

Renewable Power; Hydro and Geothermal

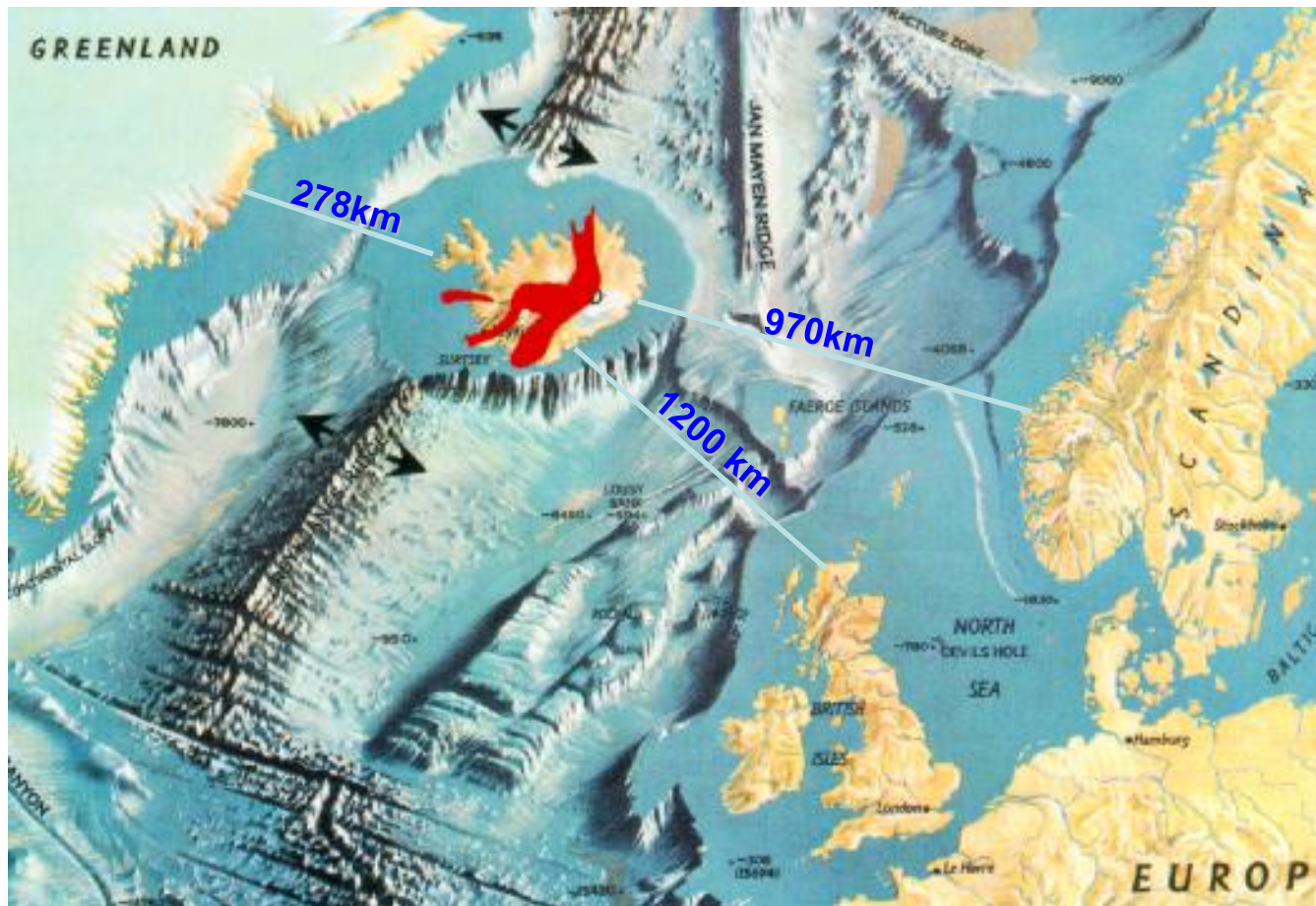


Renewables and Islands
Global Summit
Malta

Benedikt Höskuldsson,
Head of Energy Affairs
Ministry for Foreign Affairs of Iceland

ICELAND

Size: 104.000 km² Population: 317.630



Average Jan. temp: -0.4°C
Average July temp.: 11.2°

Mean annual temp: 5°C

The Icelandic highlands are the last great expanse of true wilderness left in Western Europe



