

KÁRAHNJÚKAR HEP

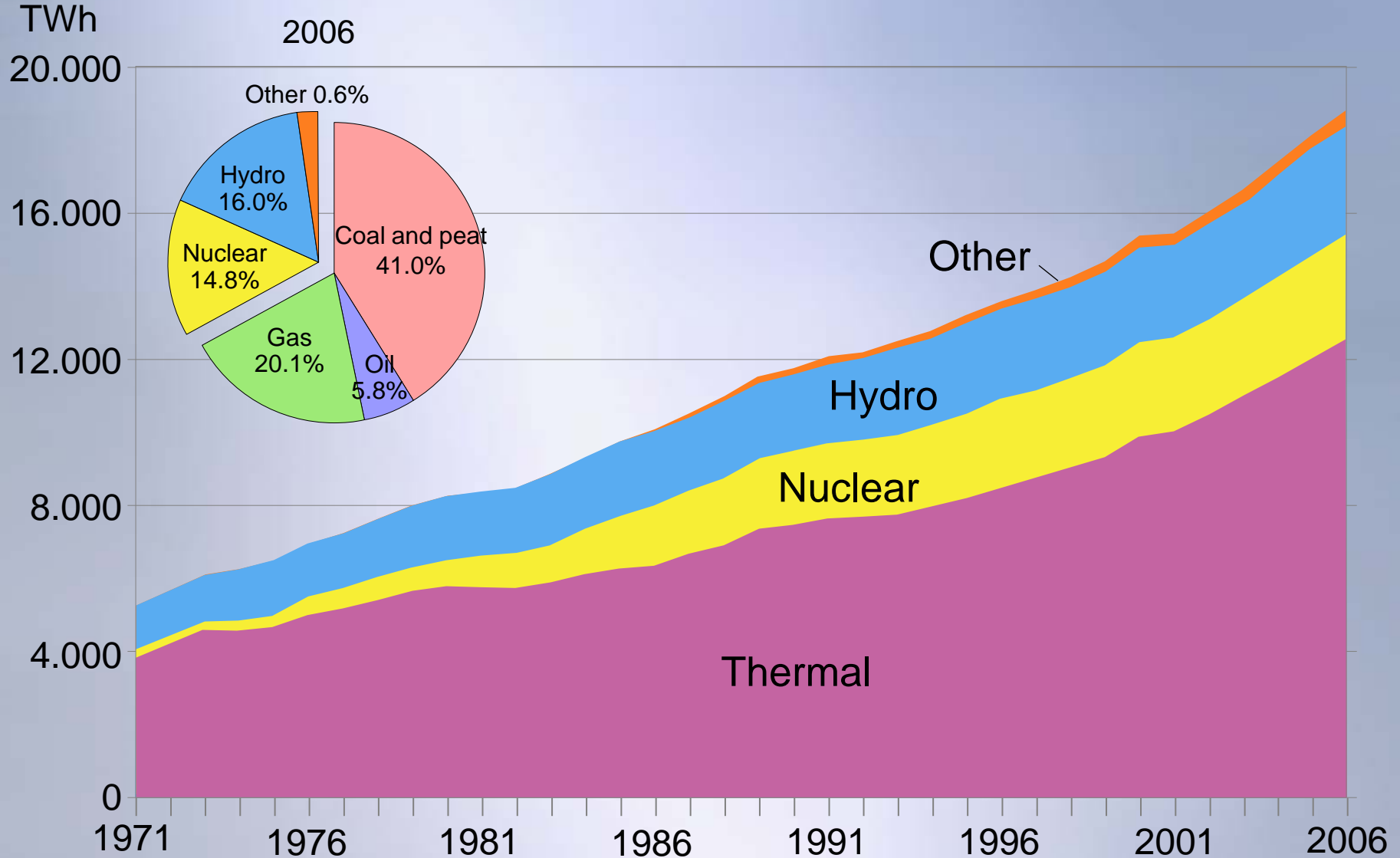
WEC Executive Assembly 2009

September 2009 in Reykjavík, Iceland

Bjarni Bjarnason

CEO of Landsvirkjun Power
Member of the Board of IHA

World electricity generation by fuel 1971 to 2006



Iceland – Geological Setting



Possible Submarine Cable Routes



Electricity Production by Sources 1983-2010

GWh/a

18.000

16.000

14.000

12.000

10.000

8000

6000

4000

2000

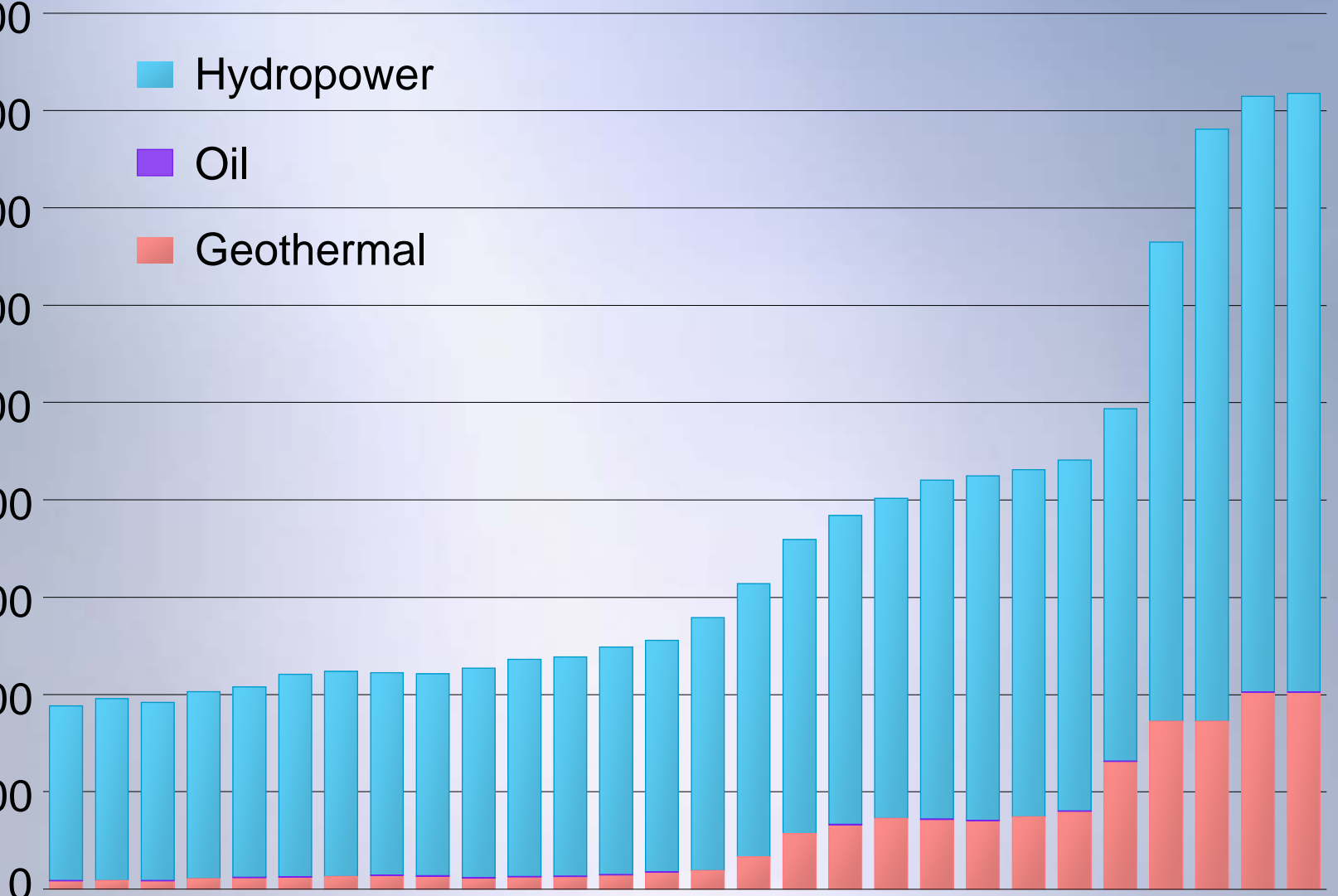
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Hydropower

