Renewable Power in Iceland

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Renewable Energy in Iceland 2012

- 85% of primary energy was from renewable sources
  - 66% of primary energy is geothermal
  - Highest ratio in OECD - and probably in the world
- Oil still meets 13% of primary energy demand
  - About half to operate the fishing fleet
  - The other half largely for motor vehicles
- 99% of houses heated with renewable energy

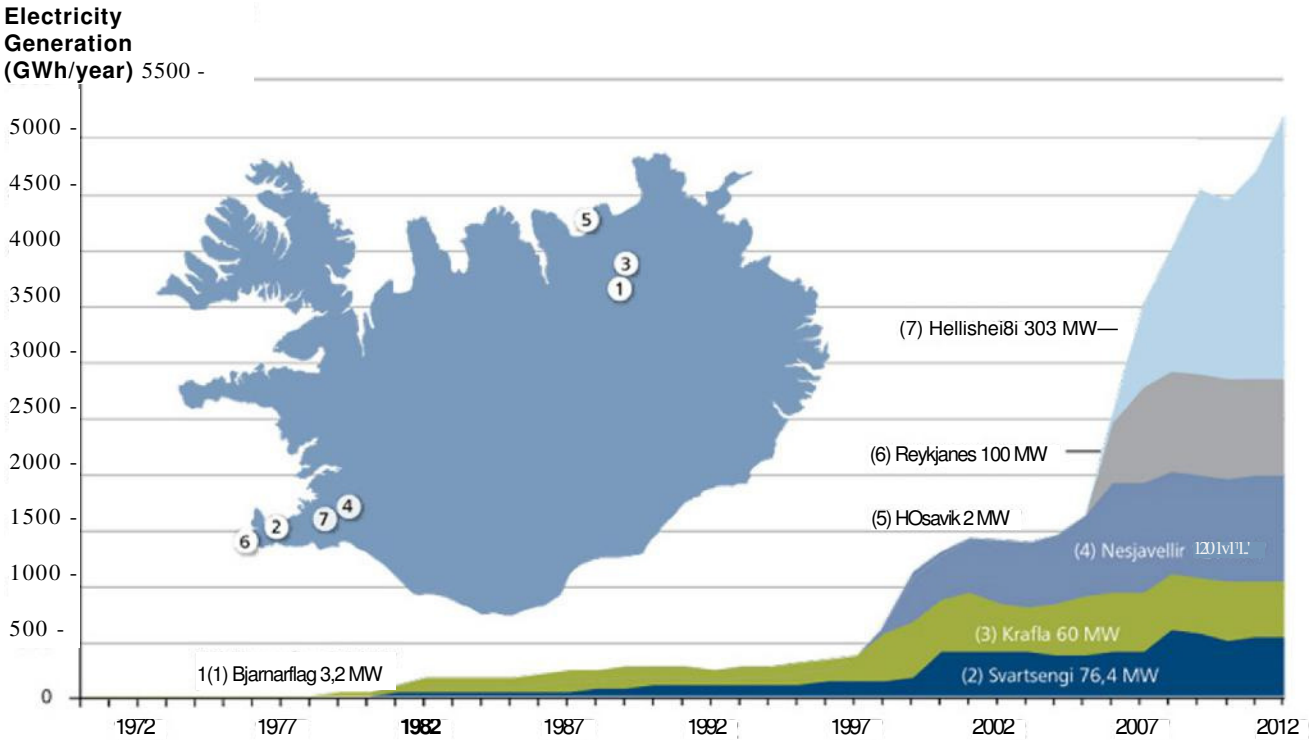
Power Production by Source 2012

	Total kWh	Percentage %
Hydro	12.336.529.833	70,3
Geothermal	5.209.539.317	29,7
Fuel	2.839.208	0,0
Wind	0	0,0
Total	17.548.908.358	100

Major Power Producers 2012 (GWh)

Landsvirkjun National Power Company	12,312
Reykjavík Energy	3,453
HS Orka	1,295
Orkusalan	259

