Instytut Gospodarki Surowcami Mineralnymi i Energią Polskiej Akademii Nauk

Maciej Miecznik

Warsztaty projektu User4GeoEnergy
Kraków, 8 grudnia 2022

Misja IGSMiE PAN

- Instytut Gospodarki Surowcami Mineralnymi i Energią powstał w 1986 roku w Krakowie jako jednostka **Polskiej Akademii Nauk**.
- IGSMiE PAN podejmuje interdyscyplinarną działalność badawczą w obszarze **gospodarki kopalinami i energią**, obejmując takie dziedziny jak: górnictwo, geologia, **odnawialne źródła energii**, energetyka i **ciepłownictwo**, inżynieria środowiska, uzupełniona o zagadnienia z zakresu geofizyki, **ekonomii**, prawa, oraz inżynierii chemicznej i materiałowej.
- **Misją Instytutu** jest dostarczanie nauce i gospodarce nowoczesnych, ekonomicznych, ekologicznych i społecznie atrakcyjnych rozwiązań służących **zrównoważonemu rozwojowi kraju i regionów w obszarze surowcowym i energetycznym**.

IGSMiE PAN w liczbach

Najważniejsze badania i osiągnięcia podejmowane przez IGSMiE PAN w obszarze energii geotermalnej

- Zaprojektowanie i budowa pierwszego w Polsce Doświadczalnego Zakładu Geotermalnego Bańska - Biały Dunajec (I poł. lat 90 XX w.), który dał impuls do budowy 1-szej w Polsce ciepłowni geotermalnej;
- Demonstracja kaskadowego wykorzystania ciepła geotermalnego (od lat 90 XX w. – nadal);
- Pierwsza w Polsce rekonstrukcja starego odwiertu badawczego Mszczonów IG-1 na cele ciepłownicze (2000 r.);
- Opracowanie wytycznych projektowch poprawy chłonności skał zbiornikowych w związku z zatłaczaniem wód termalnych w polskich zakładach geotermalnych (2011 r.);
- Atlas wód termalnych do skojarzonej produkcji energii elektrycznej i cieplnej w układach binarnych w Polsce (2014 r.);
- Liczne projekty robót geologicznych oraz dokumentacje hydrogeologiczne dla wierceń geotermalnych w Polsce;
- Modelowanie numeryczne przepływu ciepła i masy w zbiornikach geotermalnych w Polsce;
- Modelowanie matematyczne systemów energetycznych (geotermia oraz hybrydowe źródła energii);
- Optymalne zagospodarowanie wód geotermalnych w celu pozyskania ciepła i energii elektrycznej na wybranym obszarze Podhala (2016 r.);
- Efektywne wykorzystanie wód i energii geotermalnej m.in. do ogrzewania, balneoterapii, suszenia drewna, rolnictwa, hodowli ryb i produkcji wody pitnej na bazie schłodzonej wody geotermalnej (z wykorzystaniem procesów membranowych);
- Metody i ocena skutków środowiskowych wykorzystania OZE.

Rozwój IGSMiE PAN

Realizacja projektu „**Centrum Zrównoważonej Gospodarki Surowcami i Energią**” jest w końcowej fazie. Obejmuje m.in. budowę nowego skrzydła biurowego dla IGSMiE PAN wraz z budową nowych, bądź rozbudową istniejących laboratoriów:

- ❑ Kompleksowych Badań Odpadów i Biomasy,
- ❑ Modelowania Inżynierskiego,
- ❑ Geofizyki Inżynierskiej (rozbudowa)
- ❑ Laboratorium Geotermalnego w Bańskiej Niżnej (rozbudowa).

Wizualizacja nowego budynku IGSMiE PAN
w Krakowie

Marzec 2022

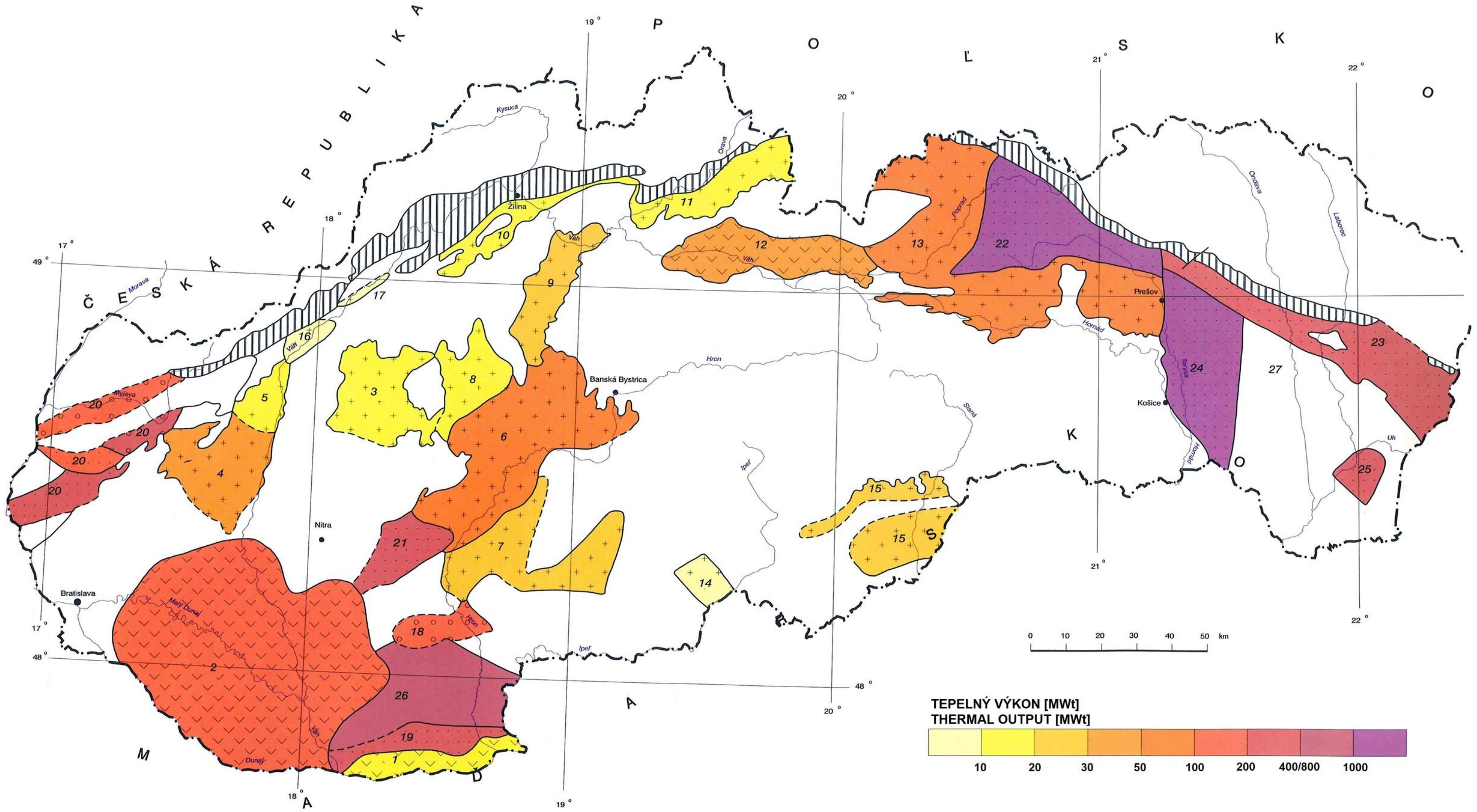
Październik 2022

Iceland Liechtenstein Norway grants

Norway grants

SLOVGEOTERM a.s.

Beneficiary partner (project partner no. 2)



Oto Halás

Managing director

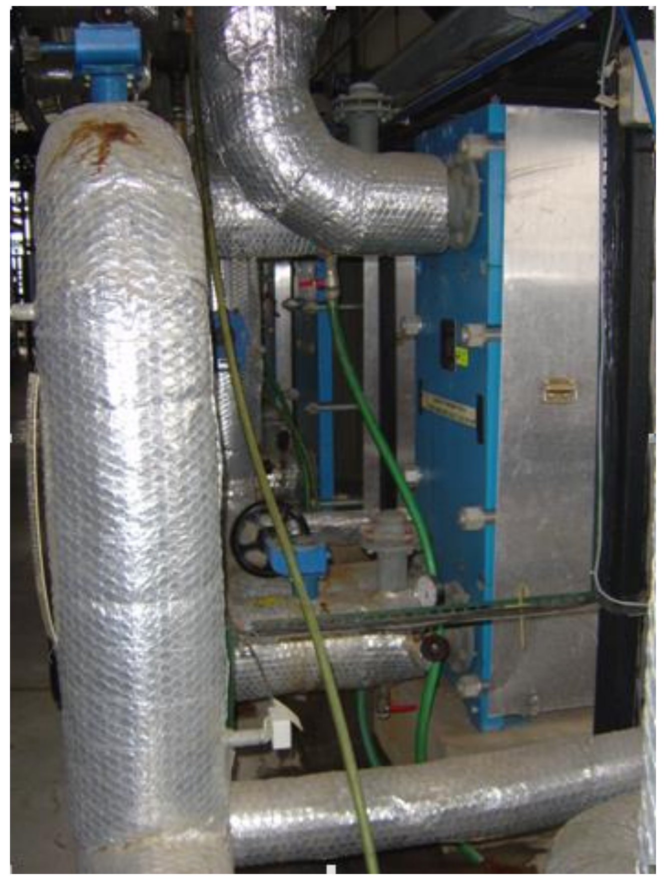
SLOVGEOTERM a.s. (2)

- Joint stock company, found in 1992
- Consulting and engineering company - projects focused on utilization of geothermal energy
- Complex Solutions for Geothermal Energy Utilization

30 YEARS EXPERIENCE OF GEOTHERMAL ENERGY UTILIZATION IN SLOVAKIA

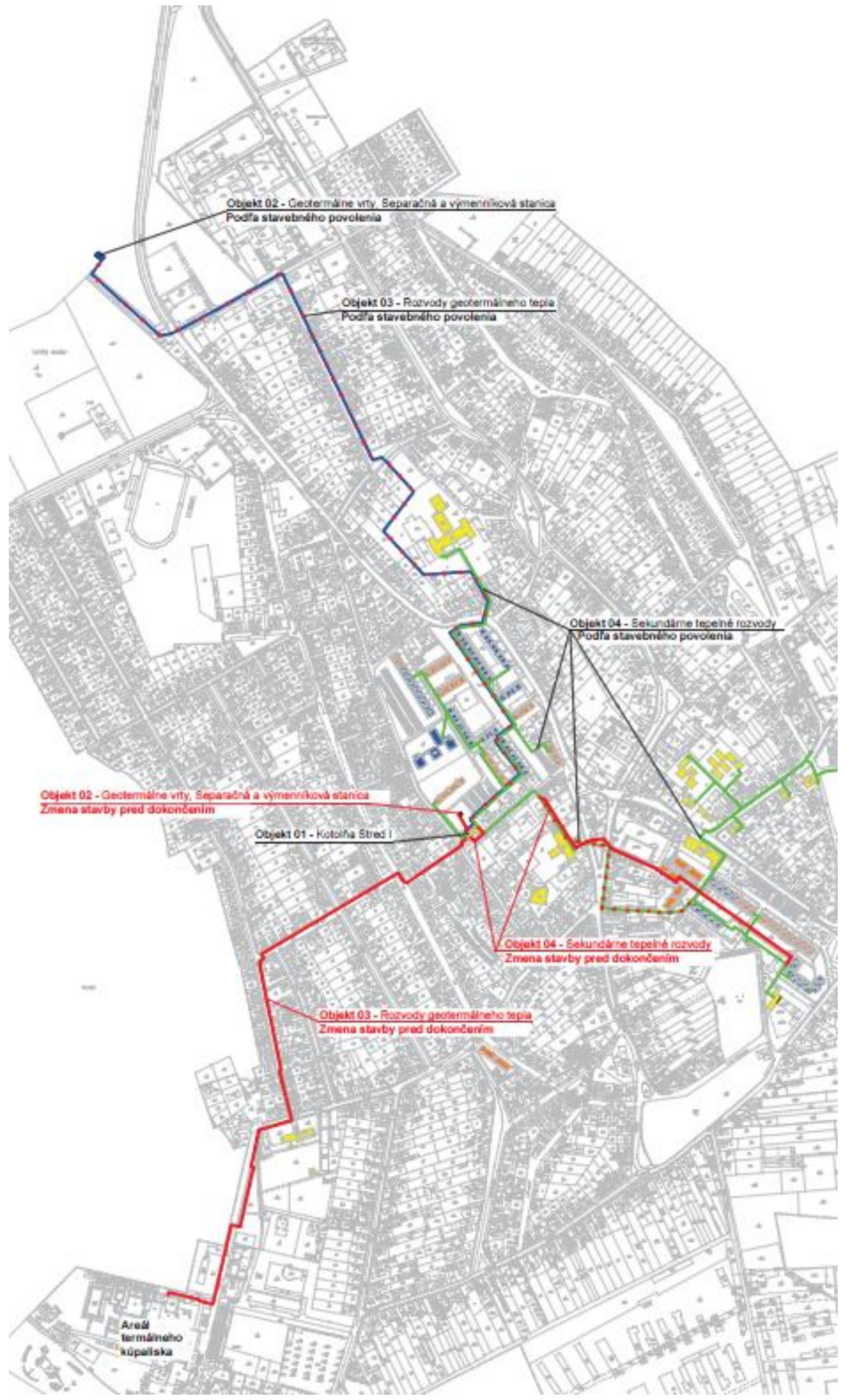
Our projects:

- Geothermal district heating system in towns of Galanta, Sala, Sered and Velky Meder (the only 4 existing in Slovakia)
- Greenhouse heating projects and spas
- Preparation of large scale DHS and power plant in the town of Kosice
- And others



SLOVGEOTERM a.s. (3)

