



Rialtas na hÉireann
Government of Ireland



Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

Ireland's Geothermal Potential

Dr Sarah Blake

Groundwater & Geothermal Unit

Heat Pumps in Agriculture, Feb 22nd 2022

About us

- Geological Survey Ireland is Ireland's public earth science knowledge centre and is a division of the Department of the Environment, Climate and Communications.
- We provide free, open and accurate data and maps on Ireland's subsurface.
- We deal with a diverse array of topics including bedrock, groundwater, seabed mapping, natural disasters, and public health risks.

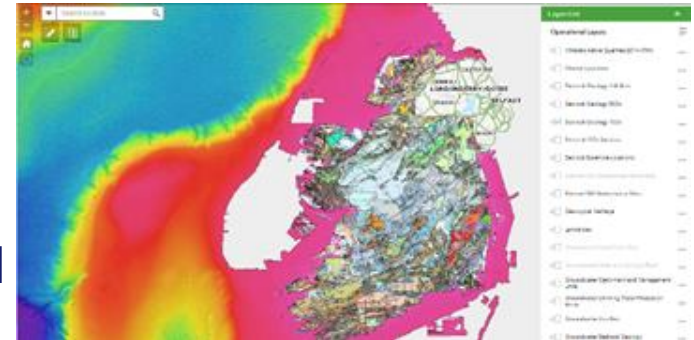
www.gsi.ie



Geological Survey

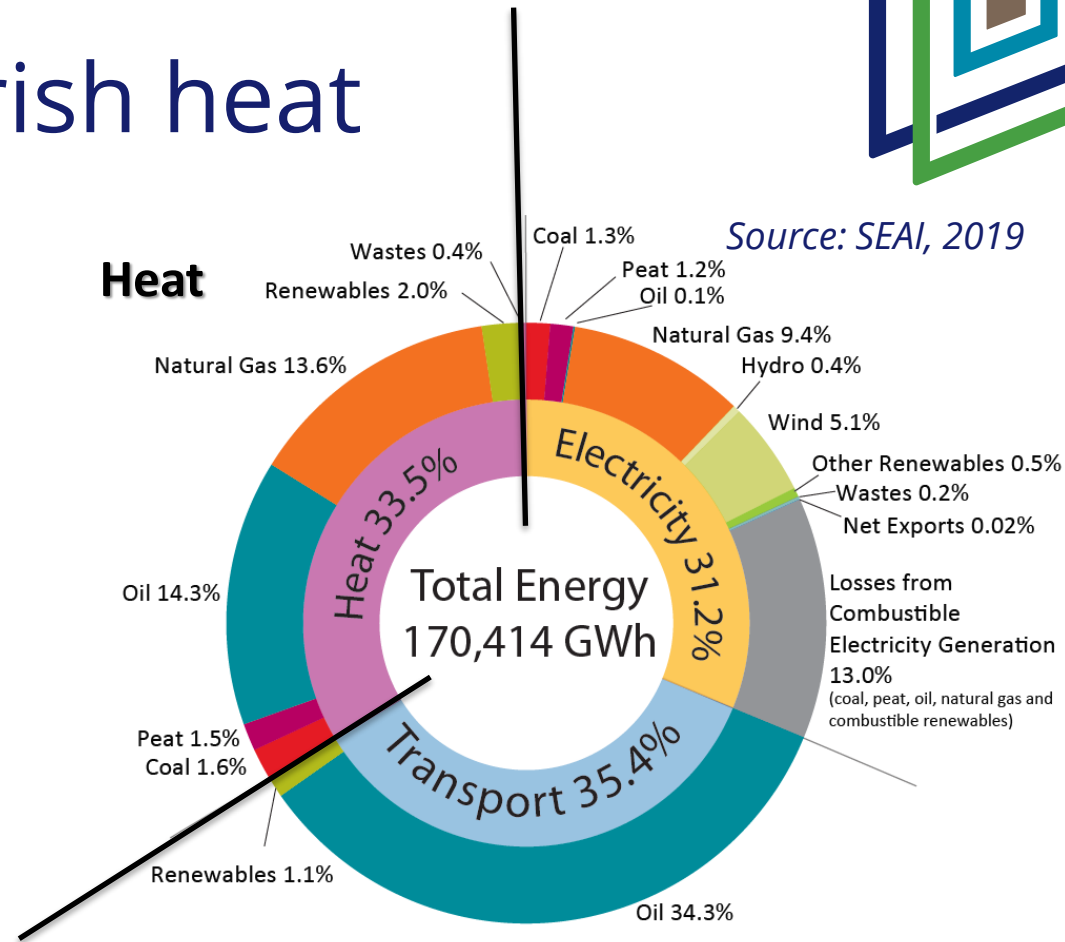
Suirbhéireacht Gheolaíochta
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175 years | bliain 1845-2020