Geothermal Electricity Generation







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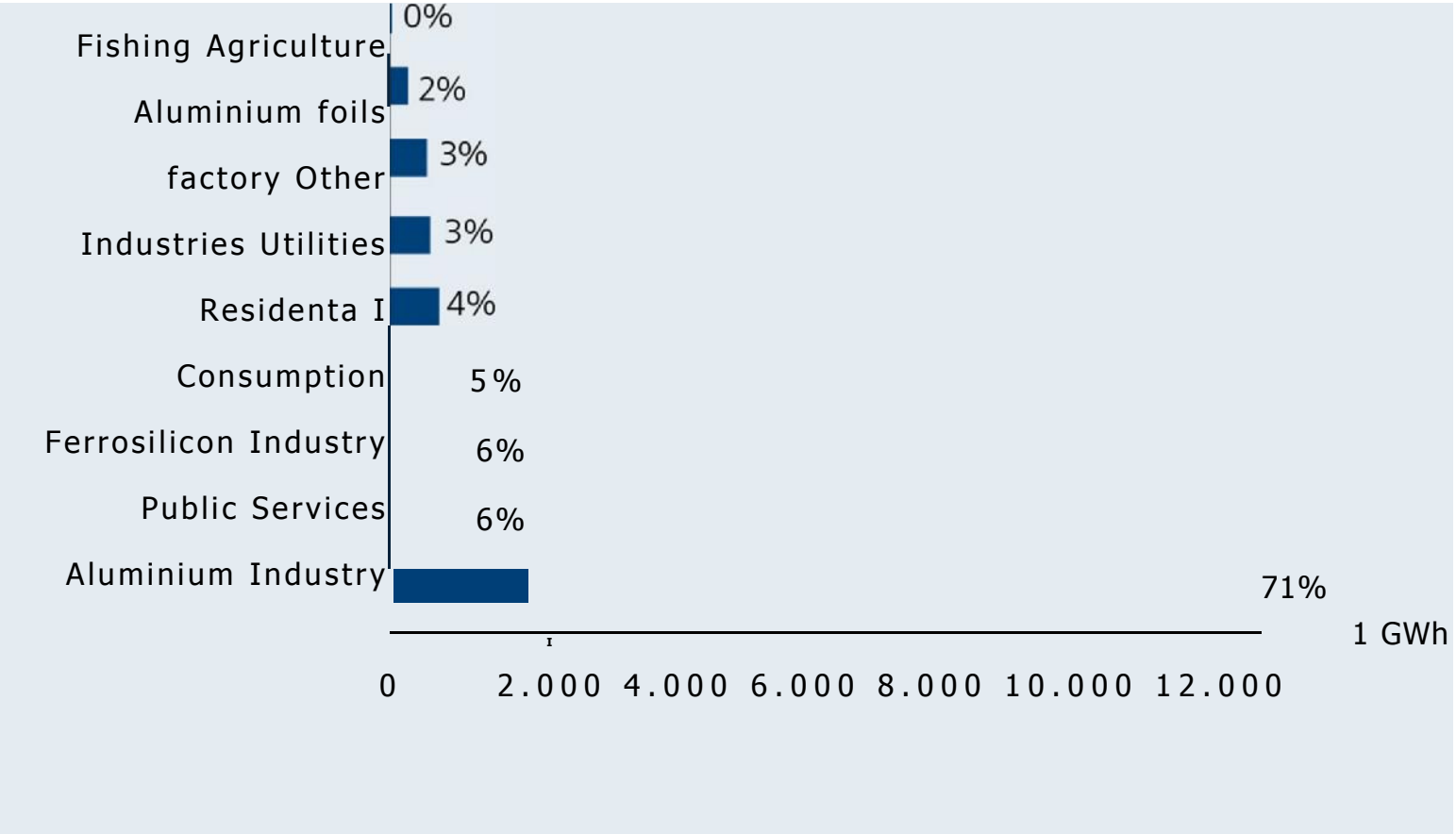