Oil

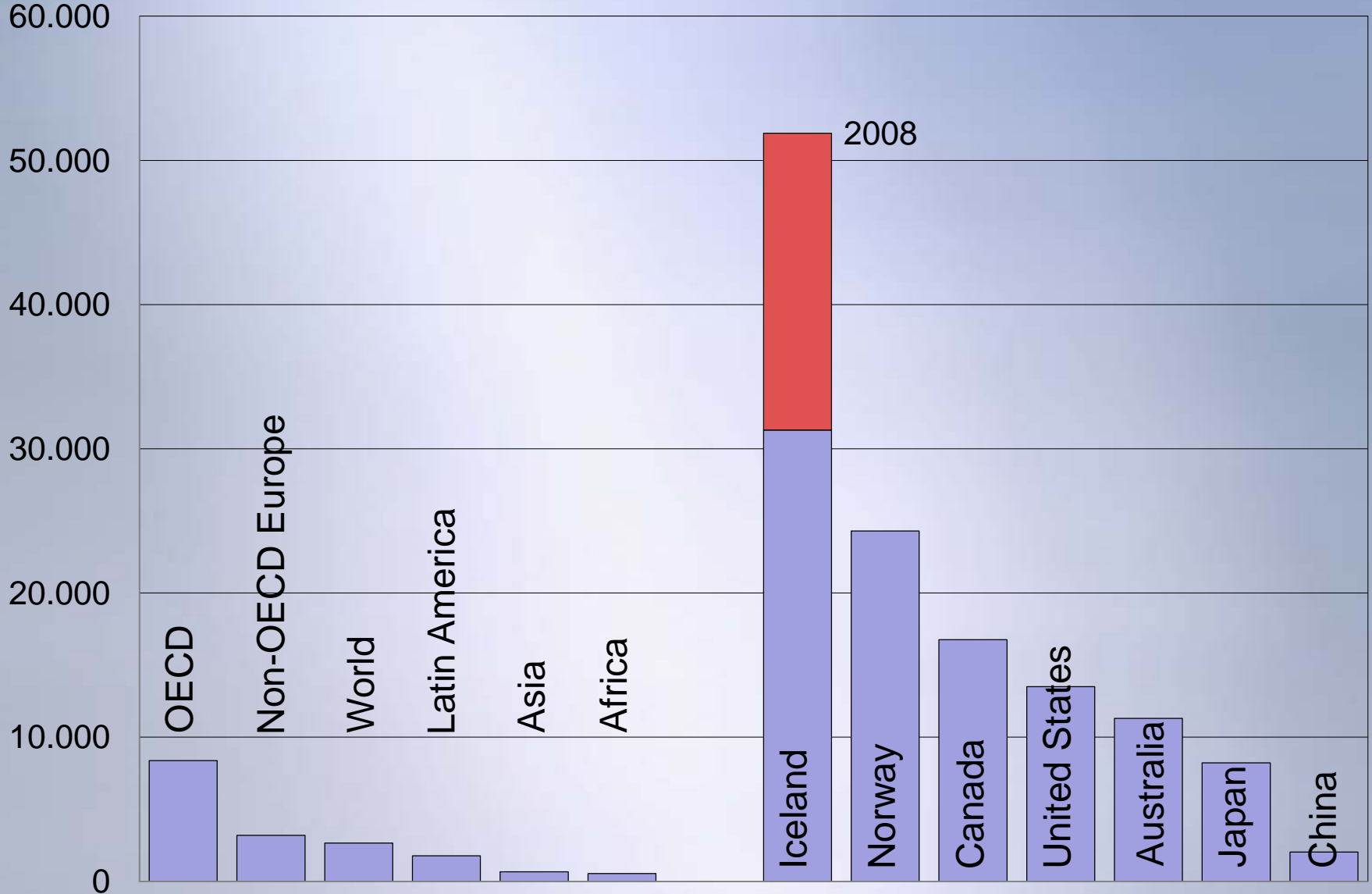
Geothermal

'83 '84 '86 '88 '90 '92 '94 '96 '98 '00 '02 '04 '06 '08 '10



Electricity Consumption per Capita 2006

kWh/a

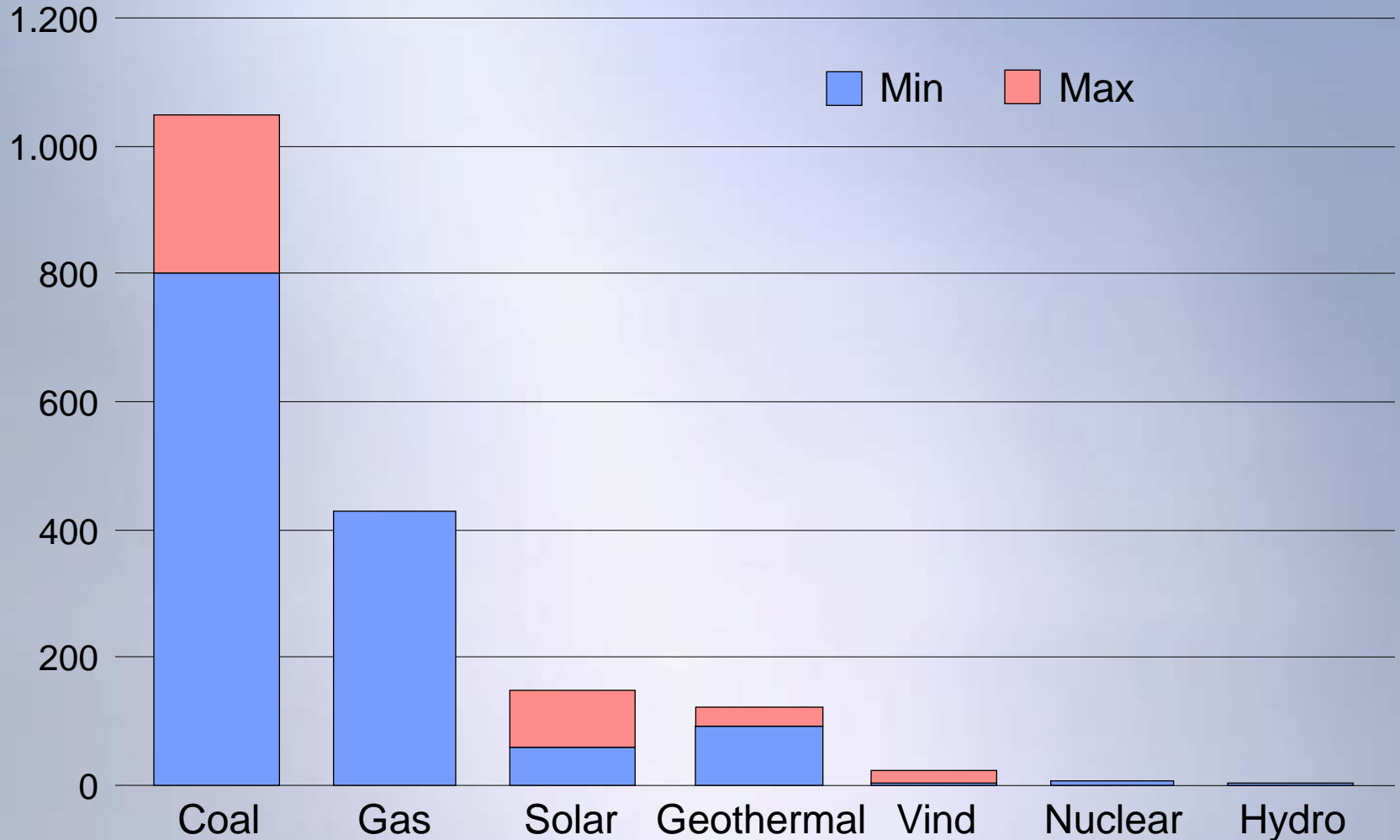


CO₂ Emissions for Different Power Sources

Life cycle analysis

gCO₂/kWh

Min Max



Total CO₂ emissions in aluminium production, by energy source

kg CO₂ /kg Al

16

12

8

4

0

Energy production
Smelting

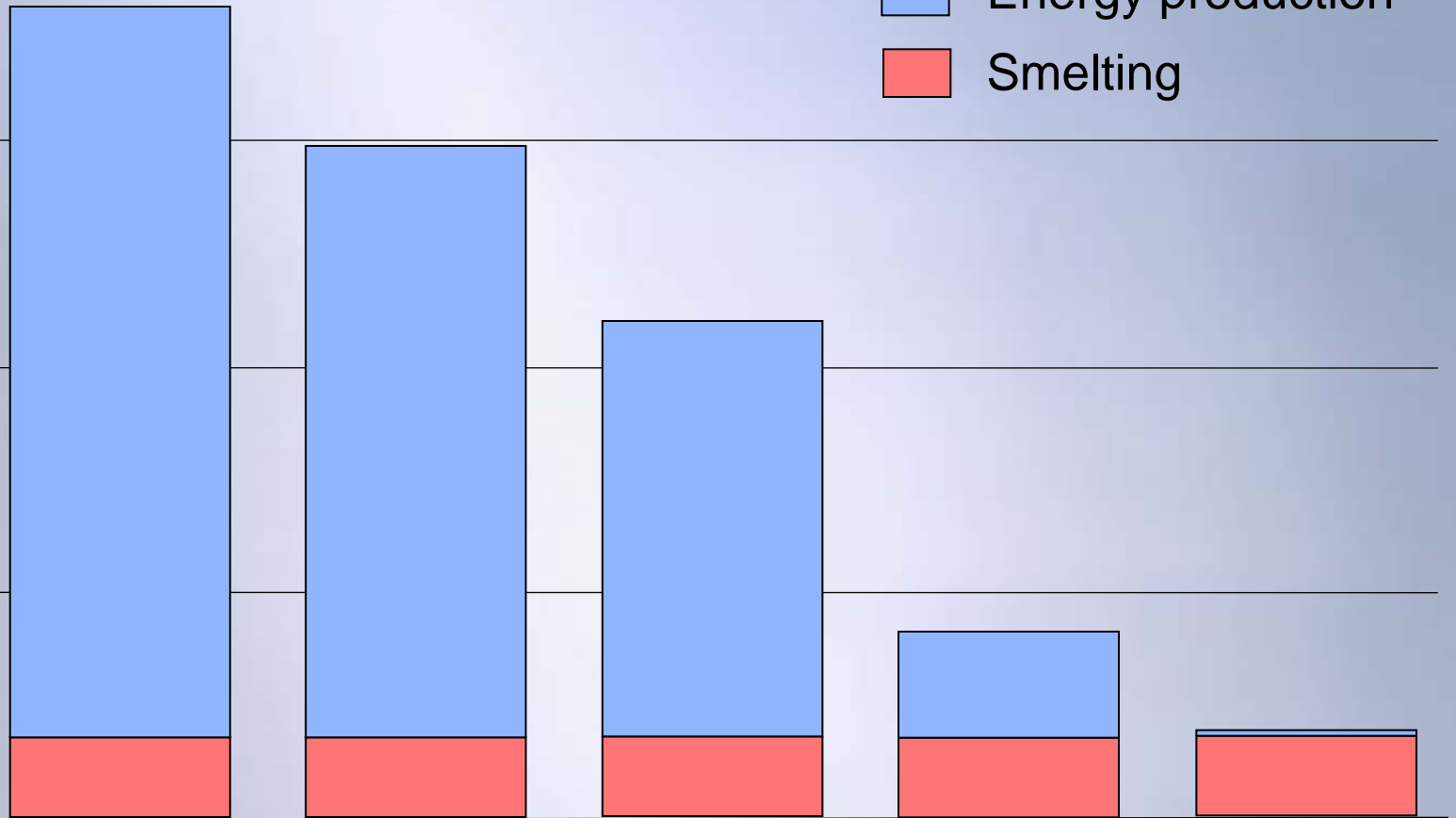
Coal

Oil

Natural gas

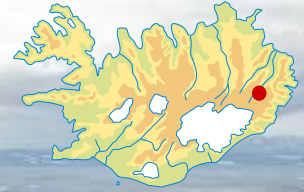
Geothermal

Hydro



Kárahnjúkar Hydropower Project

690 MW, Built 2003-2009



Installed capacity	690 MW
