Iceland – The Road to Zero Carbon Emissions

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The Icelandic National Energy Authority

- Advises the government on energy resources and related issues.
- In charge of administration of energy issues, and directs research on energy resources in Iceland.
- Grants licenses for research and exploitation of energy, mineral resources and hydrocarbons.
- Collects and disseminates data on energy and other earth resources, their utilization, and capacity.
- Develops long-term scenarios for Iceland's future energy needs and energy production.
- Executes all administrative functions as assigned under the Natural Resources Act, the Electrical Energy Act, and other energy-related statutes.

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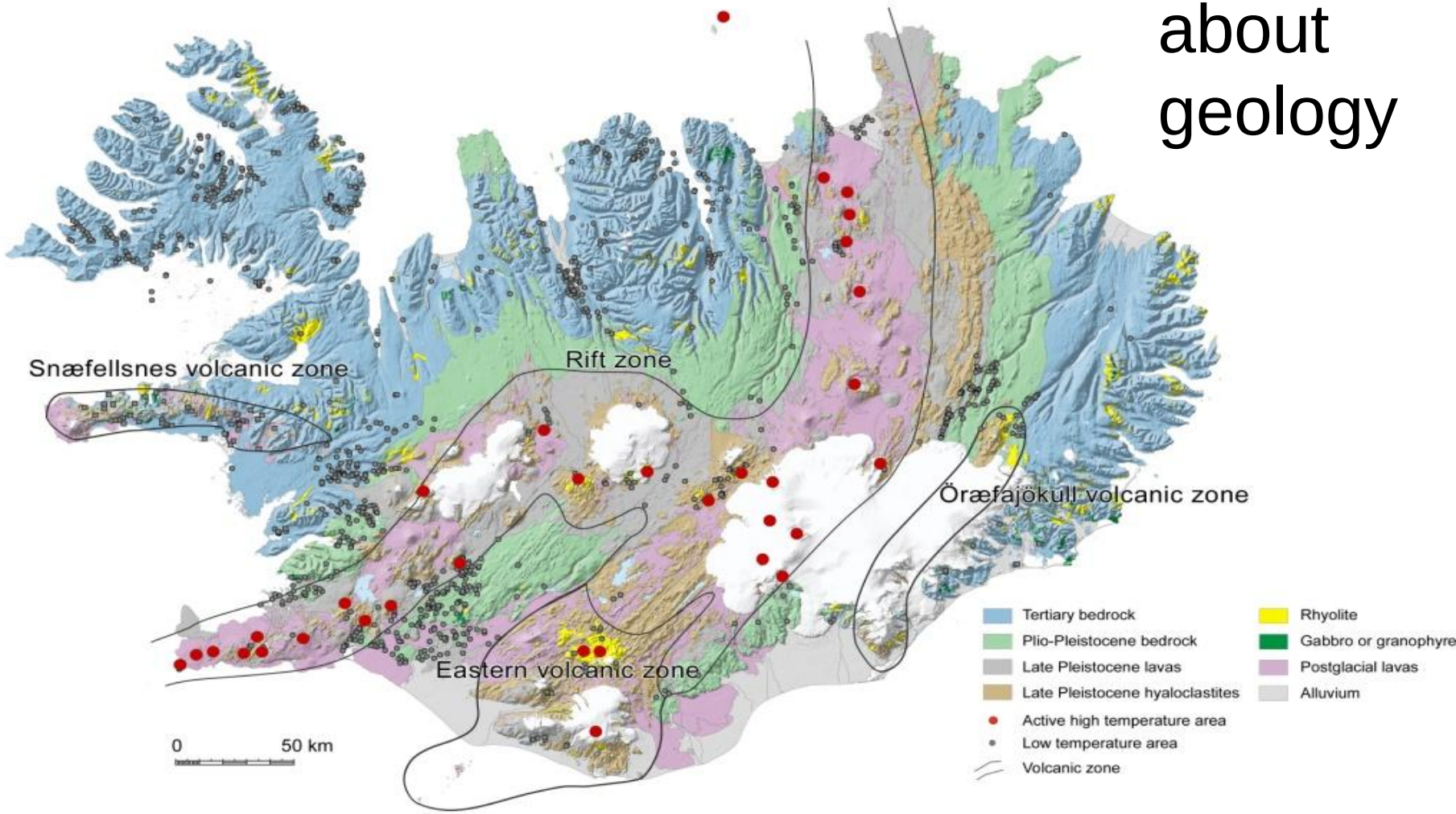
It is all about geology



Geothermal map of Iceland. (Basemap: Geological map of Iceland by Haukur Jóhannesson and Kristján Sæmundsson 1999. Iceland. 1:1.000.000. Icelandic Institute of Natural History

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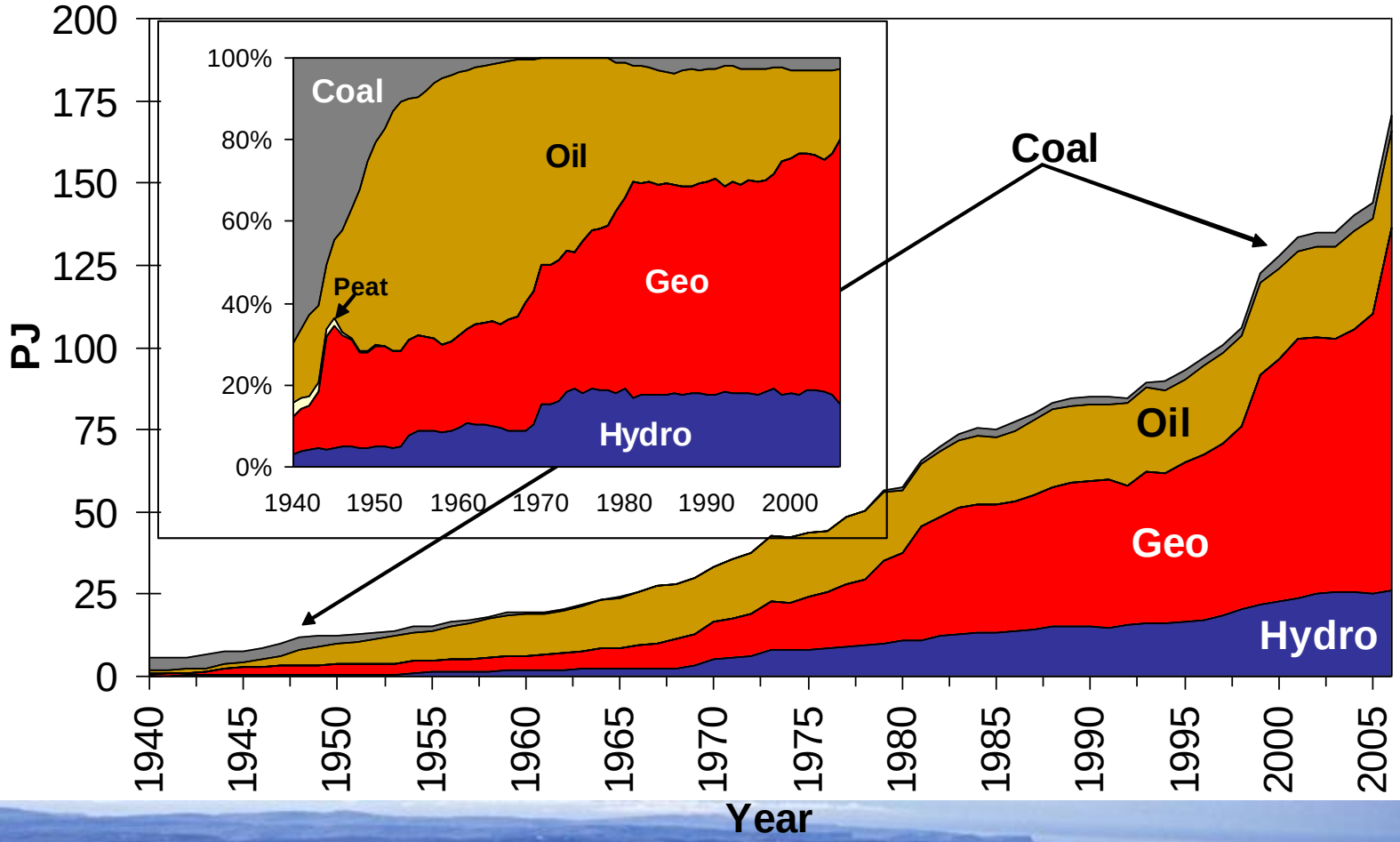
Primary Energy Use 1940-2006



