Reykjavík Energy

VEITUR | GAGNAVEITA REYKJAVÍKUR | ON ORKA NÁTTÚRUNNAR

OR Orkuveita Reykjavíkur

Geothermal Utilization

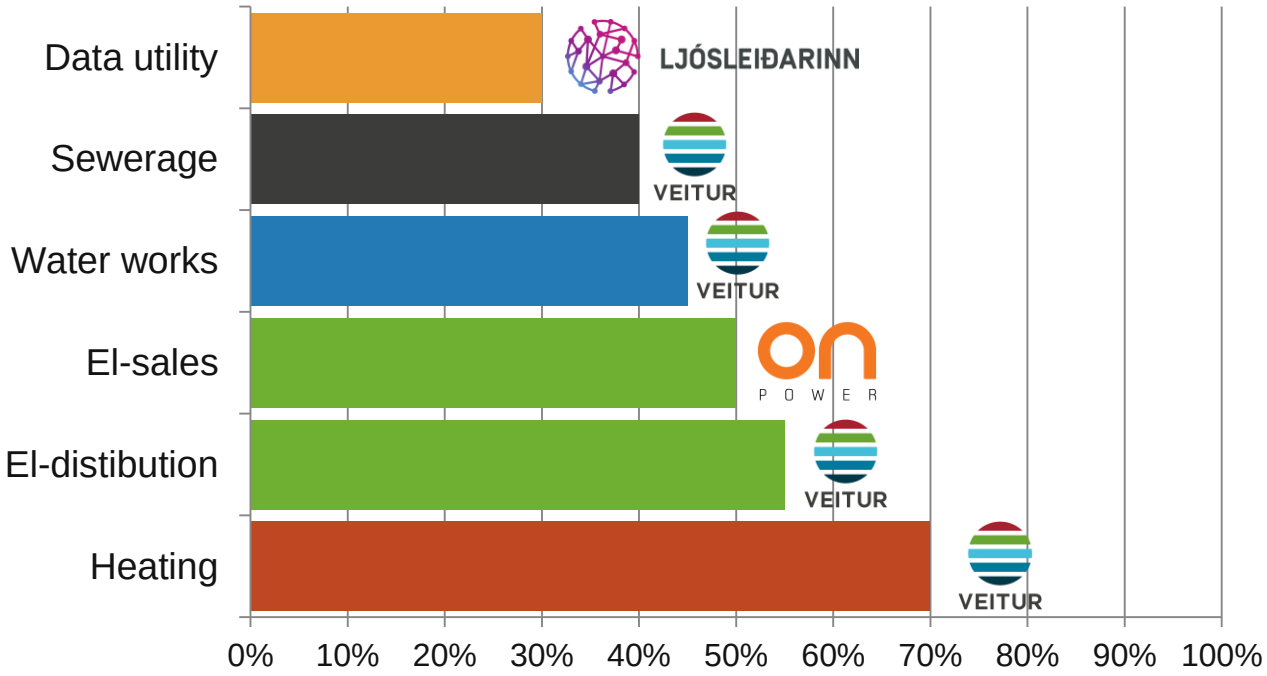
Einar Gunnlaugsson

Visit from Poland

October 4th, 2017

Percentage of Icelanders served

OR and subsidiaries



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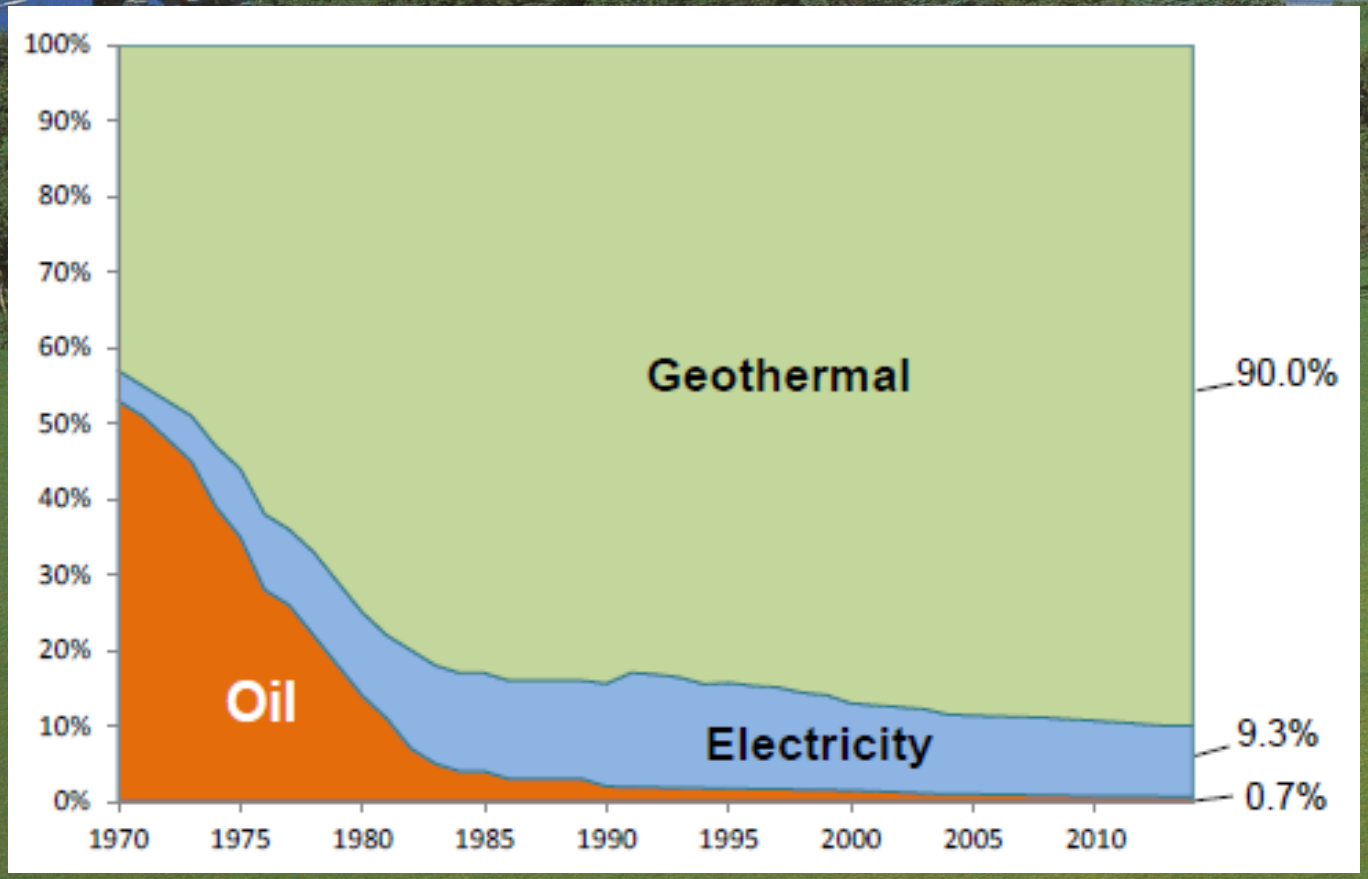
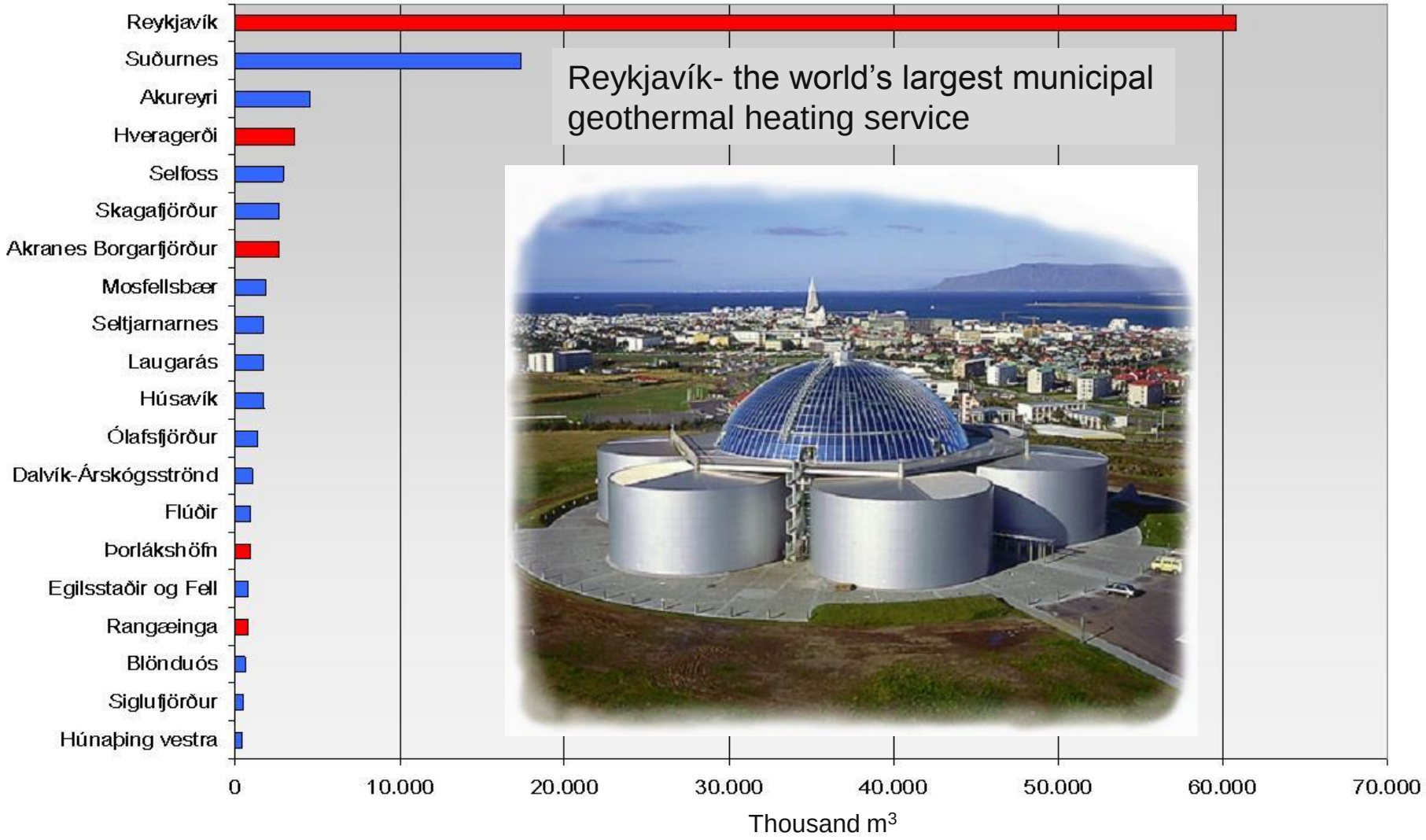
Space heating



Twenty largest geothermal district heating utilities



OR District heating utilities

Stykkishólmur
Norðurárdalur
Munaðarnes
Skorradalur
Akranes - Borgarnes
Reykjavík
Hveragerði
Austurveita
Ölfus
Þorlákshöfn
Grímsnes
Hlíðarveita
Hella - Hvolsvöllur

Geothermal activity in Reykjavík

During Reykjavik's first 1000 years geothermal heat was primarily used for washing, bathing and cooking.

For centuries women carried the laundry to the hot springs now in mid Reykjavík.