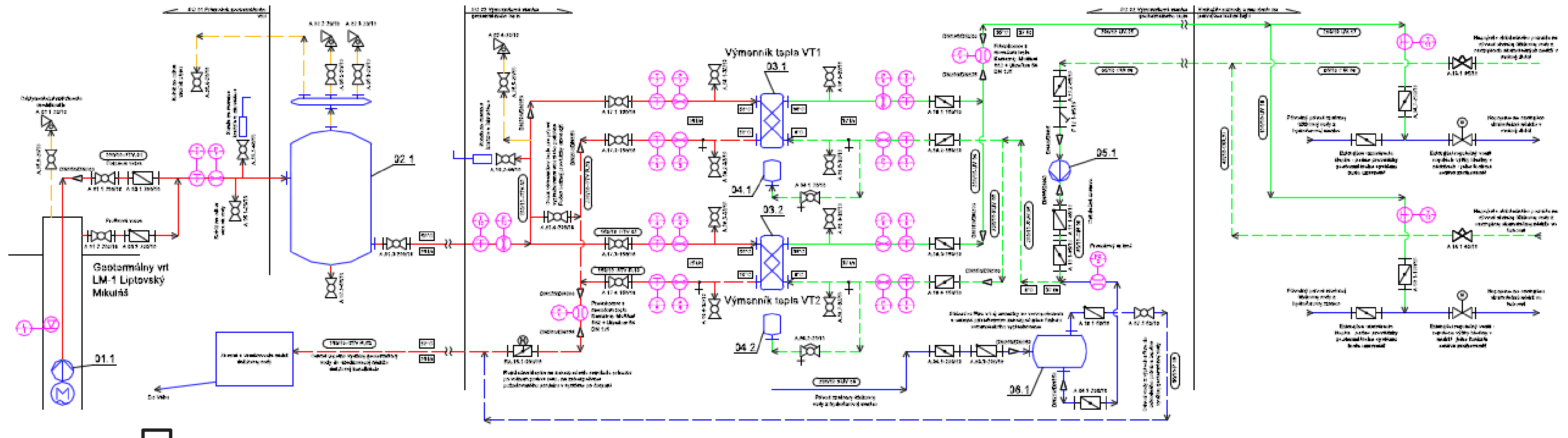


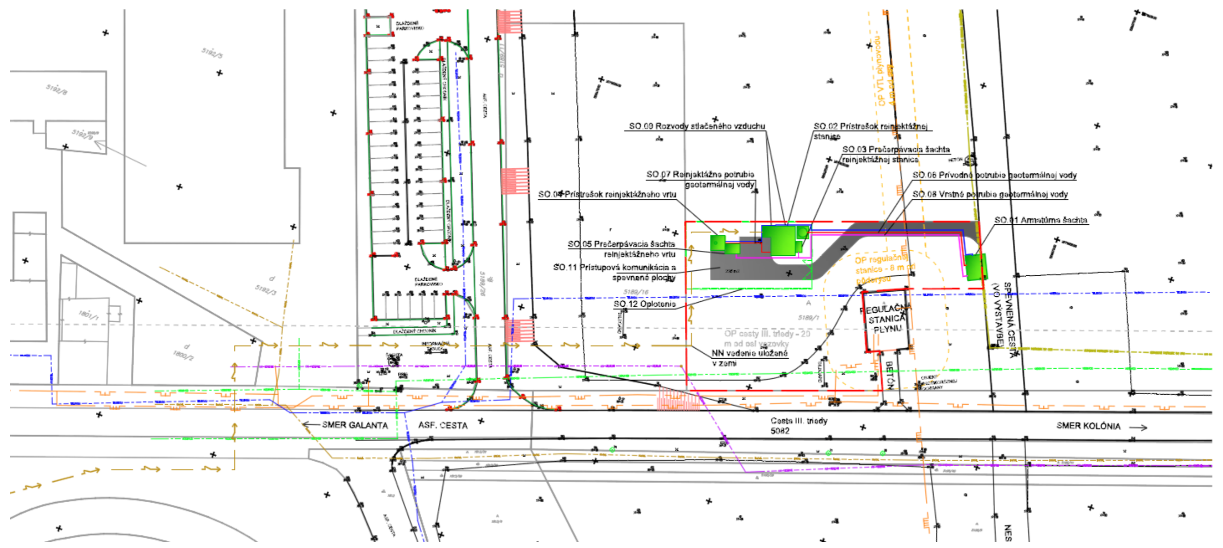
Running projects:

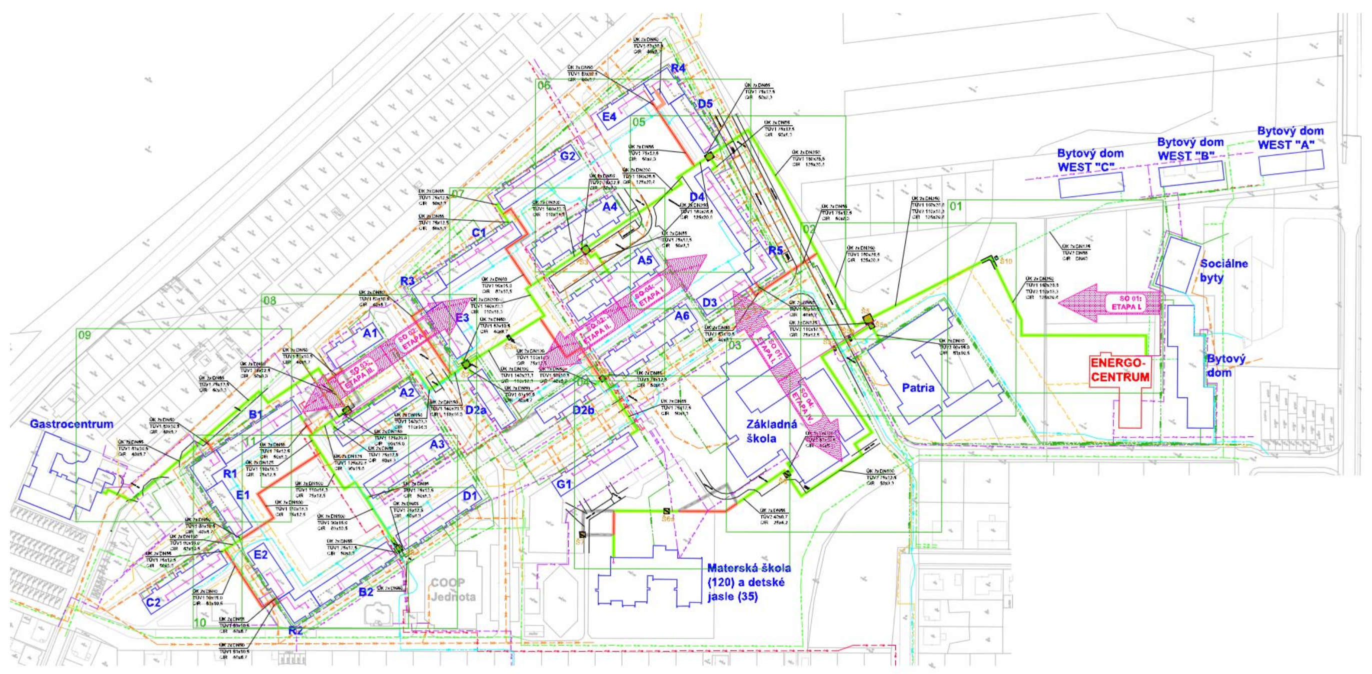
- User4GeoEnergy Project (responsible for WP4)
- Kezmarok geothermal DHS – new well drilled, well testings and connection to DHS preparation
- Liptovsky Mikulas – industrial usage of GE – new well drilled, preparation for well testing
- Kosice geothermal DHS – largest GE project in Slovakia reincarnation
- Participation at Ziar and Presov geothermal power plant projects – EIA and preparation of tender for drilling works

Thank you!

SLOVGEOTERM a.s.
Palisády 39, 811 06 Bratislava, Slovakia
slovgeoterm@slovgeoterm.sk
www.slovgeoterm.sk







Iceland Liechtenstein Norway grants

Norway grants

InnoGeo Research and Service Non-profit Ltd Szeged, Hungary

Dr. Tamas Medgyes
Project manager

InnoGeo – the team

Dr. Balázs Kóbor

Dr. Tamás Medgyes

Attila Csanádi, Nóra Czirbus,

István Pári, Dénes Tapasztó, Róbert Tóth, Emőke Egyed et al.

The Szeged case study

InnoGeo is closely associated with switching the district heating of Szeged to geothermal. This robust development provides bacground to our project activities.

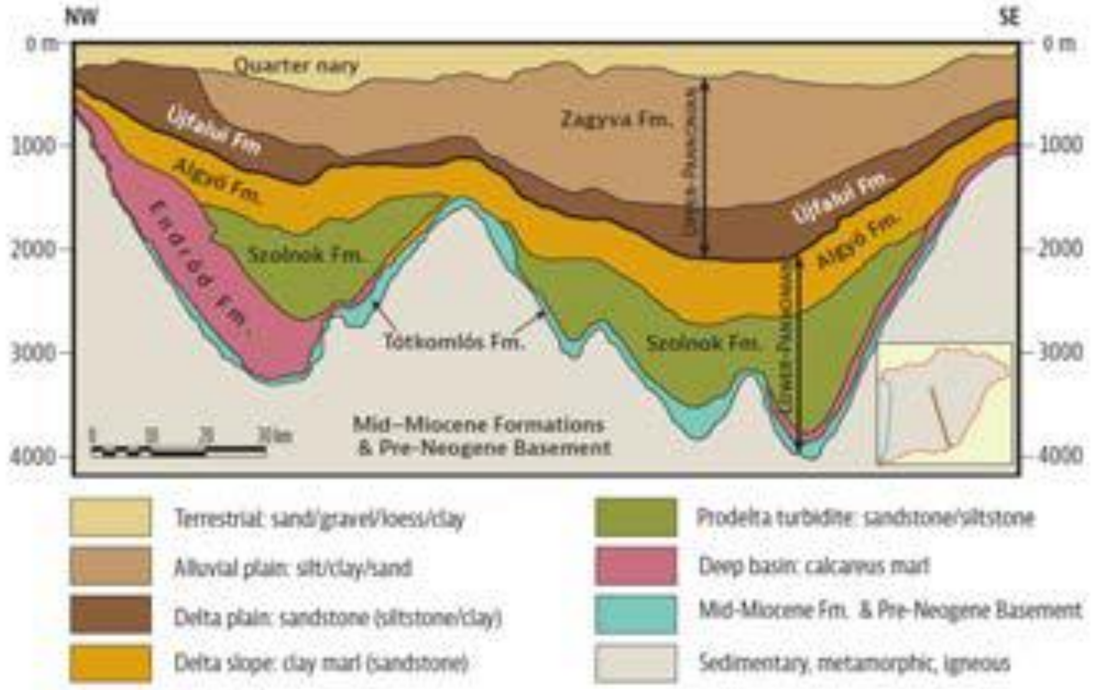
The municipally owned District Heating Company of Szeged supplies heat and domestic hot water to 27,256 apartments and 433 public buildings in Szeged, Hungary – a city of 162,593 inhabitants near the Hungarian-Serbian-Romanian tri-border.

In 2015 the City Hall appointed a new expert team to manage SZETAV and to initiate the integration of renewables into district heating. The aim was to reduce the emissions of the gas-powered heating plants, and to improve the economy of the system with the help of renewables.

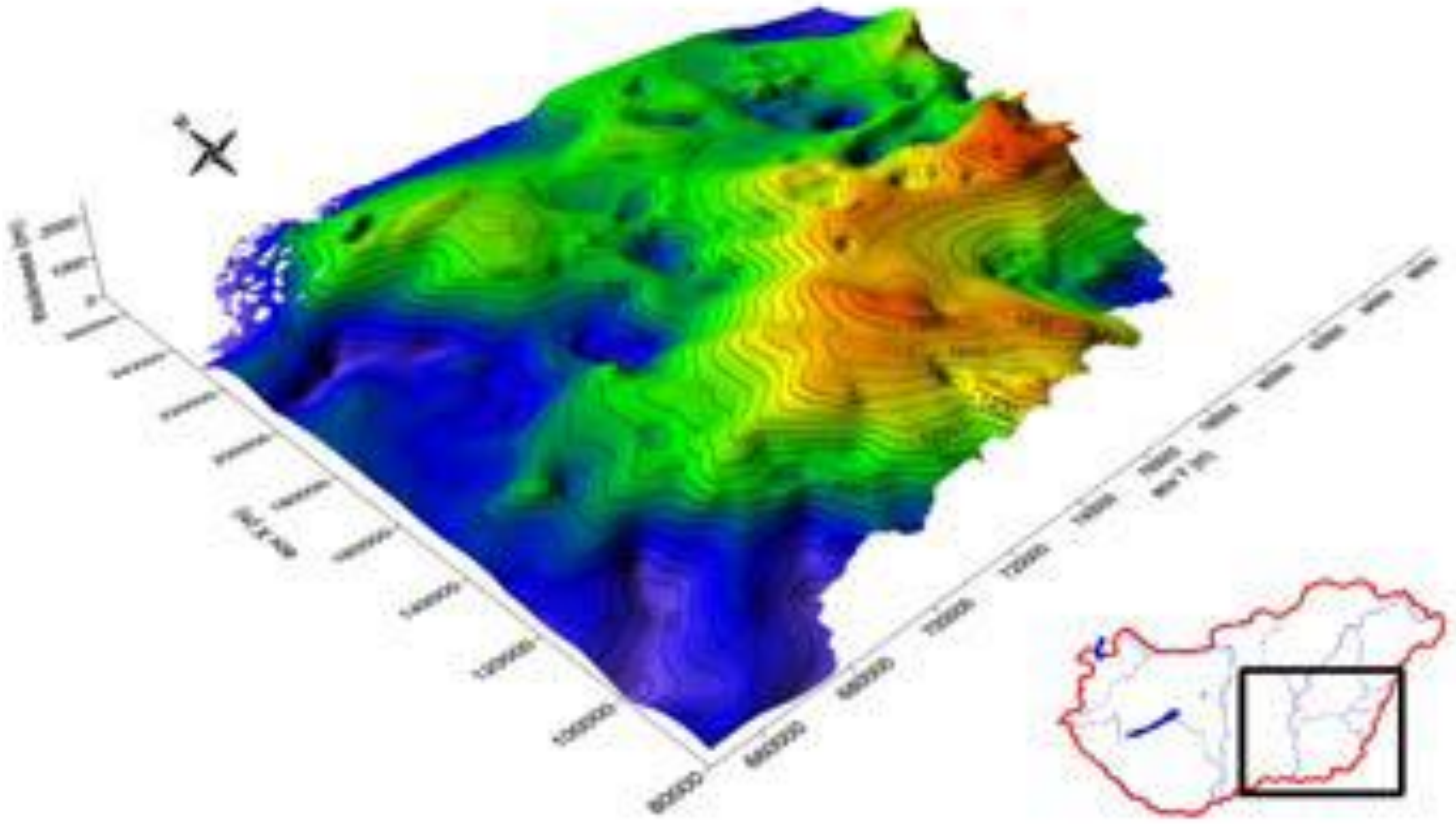
There are more than 250 geothermal DH systems in place in Europe, with capacities ranging between 1-50 MW, and geothermal energy systems are widespread in the Southern Great Plain region too. These systems are based on favourable medium enthalpy resources.