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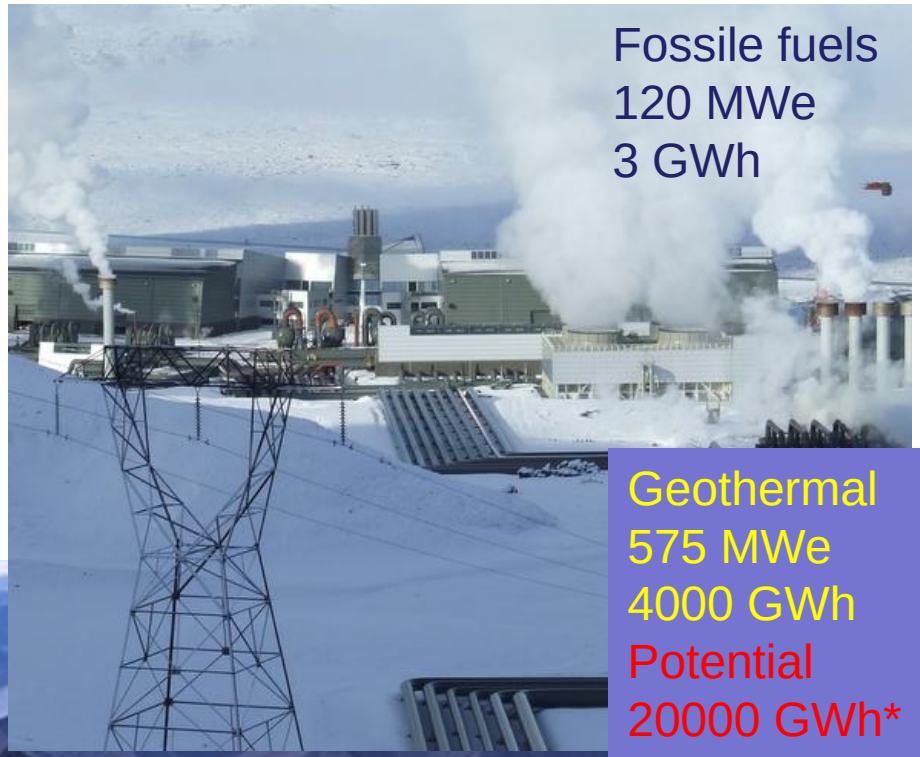
Present Electricity Use

General use	3050 GWh	18.5%
Large industries	12430 GWh	75.5%
System loss	1000 GWh	6.0%

Hydropower
1880 MWe
12400 GWh
Potential
30000 GWh*



Fossile fuels
120 MWe
3 GWh

Geothermal
575 MWe
4000 GWh
Potential
20000 GWh*

*subject to the result of the Framework program on feasibility and ranking of different power plant options

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Geothermal District Heating

Storage Tanks

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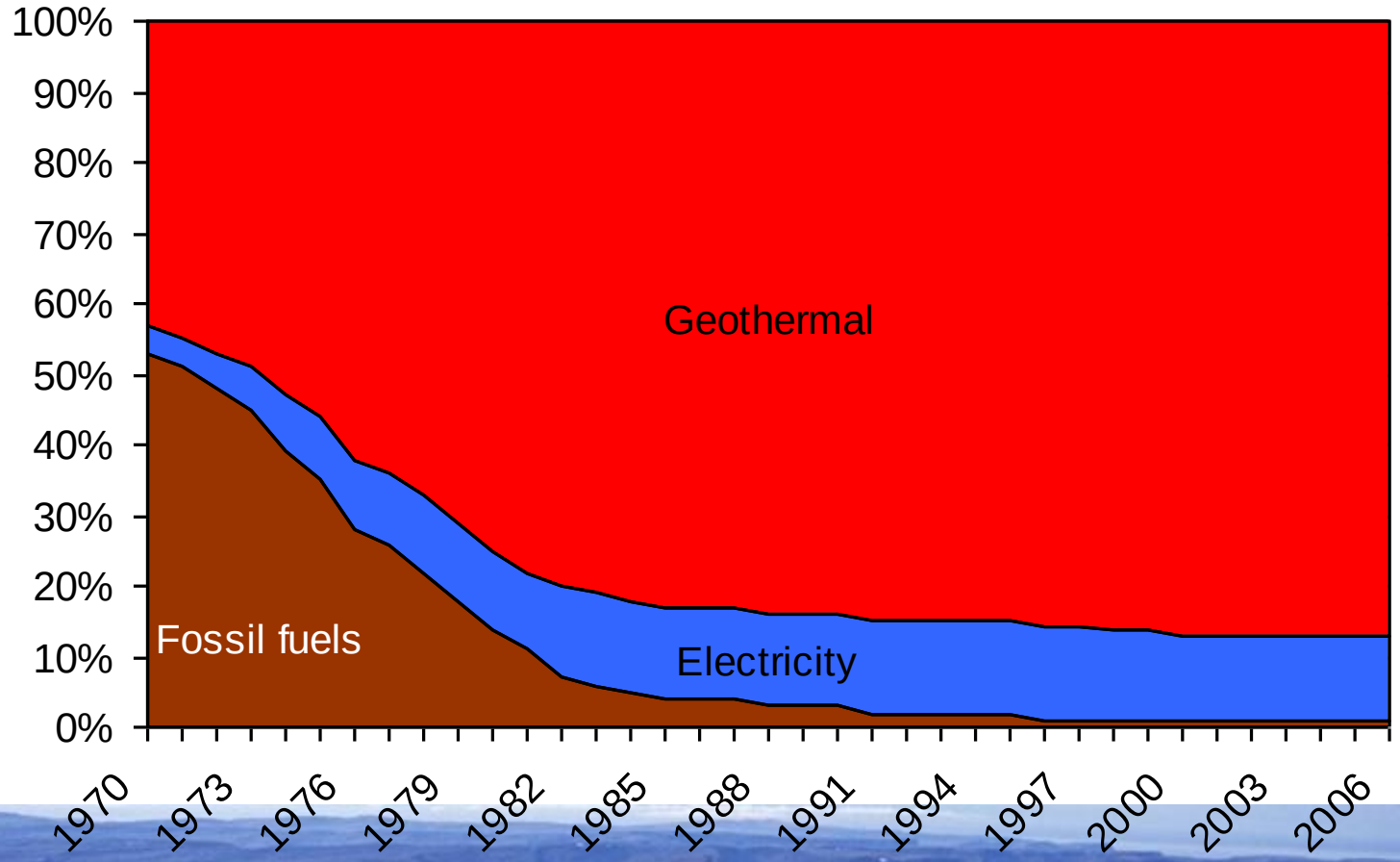
Space Heating by Source 1970-2006