Energy production	5.0 TWh/a
Gross head	600 m
Height of Kárahnjúkar dam	200 m
Tunnels	73 km
Construction time	2003-2009

Kárahnjúkar Hydroelectric Project





Kárahnjúkar HEP 690 MW

 Landsvirkjun
POWER

Krafla
60 MW

132 kV

Bjarnarflag
3 MW

Mývatn

Jökulsá á Fjöllum

Krepa

Jökulsá á Dal

Lagerfljót

Kröflulína 2
132 kV

Egilsstaðir

Alcoa
Fjarðaál

Reyðarfjörður

FL 3&4
2x220 kV

132 kV

Kára-
hnjúkar

Headrace
tunnel

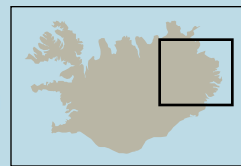
Fliotsdalsstöð
Powerhouse

Hálslón
reservoir

Ufsalón
reservoir

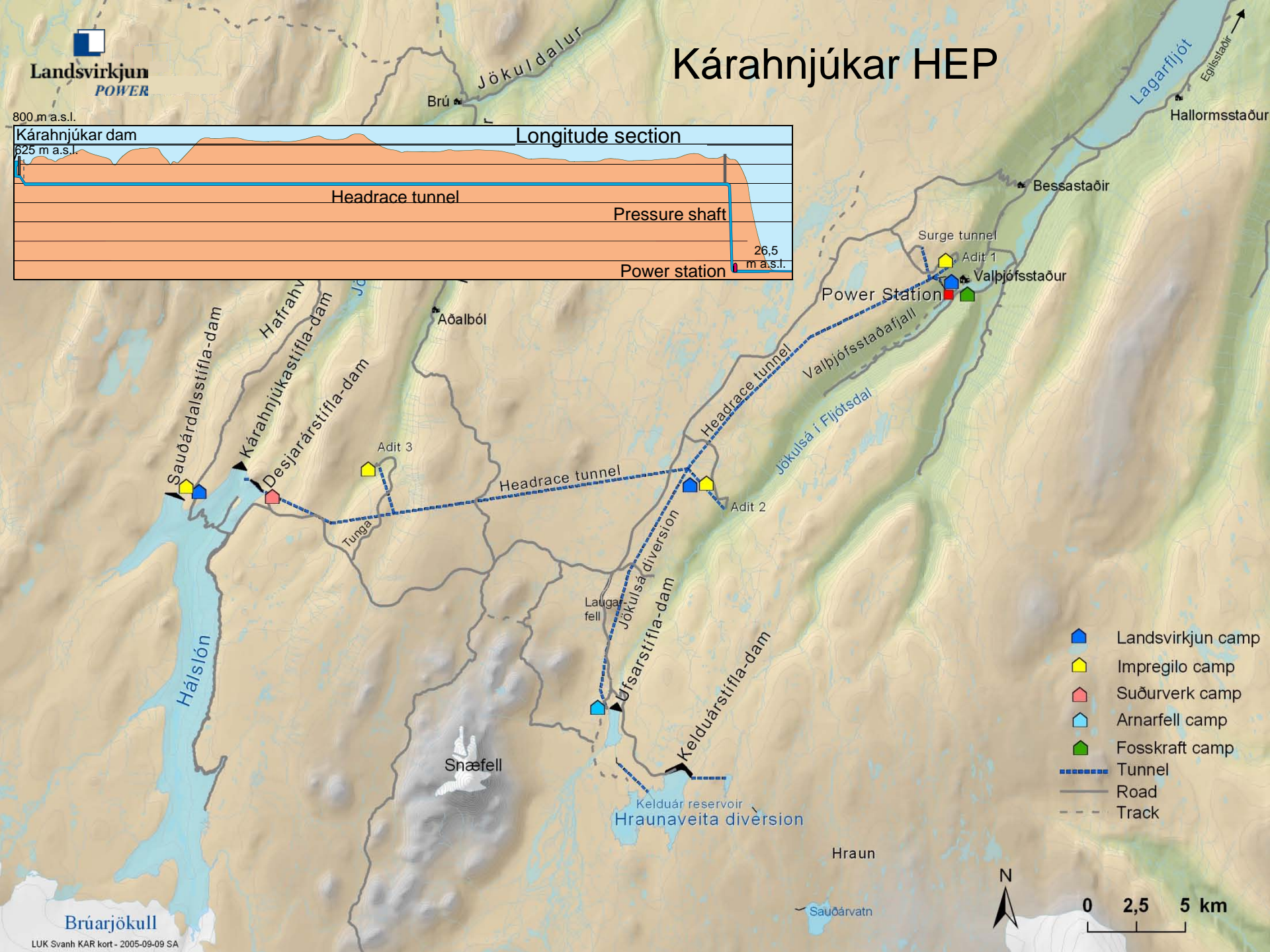
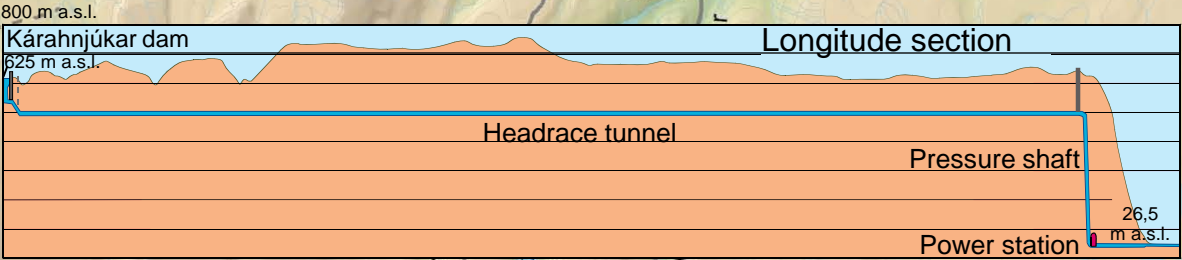
Kelduárlón
reservoir