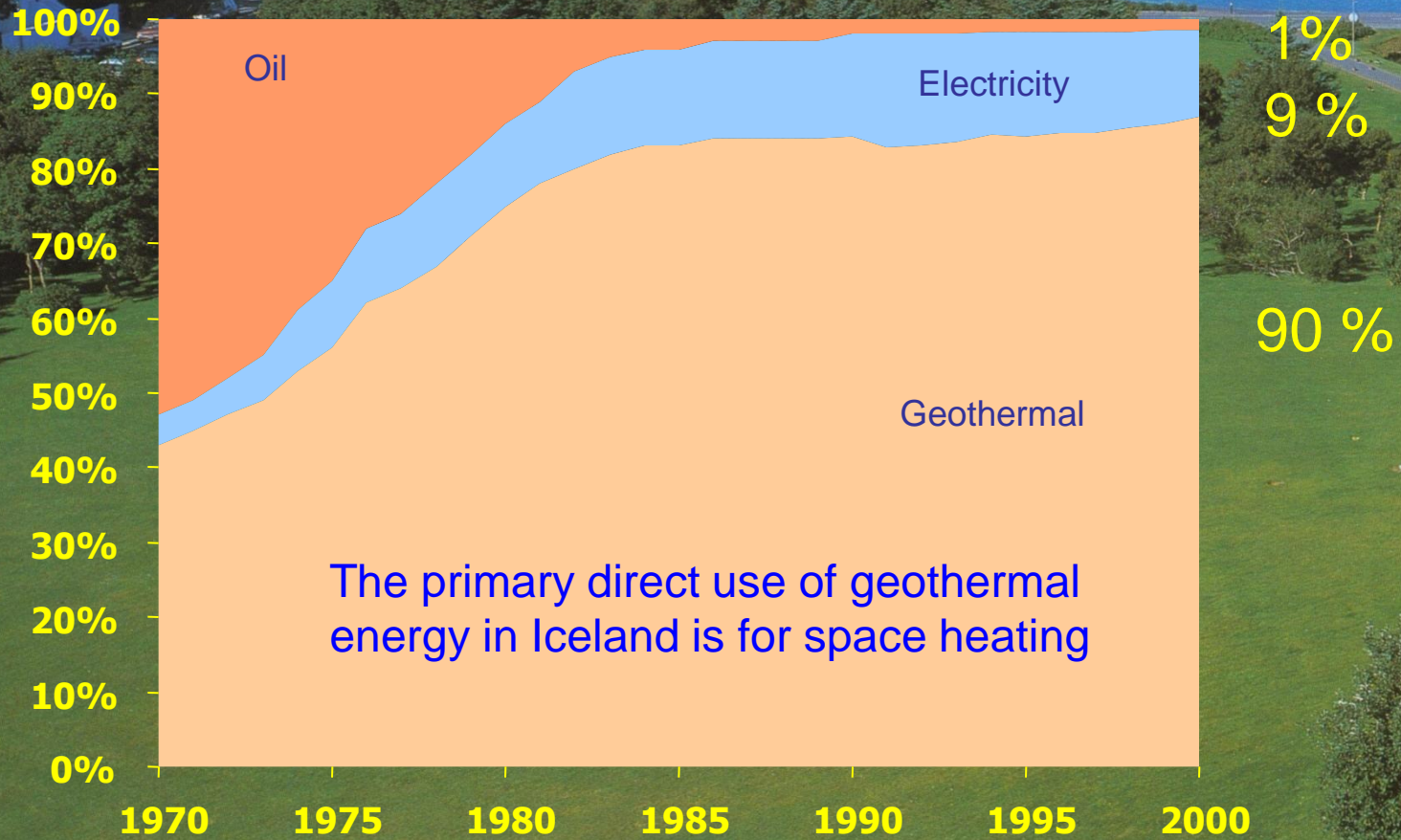
1930

Distribution of hot water



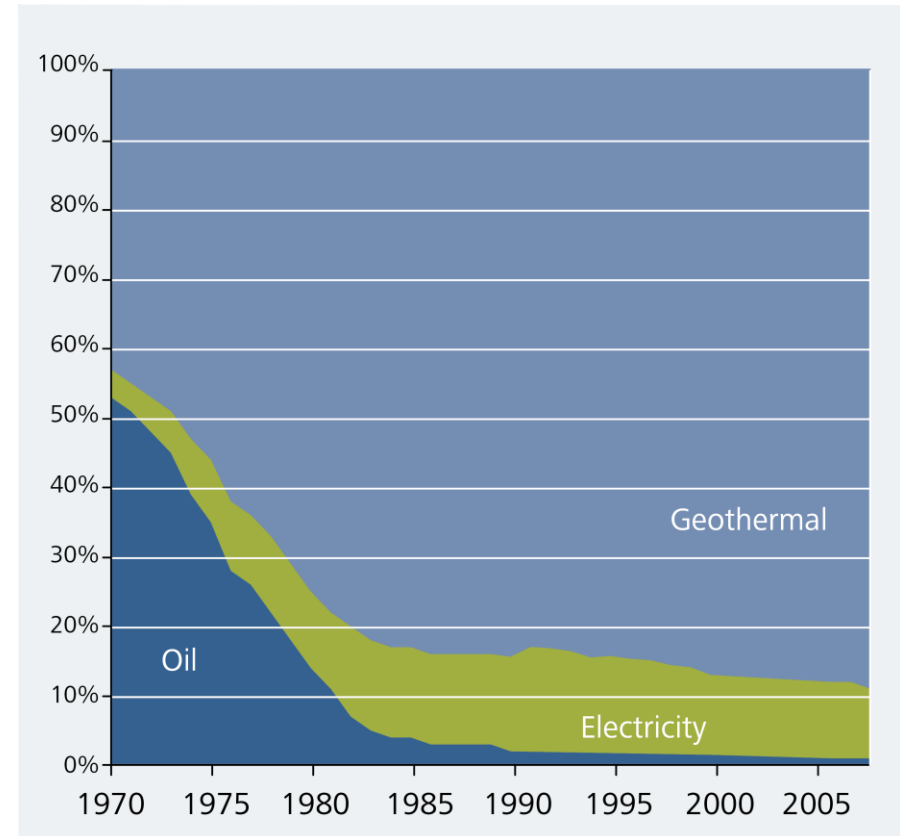
- From Laugarveitan an extensive distribution system of hot water was installed. Transporting the hot water to the town through a 3 km long pipeline.
- Two primary schools (Austurbæjarskóli shown above), a swimming hall, the main hospital and 60 family homes in the capital area

Space heating



Oil Crisis Changes National Policy

- When the oil crisis struck in the early 1970s, the world market price for crude oil rose by 70%.
- Heat from oil served over 50% of the population.
- In order to reduce the effect of rising oil prices, Iceland began subsidizing those who used oil for space heating.
- The oil crises in caused Iceland to change its policy, deemphasizing oil, turning to domestic energy resources, hydropower and geothermal heat.



Space Heating in Iceland from 1970-2008.