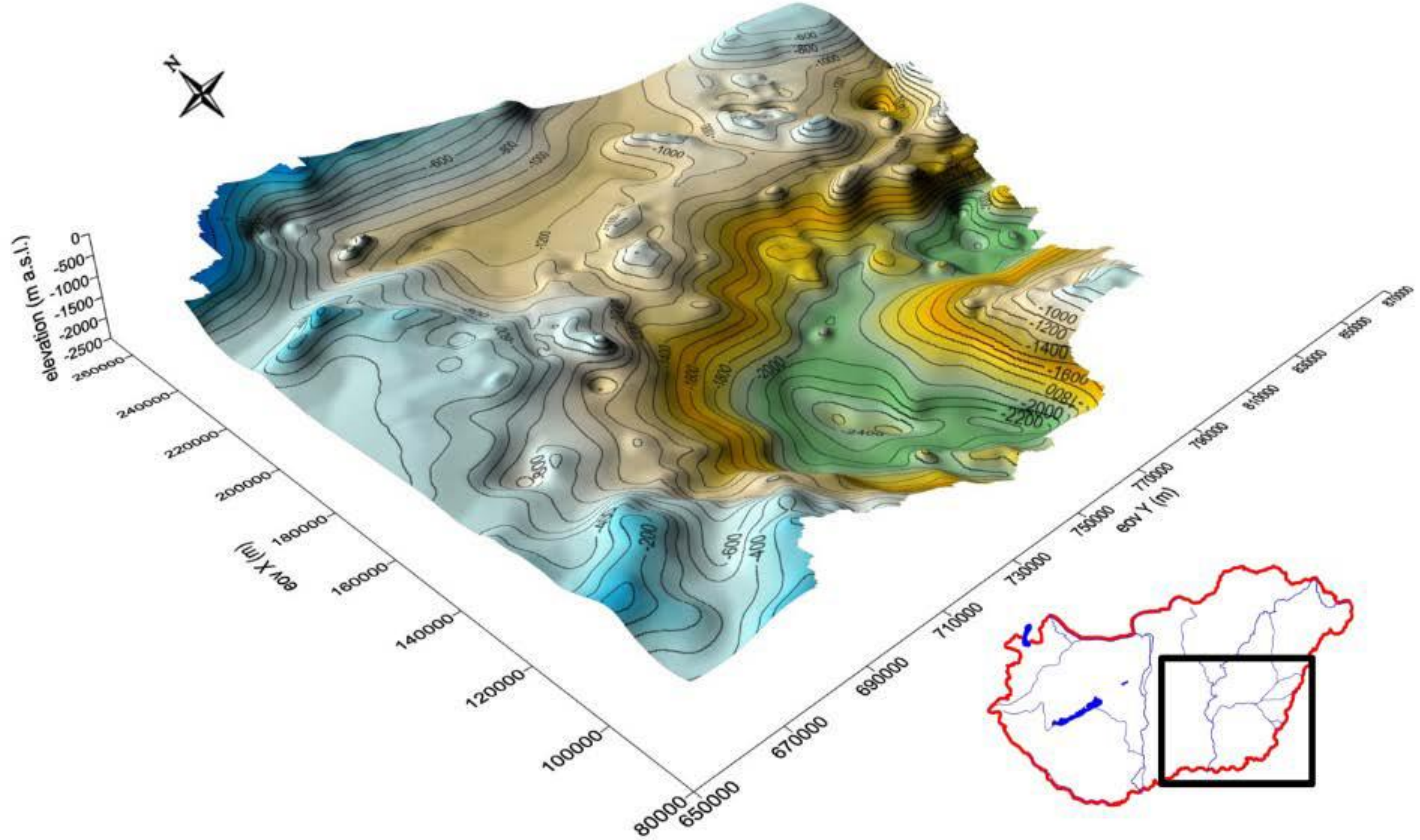
The Szeged case study

Circumstances 1: geothermal potential



- • Thickness of the thermal aquifer: 1,800
- 2,000m
- • Geothermal gradient: 150% of the world
- average
- • Average well yields: 90 oC, 70m3 /hour
- • Reservoir well researched by CH industry
- • Already operating geothermal systems, SPA's
- in nearby towns
- • Two privately owned geothermal heating
- circuits in Szeged

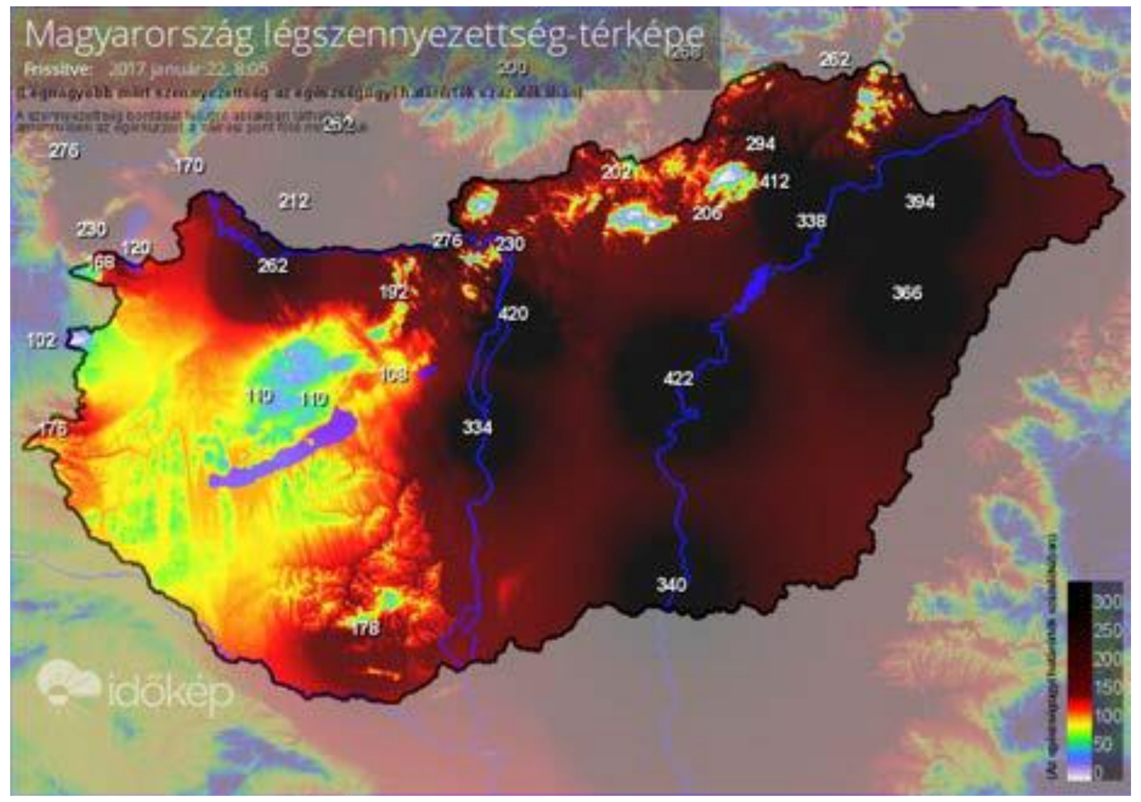




The Szeged case study

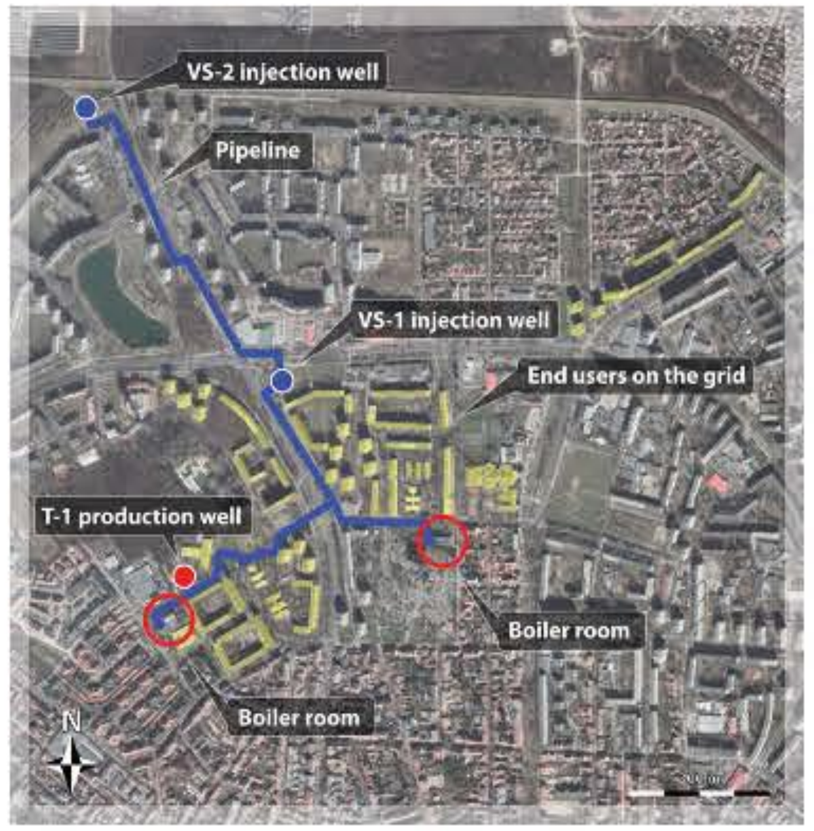
Circumstances 2: heat-market, energy supply, DH infrastructure, air quality

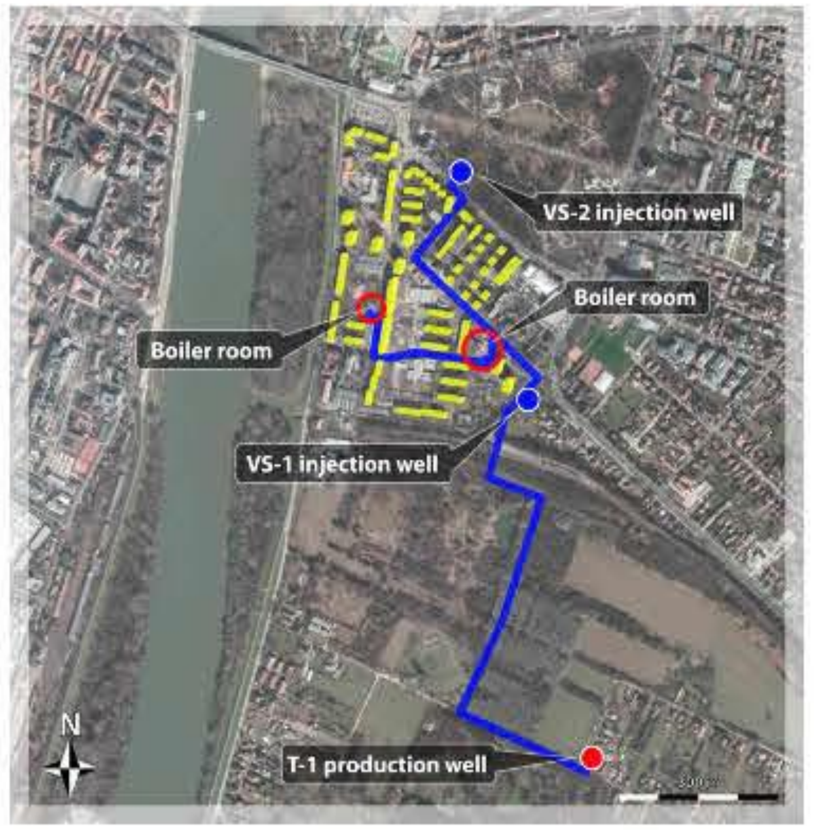
- • 27,000 households supplied by DH –
- another 27,000 not
- • Numerous near-crisis gas supply situations
- in recent years – time to look for new
- resources
- • Bad air quality throughout winter – need for
- green energy pronounced among the public
- • Making Szeged the „greanest” city in
- Hungary – a political agenda of the City Hall
- (electric public transport, geothermal DH,
- planting trees)