Jökulsá í Fjötsdal



VATNAJÖKULL GLACIER

Kárahnjúkar HEP

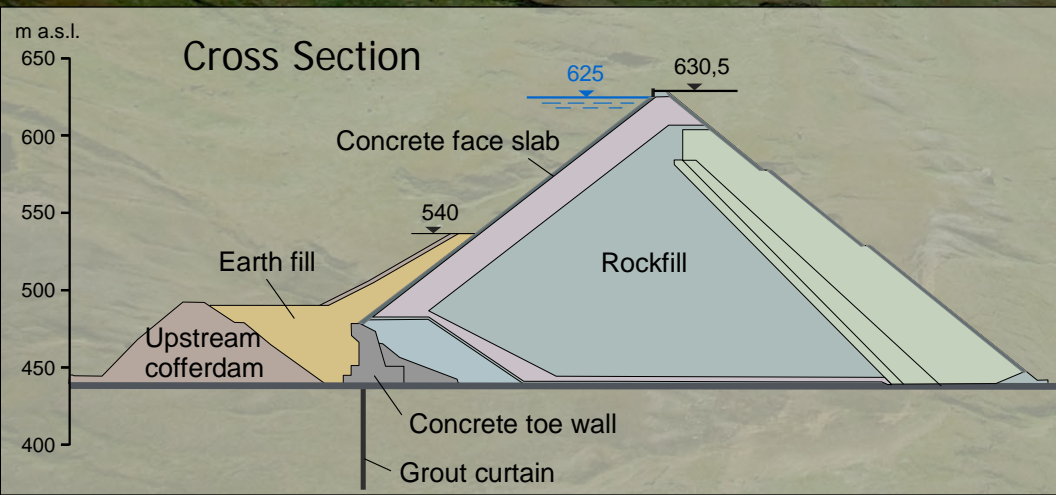


- Landsvirkjun camp
- Impregilo camp
- Suðurverk camp
- Arnarfell camp
- Fosskraft camp
- Tunnel
- Road
- Track