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Heat pumps

Economic alternative to electrical heating

Efficiency is greatly improved with increased temperature of the heat source

www.sev.nu/varmepumpar.shtml

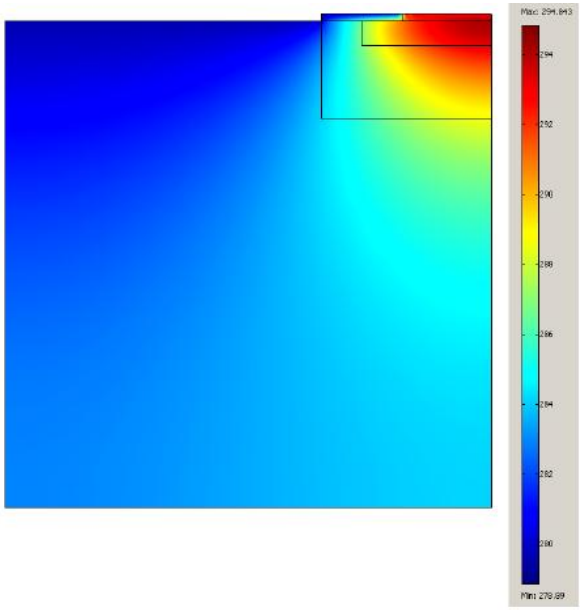

Figure 5.28: Mean Temperature distribution.

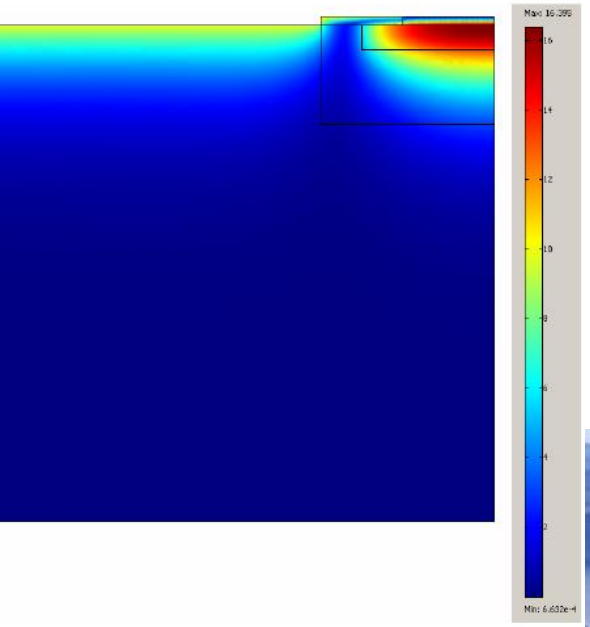

Figure 5.29: 1st Harmonic Amplitude distribution

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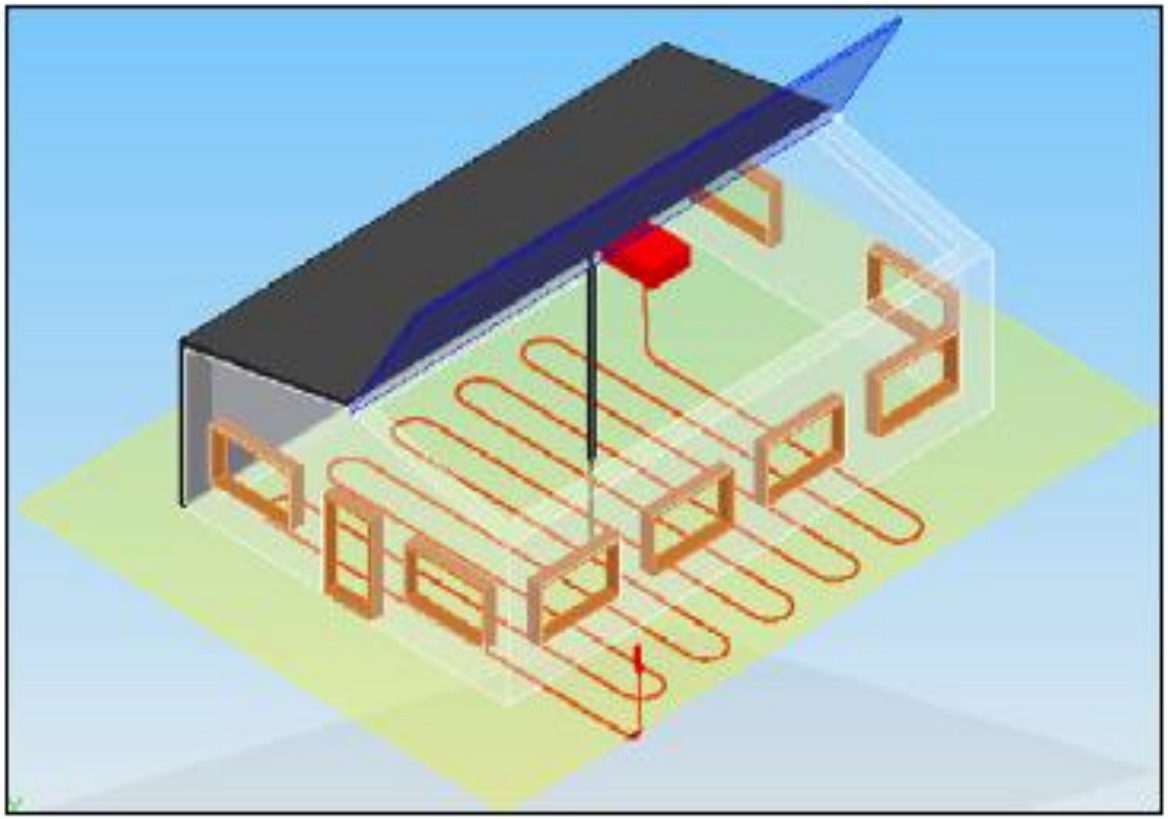
3. THE CALIDHOGAR CONCEPT