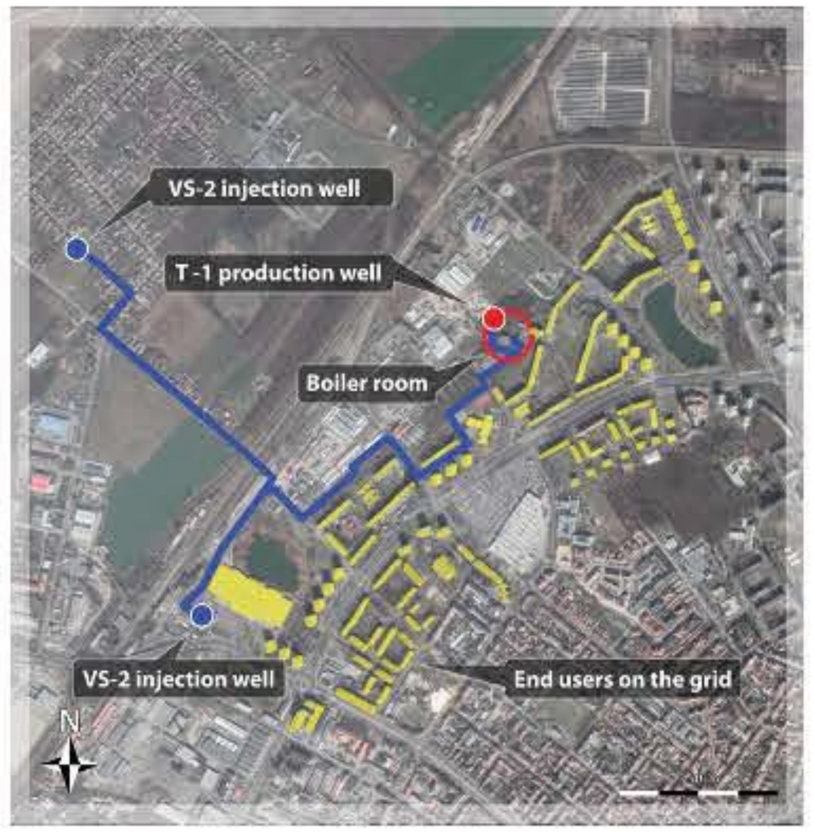


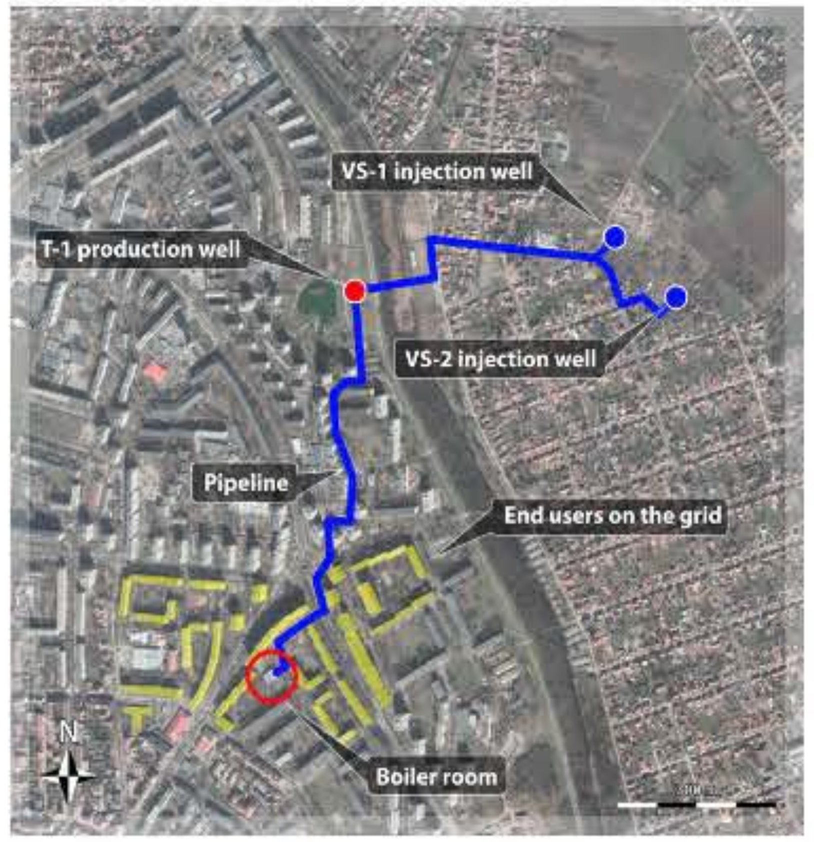
The Szeged case study

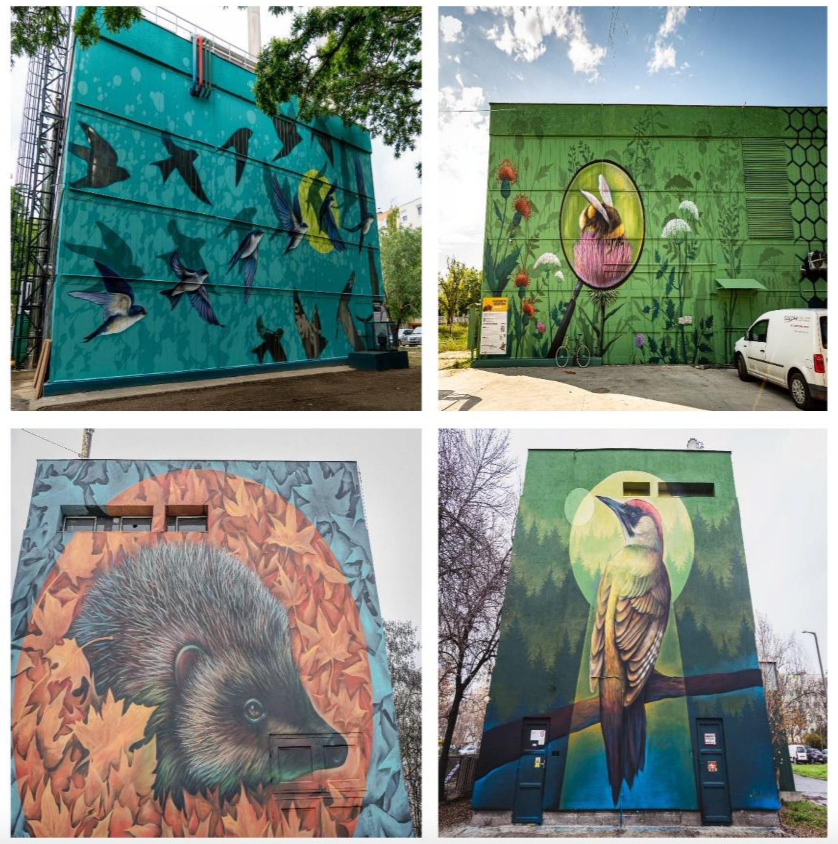
Introducing geothermal to 20 of the 23 heating circuits in 9 projects











The Szeged case study

1,700 - 2,000 m deep thermal wells are drilled to produce 70 m^3/h thermal water at 90°C. According to the plans, with the help of deep geothermal energy a total of nearly 20 million m^3 of natural gas would be replaced with 600,000 GJ of geothermal energy per annum, reducing the greenhouse gas load of the city of Szeged by 35,000 tons/year, improving air quality and security of supply. The 70-million-euro development is funded from ERDF sources and private investments.

Geothermal in the DH will result in saving 595,887 GJ/year (82%) or 17,525,718 m^3/year (68%) natural gas, provide 536,298 GJ/year thermal energy in district heating and 34,699 t/year (65%) CO_2 emission saving. The project is implemented in 9 instalments, that is 9 geothermal heating circuits (extraction – production well triplets) are being constructed, and these will provide heat energy to 15 heating circuits in the DH of Szeged.

Main contributions to the User4GeoEnergy project

So far

Social media presence (facebook, instagram) – WP2

Developing a story-teling website on the Szeged geothermal project and an e-learning material geothermal in general – WP3

Providing data on the Szeged site – WP4, WP5

Yet to come

Developing the design of the Geothermal District Heating Service Hubs

Iceland Liechtenstein Norway grants

Norway grants

Thank you!

www.eeagrants.org

Mail: tmedgyes@yahoo.com

NORCE – Norwegian Research Centre

NORCE is an independent research institute that conducts research for both public and private sectors, to facilitate informed and sustainable choices for the future.

95

MEURO

750

employees

50

nationalities

75%

doctoral degrees

NORCE's main strategic objective

1

Safe and Inclusive Societies

2

Energy Future

3

Climate and Environmental Risk

4

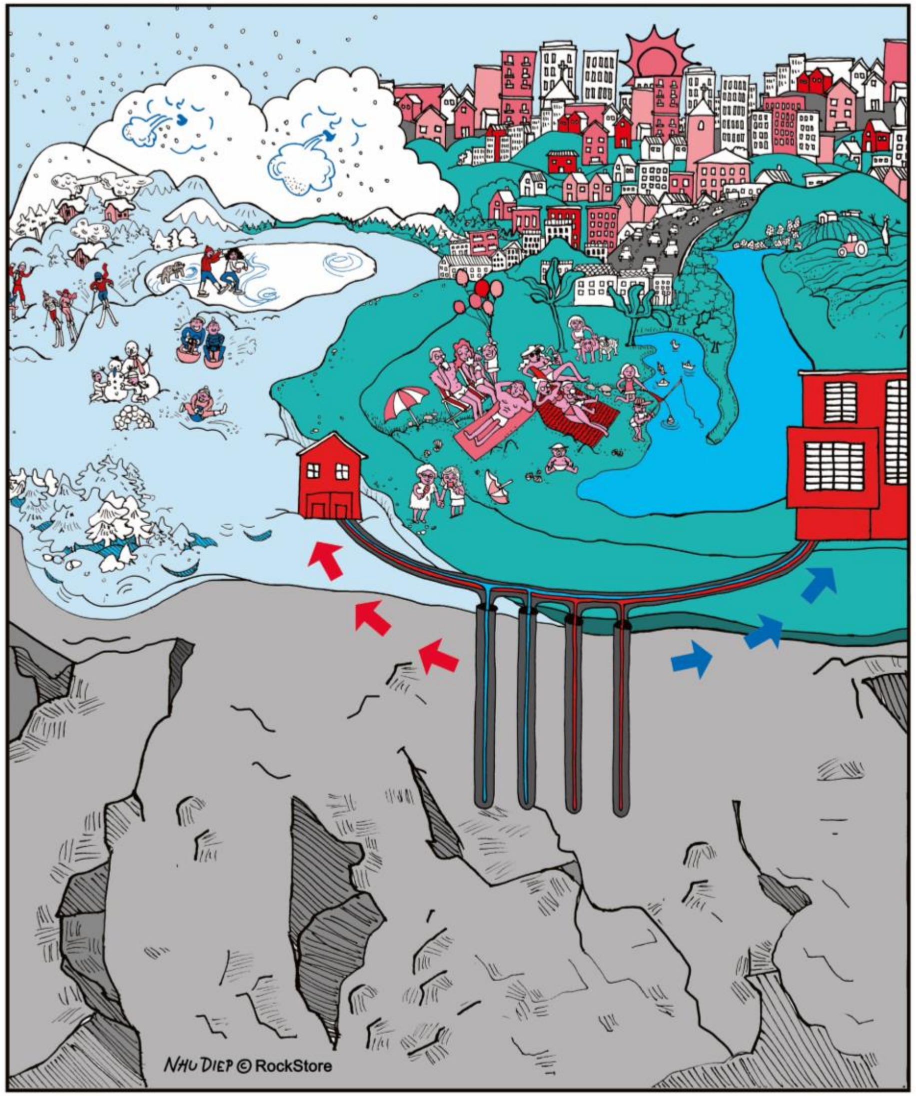
Sustainable Oceans and Coasts

Energy systems

- **Heat pump applications**
- **Underground thermal energy storage)**
- **Integrated energy systems**
  - PV &, solar thermal collectors
  - Hydrogen, Wind
  - CCS, PCM store
  - Smart systems
- **Energy system modelling**
  - Modellica, TRNSYS,
  - Optimising,

Geology & Resevoir

- **Geology & Geophysics**
  - Crystalline & sedimentary
  - Geomatics & Virtual outcrops
- **Resevoir characterization**
  - Fractured & porous
  - Geochemistry & microbiology
  - Flow laboratories
- **Modelling & flow simulation**
  - Eclipse, CGS, Roxar, OpenPore



Social

- **Social embeddedness level**
- **LCA, sLCA & LCOE**
- **Environmental impact**

Monitoring

- **Distributed fibre-optic sensing**
  - DAS – acoustic, seismic, fluid flow
  - DTS – temperature
  - DCS – chemical
- **Synthetic Aparature Radar**
  - SAR / InSAR
  - Subsidence
  - Active faults, Environmental impact
- **Drone surveys**
  - small to large (BLOS) all classes
- **Seismic Electric Effects (SEE)**
  - Fluid saturated fractures

Well and borehole

- **Drilling**
  - Automation, Hard rock drilling, Drillstring dynamics
- **Well operations**
  - Well integrity, Cementing, Barrier evaluation, Risk management
- **Borehole heat exchangers**

Thank you. Takk.

Merci. Gracias. Obrigado.

