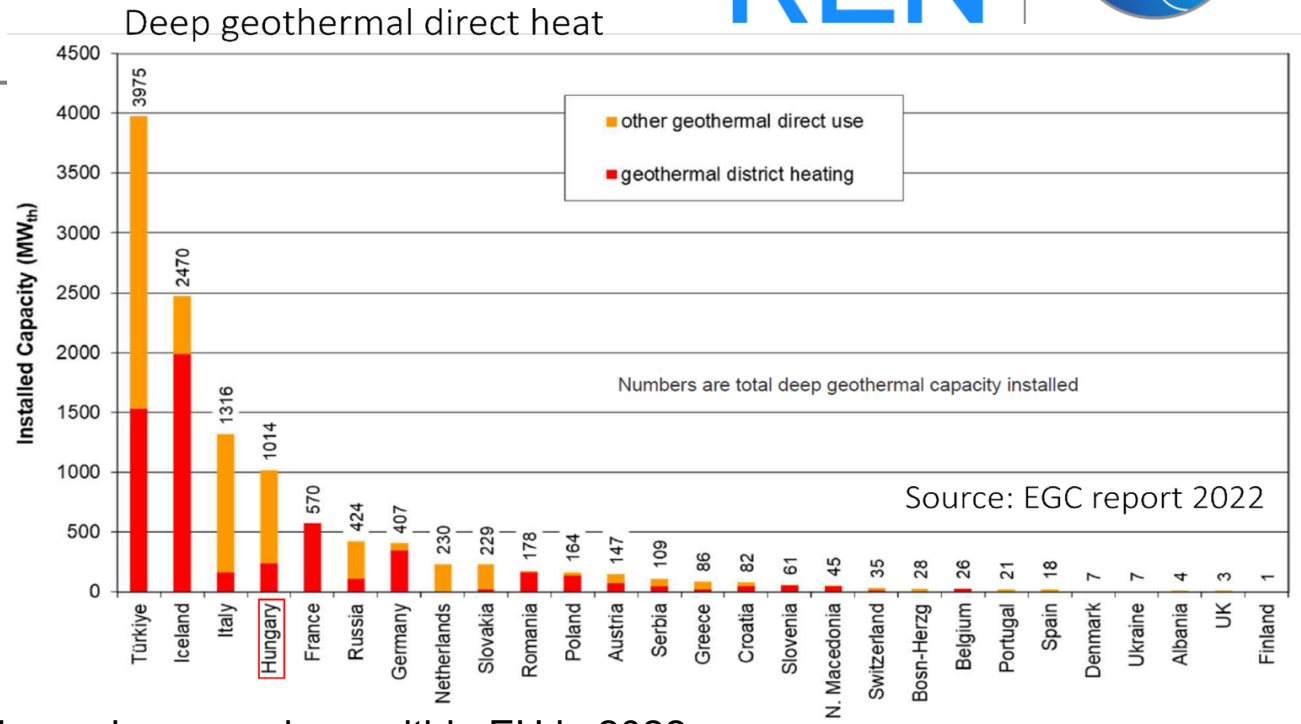
EERA
European Energy Research Alliance
Joint Programme Geothermal Energy

IMAGE

Limberger et al., GtES (2014)

Geothermal Energy





Geothermal energy share within EU in 2022:

- direct heat: **2.8 %**
- electricity: **0.2 %**

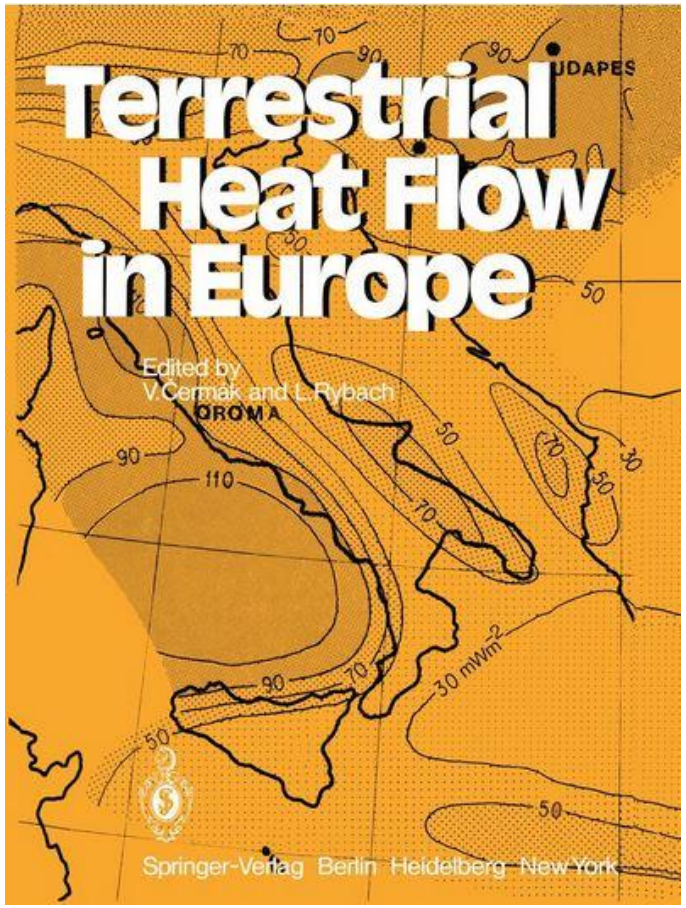
Geothermal energy share potential within EU (EGEC prediction):

- direct heat: **25 %**
- electricity: **10 %**

Ladislaus Rybach HUN-REN National Competence Center for Geothermal Research

Prof. em. Ladislaus Rybach (ETH Zürich)

Orchesterverein Zürich

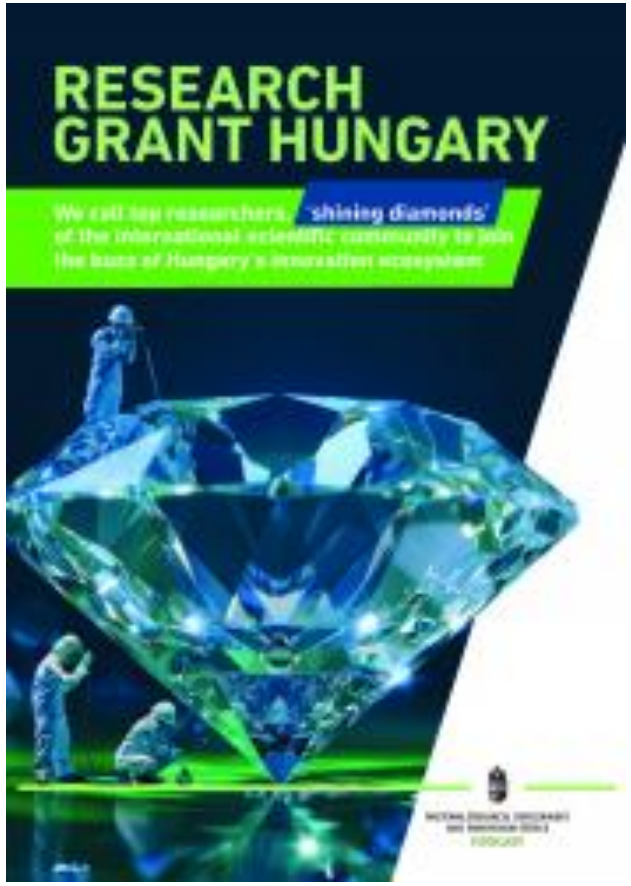


Prof. Rybach was born in Sopron and is Honorary Citizen of Sopron. He is a member of the EPSS External Advisory Board.

Research Grant Hungary:
Applying seismology and multi-parameter geophysics for geothermal research in joint project Twente University (NL) and HUN-REN EPSS

Exploring…

- how to utilize local seismic networks to advance our **knowledge of the subsurface**
- how to include multiple geophysical datasets to **refine suburface temperature models**
- how to **advance the means of geothermal exploration & monitoring** with new methods



Geo-energy research plans: Research Grant Hungary project

Collaboration with the University of Twente for the imaging of fractured/karstic reservoirs
Exploring…