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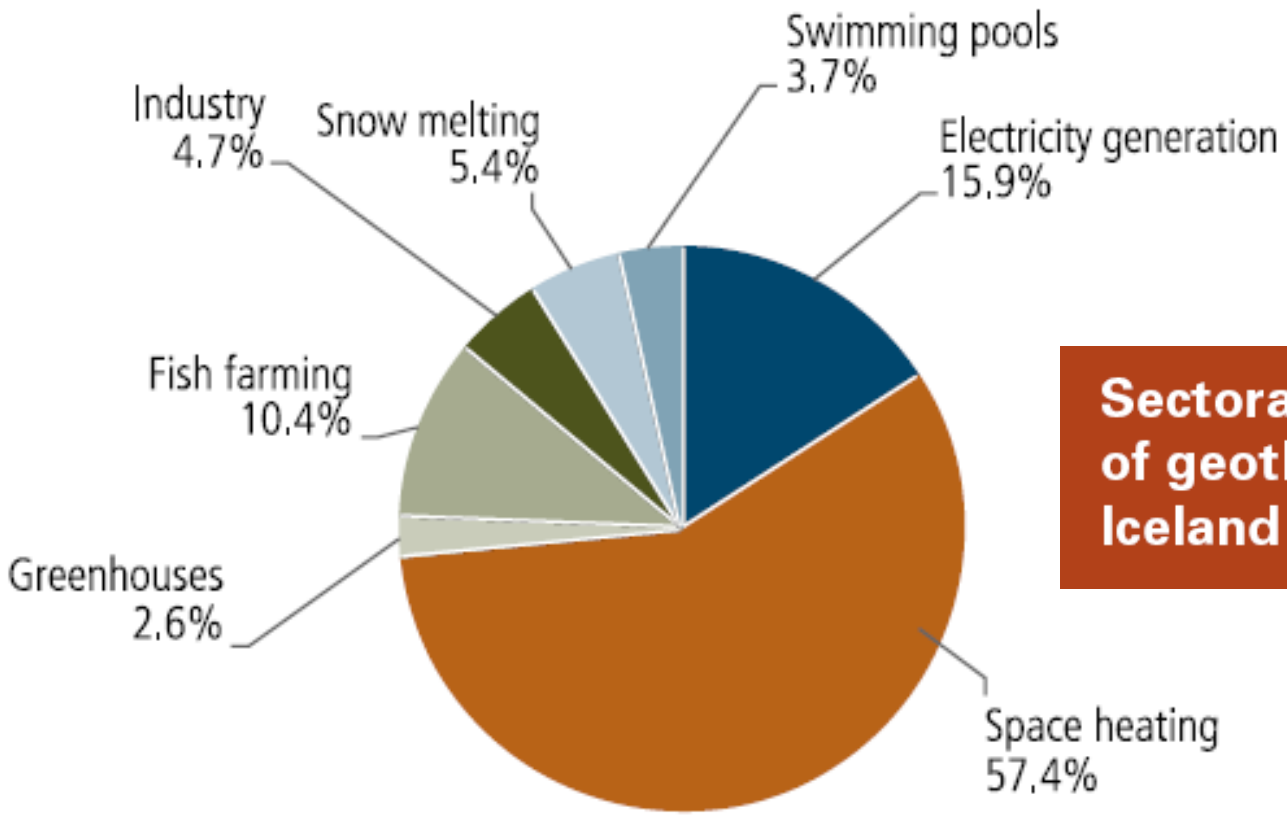