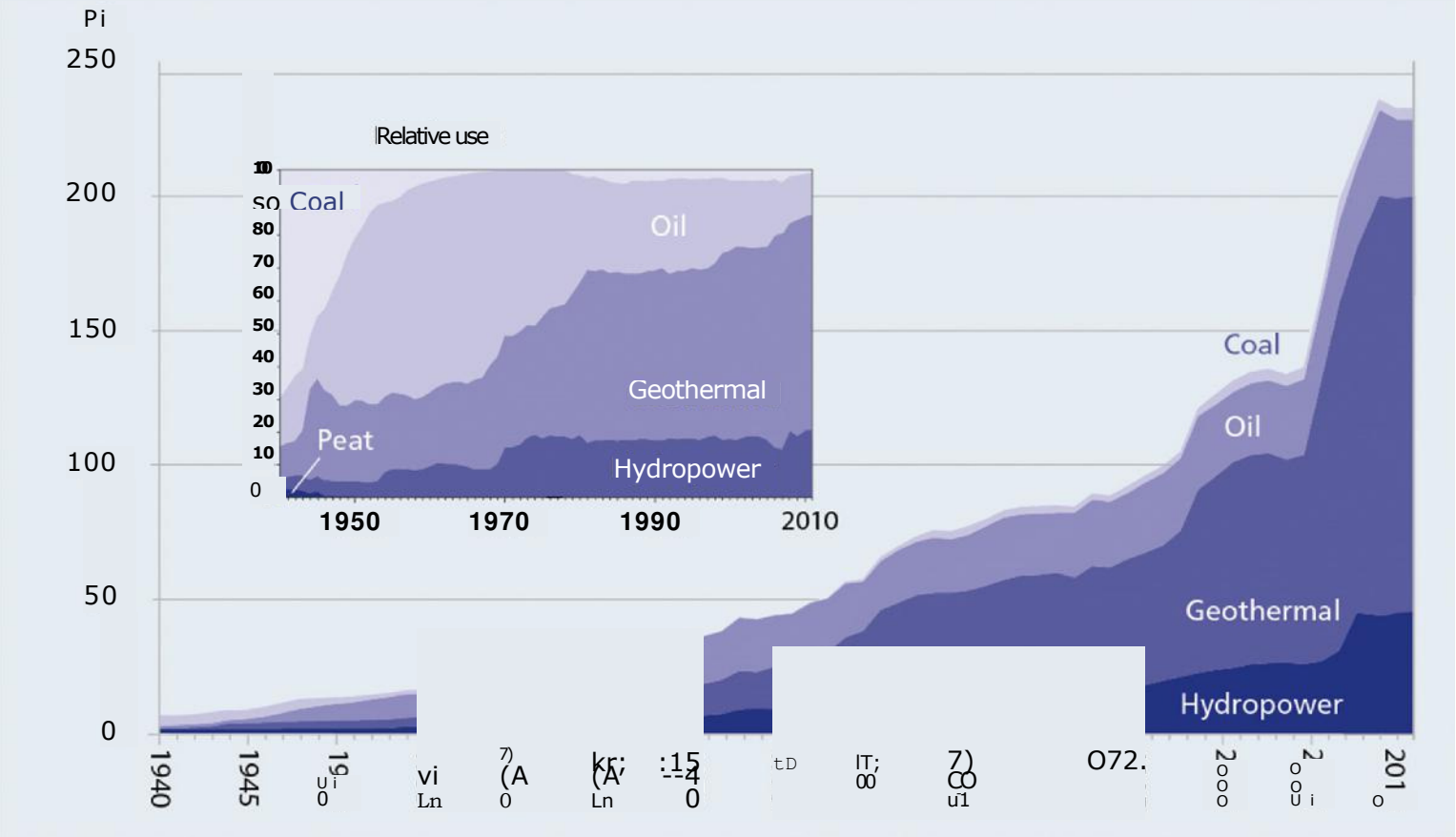
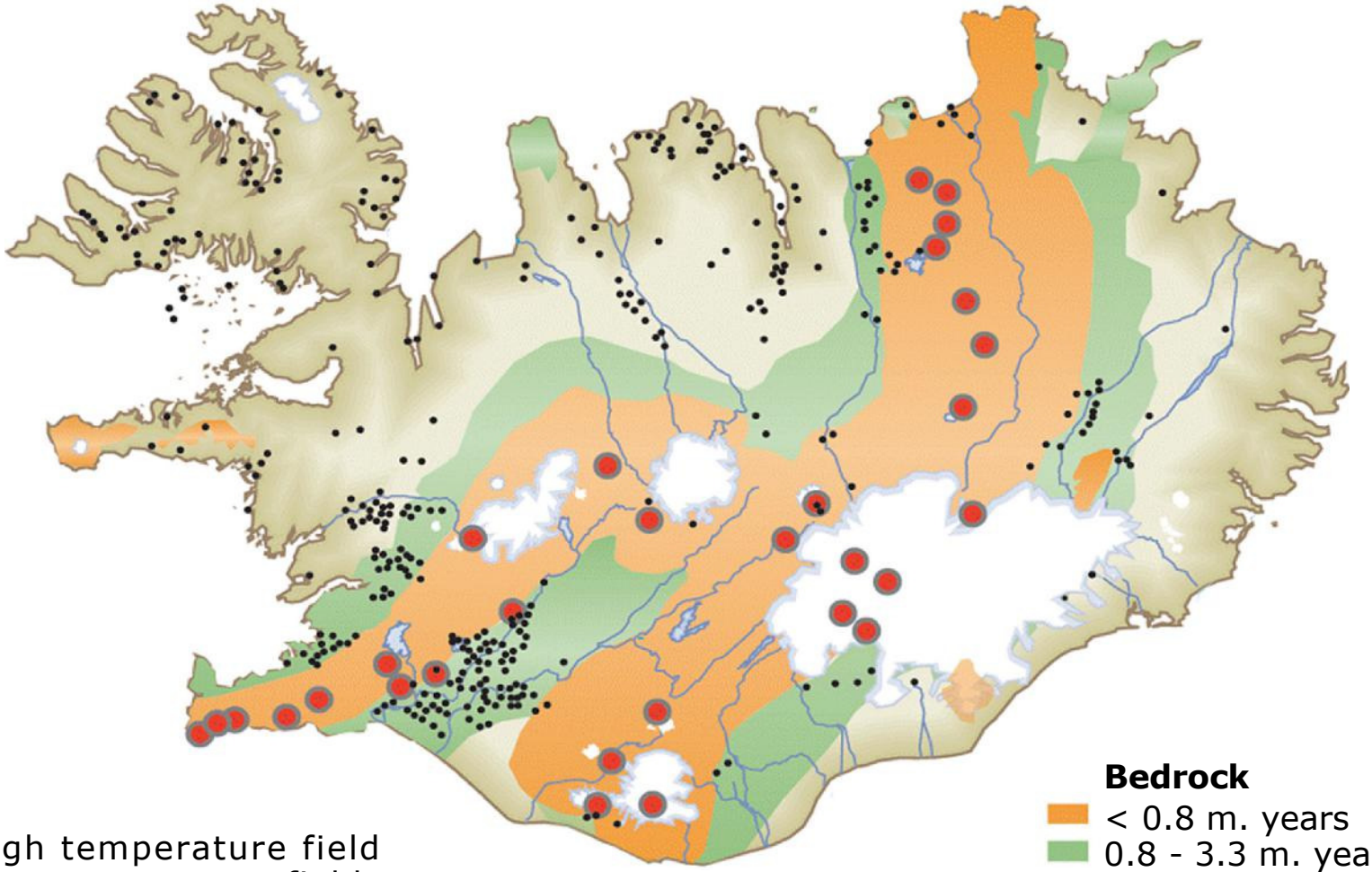
Electricity Consumption 2011