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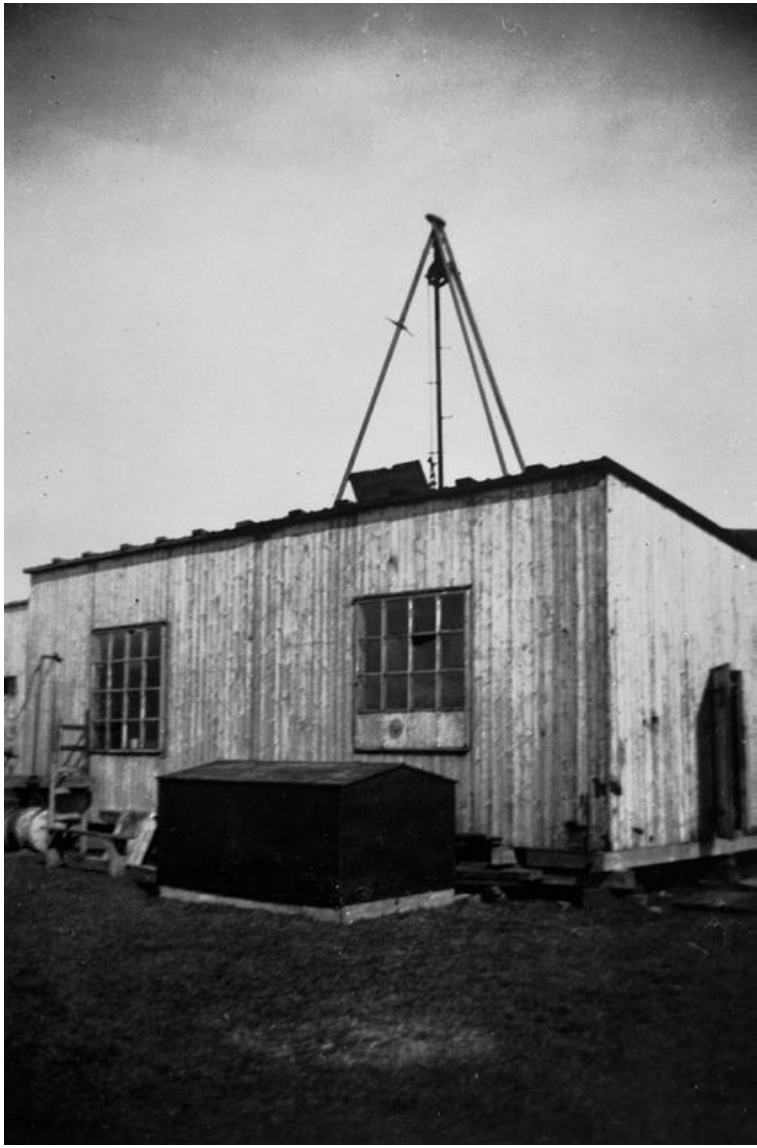
Drilling at Þvottalaugar 1928

- Drilling started in in Reykjavík for hot water
- 14 drillholes drilled
- Result about 14 l/s of 87° C water



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District Heating in Reykjavík 1930

- - 3 km long pipeline
- -Two school houses, hospital, swimming pool and 70 private houses connected

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Drilling at Reykir Geothermal Area **1933-1939**

17 km east of Reykjavík

72 drillholes (shallow)

200 l/s of 87° C water

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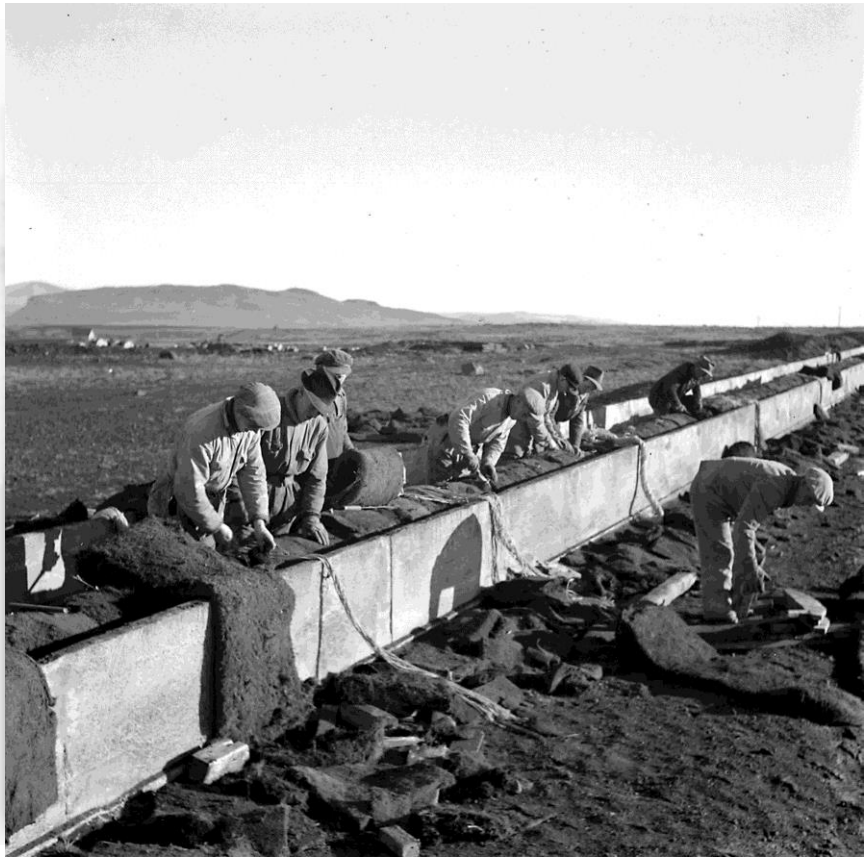
Pipeline to Reykjavík