Modern Industrial Society



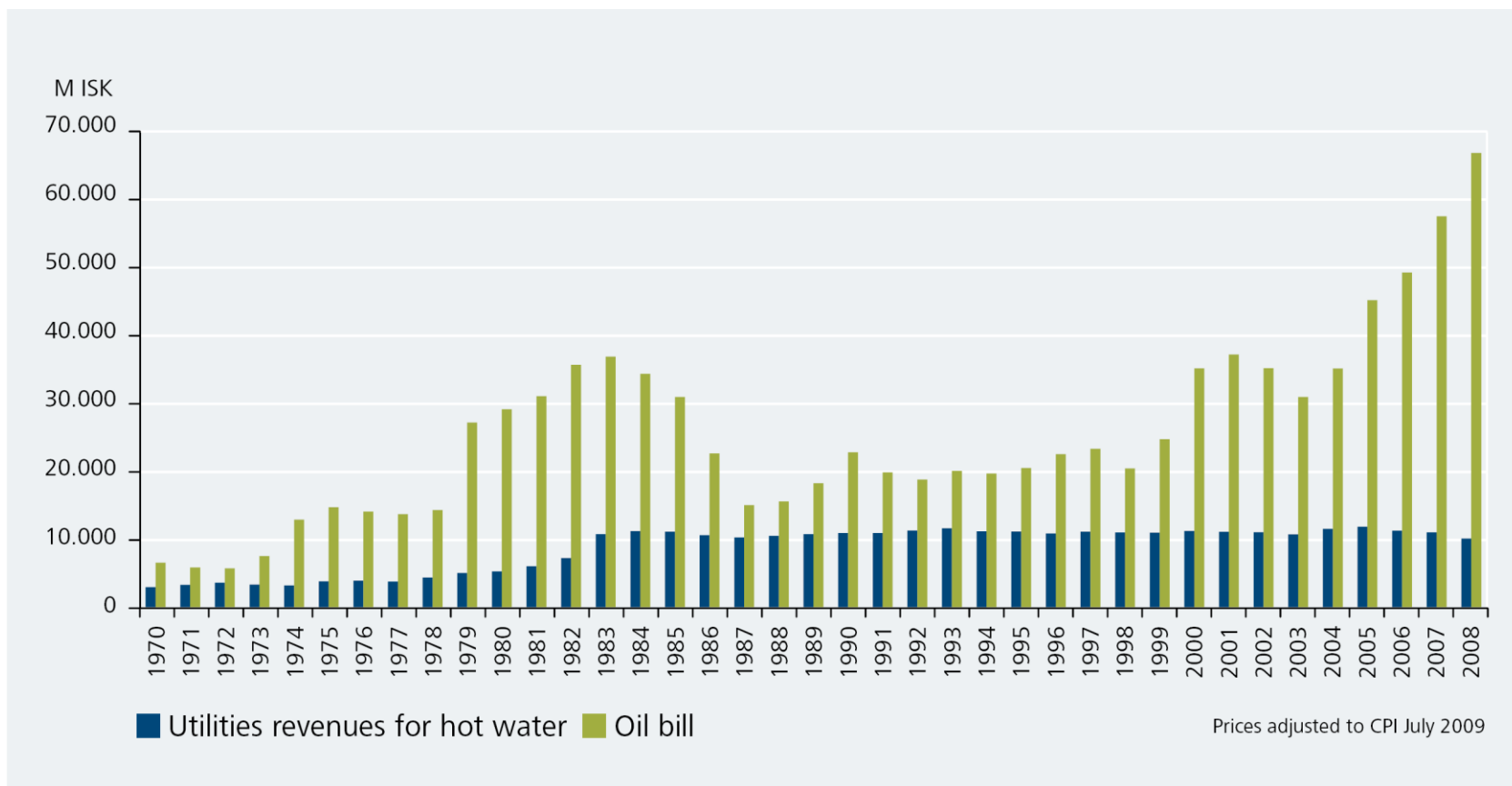
Energy Museum




Far reaching benefits



Avoided cost by harnessing a domestic source of energy



Savings in 2008 equivalent to 91% of the total imports of refined oil products.