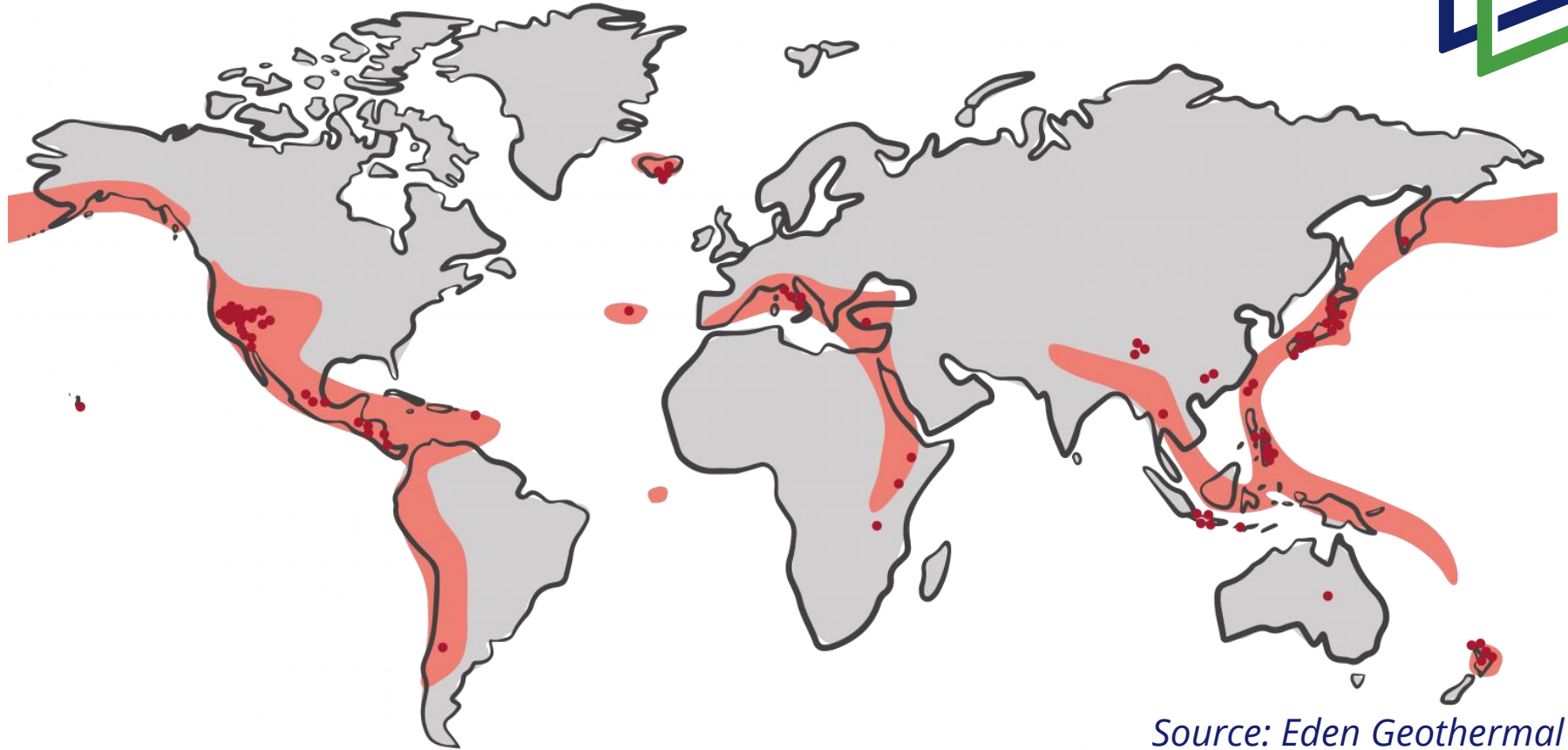


Decarbonising Irish heat

- The heat sector accounts for approximately one-third of our total energy expenditure
- Solution: **district heating** where the heat demand/population density is high enough, and by individual **heat pumps** in other (rural) settings (Connolly et al., 2016)