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NORCE

Iceland
Liechtenstein
Norway grants

Norway
grants

ORKUSTOFNUN
National Energy Authority

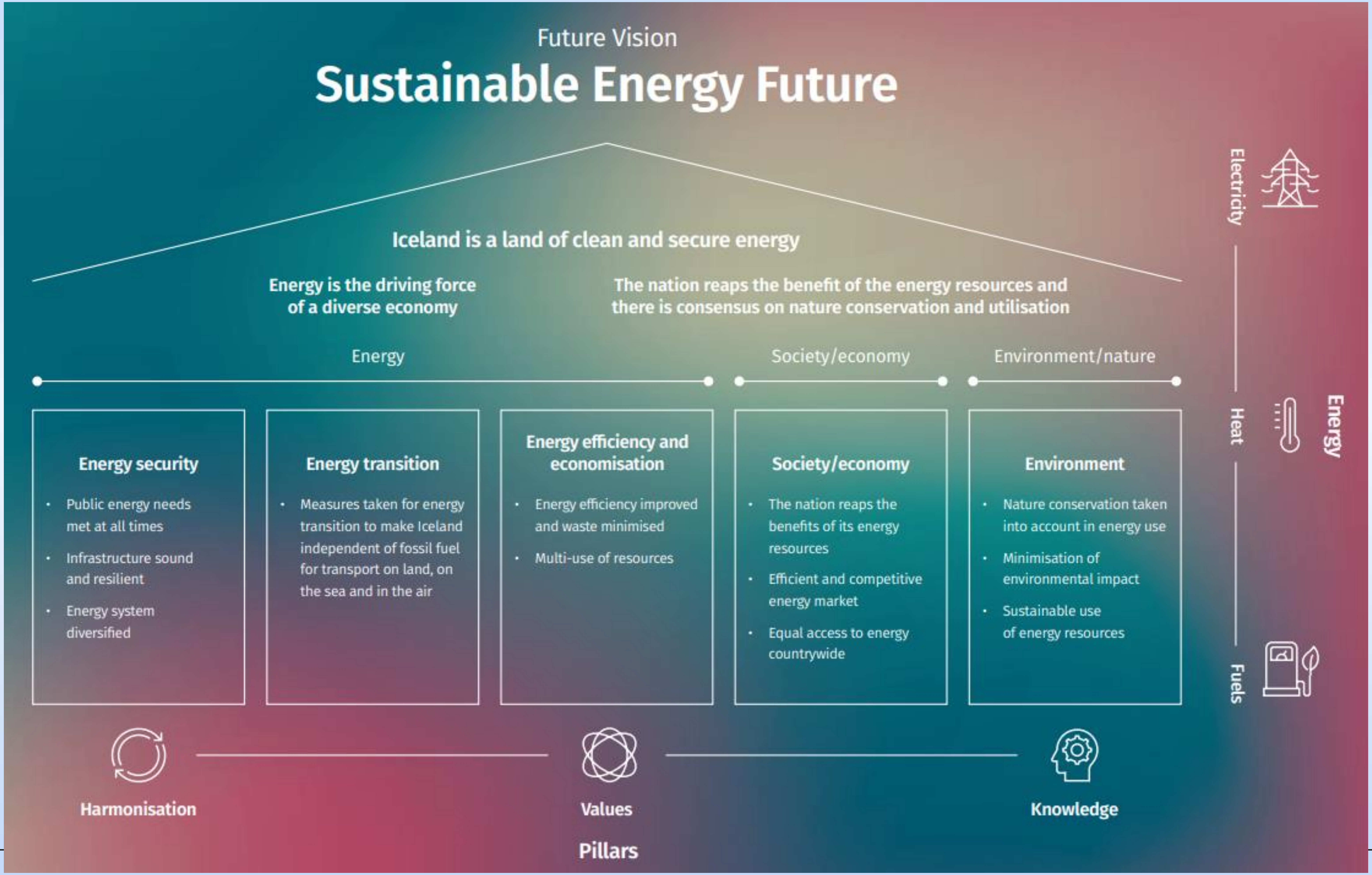
Geothermal District Heating and Good Practices in Iceland

Baldur Pétursson
Manager International Projects

Orkustofnun
National Energy Authority (NEA)

8.12.2022

Policy Towards Sustainable Energy Future



Policy Towards Sustainable Energy Future is based on 8 key elements

Role and tasks of the National Energy Authority

Energy Policy Recommendation

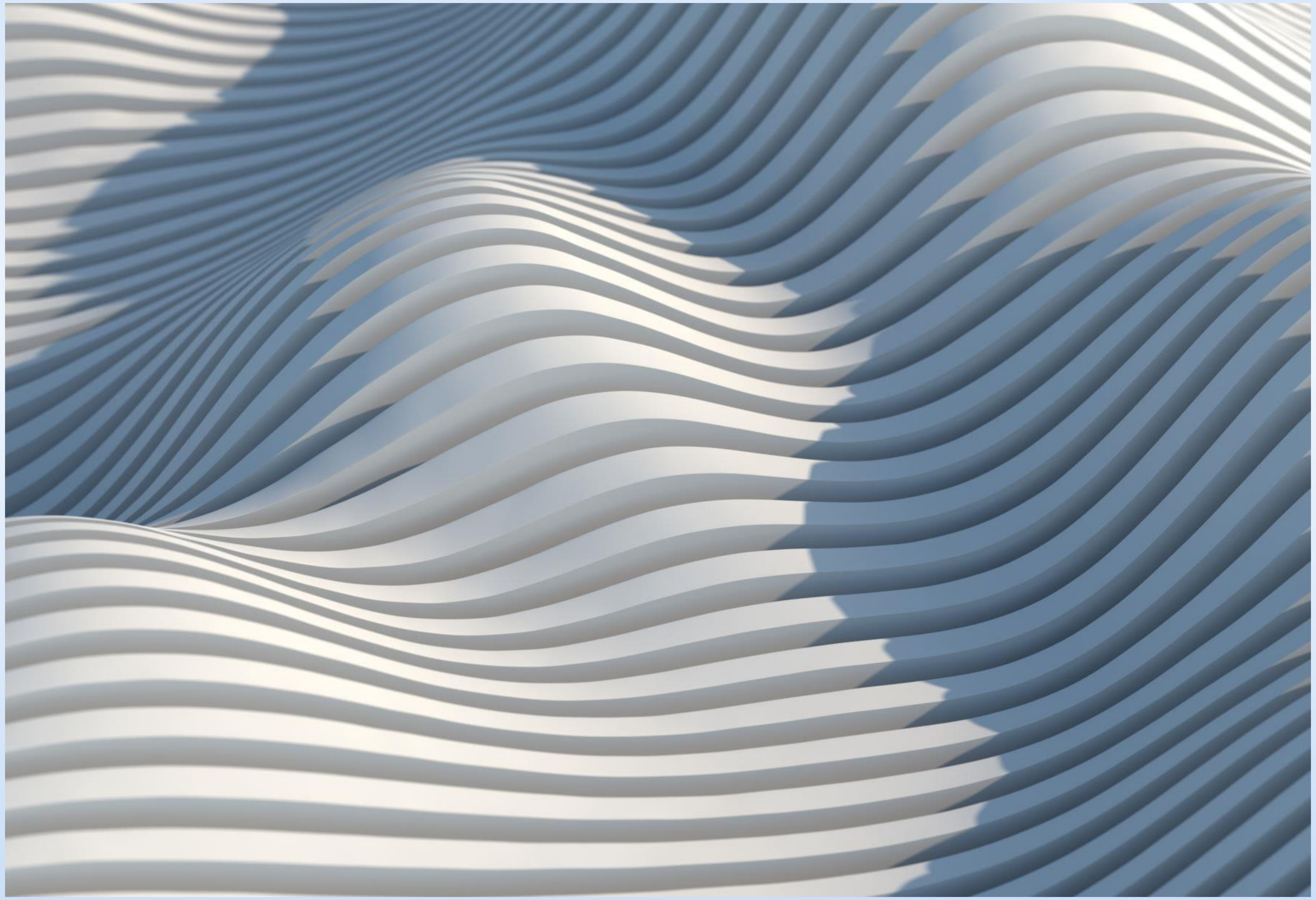
Climate change, energy transition and innovation

Licensing resources

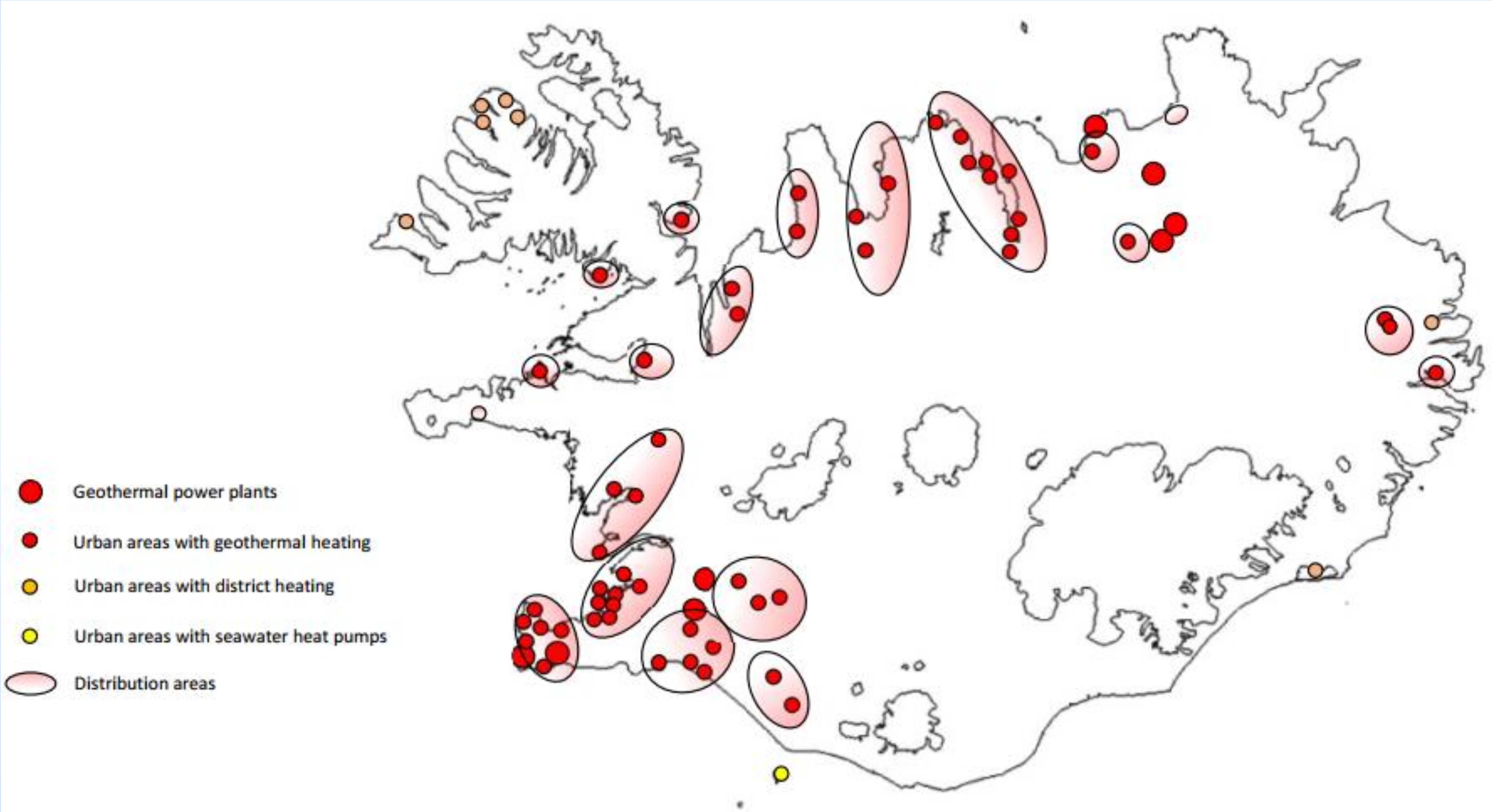
Monitoring resources

Data, energy efficiency, research

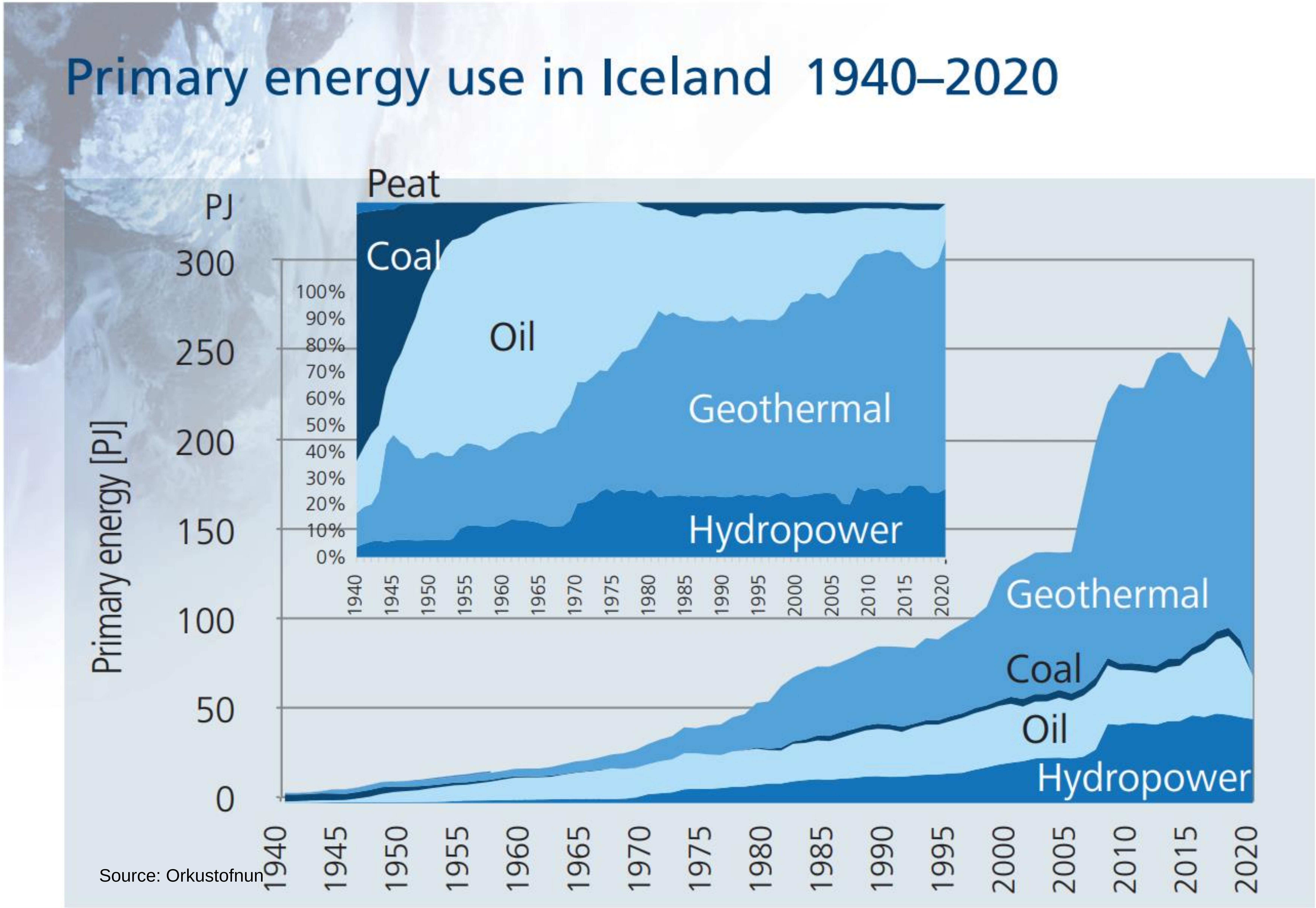
International cooperation and PR, (EEA Grants, WEC, Nordic, IGA, IEA, etc.)