1939-1943



1943 200 l/s of 86° C water, 1300 houses connected
1944 Connected houses 2850

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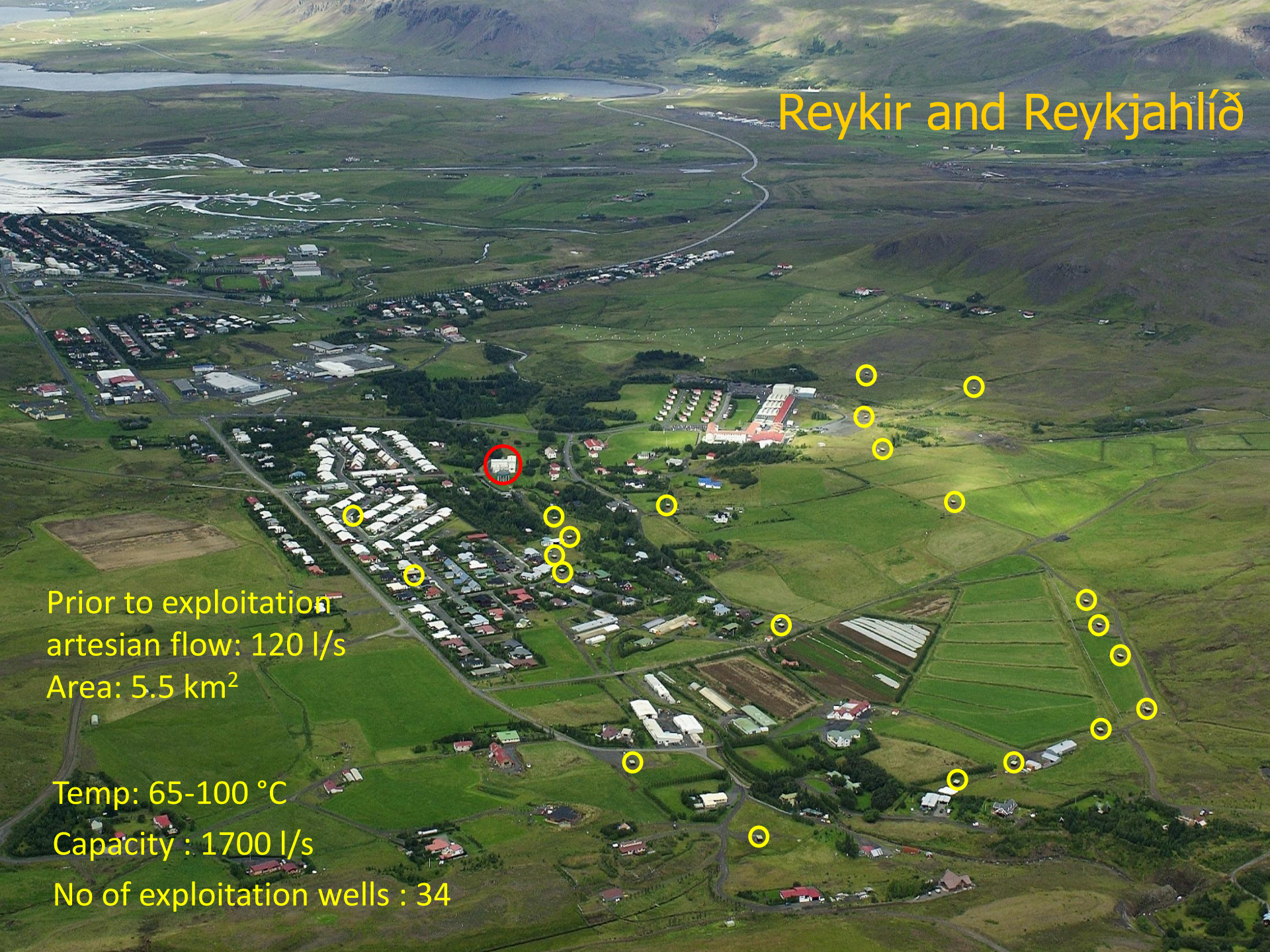
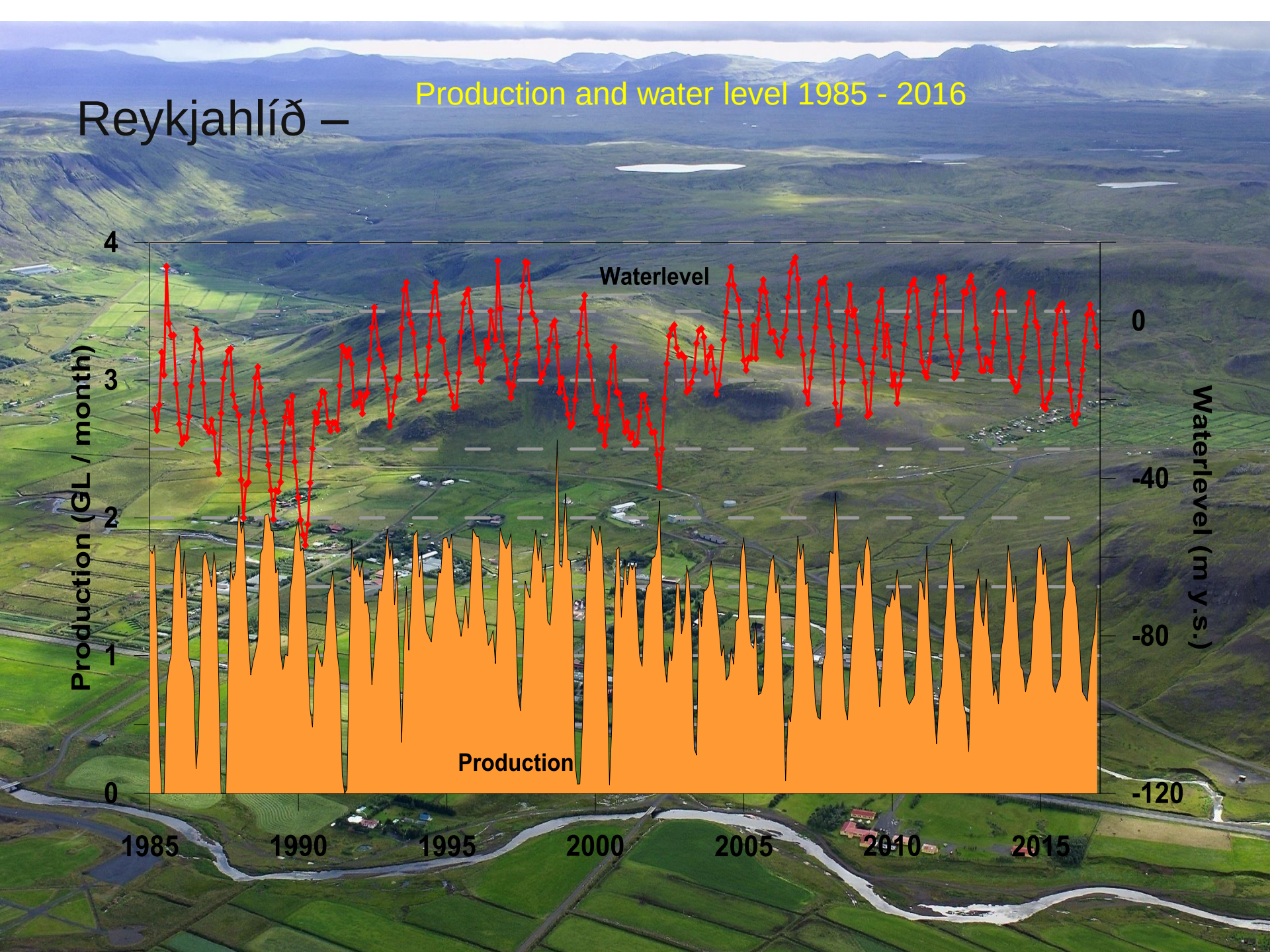