Icelandic Primary Energy Use 1940-2011



Geothermal fields



High temperature field
- Low temperature field

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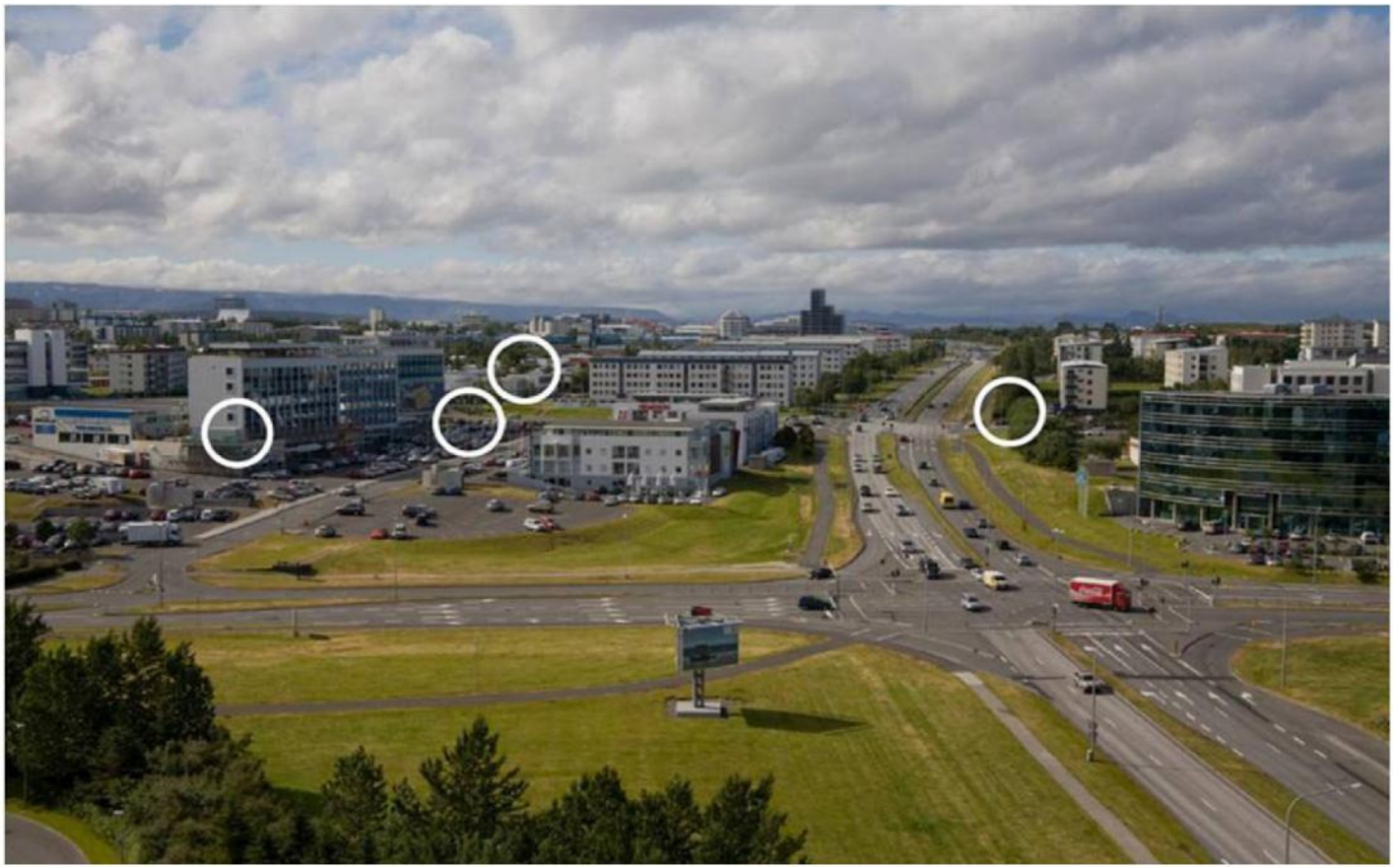
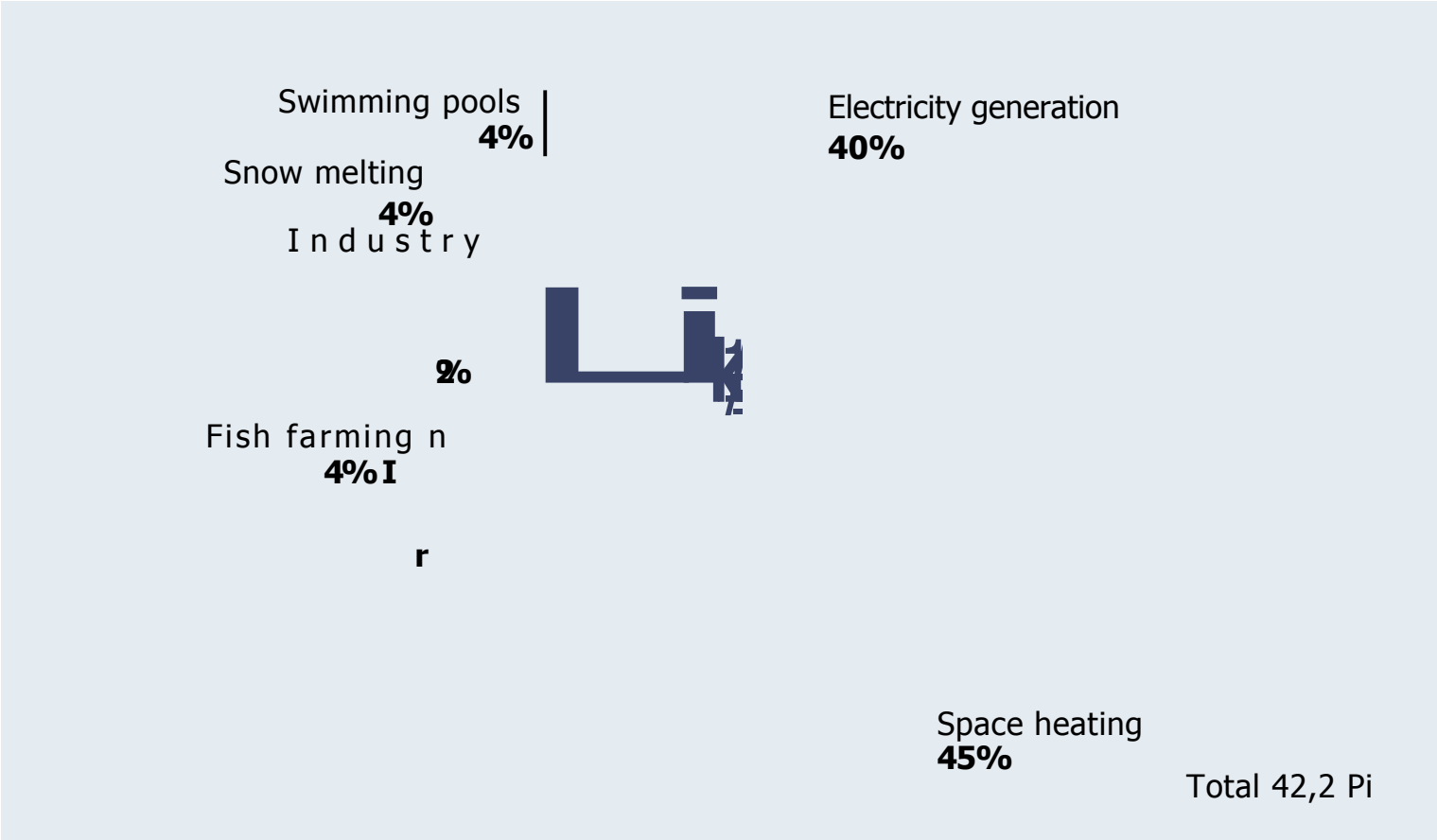
Reykjavík in 1933