District Heating Areas in Iceland



Primary energy used in Iceland

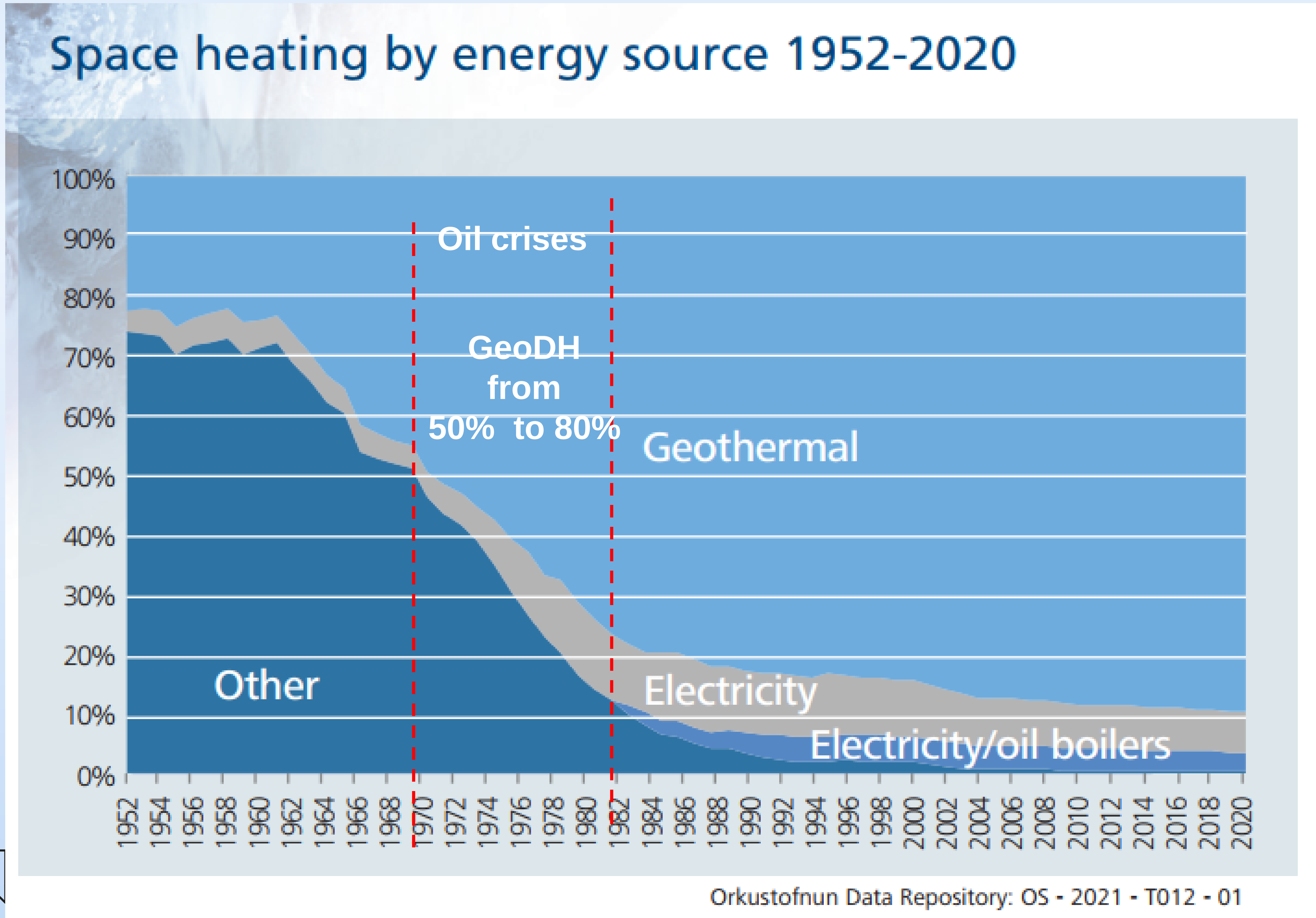


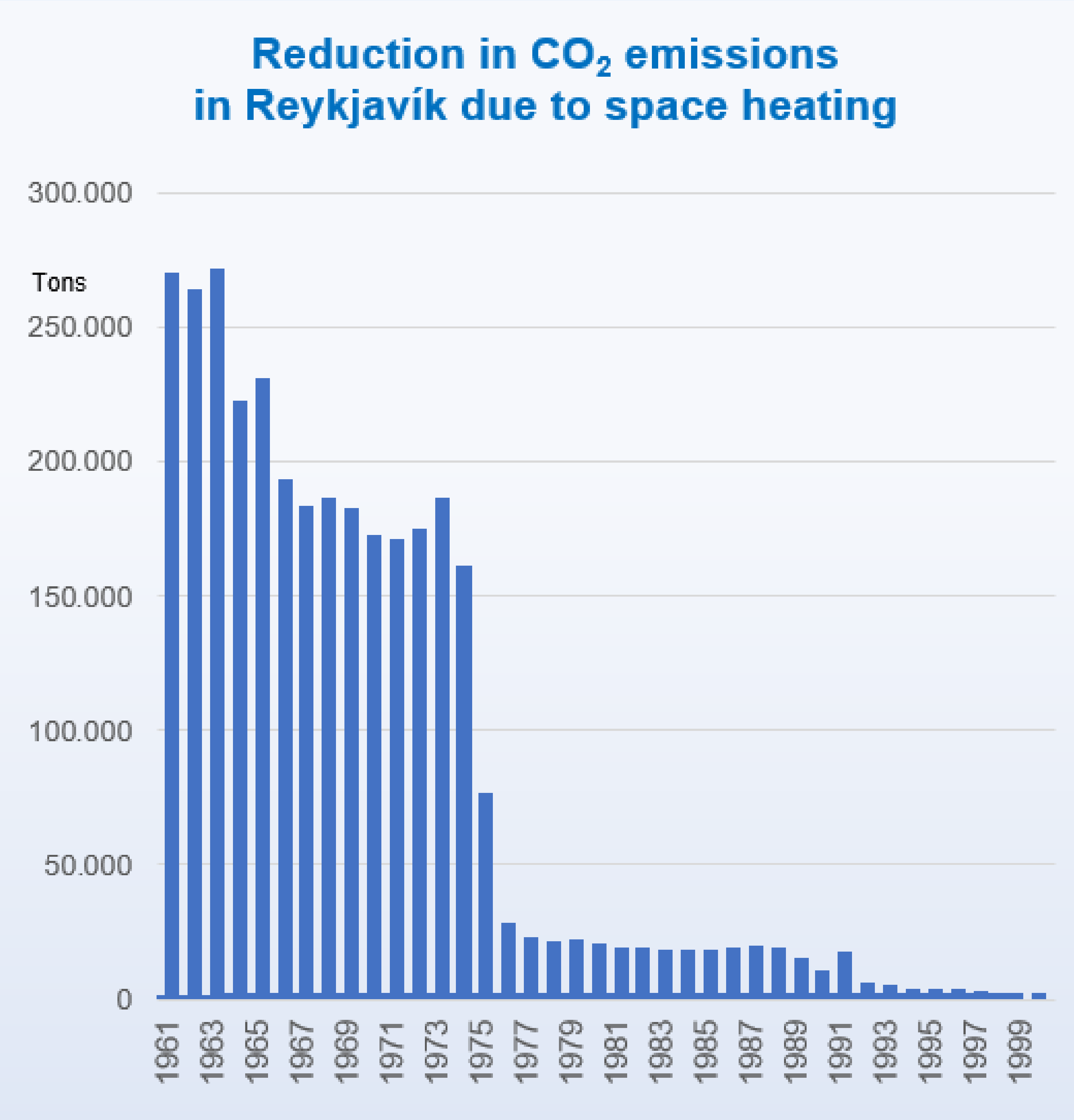
Source: Orkustofnun

Expansion of GeoDH

Space Heating by Source 1953–2019 and reduction of CO2

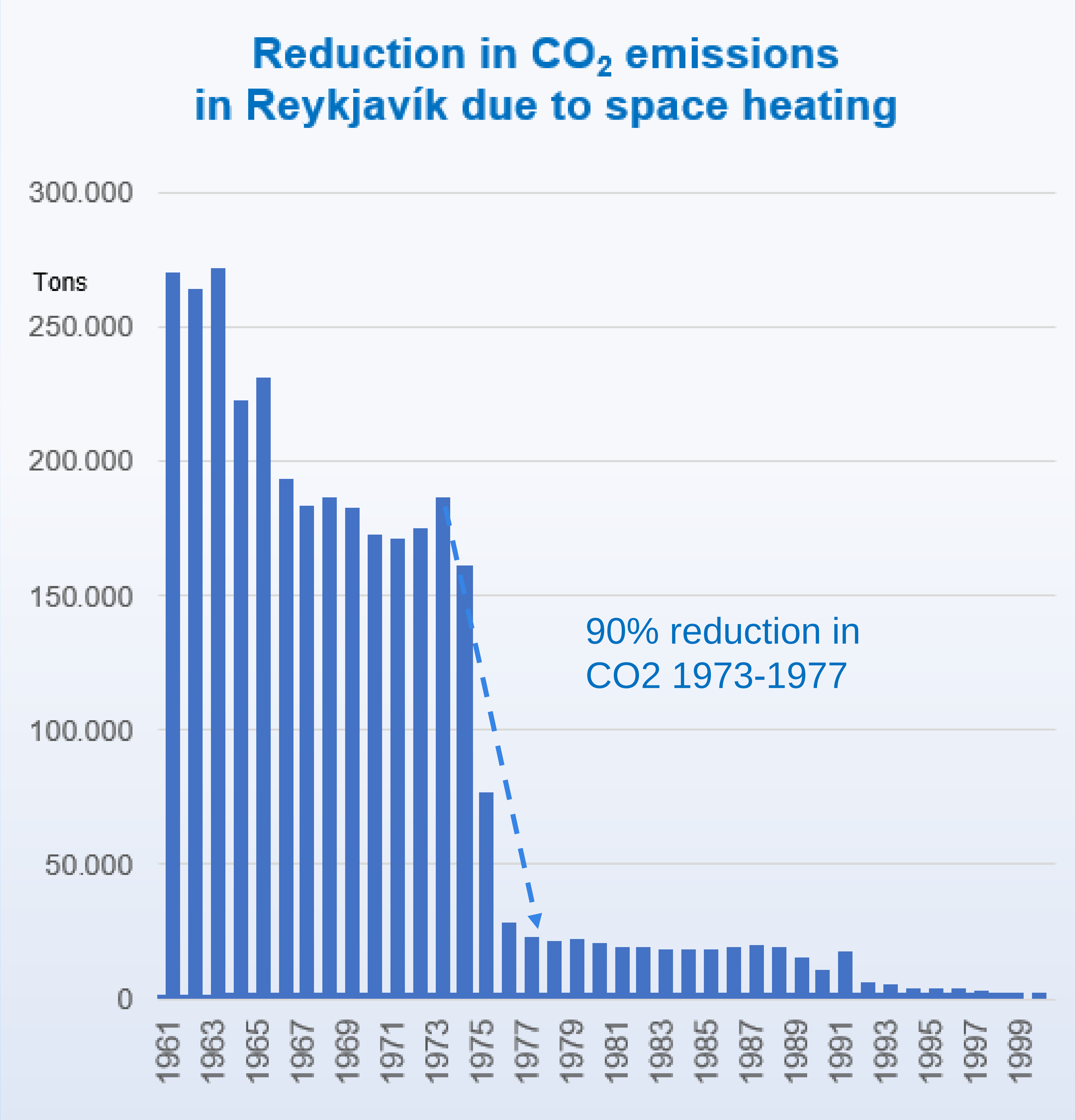
- External conditions – raised the need to increase geothermal heat and GeoDH Planning 1970 - 1982
- It took only 12 years to increase GeoDH from 50% to 90% of total space heating
- and it took only 12 years to decrease oil for heating from 50% to 10%
- the reduction of CO_2 emissions in Reykjavík decreased from 170.000 tons to 18.000 or 90%





Environmental and climate benefits of geothermal utilisation is mitigating climate changes