The heat beneath our feet

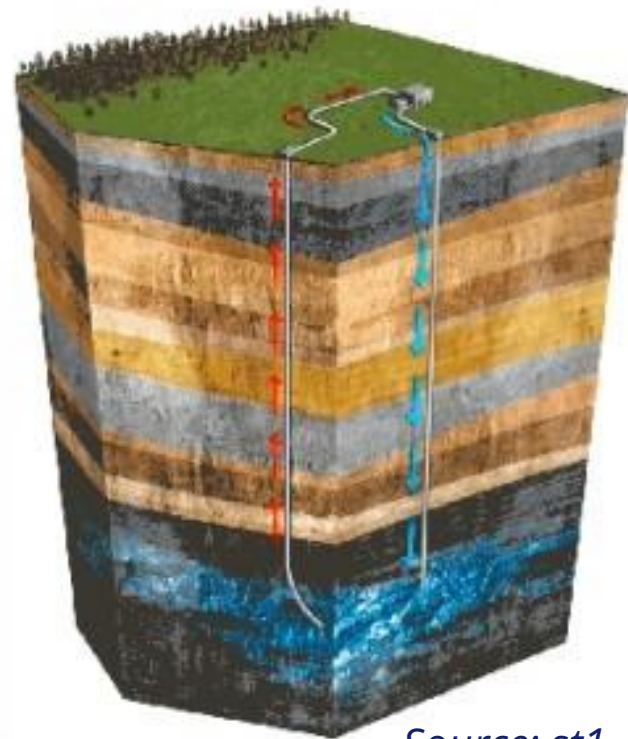


Source: *Eden Geothermal*

The heat beneath our feet



Source: Getty images



Source: st1

OVERVIEW OF SHALLOW GEOTHERMAL ENERGY SYSTEMS IN AREAS

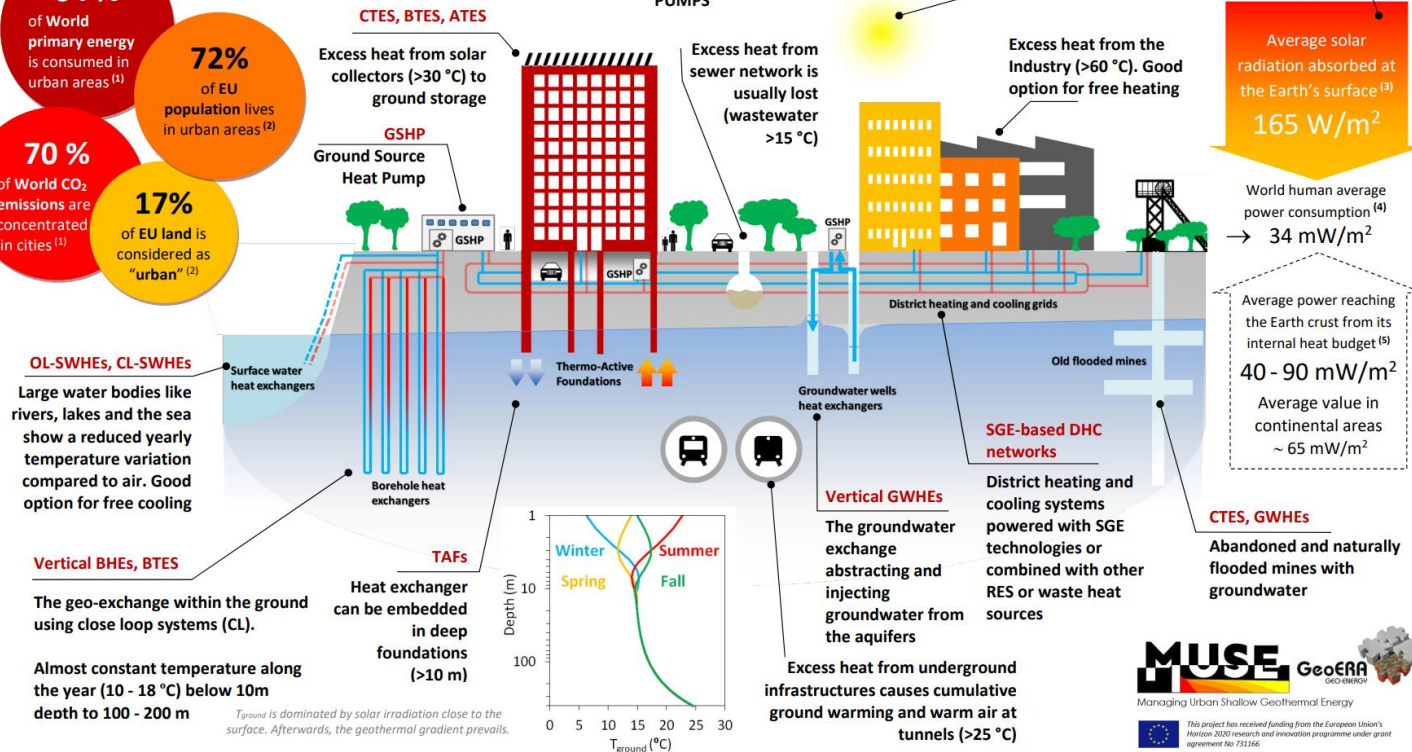
SGE is ubiquitous, available any time, weather independent, efficient and renewable

- 64%** of World primary energy is consumed in urban areas⁽¹⁾
- 72%** of EU population lives in urban areas⁽²⁾
- 70%** of World CO₂ emissions are concentrated in cities⁽¹⁾
- 17%** of EU land is considered as "urban"⁽²⁾

From 0 to 200 m under the surface (exceptionally up to 400 m) **SHALLOW GEOTHERMAL ENERGY**
 Stored/exchanged in/with the subsurface **HEAT PUMPS**
 Heat extracted/injected from/to the subsurface with (or without) **HEAT PUMPS**

The Sun is the true main source of SGE

1. IAE, "Energy Technology Perspectives" (2016)
2. PBL Netherlands Environmental Assessment Agency, "Facts and Figures on Cities and Urban Areas" (2016)
3. Nature Geoscience 5, 671-696 (2012)
4. BP, "Statistical Review of World Energy" (2019)
5. Turcotte D.L. & Schubert G., "Geodynamics" (2nd ed. 2002)