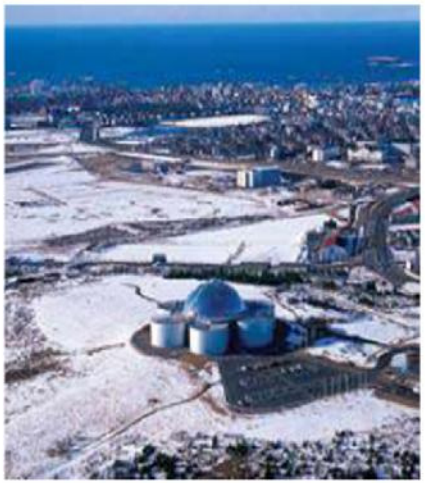
Wells in Reykjavík

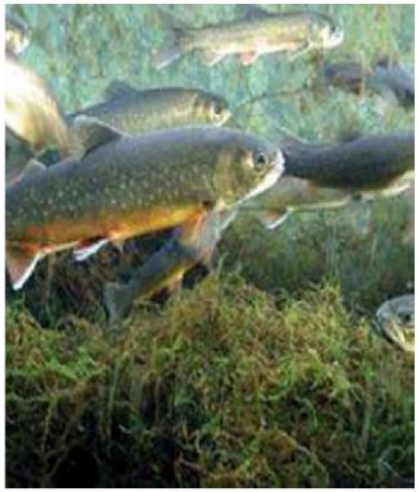


Geothermal Energy Consumption 2011

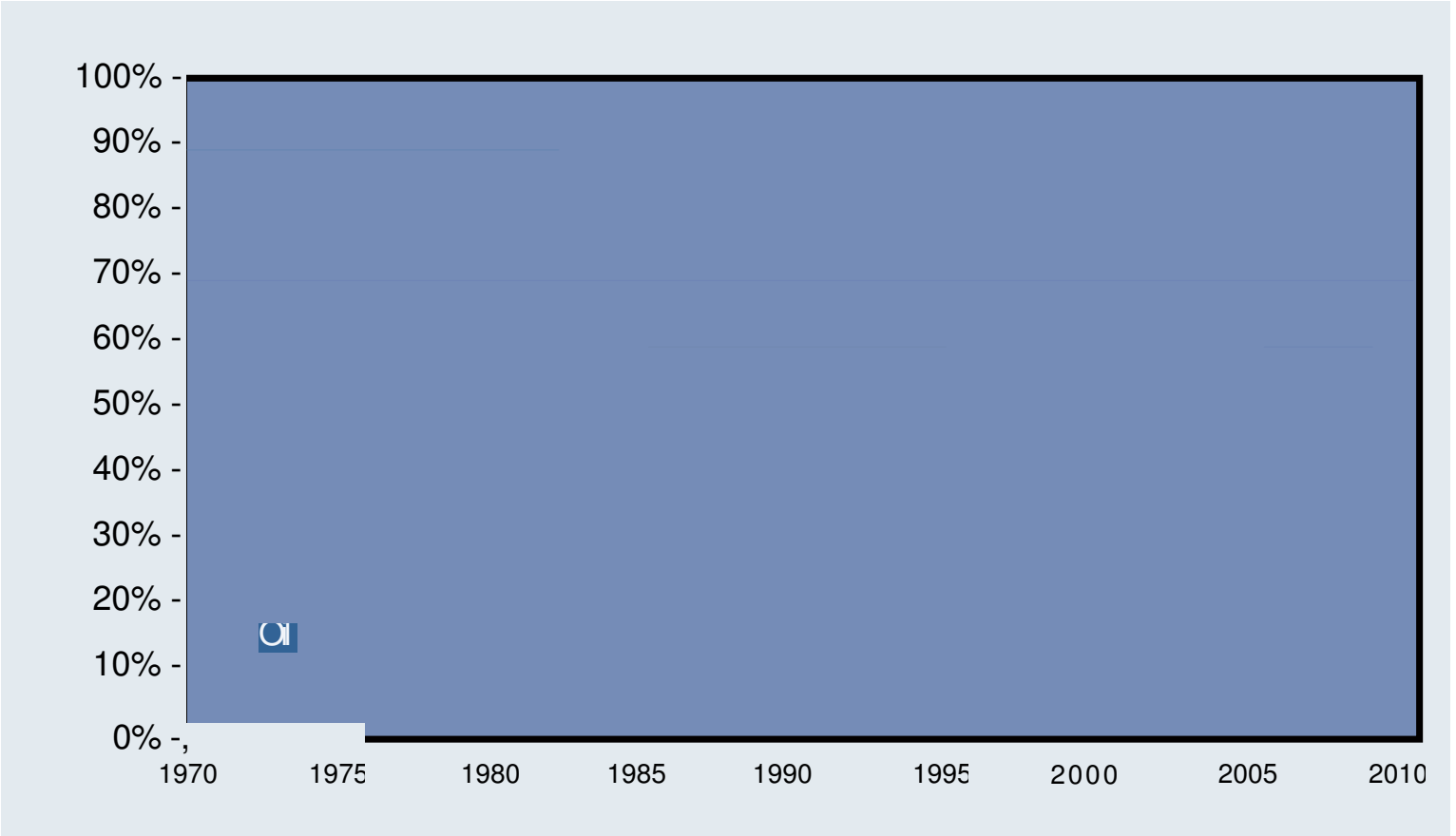


Examples of Direct Use





Space Heating by Source



Energy Meets Tourism

- In Iceland we have merged the tourist industry with our energy industry
- The energy industry has opened its doors to all those interested in the development of renewable energy in Iceland
- ... a few examples...