Reykjavík 1933 and today

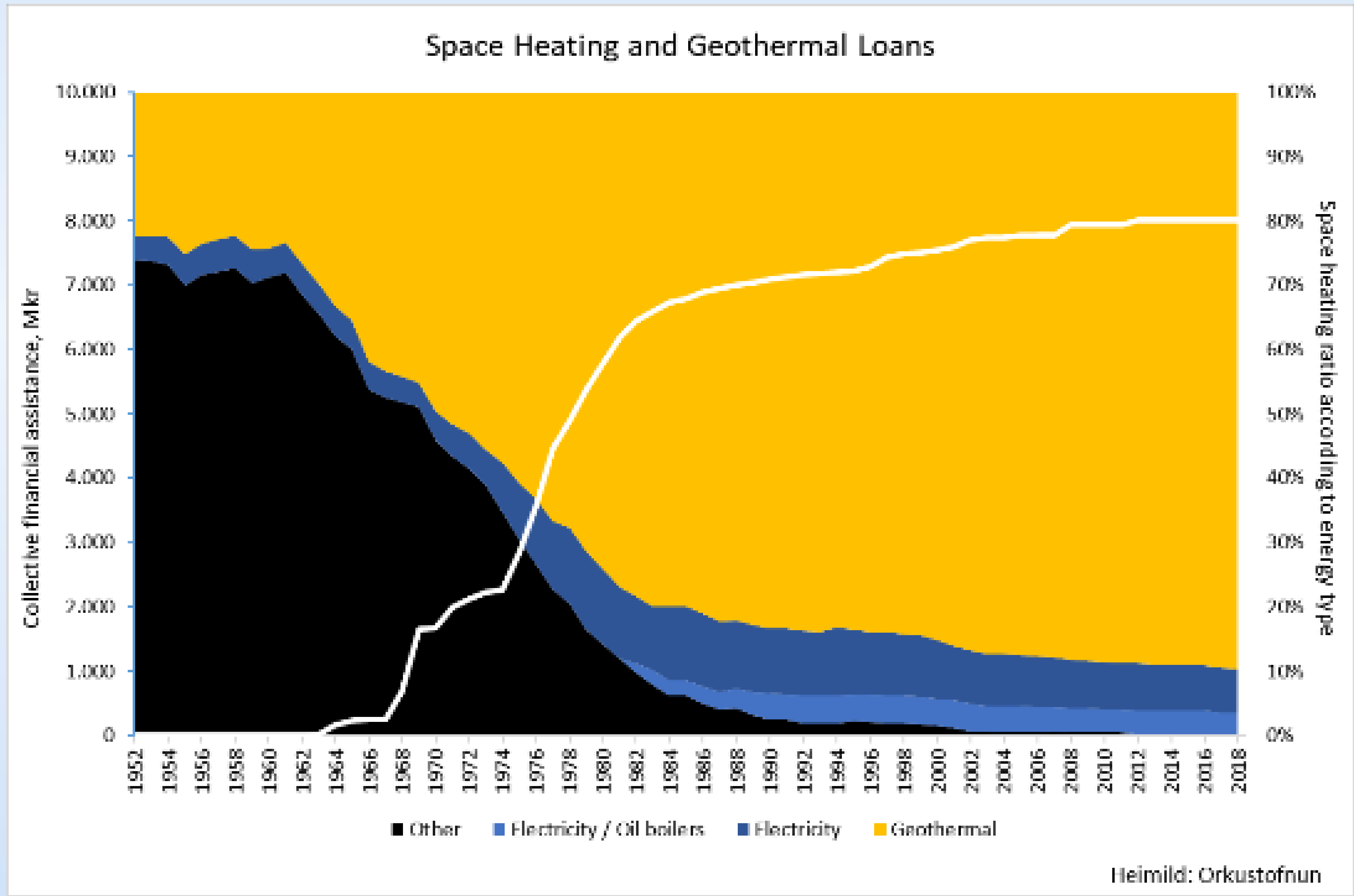


Source: Reykjavik Energy

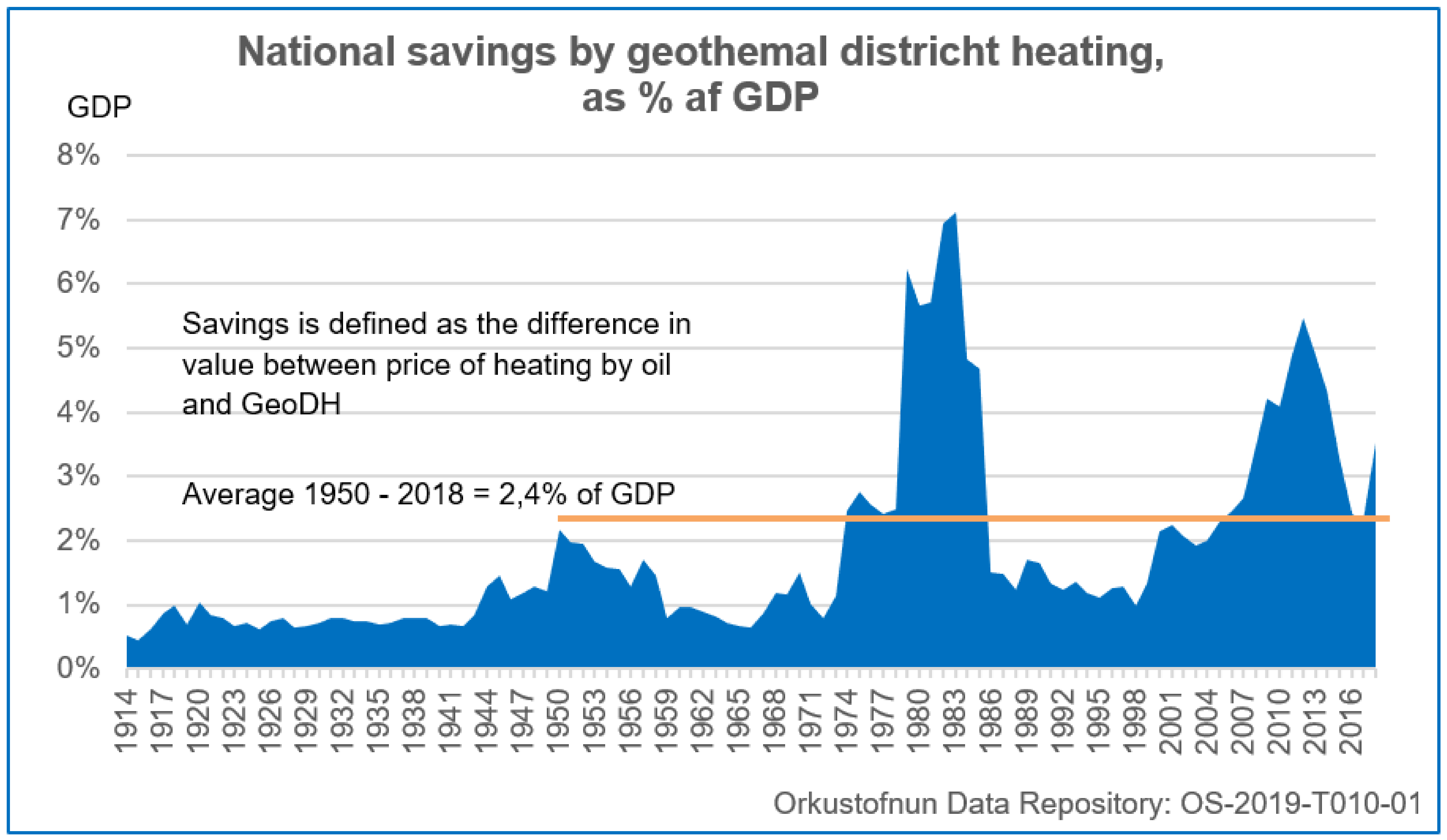
Icelanders also needed support for development of geothermal energy

350 geothermal loans granted by the government to address the upfront risk of locating geothermal resources by drilling

- Successful projects repaid the loans – **20 district heating systems developed**
- Unsuccessful projects received 50% funding vs. 50% loans
- Recent success rates of geothermal drilling: 44% for 1st well, 60% for 5th well and 75% for 15th well



Economic benefits of geothermal utilisation is valuable and increases energy security