MUSE GeoERA
 Managing Urban Shallow Geothermal Energy

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731366

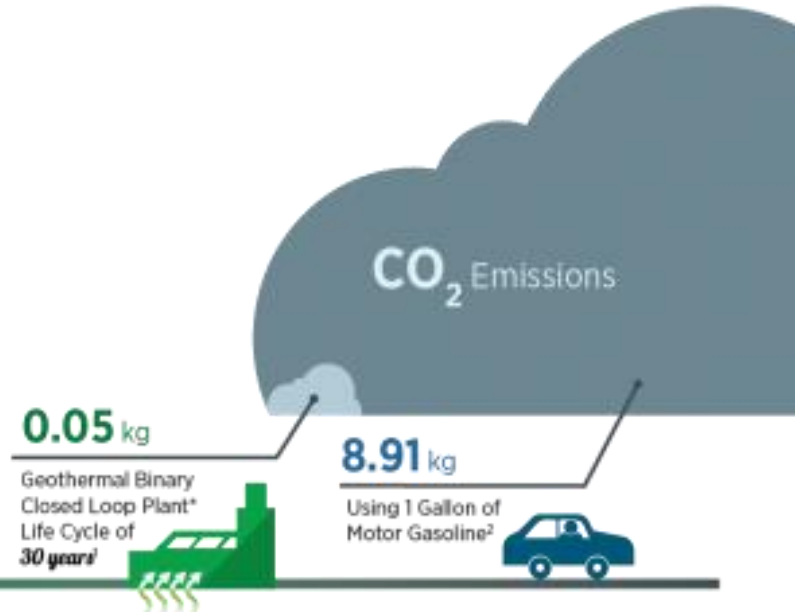
The heat beneath our feet



ENERGY THAT *Works* AROUND THE CLOCK

Geothermal is a reliable, baseload energy source. It can provide power **24** hours a day, **365** days a year, independent of weather conditions and with the flexibility to meet consumer demand.

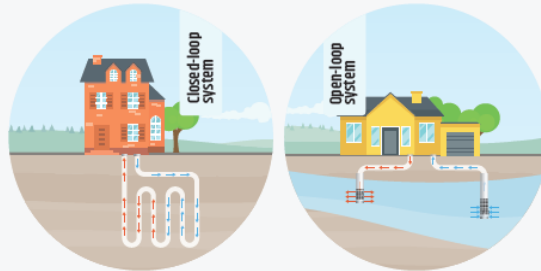
Source: USDoE



The heat beneath our feet



This renewable technology uses either open-loop (OL) or closed-loop (CL) systems to provide heating, cooling, domestic hot water or thermal energy storage.



Benefits.....



Reliable

Shallow geothermal energy is stable and capable of providing heating and cooling 24/7 throughout the year. It does not depend on weather conditions like wind or daylight.



All-rounder

A given system is able to provide domestic hot water, space heating and cooling without additional investments. The ground serves as seasonal storage in a new generation of local heating and cooling grids. All systems are adaptable to different types of resources and demands.



Green and clean

It reduces harmful emissions, such as smog and greenhouse gases. Combined with renewable electricity, the technology produces zero emissions. This supports climate and environmental policies.

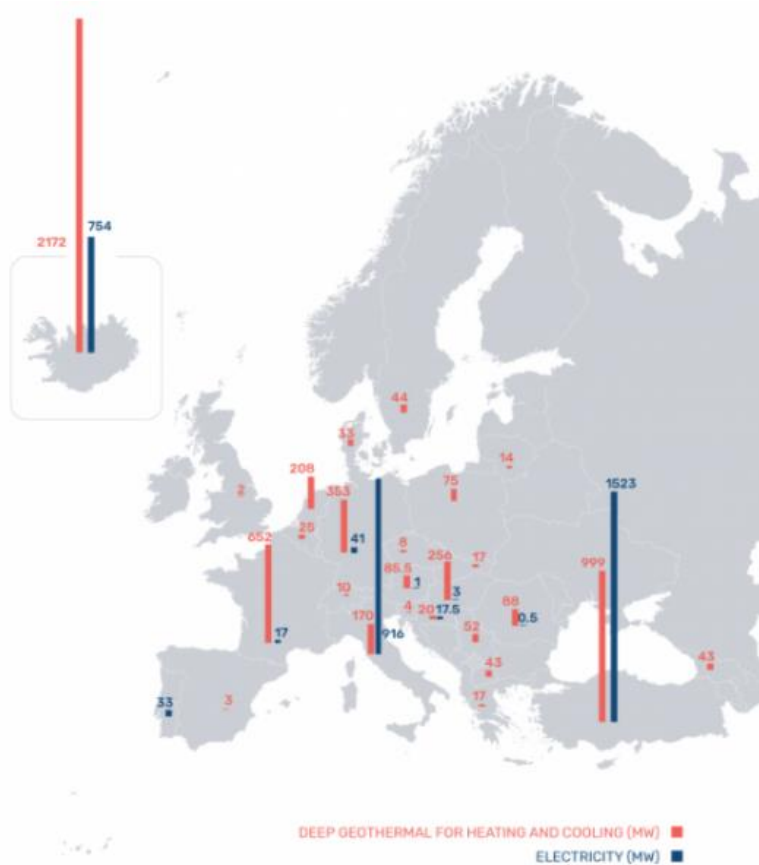


Efficient

Shallow geothermal energy systems are a high performing and efficient technology with little land use. In combination with a heat pump, each kW of electricity consumed can produce at least 4 kW of space heating.