- how to utilize local seismic networks to advance our knowledge of the subsurface
- how to include multiple geophysical datasets to refine suburface temperature models
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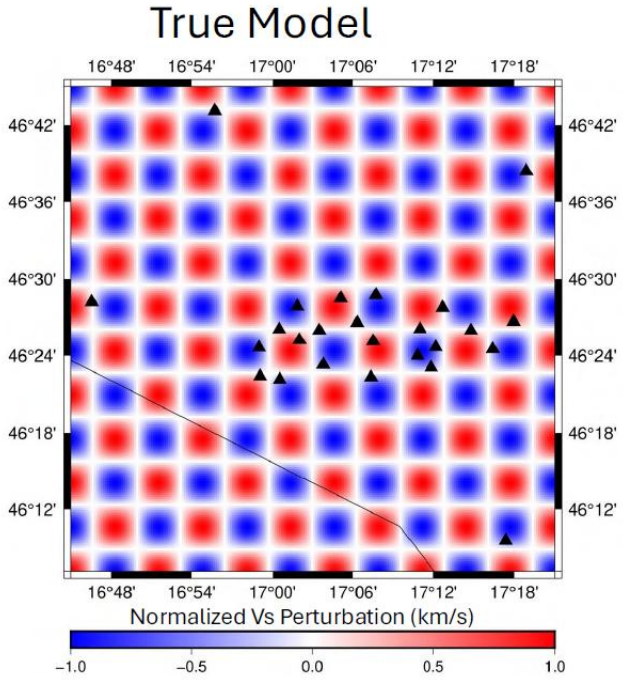
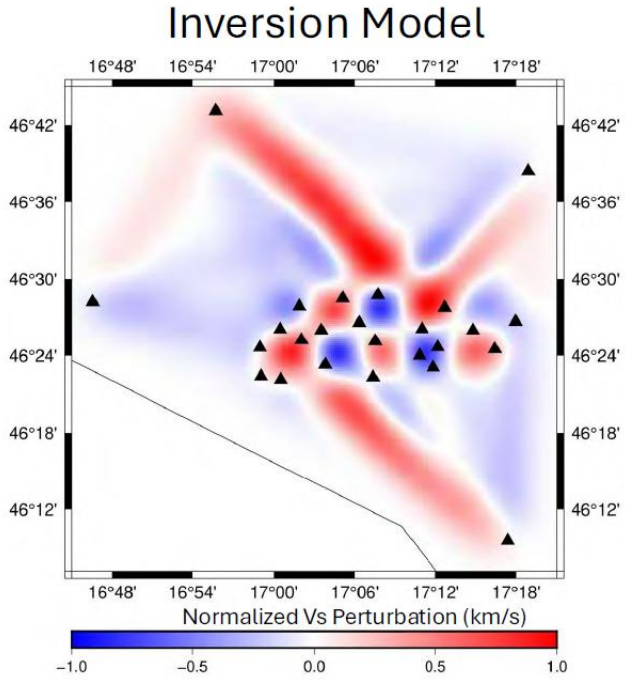
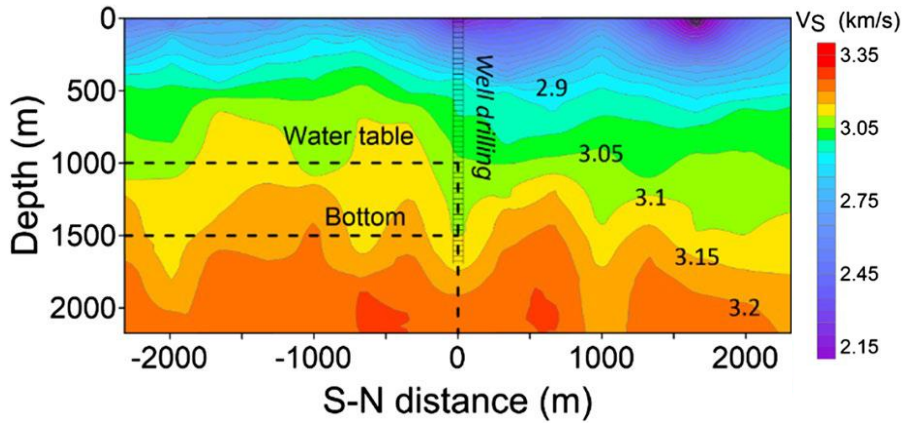
First seismic deployment project is under planning, will start in 2025





Example of resolution tests of a planned seismic station network for geothermal exploration

Example of geothermal reservoir seismic imaging after Zhou et al., 2021



Summary

EPSS key competences for geo-energy research include:

Thank you for your attention!