Power plants with an open-door policy

Geothermal Beach

Artificial Hot Springs

Iceland's Energy Challenges

- The primary challenge remaining is how to transition the transport sector and fishing fleet to a clean energy source

- The Icelandic government has supported various research and demonstration programs for the transition from hydrocarbon fuels

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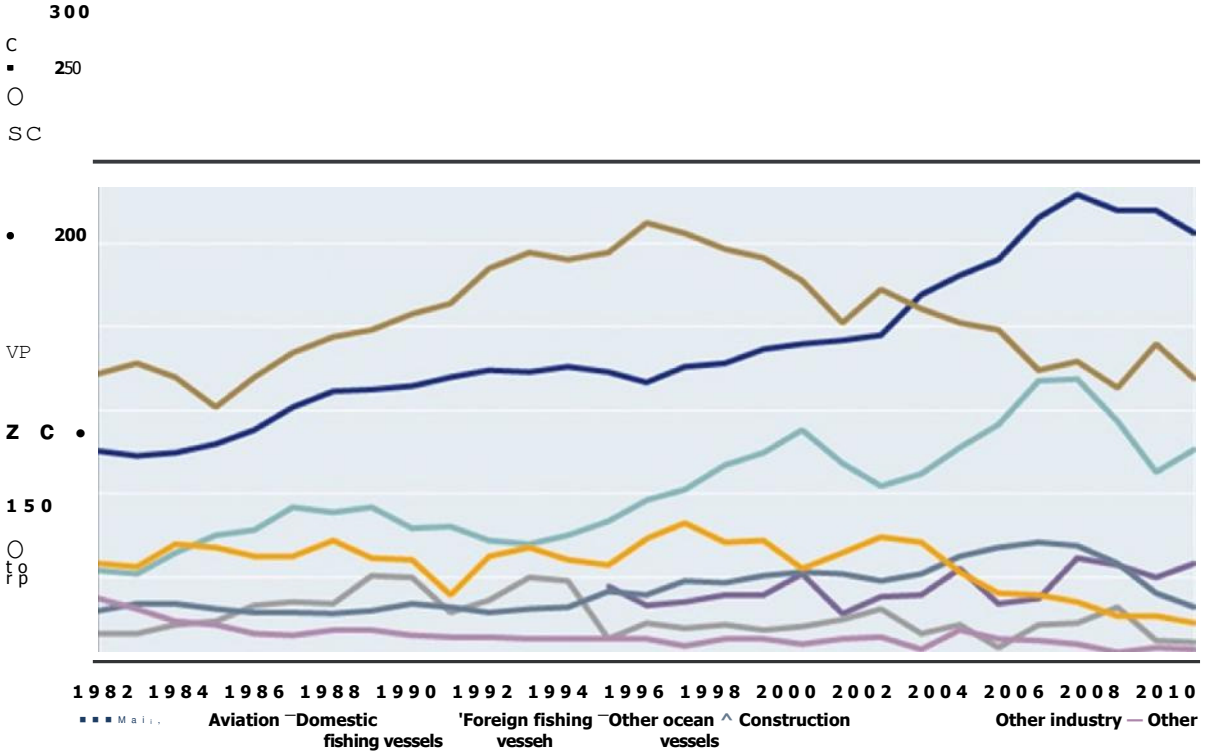
Oil consumption in Iceland 1982-2010



Electricity as Fuel

- Almost all electricity in Iceland is produced from renewable energy sources – 99.9%
- This means that all use of electricity in transport, in Iceland can be fossil free from well to wheel
- Possible to claim that no place is better suited than Iceland for the use of electricity in transport


Switch!
Electric Vehicle
MiEV

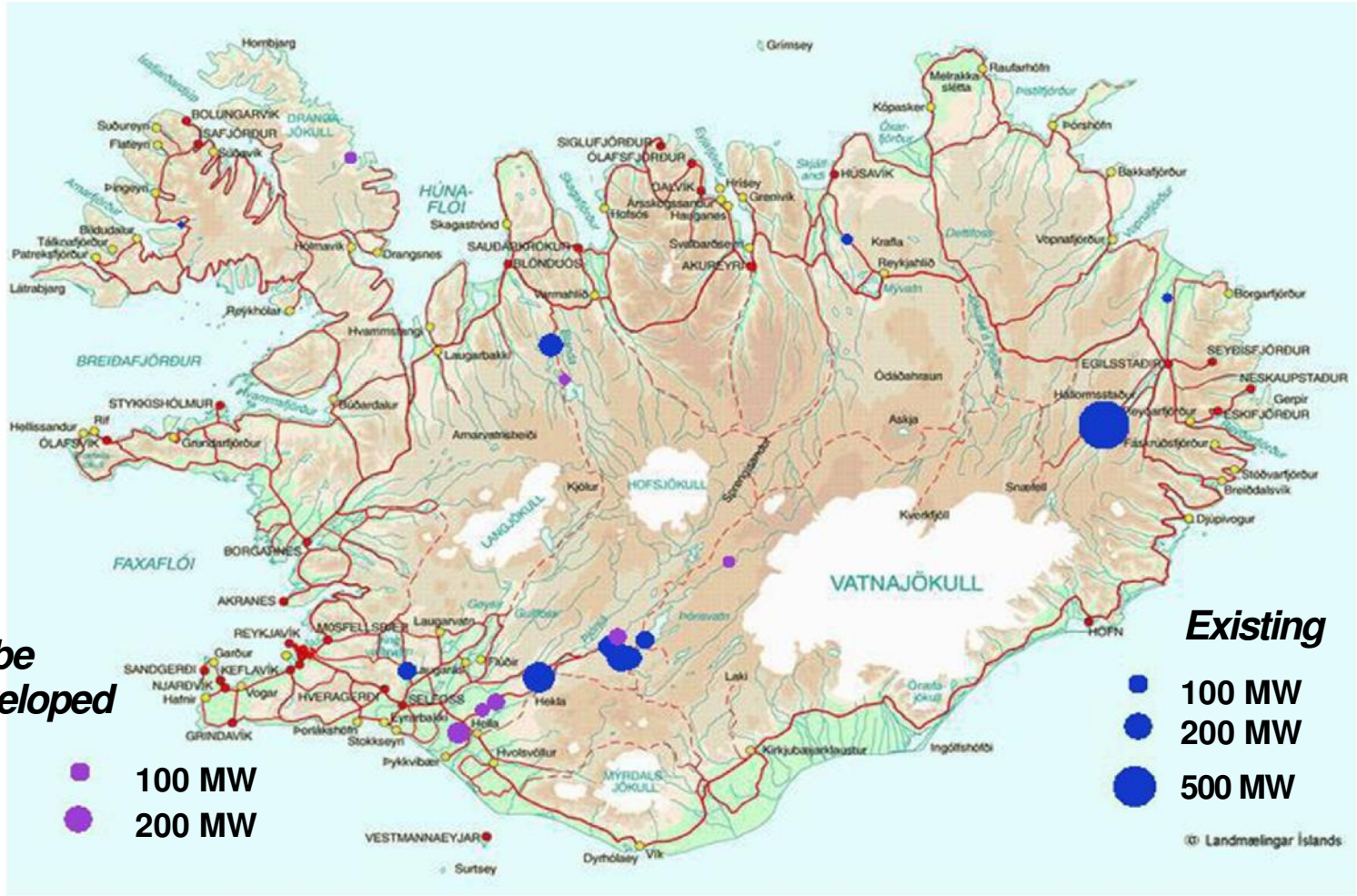
Master Plan
for the Utilization of Energy Resources