GeoGreenhouse

Pure Resources - Healthy Living

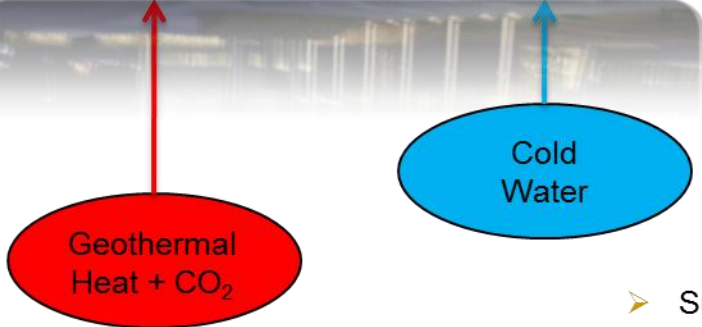
GeoGreenhouse Concept

Hellisheidi Geothermal Power Plant



Electricity →
Hot Water →
Cold Water →
CO₂ →

The Green House

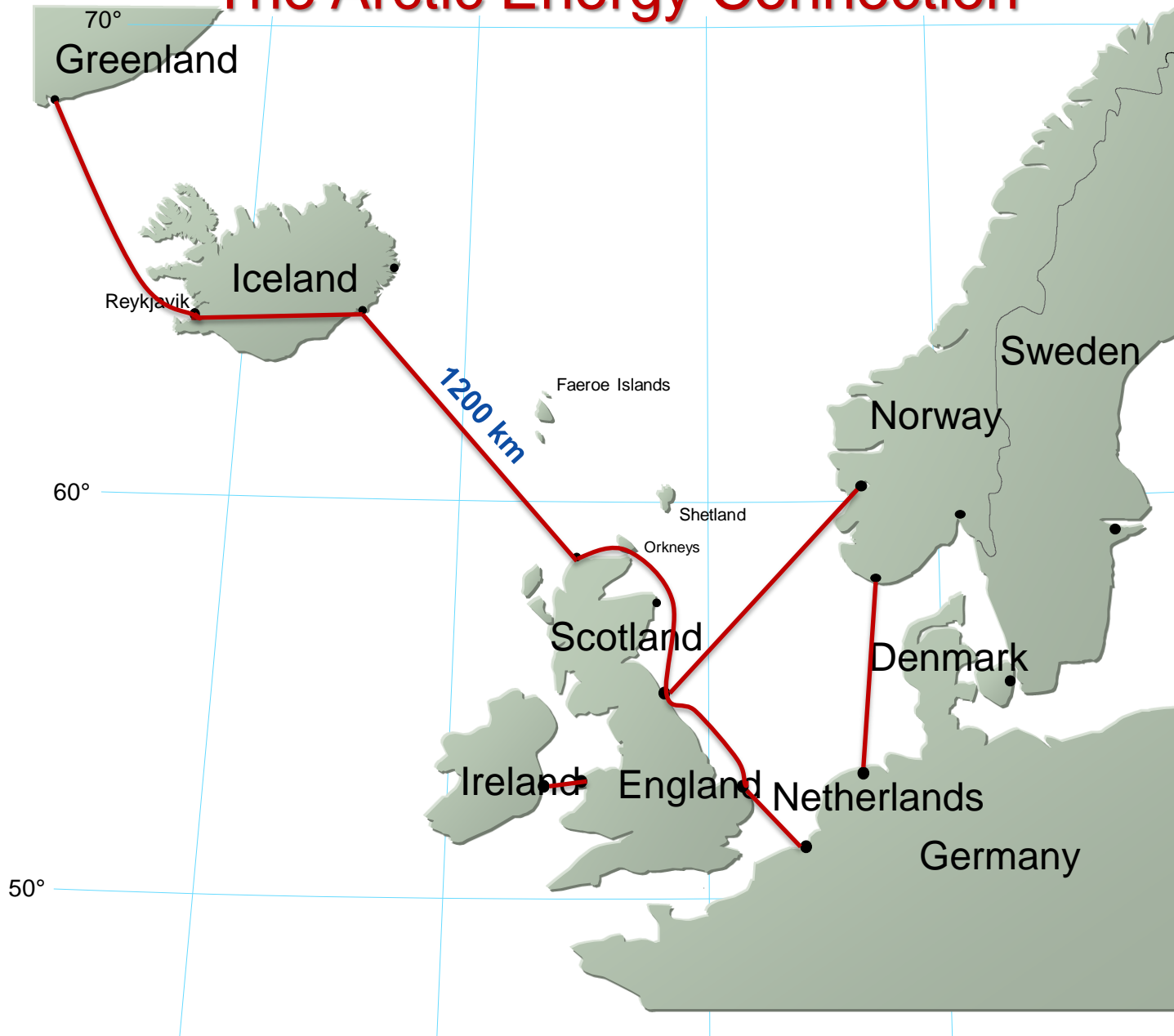


- Supply of 4 main resource materials from the Geothermal Plant
- Site with enormous future growth potential

Risk Mitigation –meant success

- A system of grant support for geothermal development was set up
- During the first three decades of geothermal development in the country no private developers were willing to fund explorations
- The National Energy Fund (NEF) provided risk insurance:
 - NEF would reimburse up to 80% of cost of unsuccessful drillings.
 - Later on the NEF played a critical role in mitigating the exploration and drilling risks, thereby leaving project developers with minimal risk
 - As the Icelandic companies and utilities became more experienced with fewer failures in drillings and dry boreholes, the Fund has become less important for the development of new projects.