Hálslón Reservoir
57 km² when full

Kárahnjúkar Dam



Kárahnjúkar Dam CFRD



June 2, 2006





Melting Ice and snow with hot water



Winter day at the dam



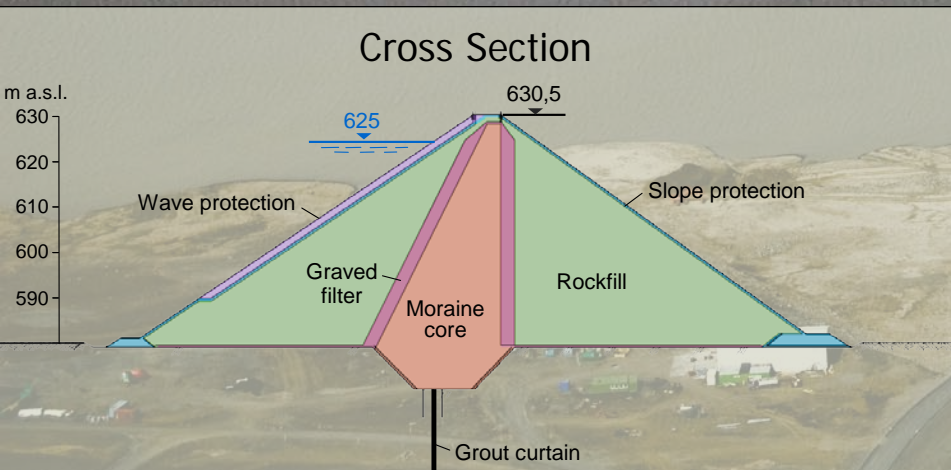
December 2006

Kárahnjúkar dam



July 2006

Desjará Dam

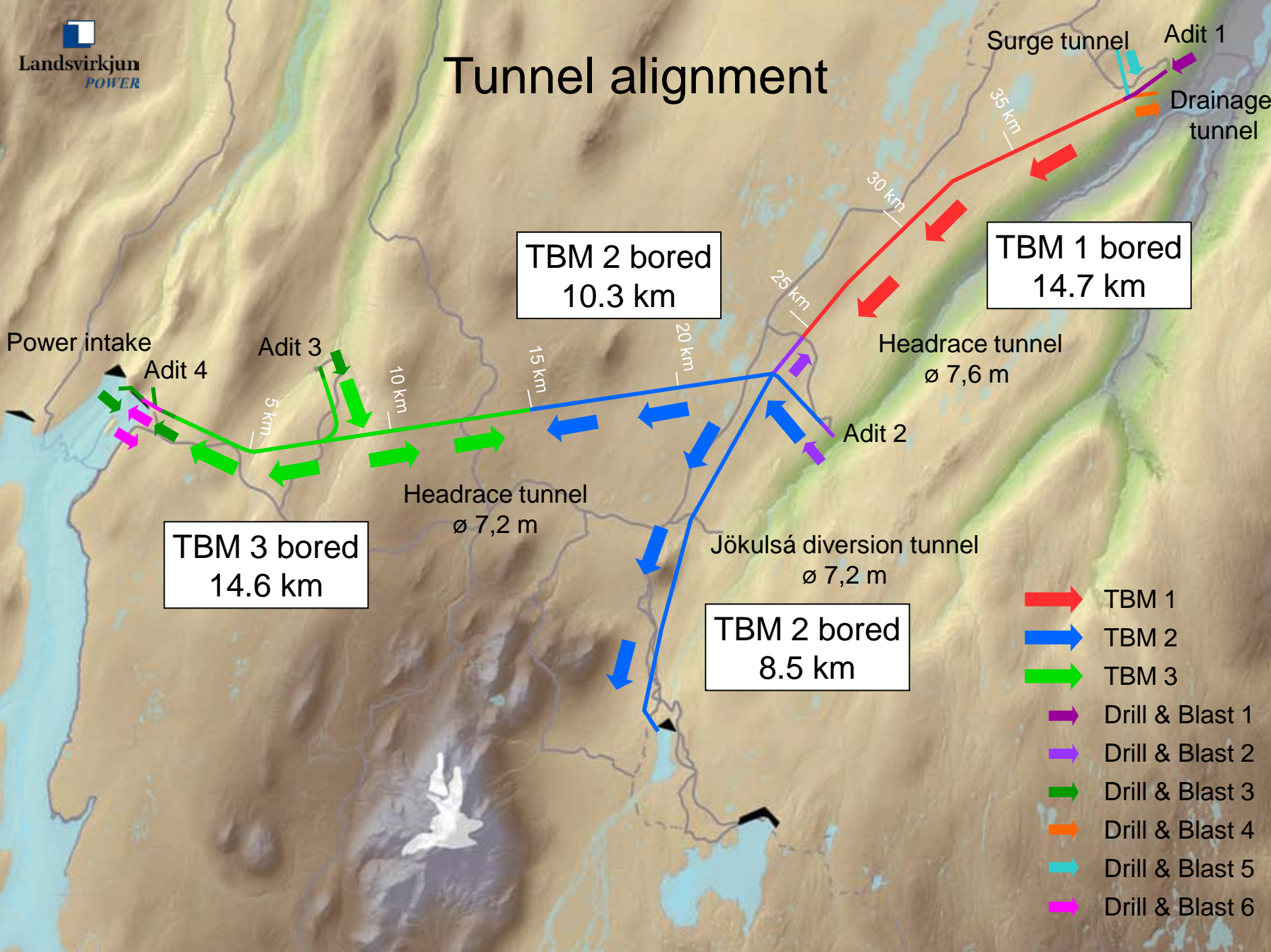


July 20, 2008

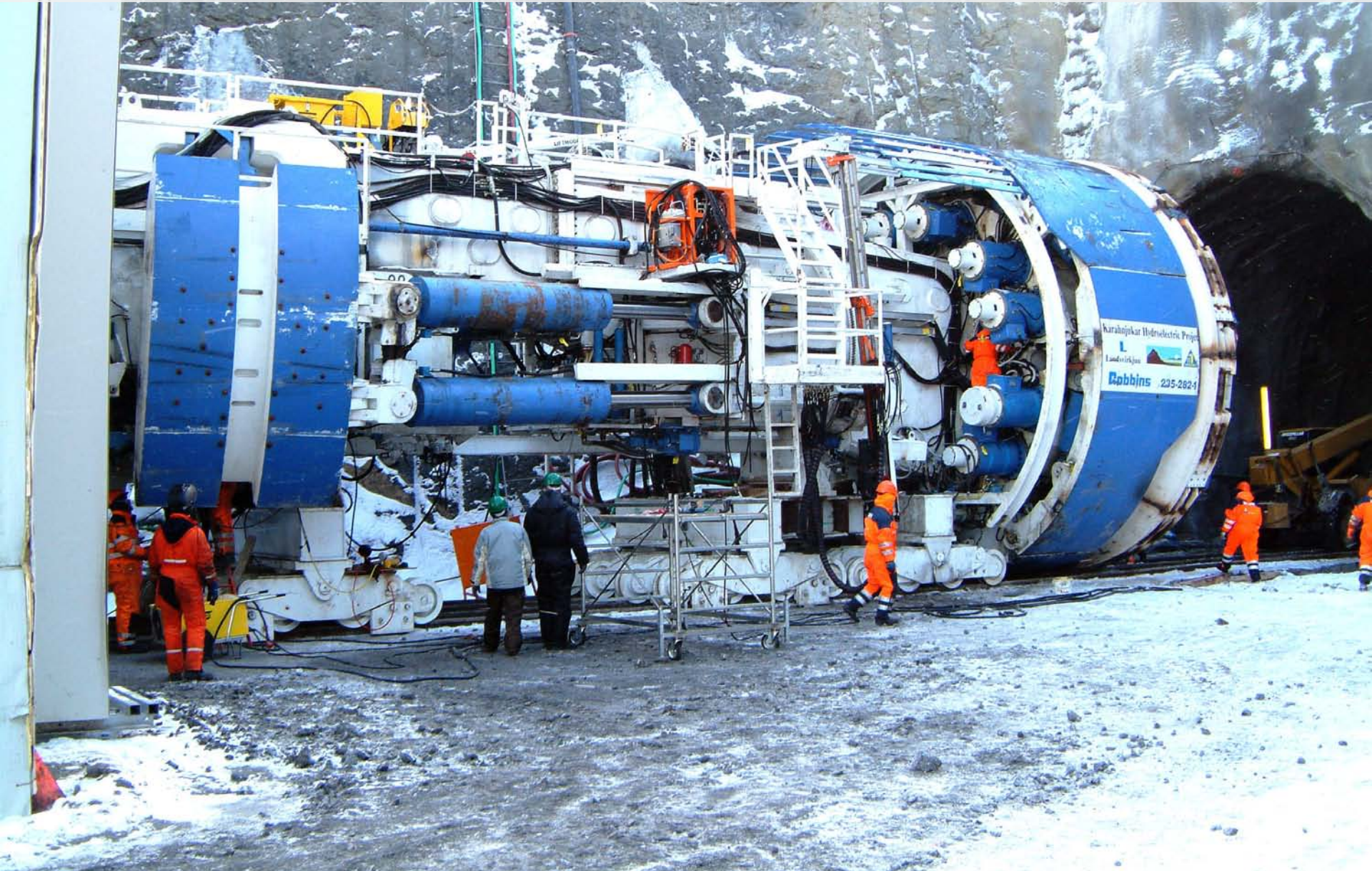
Kárahnjúkar Dam



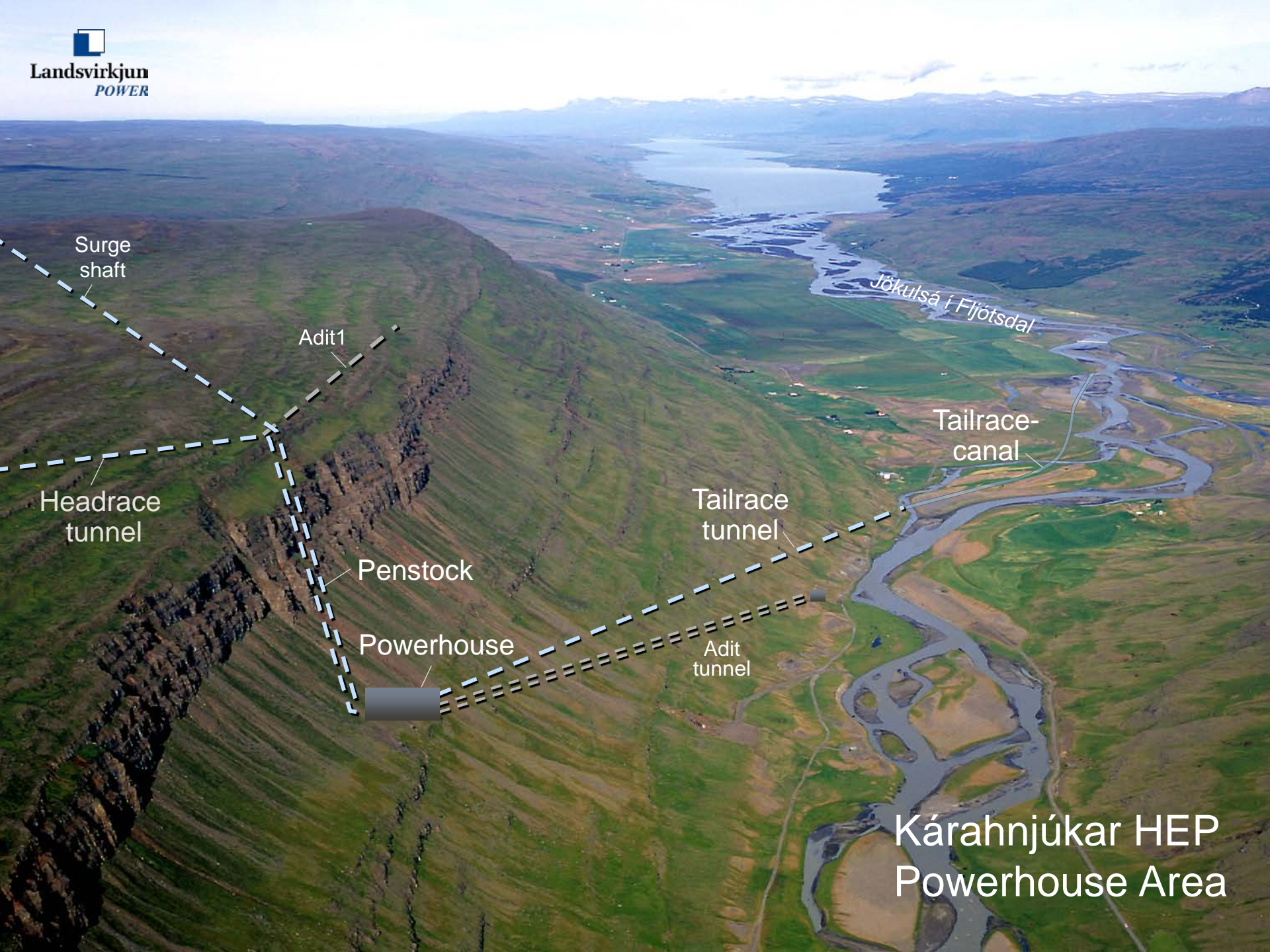
Tunnel alignment



TBM machine, dia 7.2-7.6 m







Surge shaft

Adit1

Headrace tunnel

Penstock