Sectoral share of utilization of geothermal energy in Iceland in 2005

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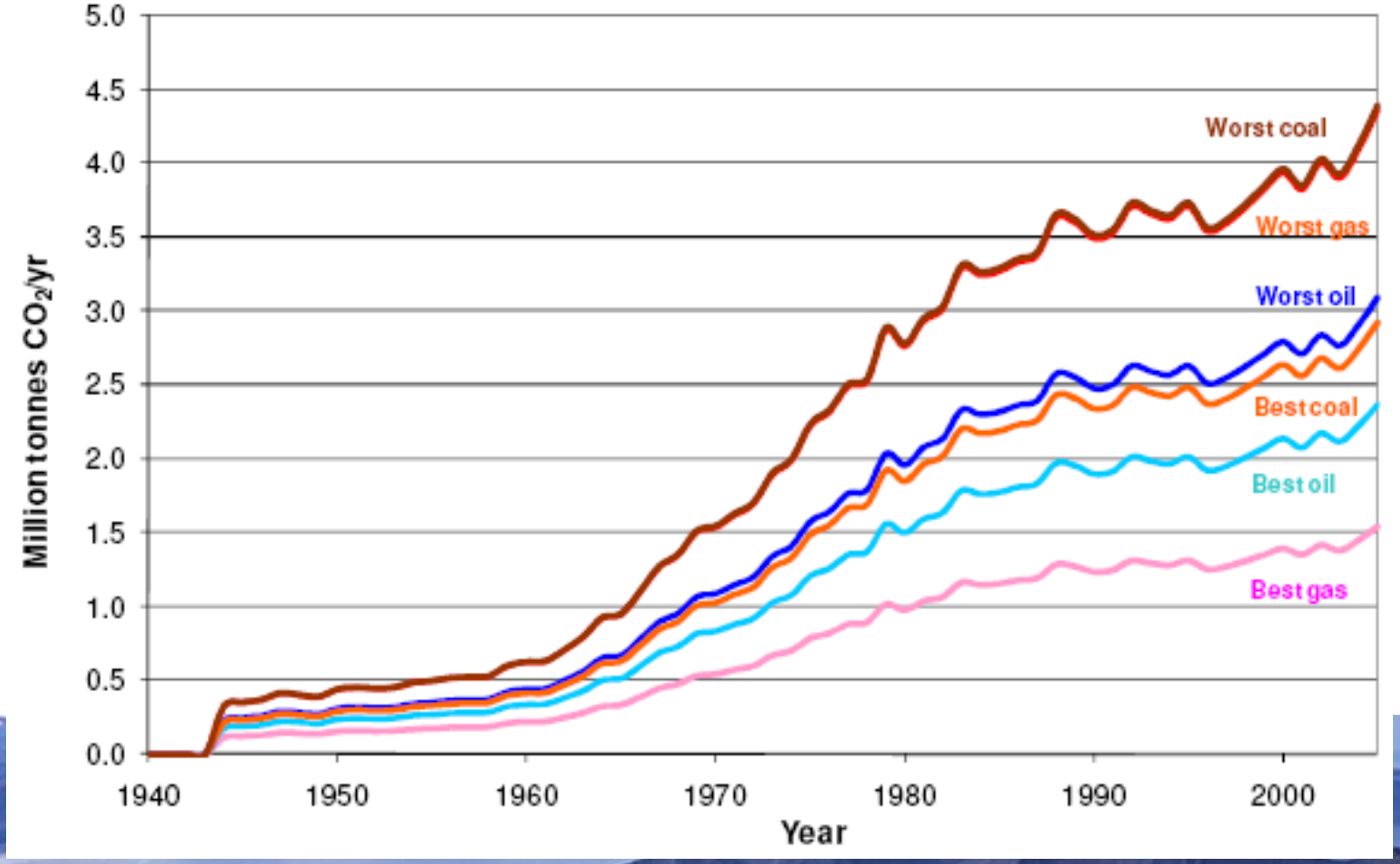
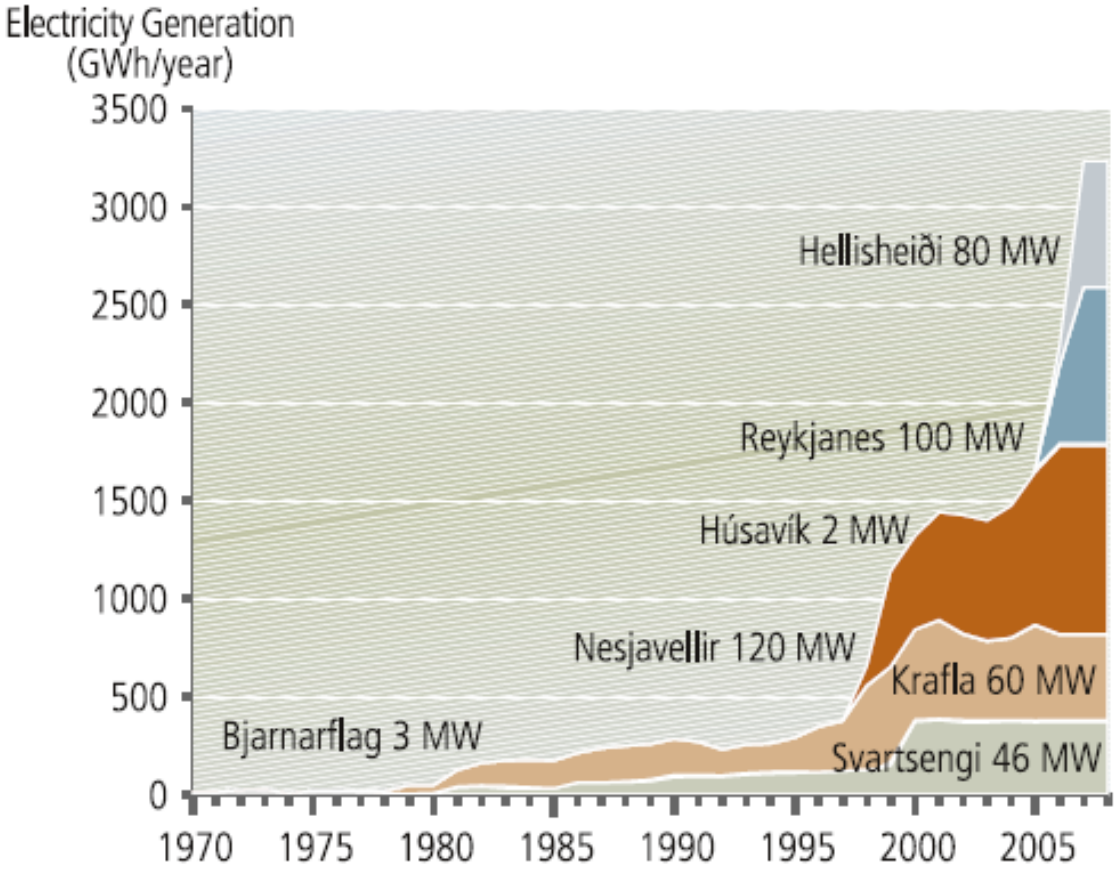
CO2 savings using geothermal water in Reykjavik (Iceland)



Gunnlaugsson, 2008).

Generation of electricity using geothermal energy 1970 - 2008



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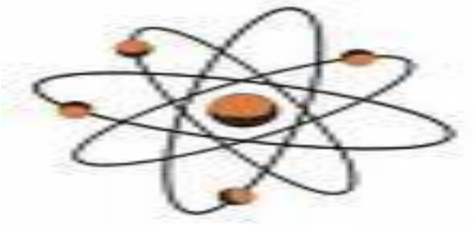

Cost Per kWh ?

Freshwater	Saltwater

2	4	8	16	32	64	ISK/kWh

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Opportunities

- Sustainability metrics and certificates
- New technologies for survey and exploration
- Offshore sources
- Deep drilling and high temperatures
- Multiple revenue streams
- Carbon fixation in basalt rock
- Investment in energy intensive industries
- Electrical cars
- Synthetic fuels