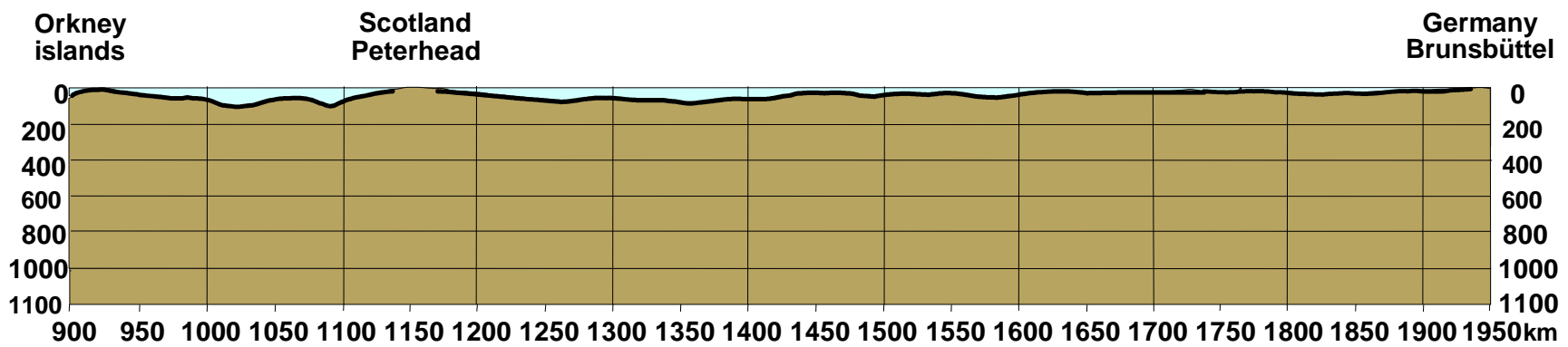
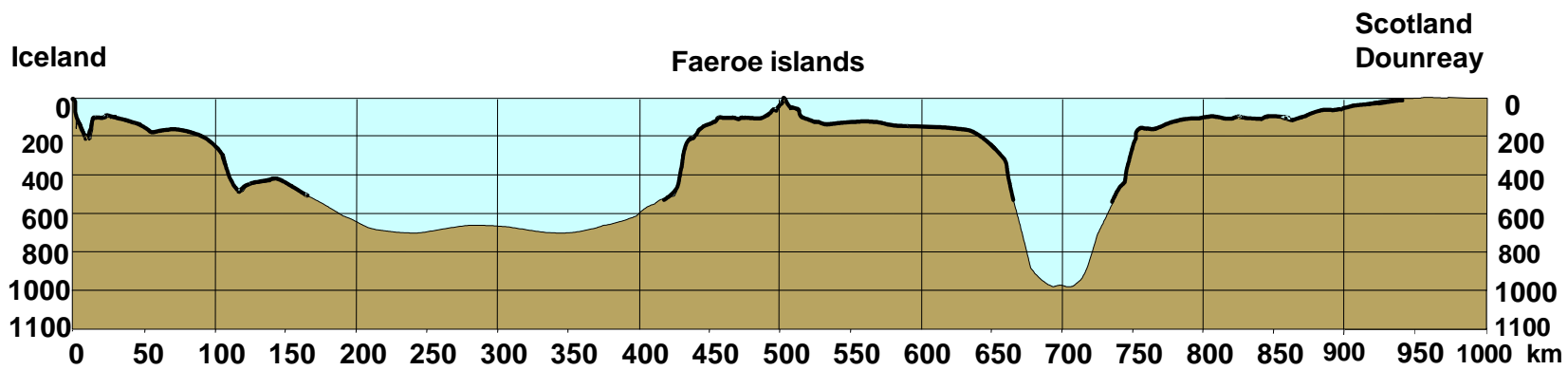
The Arctic Energy Connection



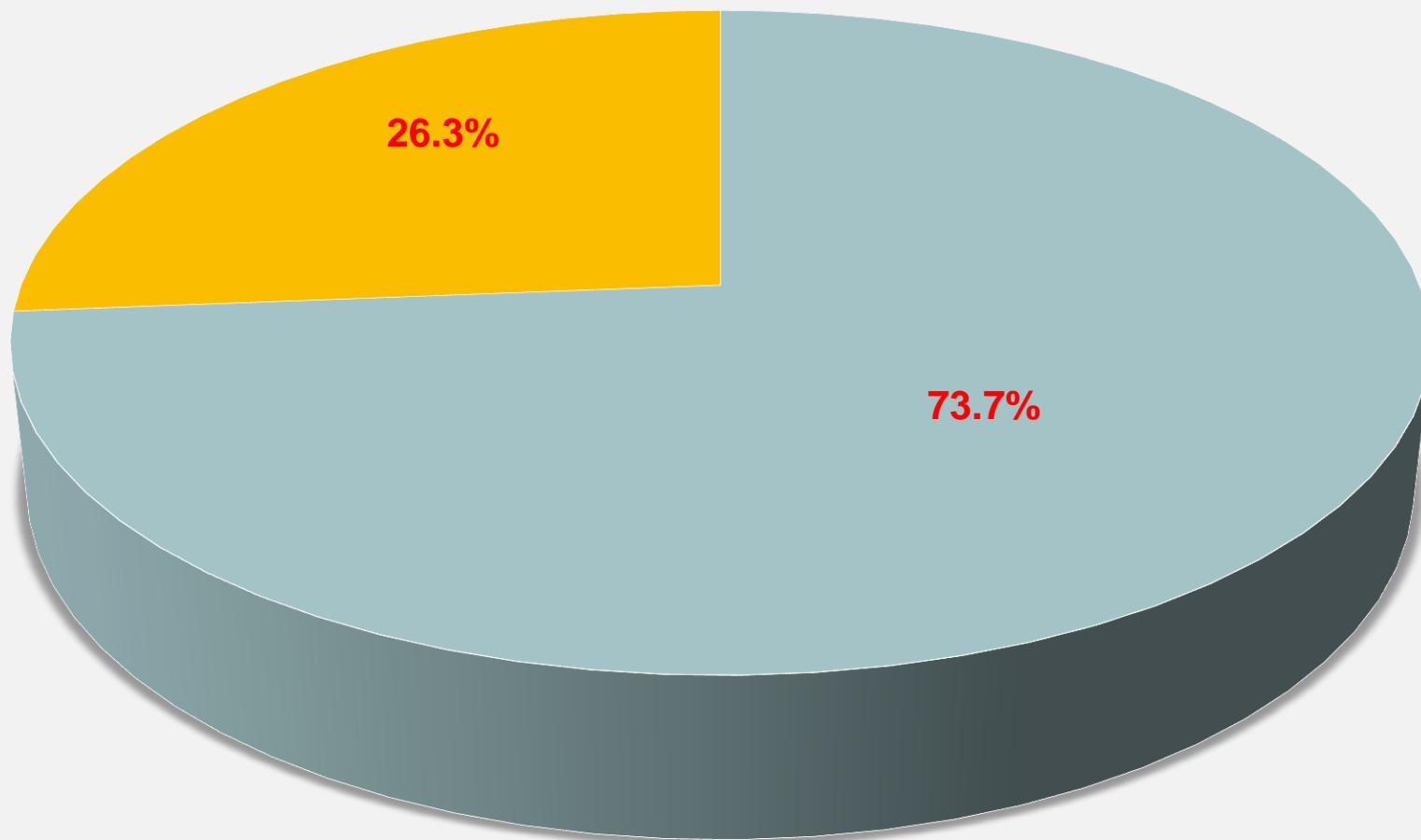
Why export energy direct

- Lowering CO2 emission in Iceland
- Lowering CO2 emission in the Europe
- Increase energy security both in Iceland and Europe
- New energy opportunity in Iceland i.e. wind, wave, tidal etc.
- Diversification of the Icelandic energy market
- Better return on investment
- Presence in a market with increasing demand and prices