Powerhouse

Tailrace tunnel

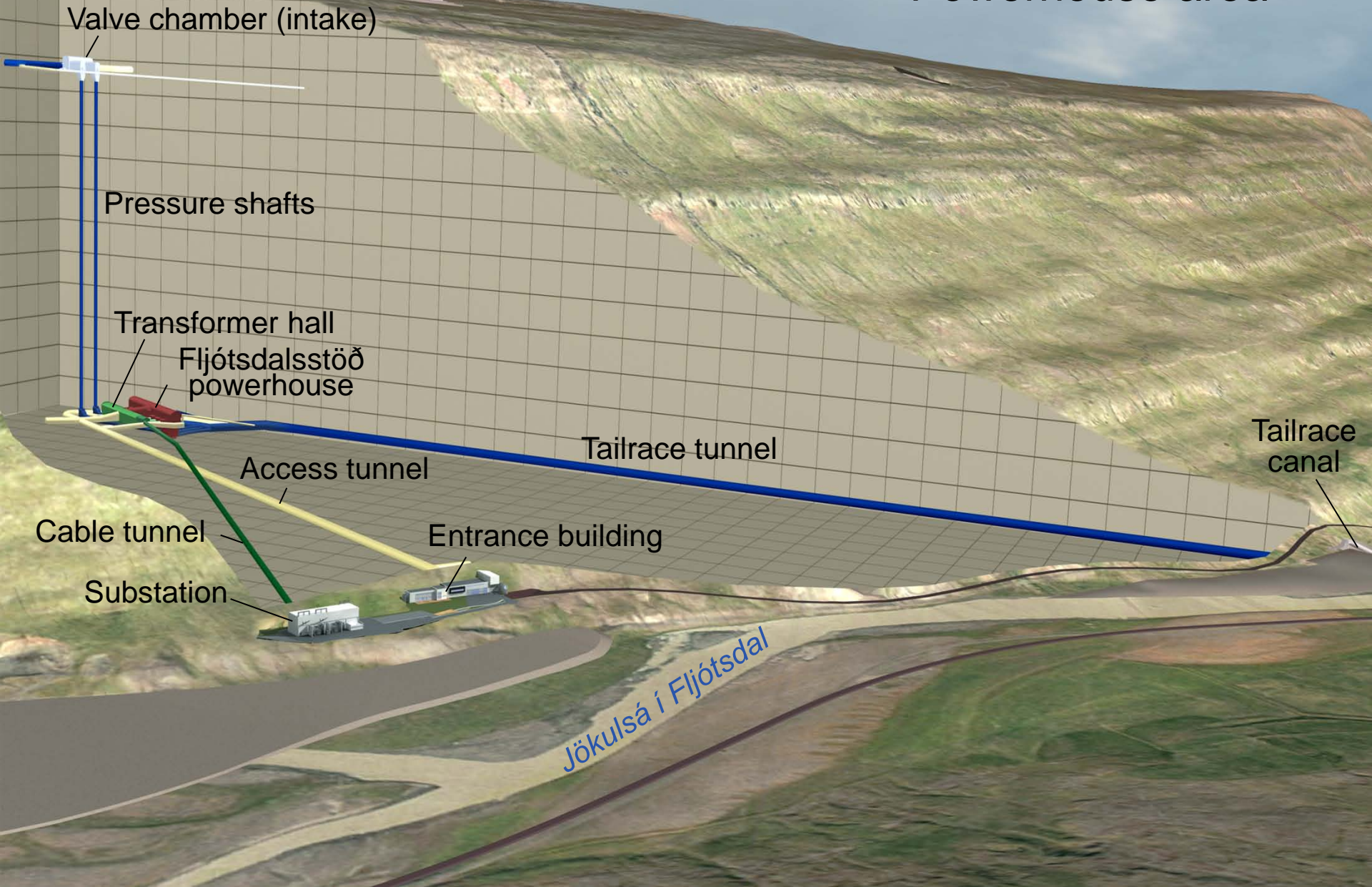
Adit tunnel

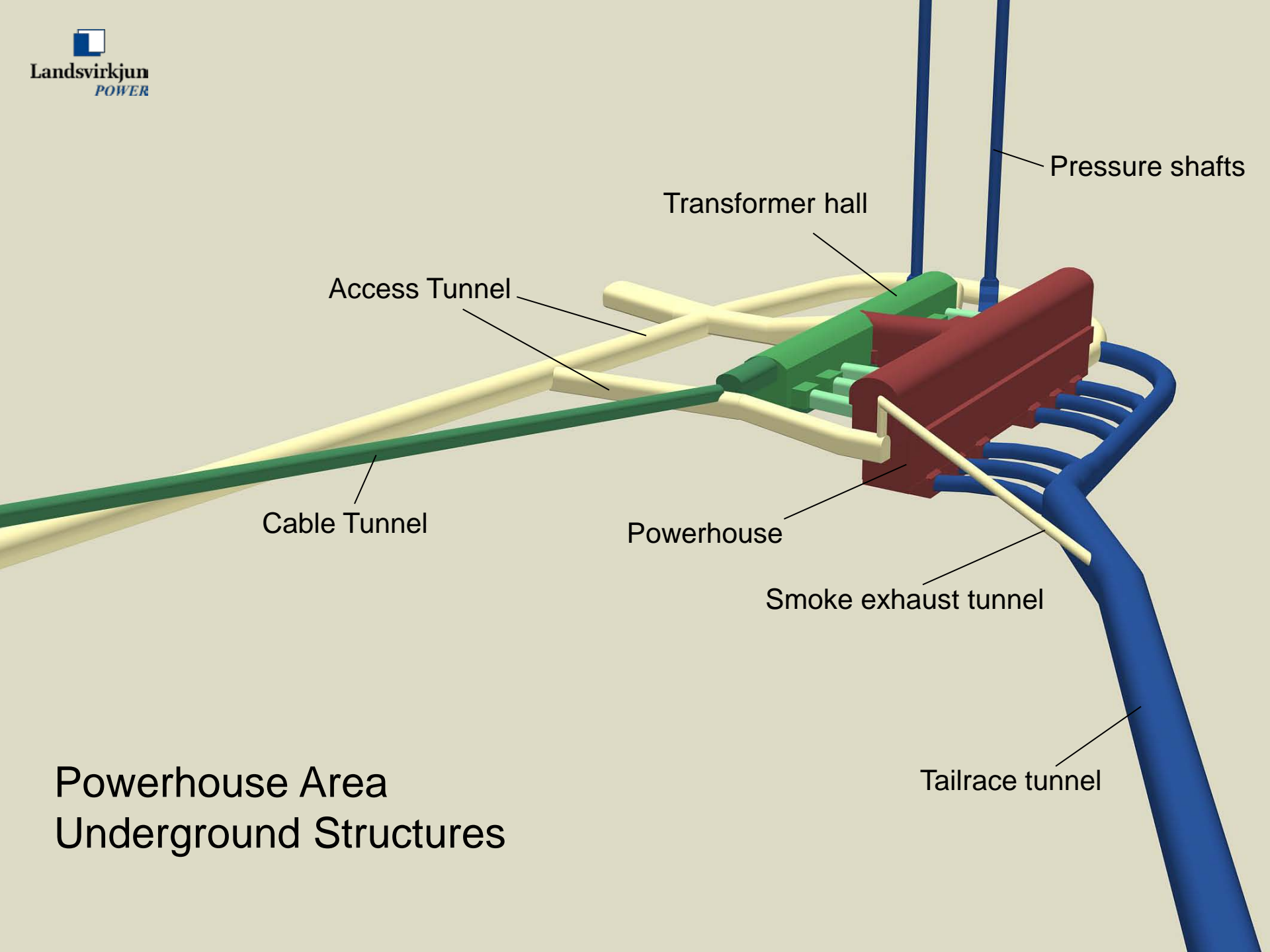
Jökulsá í Fljótsdal

Tailrace canal

Kárahnjúkar HEP
Powerhouse Area

Kárahnjúkar HEP Powerhouse area





Pressure shafts

Transformer hall

Access Tunnel

Cable Tunnel

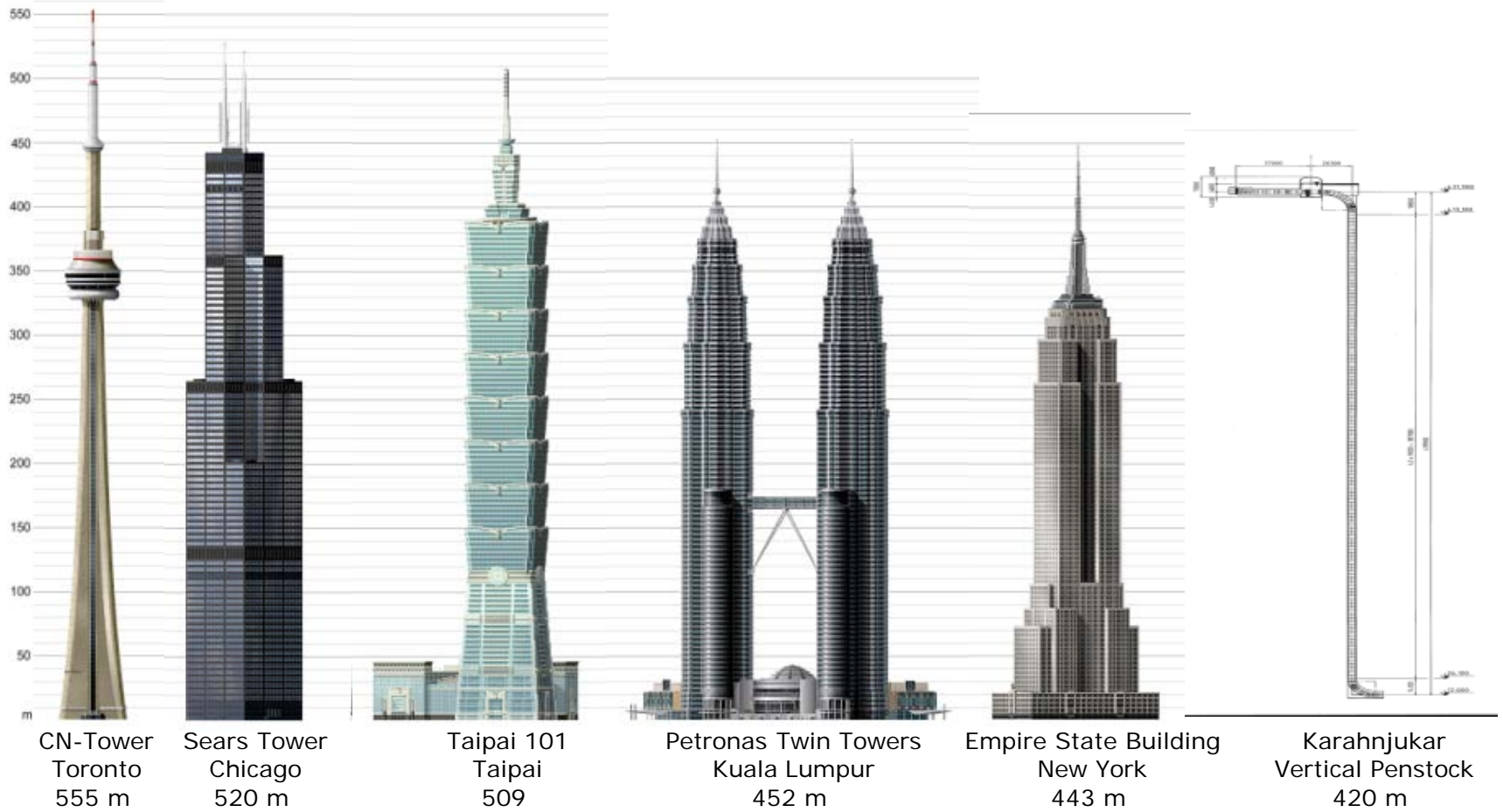
Powerhouse

Smoke exhaust tunnel

Tailrace tunnel

Powerhouse Area Underground Structures

Kárahnjúkar Penstock in Comparison with the Highest Skyscrapers





Switchgear
house



Service