Reykir and Reykjahlíð
Prior to exploitation
artesian flow: 120 l/s
Area: 5.5 km²
Temp: 65-100 °C
Capacity : 1700 l/s
No of exploitation wells : 34

Reykjahlíð –

Production and water level 1985 - 2016



Pumping station at Reykir

Drill holes at Reykjir


Elliðaár
Area : 0.08 km²
– Temp: 85-95 °C
– Capacity : 220 l/s
– No of exploitation wells : 8

Laugarnes

- Area: 0.28 km^2
- Temp: 125-130 ° C
- Capacity : 330 l/s
- No of exploit. wells : 10

Pumping station

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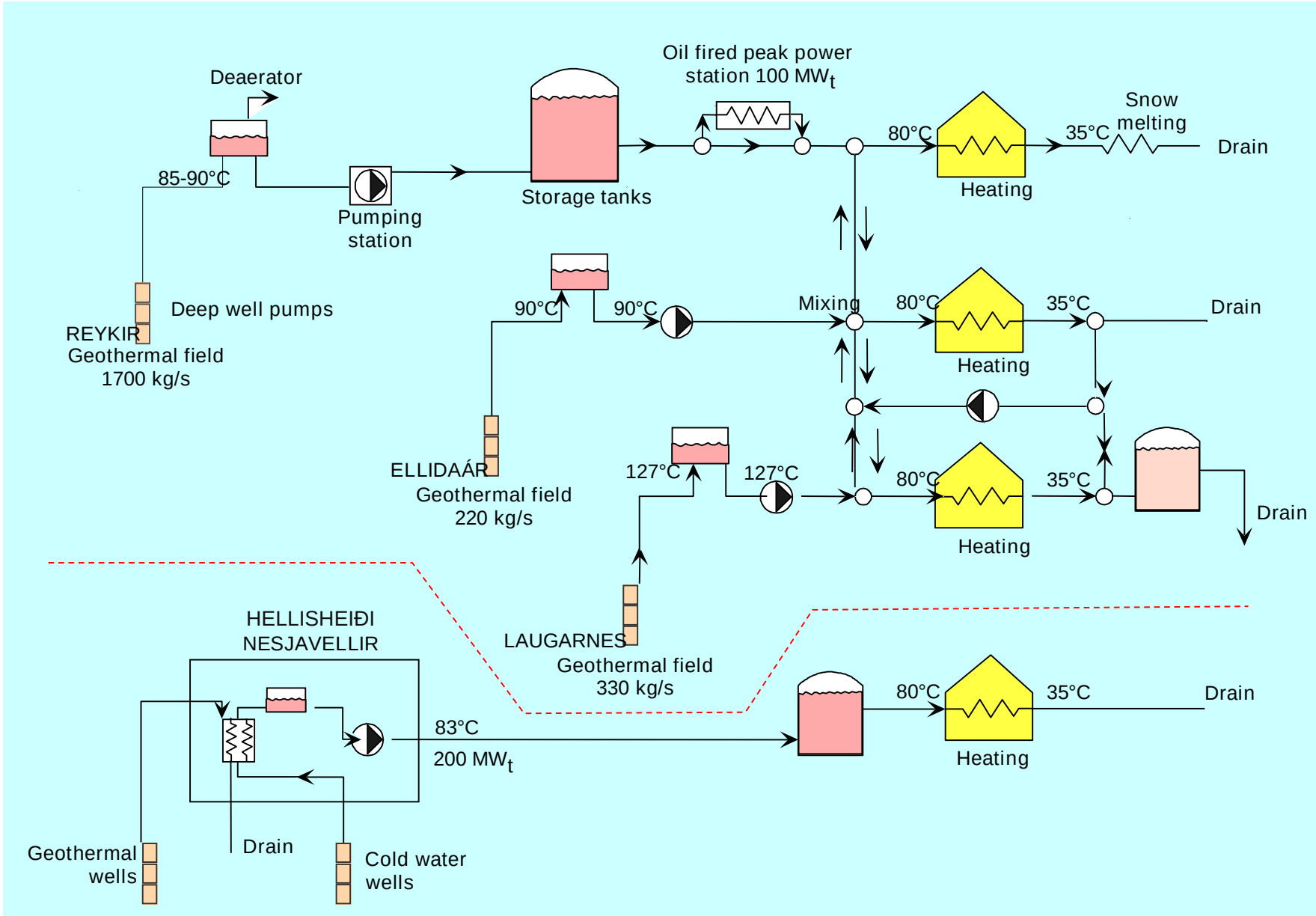
• Location 30 km east of the capital
• Started operation 1990 with thermal water
• Co-generation of electricity from 1999
• Installed capacity 120 MW electrical and 300 MW thermal
Nesjavellir