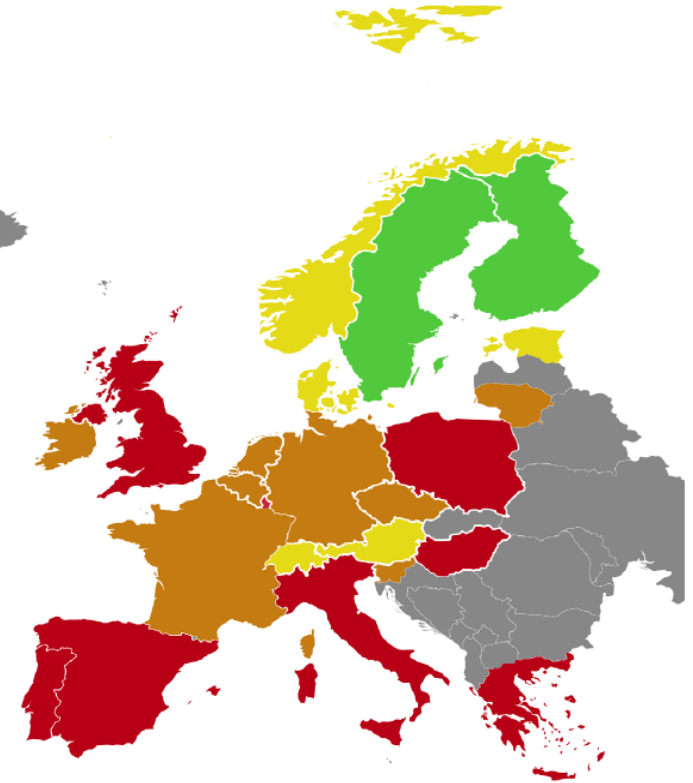
Source: GeoERA MUSE project

Irish geothermal sector



No. of GSHPs per 1,000 households

- 12.3% - 5.8%
- 3.1% - 2.3%
- 2% - 1%
- less than 1%



Irish geothermal resources



Irish geothermal resources



Svartsengi geothermal power station, Iceland

Irish geothermal resources



Svartsengi geothermal power station, Iceland

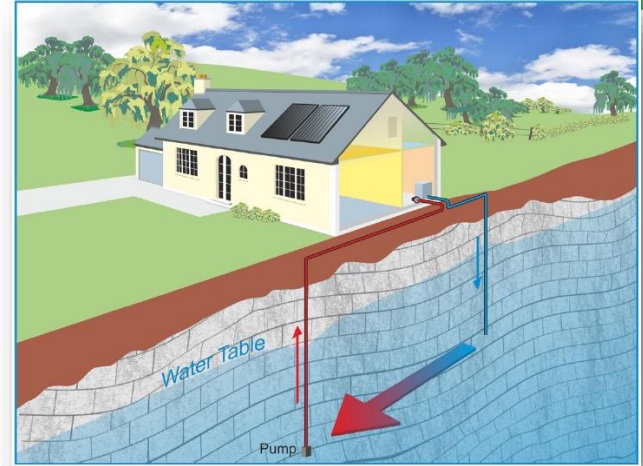


Villejuif geothermal heat plant in Paris, France

Irish geothermal resources

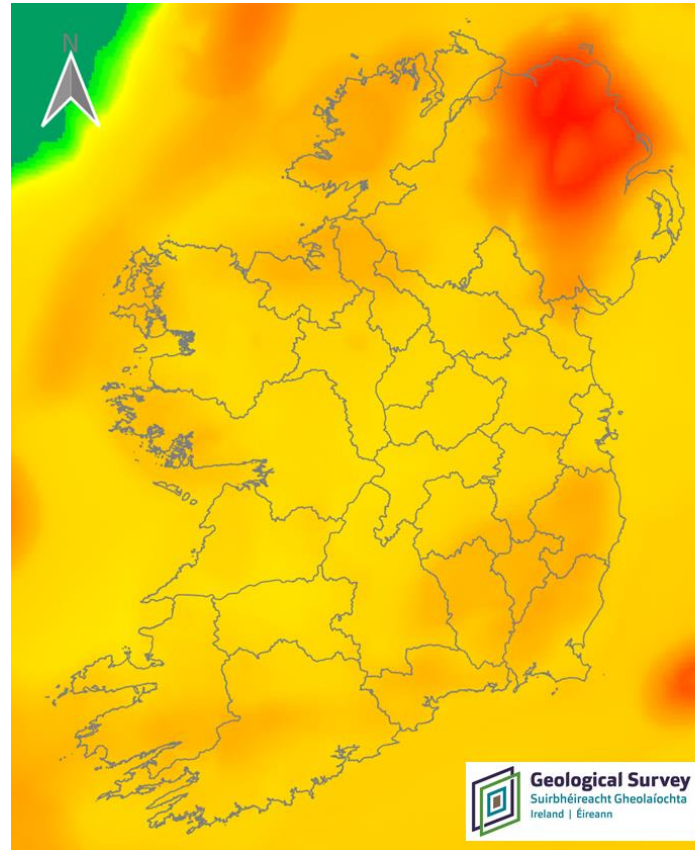
- **'Shallow'** resources are relatively well characterized and accessible across the whole country (domestic and commercial heating)
- Used with a heat pump, some financial support available
- GSI existing products:
 - Geothermal Suitability maps
 - Homeowner's Guide (2015)