building



Access
tunnel

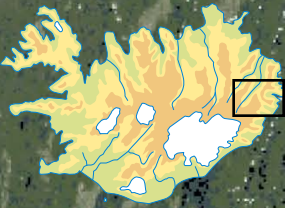
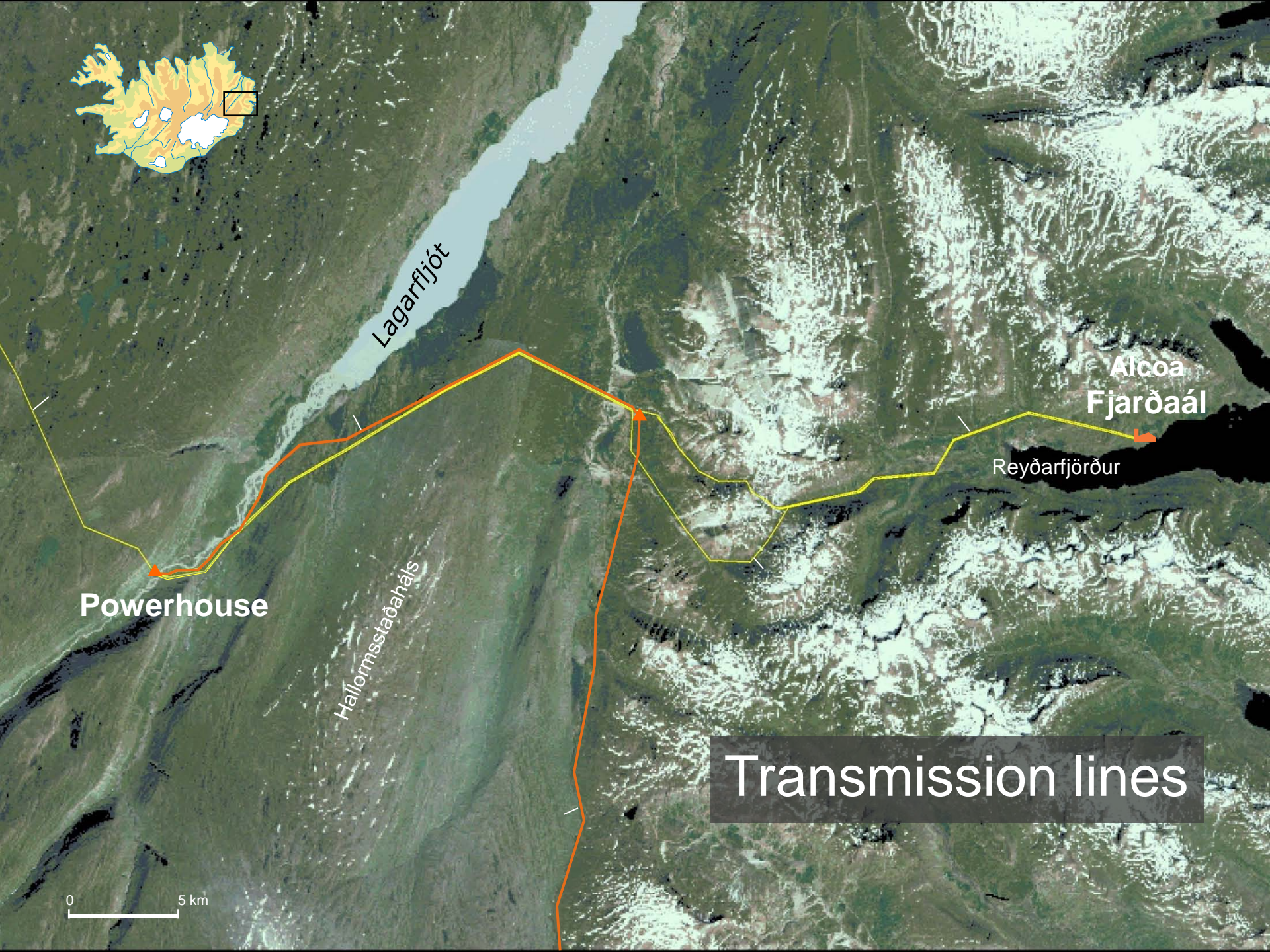


Kárahnjúkar Hydroelectric Project
Powerhouse Area



Control and staff building at access tunnel
to Powerhouse in Fljótsdalur, 10.09.2009





Lagarfjót

Alcoa
Fjarðaál

Reyðarfjörður

Powerhouse

Hallormsstaðaháls

Transmission lines

0 5 km



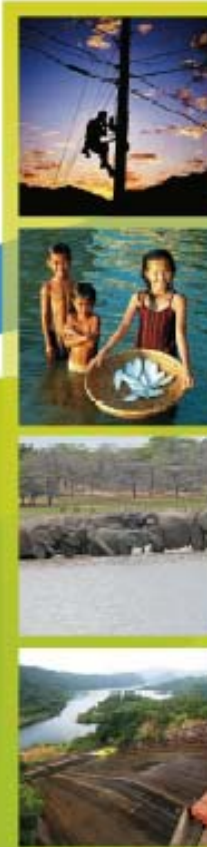
Avalanche Towers

Alcoa - Fjarðaál 346,000 tpa



Project summary

- Generates 5 TWh of electricity per annum