- Low enthalpy generation

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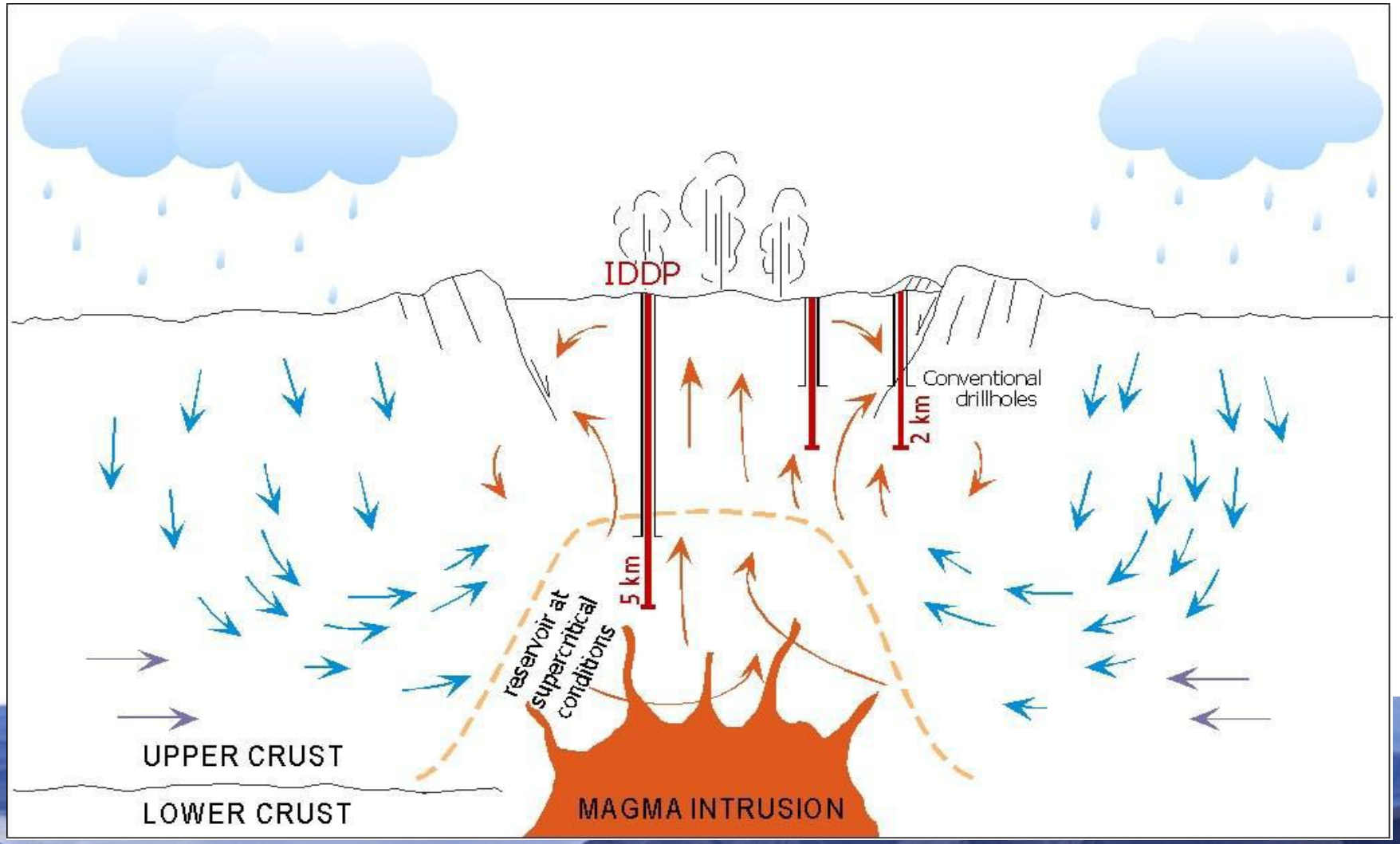
The Deep Drilling Project



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Energy market

- Distance from larger electricity markets
- Impact on landscape and scenic values
- Small market with varying volume and discontinuities

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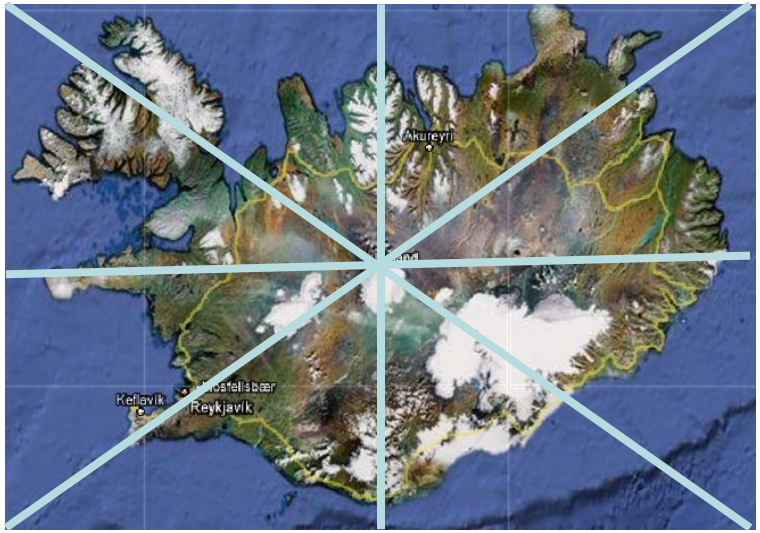
The Challenge:
Conflicts of Interest in Sustainable Utilization of National Resources