Hellisheiði

- Electricity 90 MW 2006
- Low pressure unit 2007
- Electricity 90 MW 2008
- Hot water to Reykjavík 2010
- Electricity 90 MW fall 2011

- Total installed 303 MWe
- 303 MW_e
- 133 MW_{th}

Simplified flow diagram



87 years of district heating

- We are experiencing numerous benefits of geothermal utilization

- Better air-quality
- Better homes
- Better health
- Better off

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Living standard

- Warm homes, consumer behaviour
- Outdoor swimming pools
- Health, cold infections, asthma & arthritis
- Snow smelting

- Growing vegetables in greenhouses
- Fish farming
- Heated football fields
- Heated holiday homes
- Heated stables

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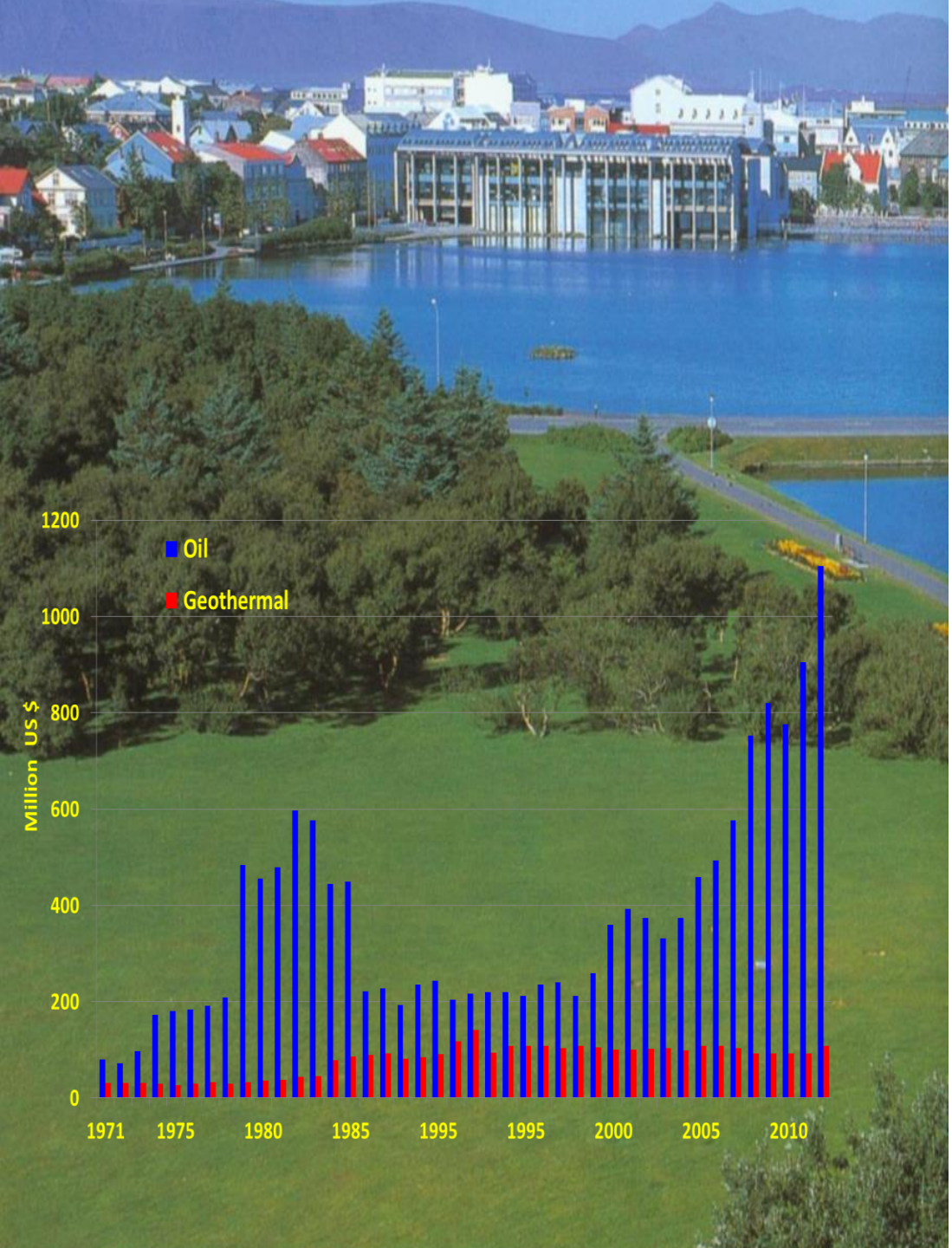

Economic benefits to the Icelanders

- In 2010 Iceland's total economic benefit from geothermal was calculated to be about **$480-830** million.
- That equals **4-6%** of gross domestic product (GDP)
- Includes:
  - Space heating benefits
  - Related industry benefits
  - Resource leasing
  - Social impacts