Profile of Cable Route between Iceland and Scotland



Installed Capacity 2.520 MW
Hydro 74% Geothermal 26%

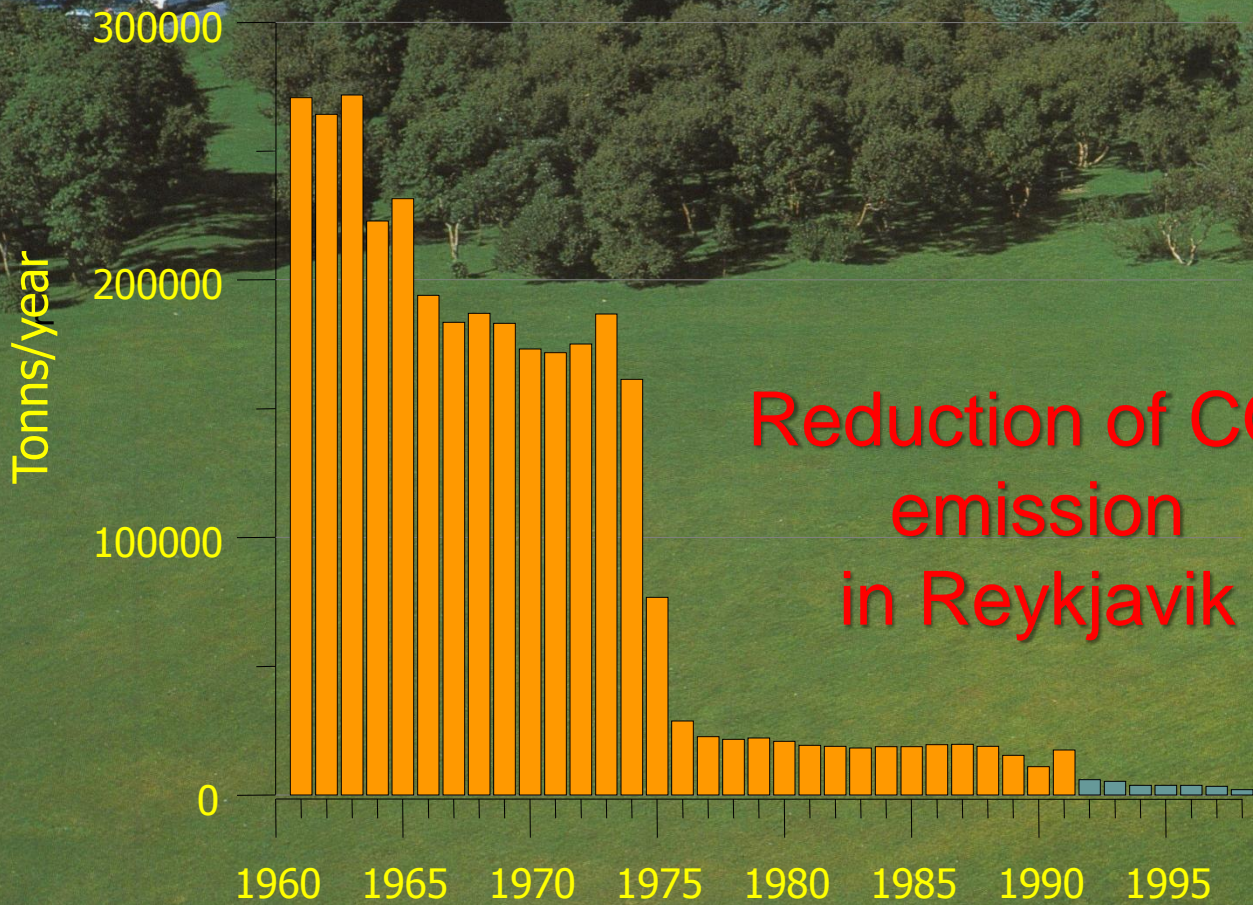
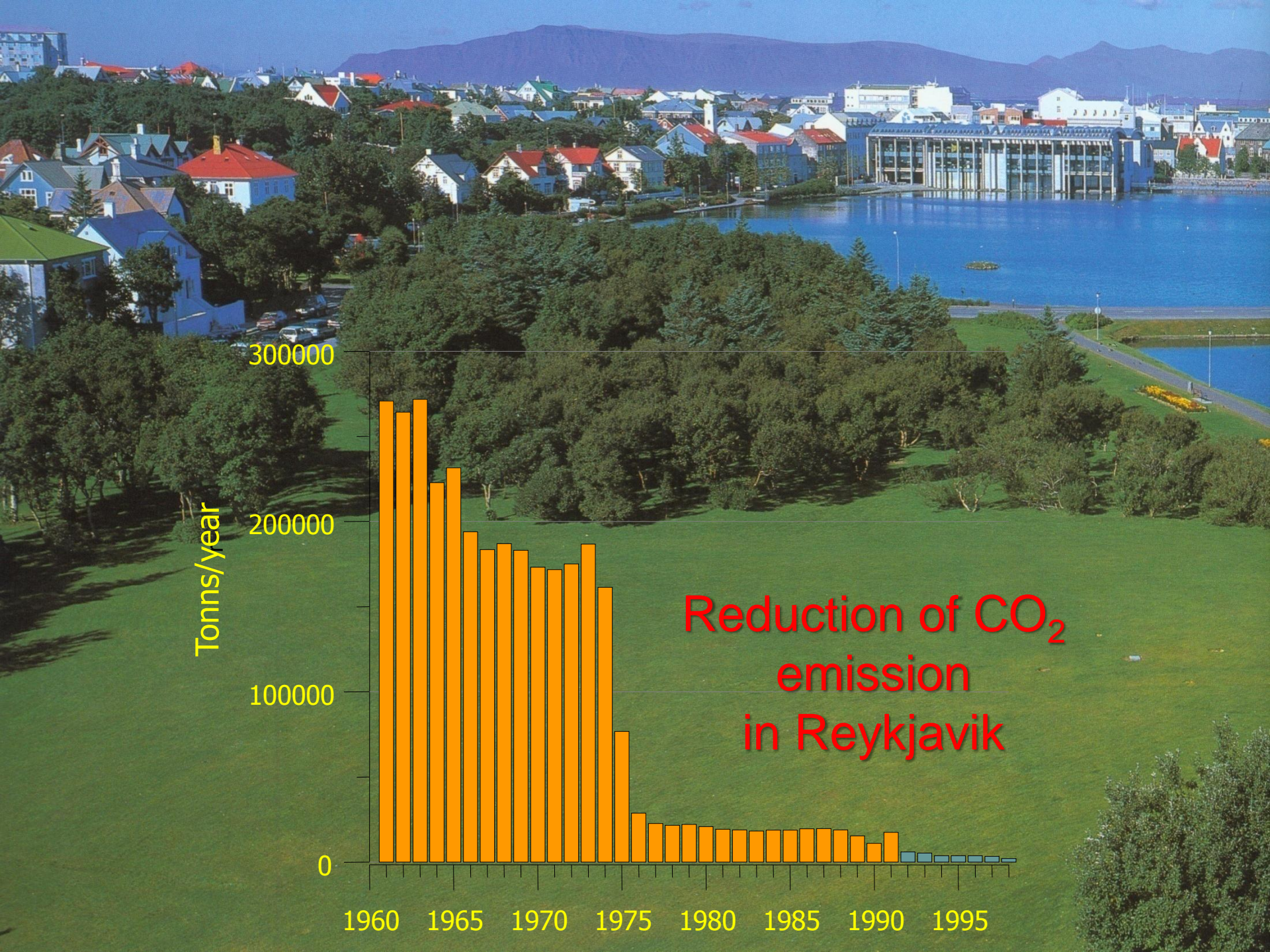