[Access GSI shallow geothermal products here](#)



Irish geothermal resources

- **Deeper** resources are not as well characterised
- Estimated crustal geothermal gradient 25 – 30 °C/km
- Low-enthalpy (low-temperature) geothermal setting

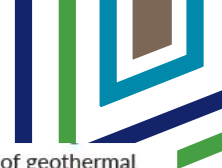


T (°C)

250
100
60
40
20
0

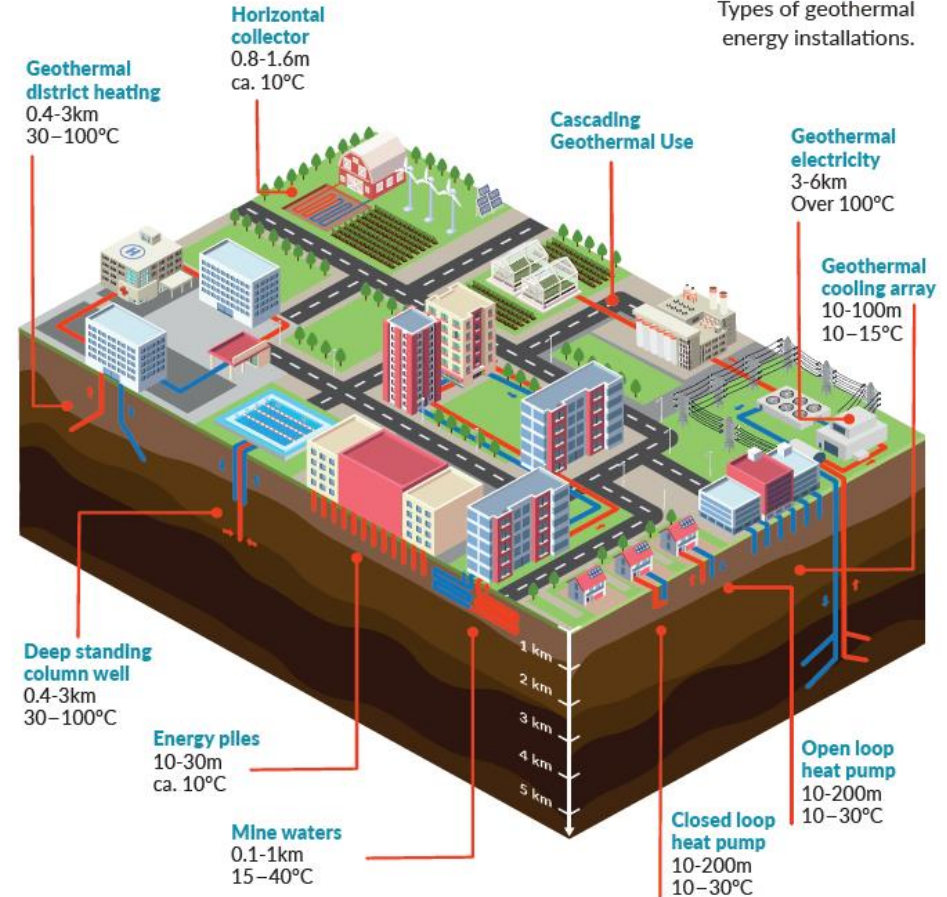
Modelled temperatures at 2.5 km depth. Data from Mather et al. (2019)