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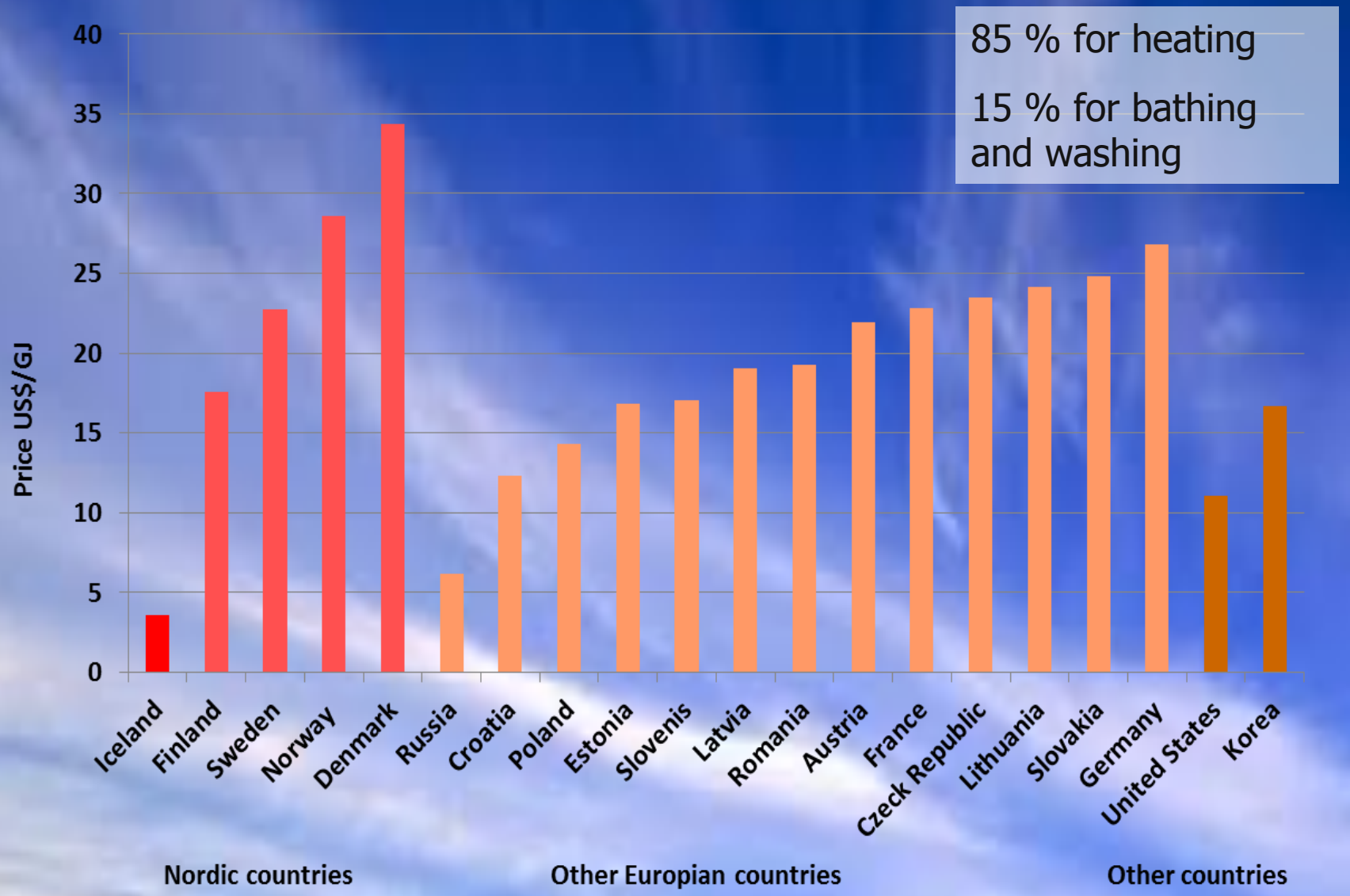
Average district heating prices



Economy

- Heating cost has followed consumer price index (CPI) since 1930's, despite significantly more expensive technical solutions.
- The alternative is to use coal and oil as a fuel.
- Cumulative oil savings 22 billion USD or 5 times the Icelandic treasury budget.