- Avoids some 5 million tons of CO₂ per annum compared to coal fired generation
- Similar to total CO₂ emissions of Iceland
- Produces 340,000 tpa of aluminum
- It is not the size that matters – but the quality !



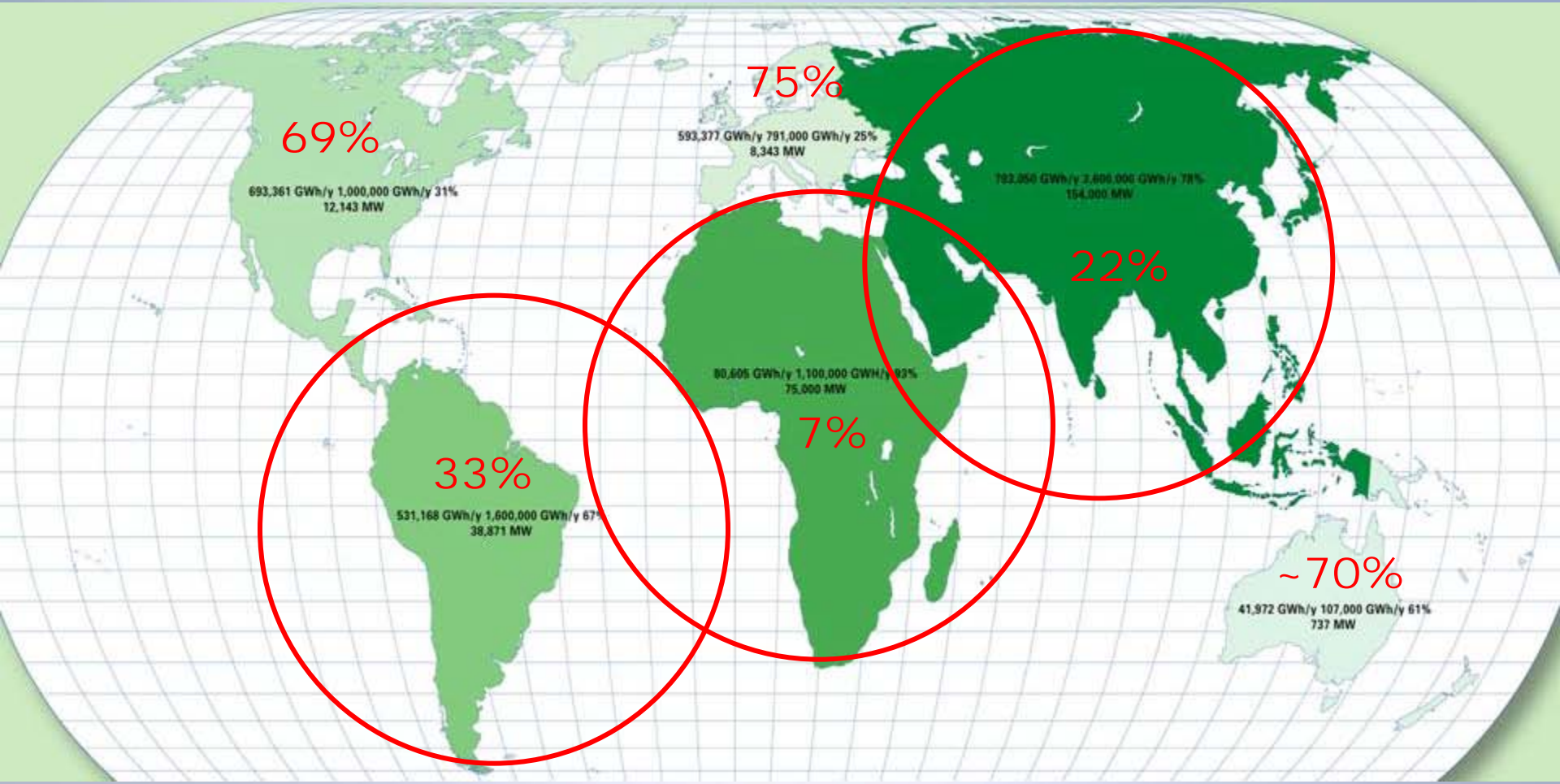
Draft
Hydropower Sustainability
Assessment Protocol

August 2009

Section I:
Strategic Assessments



Global hydro production: ~ 2900TWh/y in 2006
Realistic potential production: ~ 8600 TWh/y



Only about 1/3 of the potential has been developed

Thank you for your attention