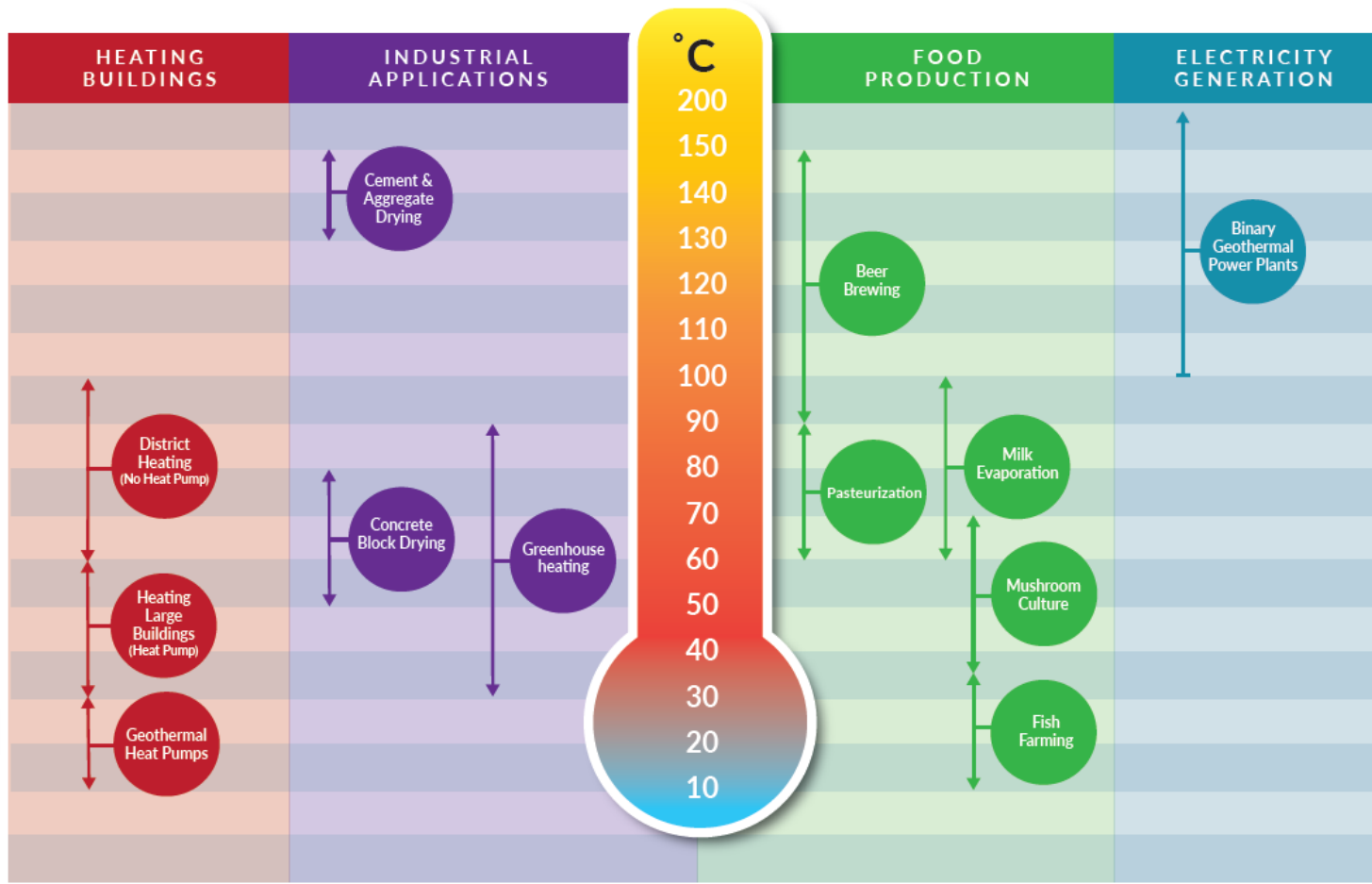
Using geothermal energy in Ireland



Types of geothermal energy installations.

- Heating individual homes
- Heating large buildings
e.g., IKEA ($1.5 \text{ MW}_{\text{th}}$)
- Cooling buildings & industry
e.g., Vistakon ($0.9 \text{ MW}_{\text{th}}$)
- Industrial processes
Drying/Brewing
- Horticulture
Greenhouses
- District heating
- Electricity production
Enhanced geothermal systems
Low-temperature turbines





Heat Pumps in Agriculture, Feb 22nd 2022

Geothermal veg: case study from NL



Geothermal propels Dutch horticulture industry to new heights



Westland Greenhouse, Wateringen, The Netherlands (Source: Flickr/ Jeroen van Luin, Creative Commons)

Backed by government subsidies, the geothermal heating project in Koekoekspolder has allowed its horticulture industry to shift away from burning natural gas.

Sources: *Thinkgeoenergy* (2019)

greenhousegeopower.nl

- “Aardwarmtecluster” 23.5 hectares of greenhouses in Koekoekspolder
- 5 growers in a 2 km radius
- Doublet drilled to 1.95 km depth
- 72 °C waters at surface
- 7.4 MW_{th}
- Cost €12.5 M, funded by growers with assistance from loans and grants from national and local govt.