Takk fyrir –thank you



Reykjavík- the world's largest municipal geothermal heating service





Benefits of district heating

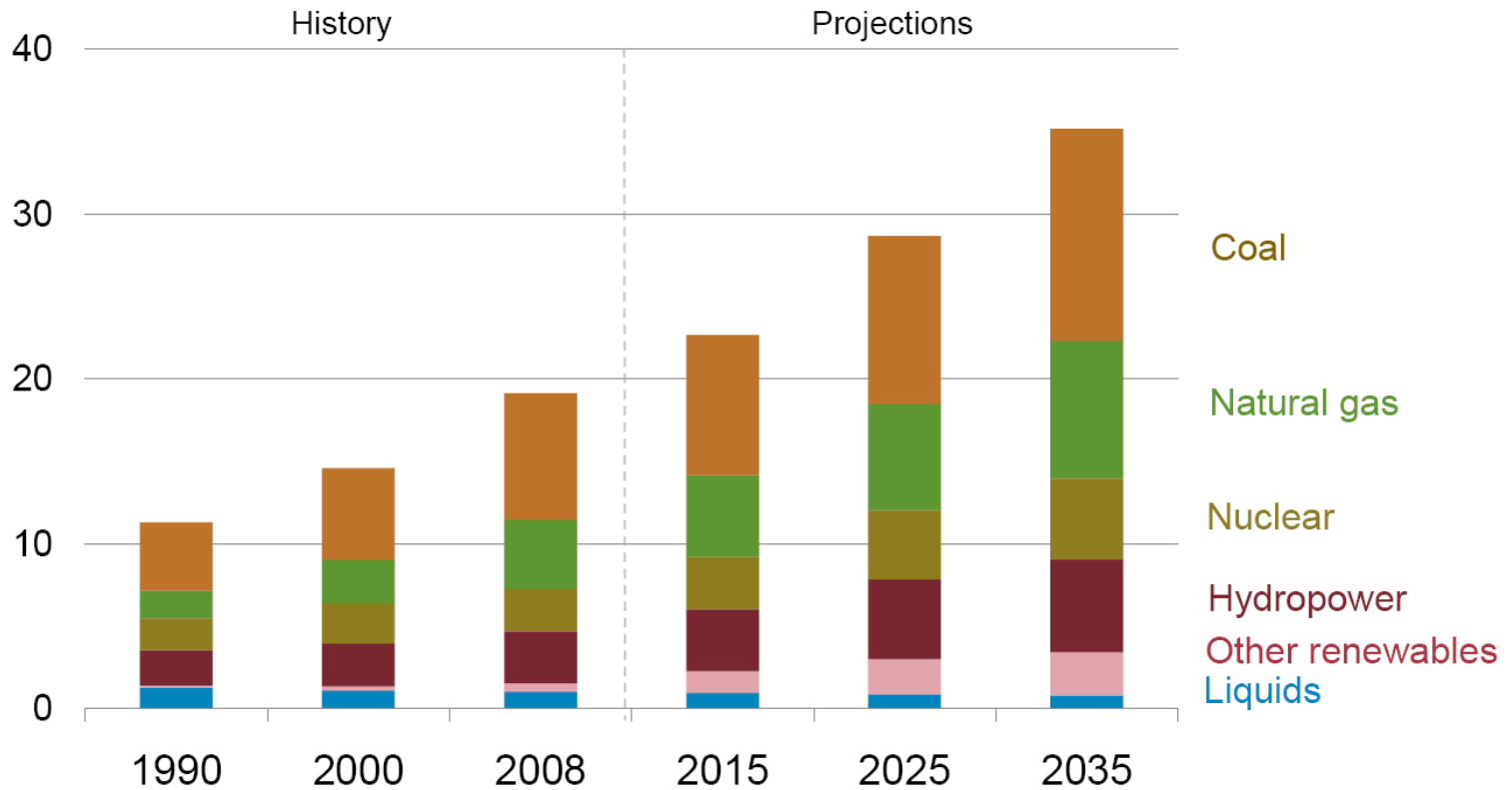
Heated garden conservatory



Estimated world electricity production to 2035

Renewables and natural gas are fastest growing, but coal still fuels the largest share of the world's electricity in 2035

world electricity generation by fuel
trillion kilowatthours



Source: EIA, International Energy Outlook 2011



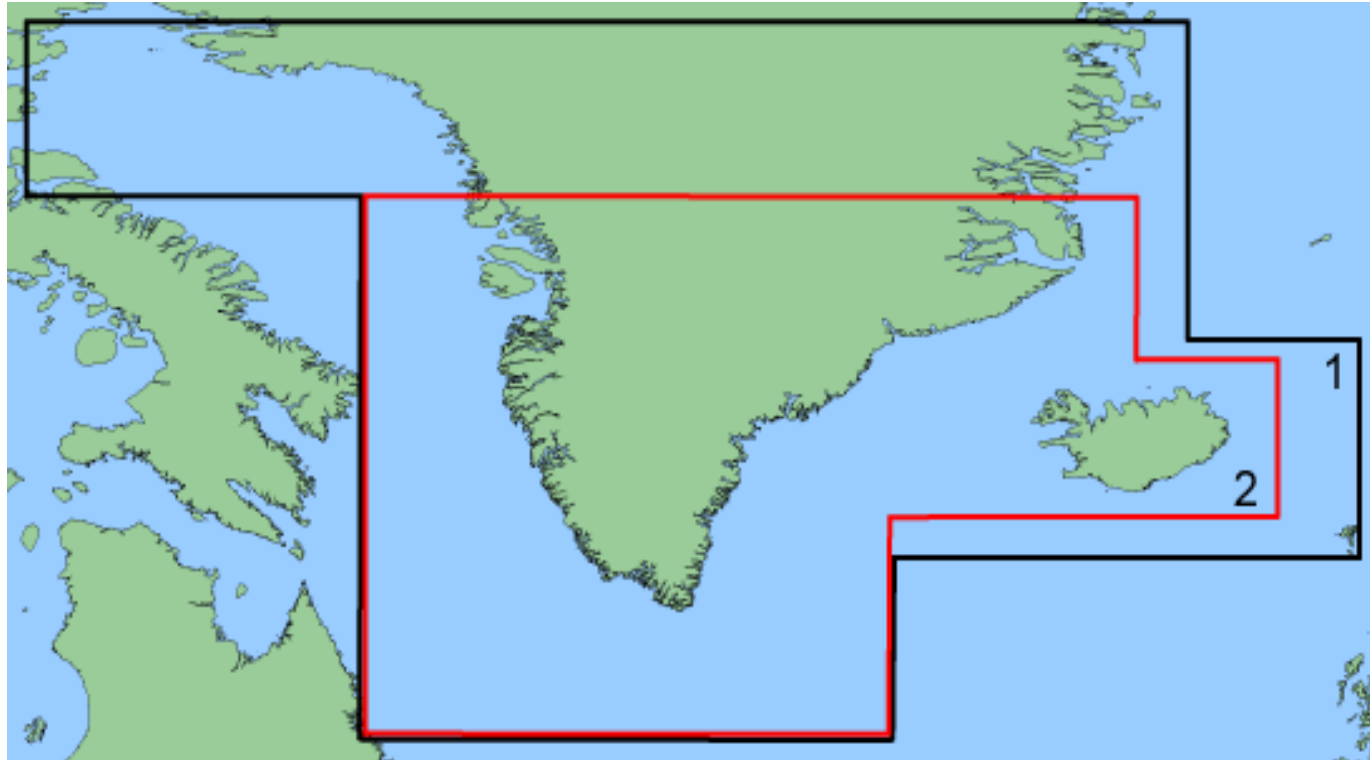
Conclusion

- Geothermal and hydro are an important part of the energy solution of the future
- We must join forces and bring together all stakeholders
- We must increase awareness of the benefits geothermal brings not only energy but also economic livelihood
- We must address the inherent risk associated with geothermal exploration and help countries overcome it
- We must assist States in addressing issues of resource management and utilization and fair payment to the people for these resources

All stationary energy is renewable

- **85% of primary energy is renewable**
 - Geothermal contributes 66% of primary energy (155 PJ)
 - Highest ratio in OECD - and probably in the world
- **Oil still needed for 14% of the primary energy demand**
 - About half to operate the fishing fleet
 - The other half mainly for motor vehicles
- **Electricity generation amounted to 17.1 TWh**
 - Hydro power plants 74%
 - Geothermal power plants 26%
 - 77% to the power intensive industry
- **99% of all space heating from renewables**
- **100% of all electricity from renewables**

Energy capability in the Arctic Region



- Iceland energy potential is estimated at 4-7 GW
- Greenland energy potential is estimated at >250 GW
- Identified sites in Greenland are at 60-120 GW

Power plants with open-door policy