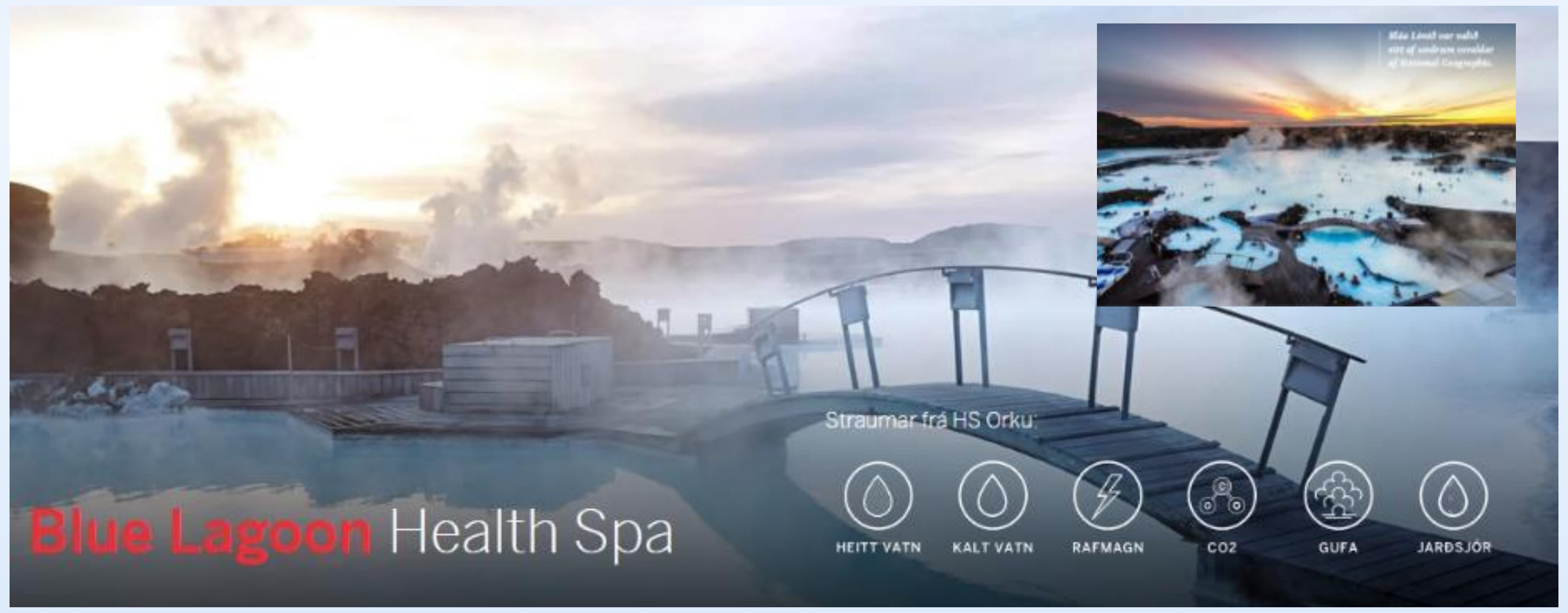
Utilisation of Geothermal Energy

Companies within the Resources Park at Reykjanes

Geothermal Power and Heat Generation

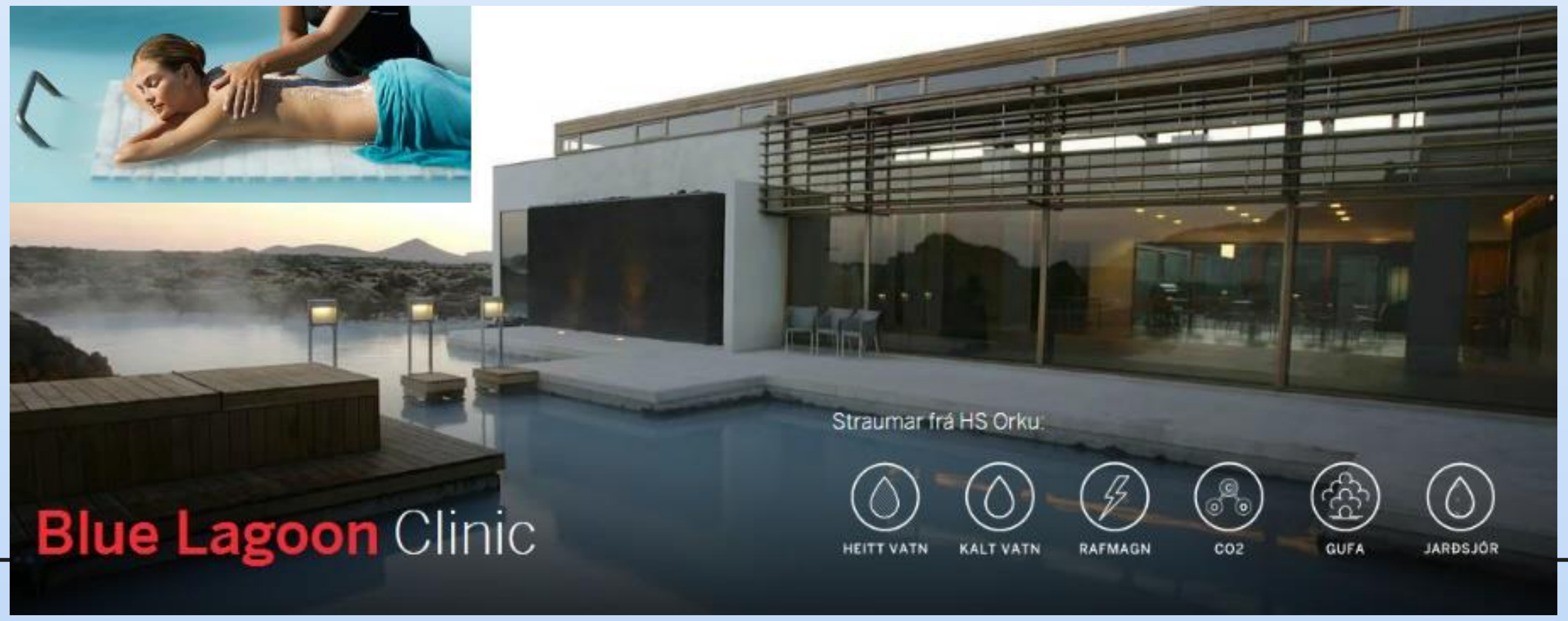
Geothermal Power and Heat Distribution

Blue Lagoon Health Spa

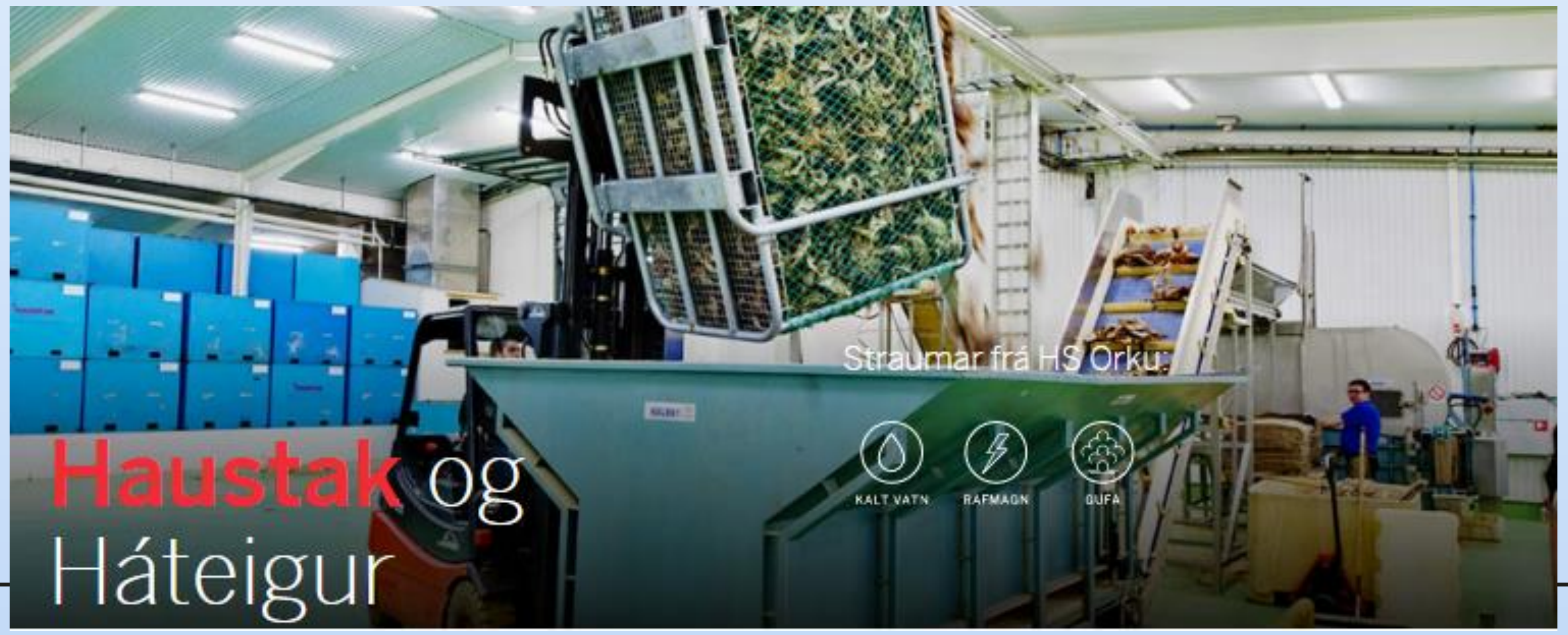


Blue Lagoon R&D Centre

Blue Lagoon Clinic

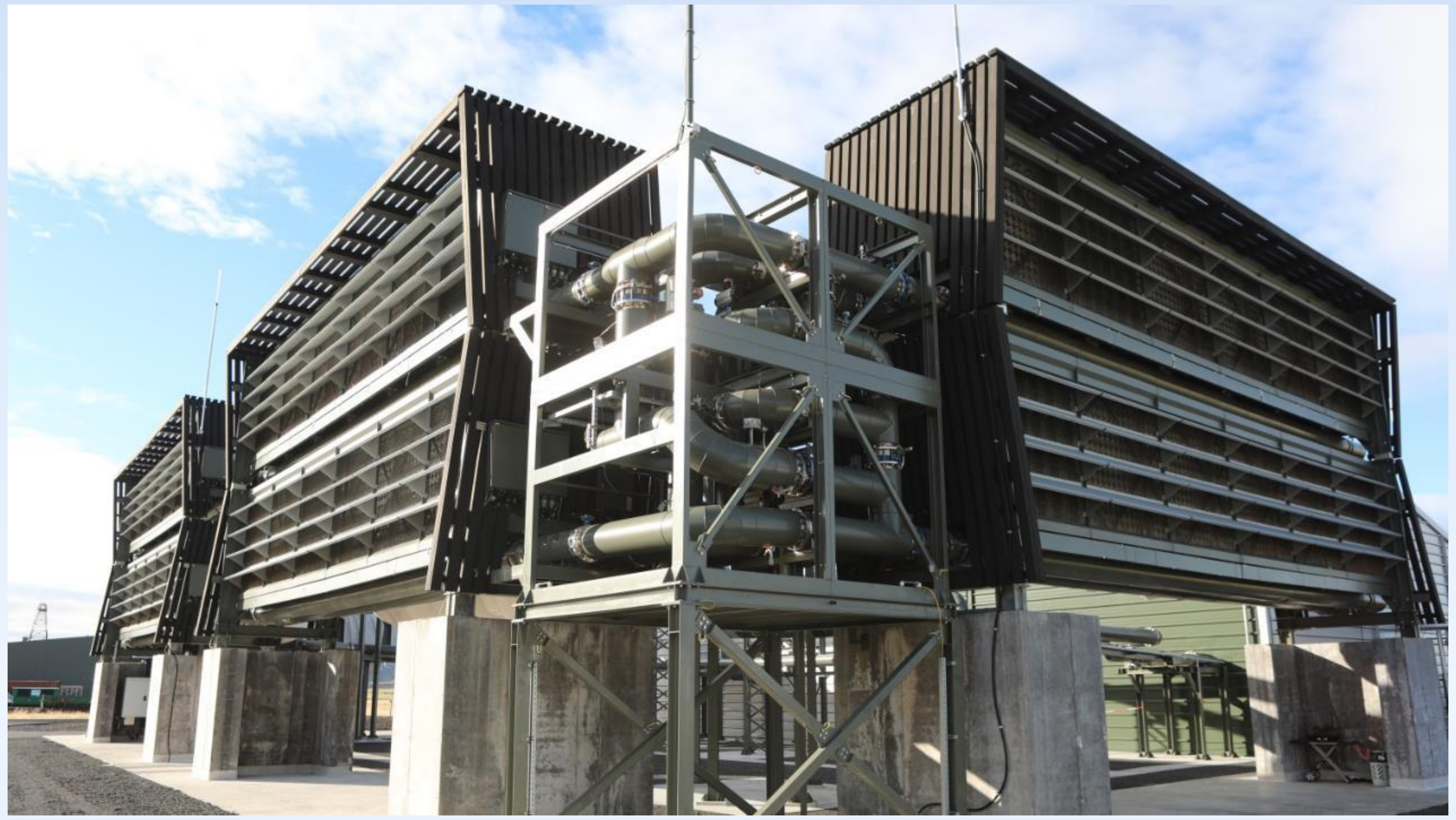


Fish Drying



Utilisation of Geothermal Energy

Companies at Hellisheiði Resources Park



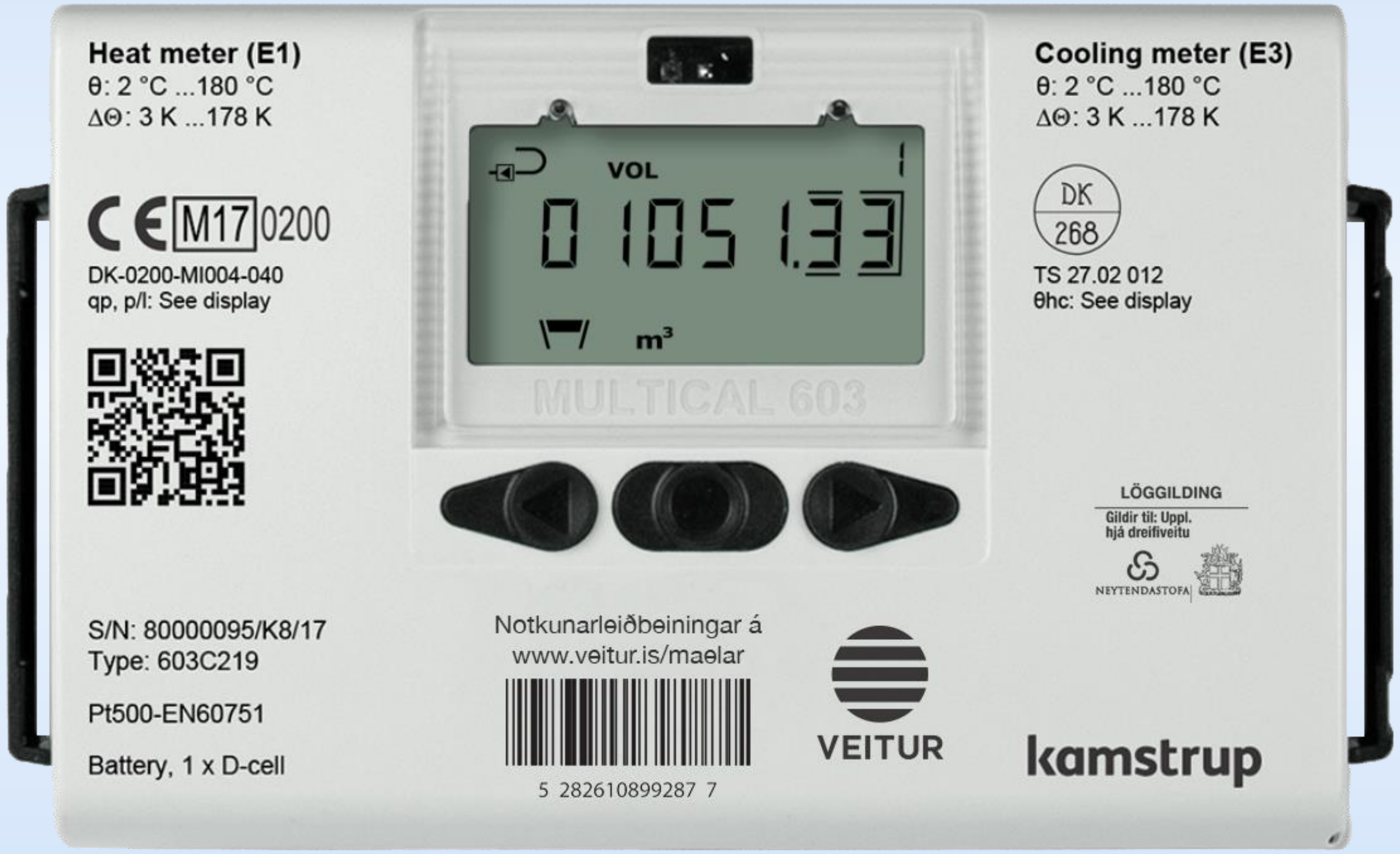
Geothermal Heating System at Höfn

The Latest Geothermal Heating Utility in Iceland

- Most cost effective for both customers and heating company if customers connect to the heating utility in the beginning.
  - Connection on later stages will depend on real costs in addition to the initial cost.
- Further work in progress: Further information, e.g. regarding technical information and requirements.

Energy Meters – Smart Metering

Two types of energy meters used in Iceland



Competitiveness of the Geothermal Sector

Success of Geothermal District Heating is based on 8 Key Factors

8 Key Elements of Success in the Geothermal Sector and District Heating

1. Authorities and regulation,

2. Geothermal resources,

3. Scientific & technical factors,

4. Education & human factors,

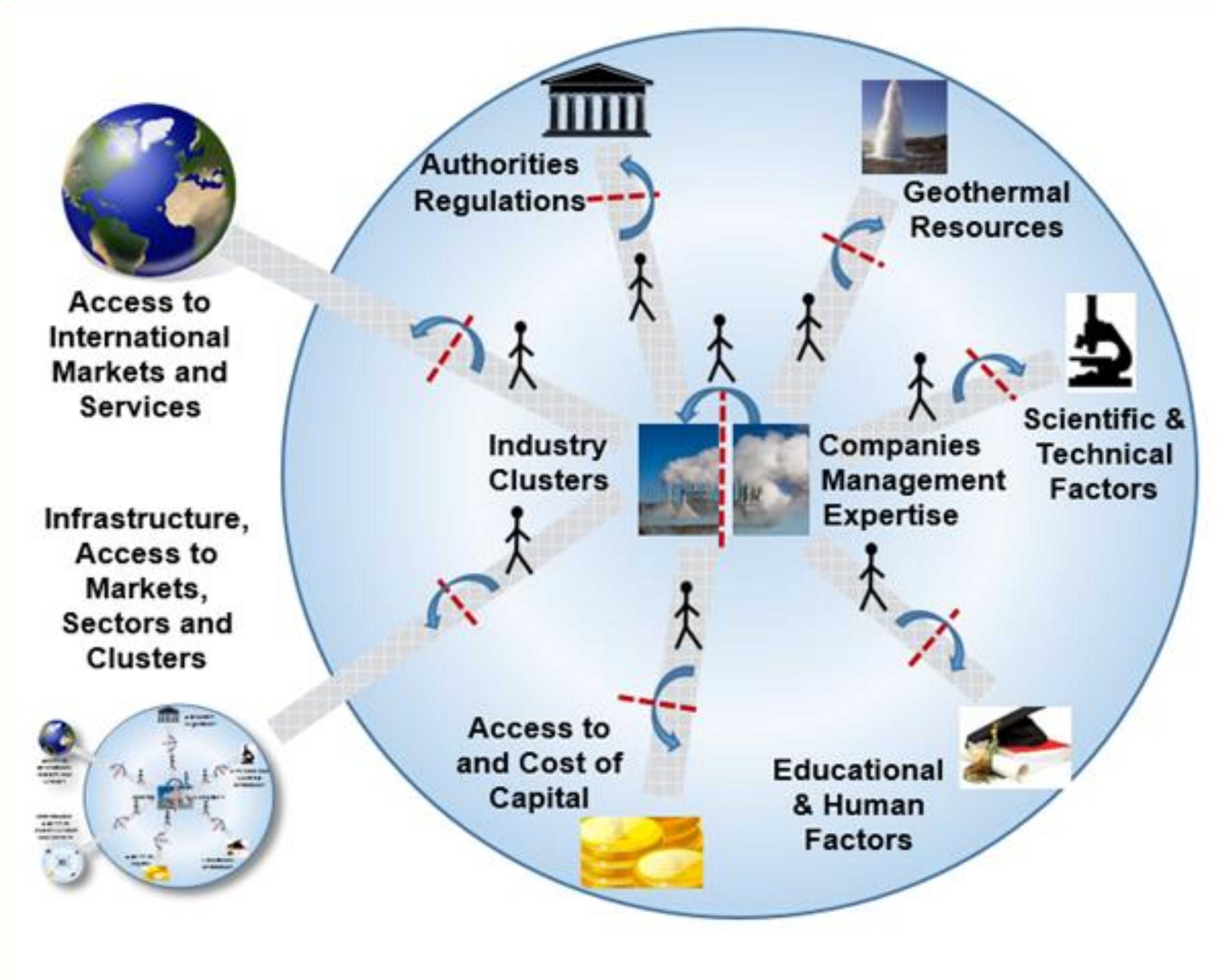
5. Access to capital,

6. Infrastructure and access to markets, sectors and other clusters,

7. Access to international markets and services,

8. The company, management, expertise & industry, clusters assessment

In cooperation with international and domestic experts, on geothermal resources, finance, legal, management and other expertise.



Source: Sölvell & Lindquist 2012, Amended, B. Petursson, National Energy Authority, 2014

Renewables and Energy Transition is a powerful tool to mitigate global warming and increase energy security

Thank You