Learning from successful geothermal energy utilization in Iceland

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Online workshop on ‘Possibilities and limitations of geothermal energy use for heating and production of electricity on volcanic islands’. Oct 1st 2020
Mid-ocean ridge and mantle plumes
• Iceland has no local fossil fuel resources
• All fossil fuels are imported
• No cross-border energy flows
• ~100,000 km² of glaciers, which store fresh water.
Rain and Heat → Geothermal and hydro resources

Iceland primary energy

- Heat & Electricity
- Transport (aviation, road & marine)
- Electricity

Orkustofnun Data Repository: OS-2020-T007-01
Geothermal heat

- Space heating: 73.6%
- Swimming pools: 9.5%
- Snowmelting: 5.6%
- Fish farming: 6.6%
- Industry: 2.8%
- Greenhouses: 1.9%

Total: 33.7 PJ
Geothermal: 97.6%

Orkustofnun Data Repository: OS - 2019 - T007 - 01
Space heating by energy source 1952-2019

- Geothermal
- Oil
- Electricity
- Electricity/oil boilers

Orkustofnun Data Repository: OS-2020-T008-01

Geothermal well for district heating in Reykjavík urban area
District heating plant, Svartsengi

District heating plant, Hellisheiði

Reykjavik 2017 with geothermal heating
Geothermal space heating has had a large influence on quality of life in Iceland.

Important points:
- Developed by the municipalities
- Investment over ~80 years
- Very good aquifers – high purity
- Source water temperature is 85 to 125 °C
- Geothermal Cooling is desirable in warmer climates

Cost (in billion ISK) of geothermal energy vs cost of oil for space heating 1970 to 2009.

Figure: Haraldsson and Ketilsson. Efnaðhagslegur samanburður húshitunum með jarðhita og olíu árin 1970-2009. Órkuðofnun 2010
Greenhouses

• Increase food security
• Promotes sustainability
• Supports the rural economy
• Provides fresher local produce
• Greenhouses are also relevant in temperate climates

Greenhouse Agriculture in the Icelandic Food System. Available from: https://www.researchgate.net/publication/330340194_Greenhouse_Agriculture_in_the_Icelandic_Food_System
Tourism – geysers & hot springs, balneology

& beer tubs
Geothermal electricity generation (total 799 MW)

<table>
<thead>
<tr>
<th>Installed</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydro</td>
<td>71.6</td>
</tr>
<tr>
<td>Geothermal</td>
<td>26.0</td>
</tr>
<tr>
<td>Fossil</td>
<td>2.3</td>
</tr>
<tr>
<td>Wind</td>
<td>0.1</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>
Electricity – Iceland’s latest power plant

Figure 1. Overview of Flúðaorka Power Plant

- POWER PLANT NAME: The Flúðaorka Power Plant
- LOCATION: Flúðir, Iceland
- STATUS: In operation since April 2019
- APPLICATION: Geothermal
- CUSTOMER/END USER: HS Orka
- MODEL: Climeon HP 150
- PLANT SIZE: 600 kW
- WATER TEMPERATURE IN/OUT: HW in 116 C HW out 65 C
- COOLING AGENT: Wet cooling towers
- GENERATOR VOLTAGE: 400 V
Thank you!

Looking south over Kleifarvatn and Krýsuvík