Iceland Liechtenstein Norway grants

Norwegian best practices in heat pump applications

Work in progress

Usman Dar, Sweco Norway
18.09.2017

Contents

- Background
- Role of geothermal in future
- Status of DH and geothermal
- Heat pump applications
- A Norwegian case studies

Background

- Paris agreement
  - global temp well below 2 °C
- Heat roadmap Europe 2050
  - Quantified advantages of DH and its resource mix
  - Heating and cooling – largely overseen
  - Expanding DH from around 12% to 50% of heat demand
  - Reduction of primary energi
  - Reduction of CO2 emission
  - Enabling more renewable and waste heat
  - More jobs

Role of geotermal heat

Iceland Liechtenstein Norway grants

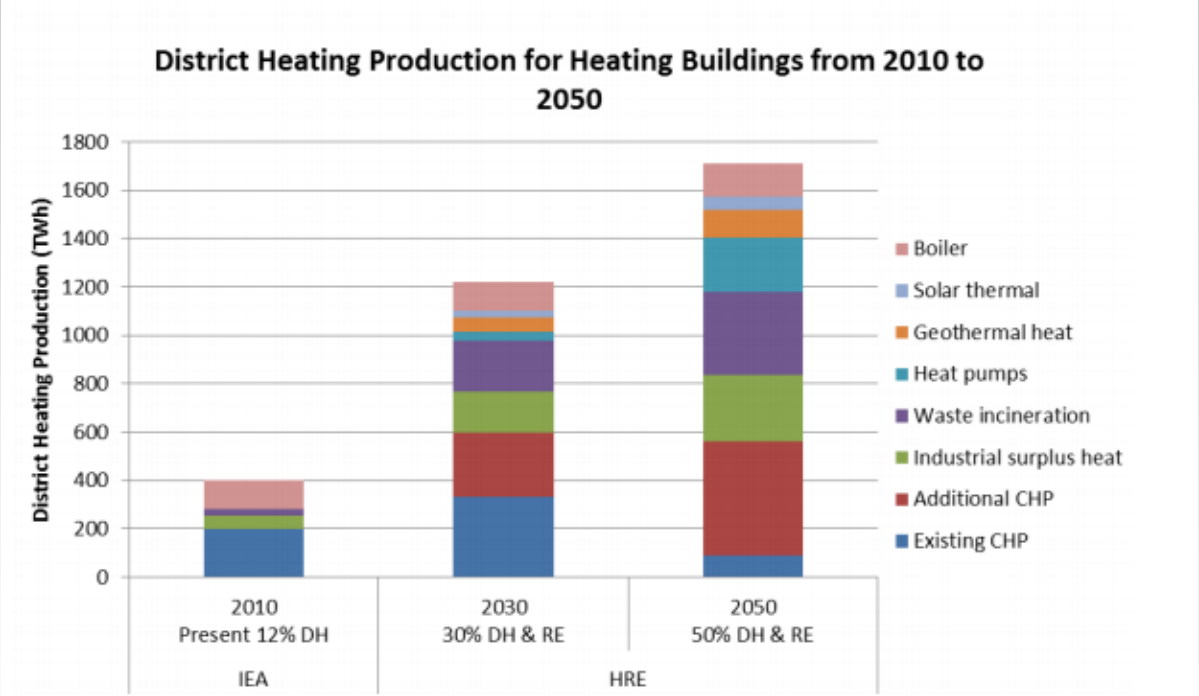
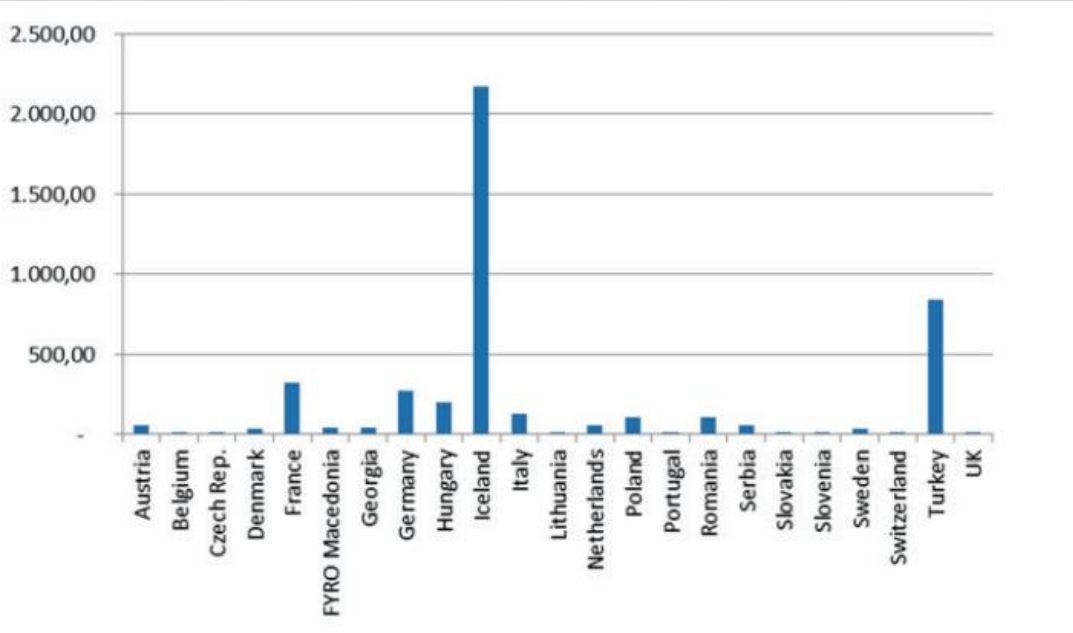