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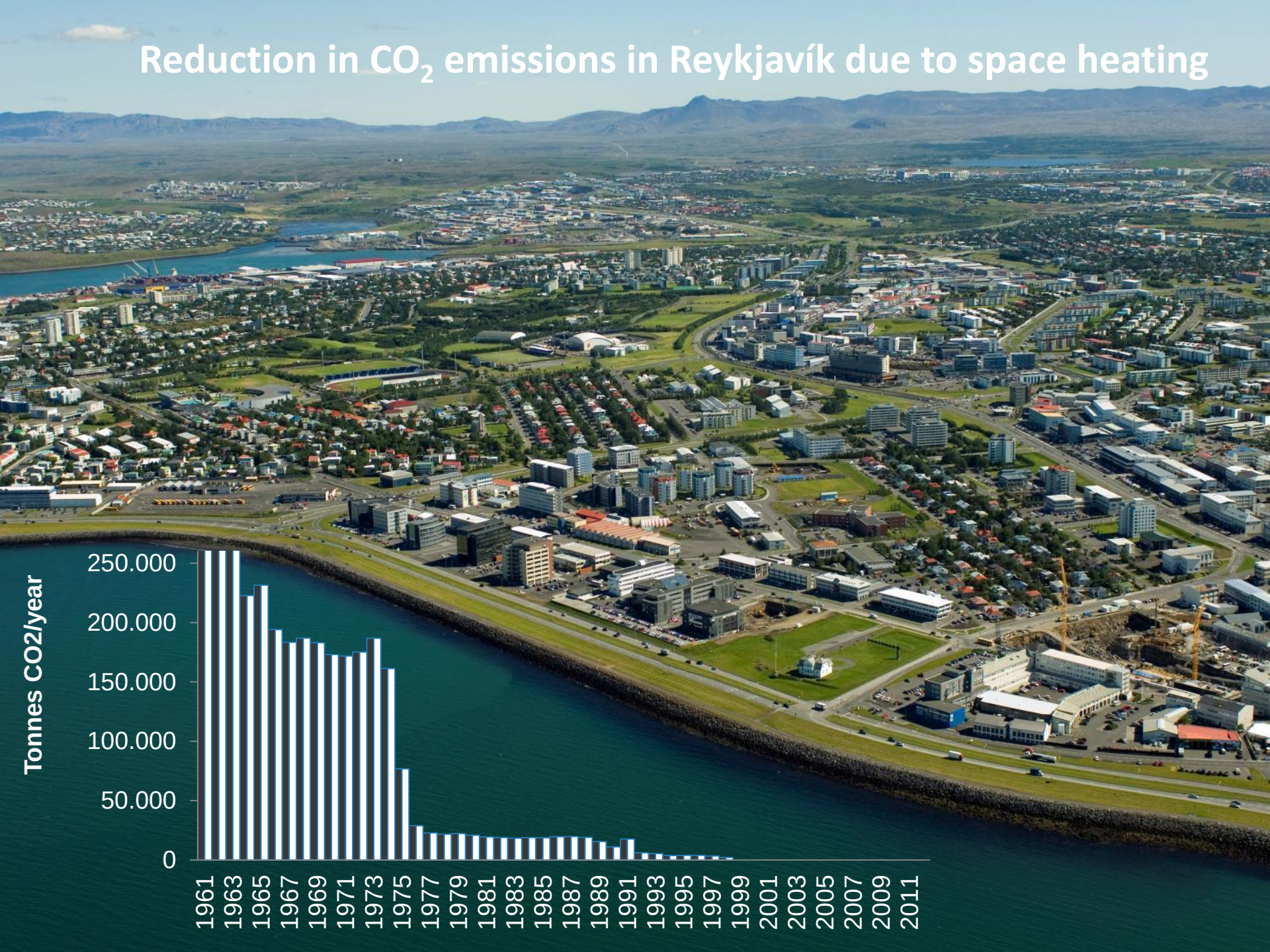
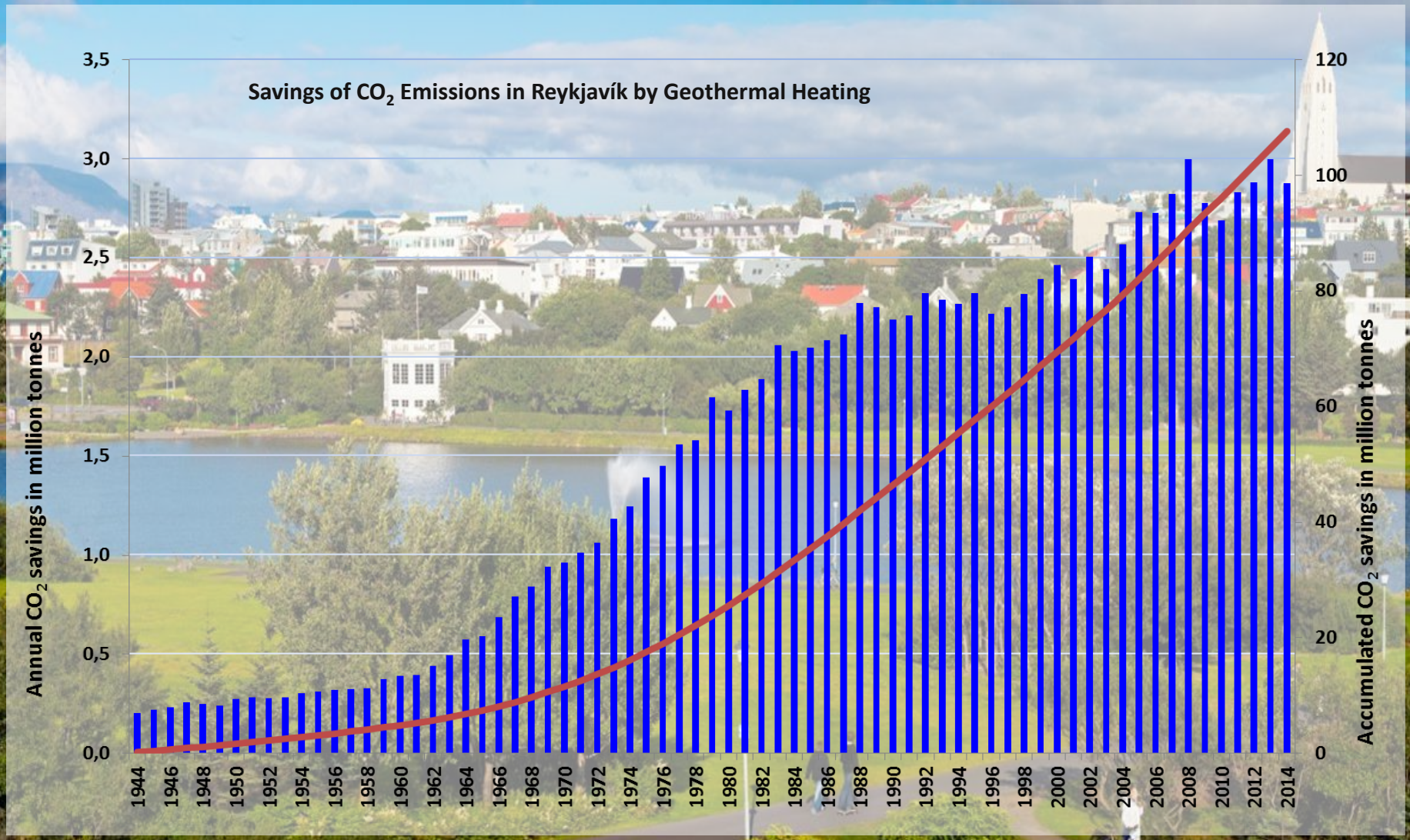
Environmental benefits

Reduction in CO_2 emissions in Reykjavík due to space heating



Reykjavík today



Climate

- Geothermal energy is a renewable resource
- The electricity and heat production account for 4% of the total CO_2 emissions in Iceland

- Compared to oil, geothermal heating saves 3-4 million tones of CO_2 annually
- Similar as the total annual CO_2 emission from Iceland

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Conclusion

- One of the cleanest energy source
  - Reduces CO_2 emission
  - About 100,000,000 tonnes of CO_2 has been saved in Reykjavík by using geothermal water for heating houses
- Sustainable energy source
- In all cases domestic energy and used locally
  - Reduces import of other energy sources such as fossil fuels

Thank you