- Parliament started the work in 1997
- Proposed power projects are evaluated and categorized on the basis of:
  - Energy efficiency and economics
  - Impact on the natural environment, cultural heritage sites, fishing, hunting and recreational activities
  - Implications for regional development
  - Priorities projects

Master Plan

- Hydropower production could be increased by 26%
- Electricity production from geothermal could be more than doubled
- Greater degree of cohesion between viewpoints on developement of energy and protection of nature

Hydropower Plants in Iceland (>10 MW)
Existing & To be developed by Master Plan



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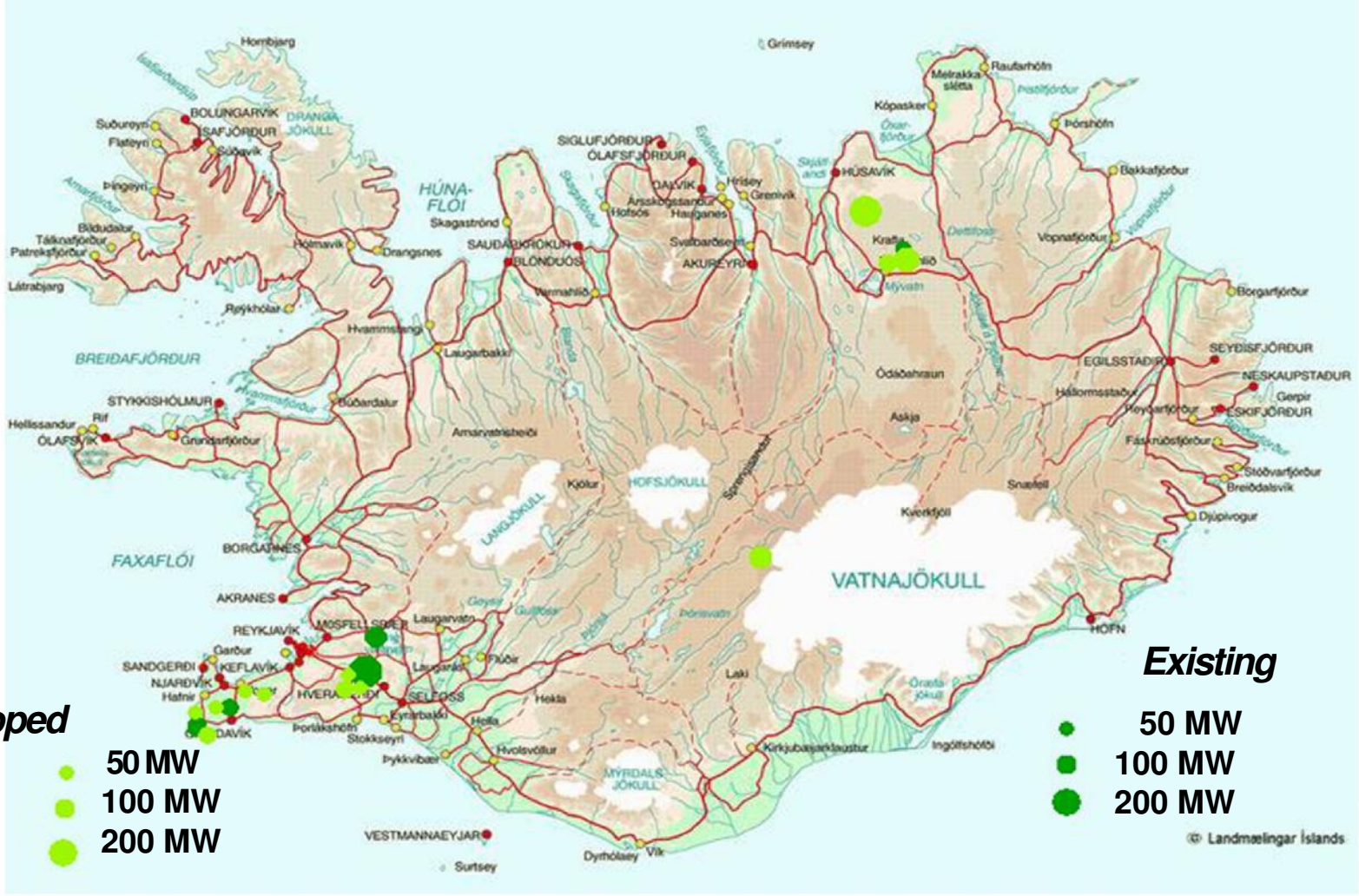
National Energy Authority, Kristinn Einarsson, September 2011