80,500,000kg

Less CO₂ emissions since 2012

45.0 million m³ of natural gas saved



Building a geothermal industry

Aims

Increase installed capacity

Decarbonise heat sector

Jobs and skills



Building a geothermal industry



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Increase installed capacity

Decarbonise heat sector

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Barriers

Lack of public interest/support for GT

No “proof of concept” in Ireland (deep)

Lack of funding for demonstrator projects

Lack of regulatory framework

Lack of subsurface knowledge

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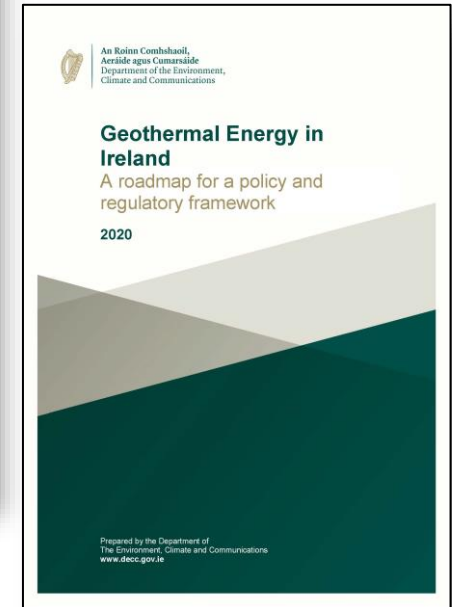
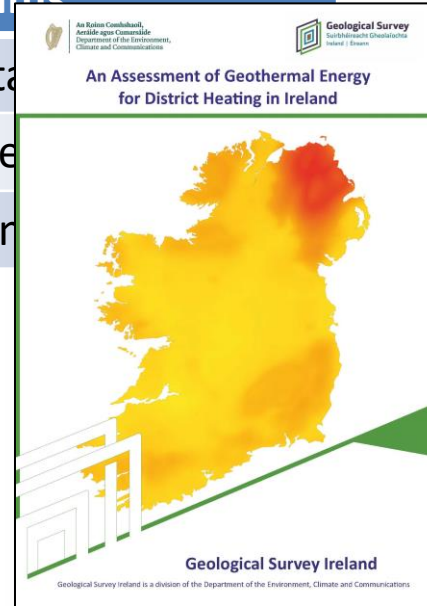
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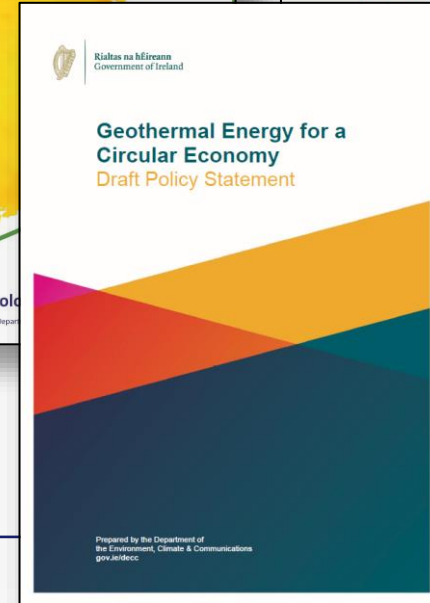
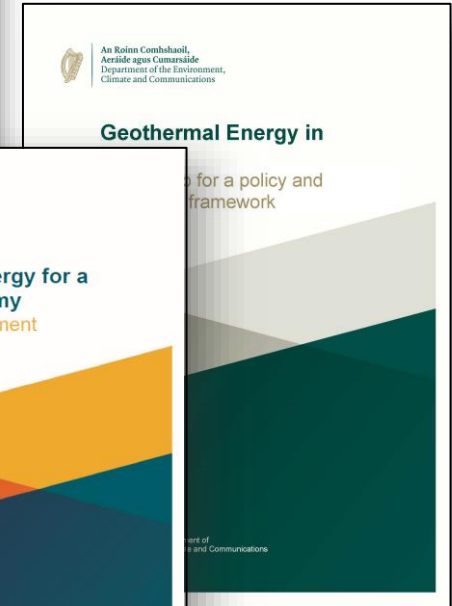
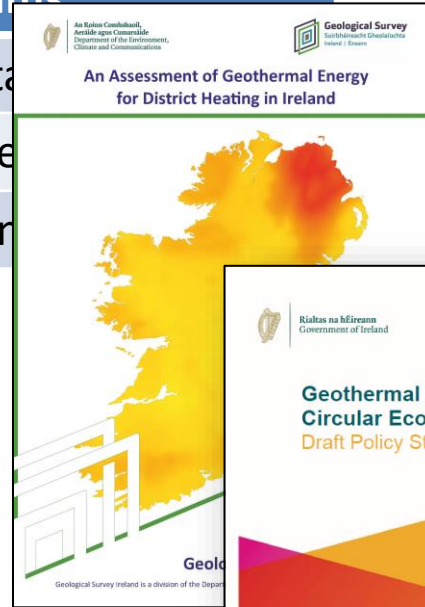
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Takeaway messages

- Geothermal energy can be found everywhere at depth ***even in Ireland***
- **It is extremely clean, secure and stable (baseload)**
- Shallow geothermal heat (for heat pumps) is available everywhere
- Deeper resources can be accessed using boreholes (expensive)
- Projects pay for themselves after several years
- Improving our geological knowledge is vital to reduce risk for deeper projects
- Financial support is necessary to develop shallow and deep industries

A silhouette of a person wearing a hard hat and safety gear, working on a large industrial spool. The person is positioned on the right side of the frame, leaning over the spool. The background is a bright, sunlit sky with some clouds, creating a strong backlight effect. The overall scene is industrial and focused on manual labor.

Go raibh maith agaibh.

www.gsi.ie

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