Tourism
Recreation

Power
Industry

Farming
Agriculture



Infrastructure
Communication

Fishing Industry

City Planning
and Construction

Energy Intensive
Industry

Nature
Preservation

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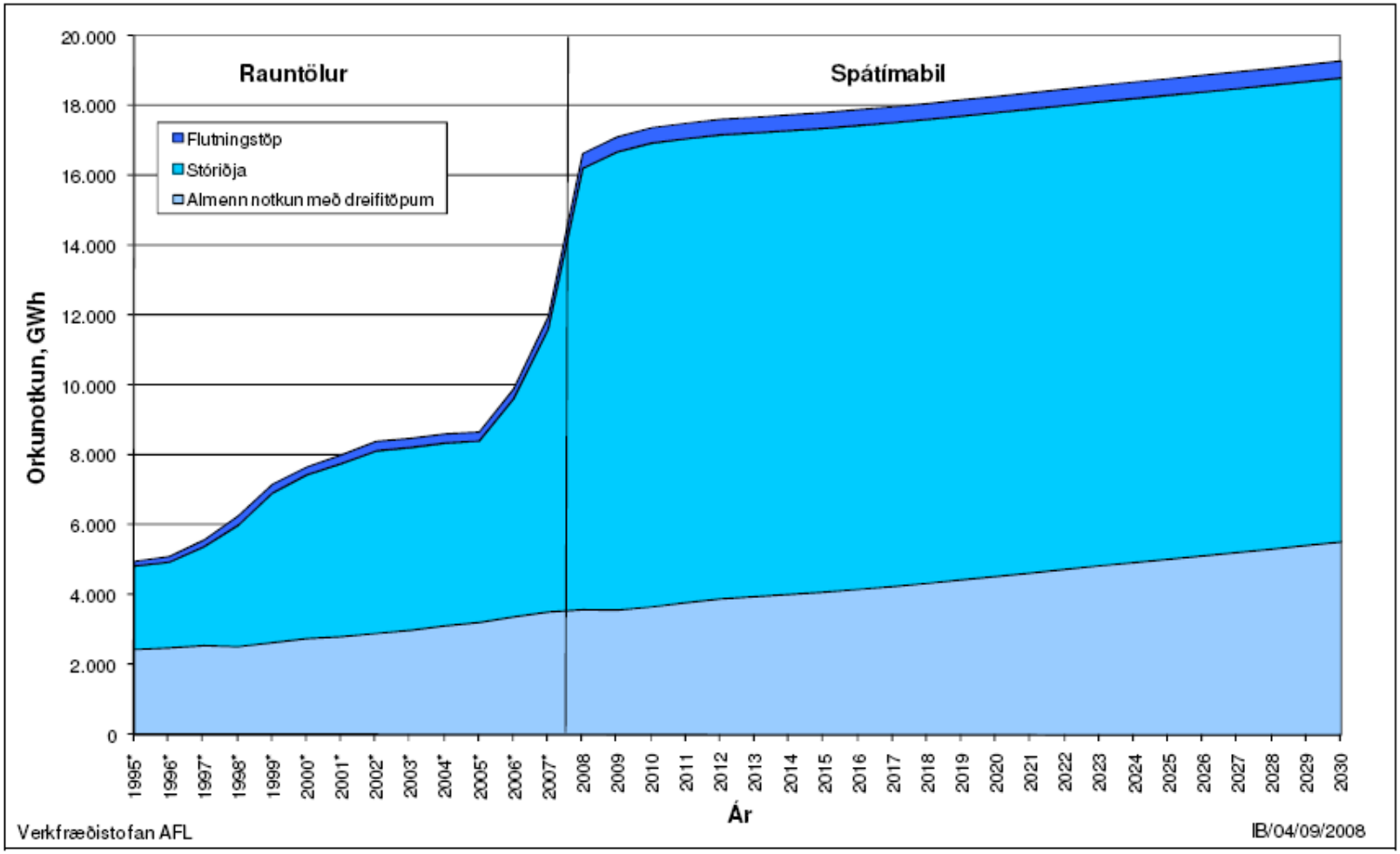
Energy market development

- Icelandic Energy Forecast Committee
- The Icelandic Energy Forecast Committee, established in 1976, has representatives from companies, institutions, and organizations involved in the energy sector.