Geothermal Power Plant (>10 MW)



To be developed

50 MW
100 MW
200 MW

Existing

50 MW
100 MW
200 MW

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National Energy Authority, Kristinn Einarsson, September 2011

Master Plan

Electric Power Potential	Hydro GWh/a	Geo-thermal GWh/a
Electricity Production (2010)	12,592	4,465
Appropriate for Development	3,326	9,908
Existing & To be developed	15,918	14,373
Appropriate for Protection	7,745	17,765
Awaiting further Consideration	6,008	3,098

Total – Existing & Master Plan	**29,671**	**35,236**

The Research Project IDDP

The hottest well in the World

- By joining forces of key players Iceland has been able to pull off one of the most promising research projects.
- The IDDP-1 well drilled in Krafla is at the moment the hottest well in the word with a temperature of 450 ° C at 40 bar pressure and 12 kg/s steam flow on surface with an estimated 25-35 MWe electric production capacity
- Second well in preparation in Reykjanes
- Previously mentioned reserve estimates exclude supercritical resources

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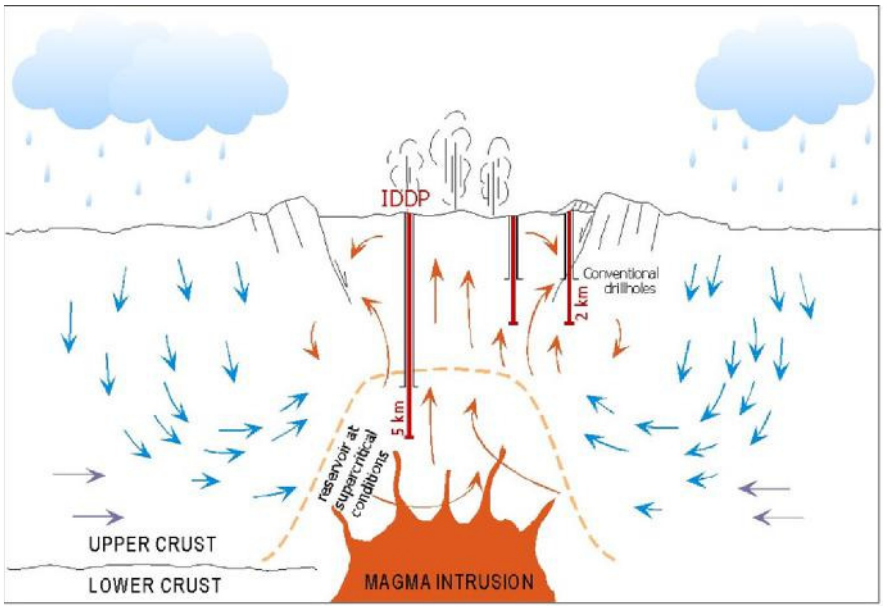
- **A new era in geothermal development**
  - 400-600 °C, superheated steam at up to 5 kilometer depth
  - 40-50 MWe from each well
  - First IDDP well at Krafla reached the target in temperature but not fully in pressure (too shallow)
  - Extensive research program in progress
  - 2nd & 3rd IDDP to be drilled within Hengill and Reykjanes fields.
  - Pilot plant testing planned in continuaton of that



Thank you!

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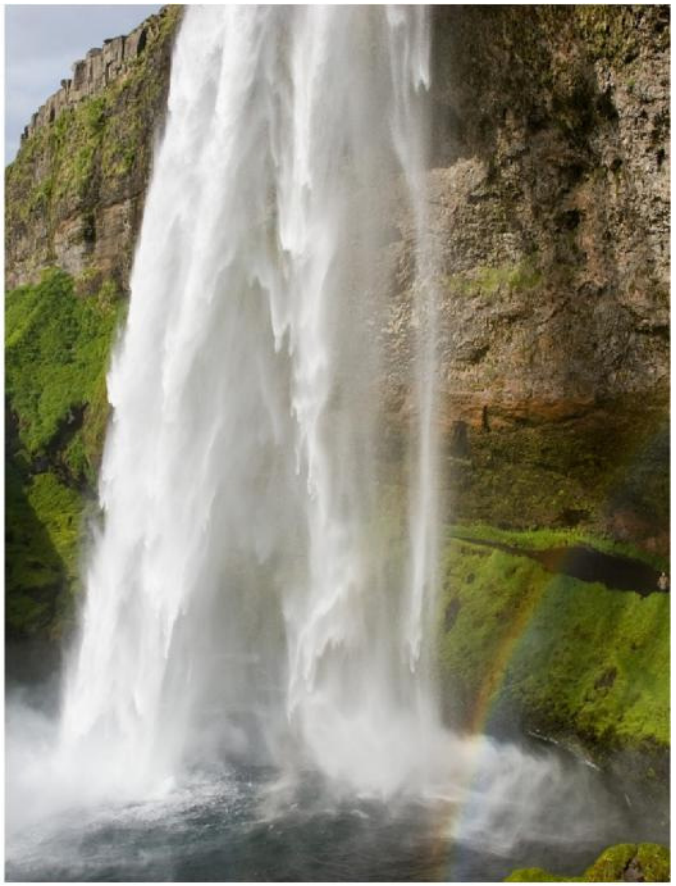
Role of Orkustofnun
The National Energy Authority

- Manages public administration of the energy sector and provides the government with specialised services
- Handles long term planning for energy utilisation and energy systems
- Contracts and conducts research on resource utilisation
- Accumulates and maintains databases on energy utilisation and forecasts for future trends



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Role of Orkustofnun
The National Energy Authority

- Issues permits for exploration and utilisation of energy and earth based resources
- Issues power plant licences
- Regulates transmission and distribution companies
- Is the official monitoring body for issued licenses
- Handles fuel sector administration and aids in the transition to low carbon fuels
- Administers The Energy Agency, The Energy Fund and special initiatives for geothermal exploration
- Hosts the UNU University Geothermal Training Programme