Electricity forecast



8,26 x 11,69 in

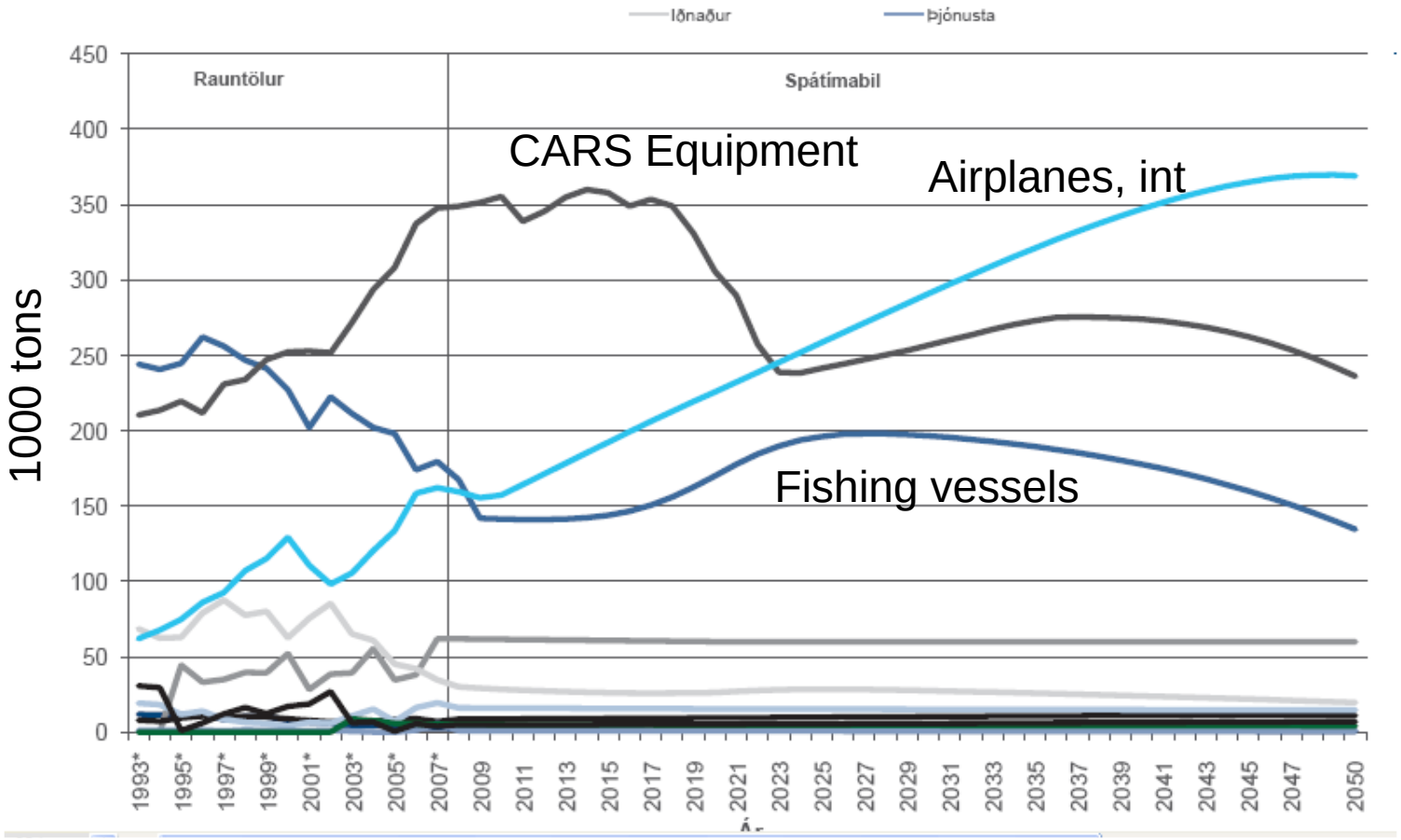
Done

Unknown Zone

Slide 6 of 14 "Default Design" Icelandic 61%

16:38

Iceland - Forecast hydrocarbon use



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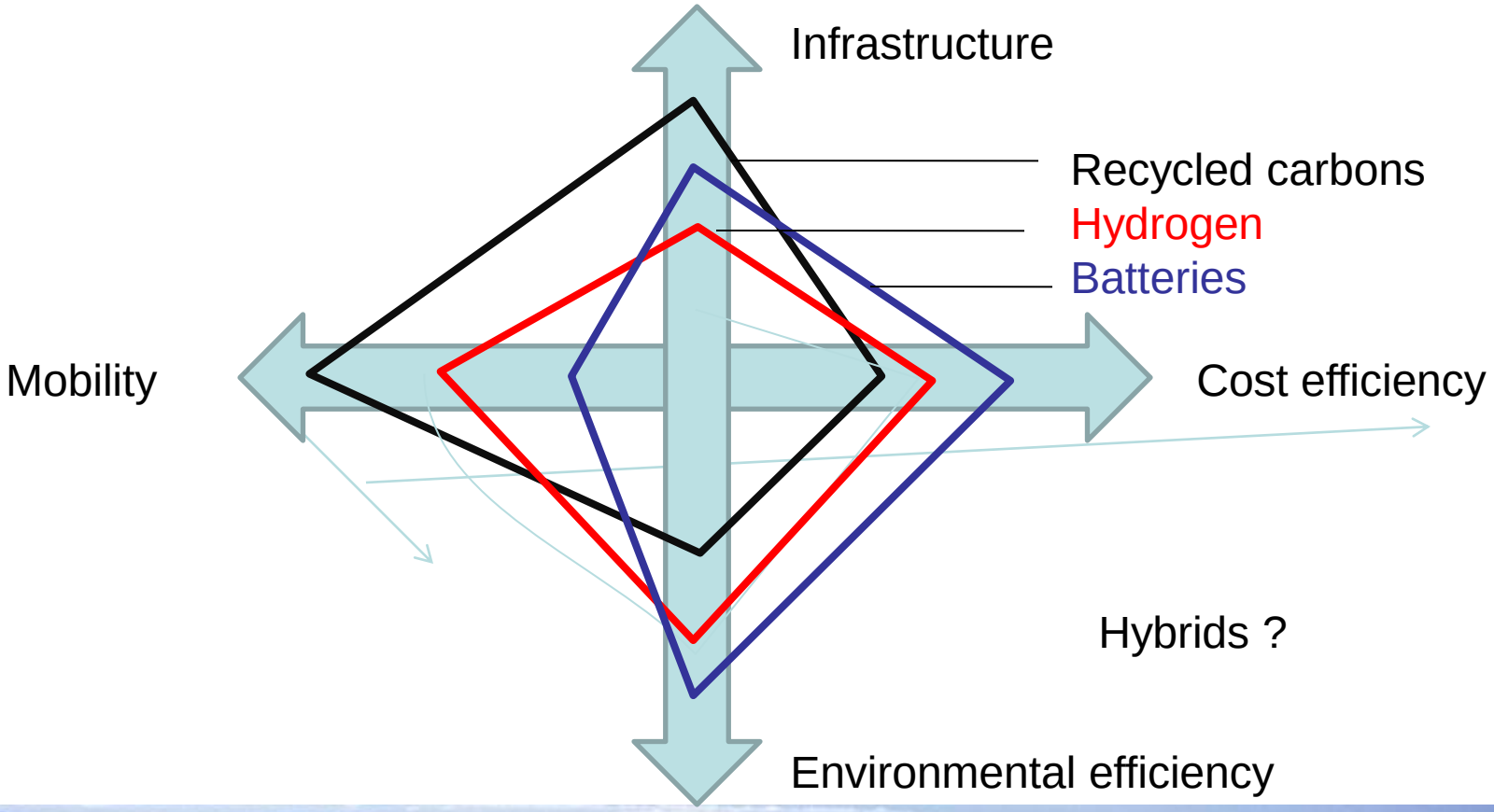
The Alternative Fuel Race



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Electrical cars

Test program in 2010

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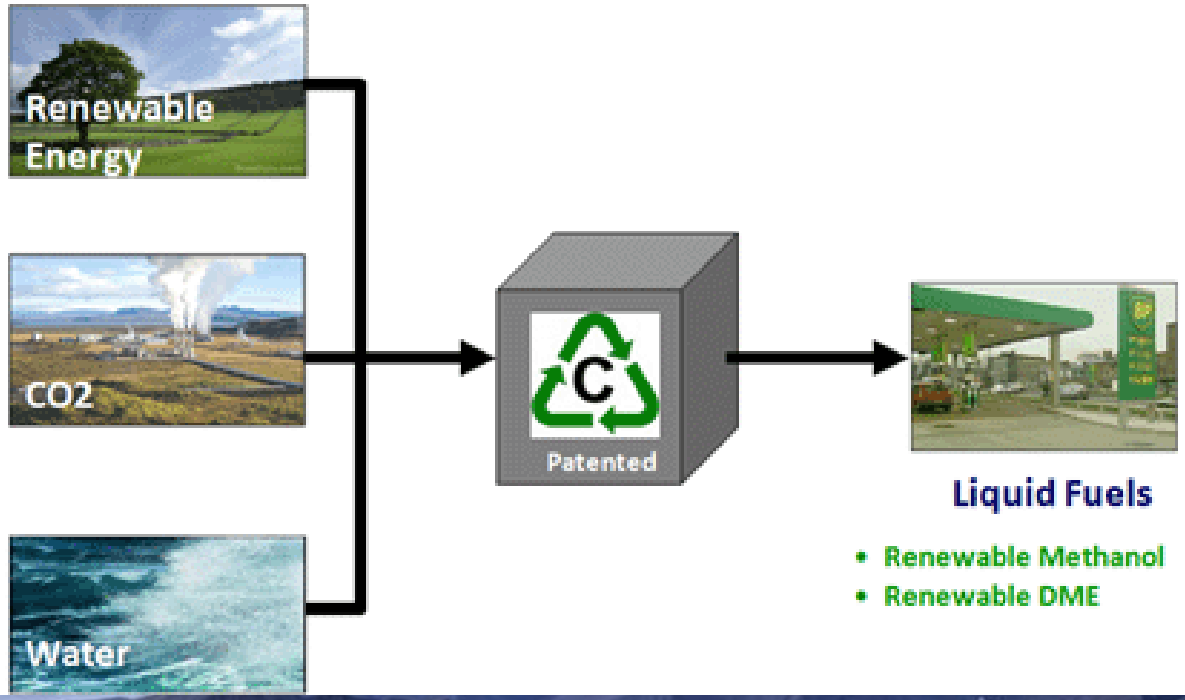
Recycling CO_2

Carbon Recycling International (CRI) captures carbon dioxide from industrial emissions and converts carbon dioxide to ultra clean fuel. Methanol plant under construction.



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DME Feasibility study

CO_2 from Ferro – silica smelter in Hvalfjördur
300 MW of electricity
Generation of hydrogen
Methanol production
Methanol and hydrogen to DME
DME can be used directly for diesel engines (boilding point -25 deg C)
Evaluation of needed taxreduction compared to diesel fuel