Figure 7: District heating production for the entire EU27 energy system in 2010, 2030, and 2050 under a business-as-usual scenario and if district heating and CHP were expanded to 30% in 2030 and 50% in 2050, in combination with the expansion of industrial waste heat, waste incineration, geothermal, and solar thermal heat for district heating.

Taken from Heat Roadmap Europe I 2012

Status today



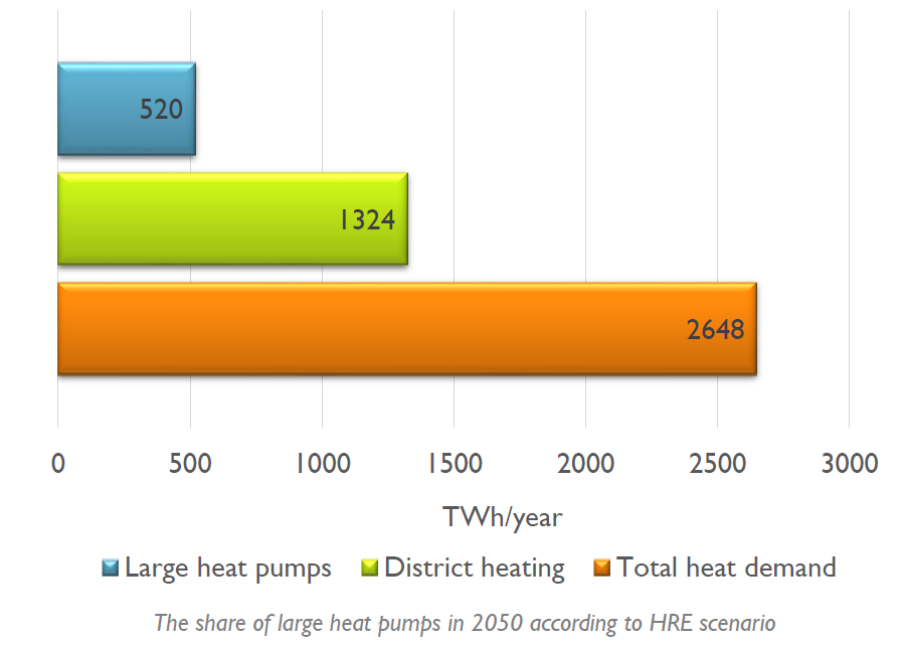
Installed capacity per country (MWth) -2014 Source EGEC

Taken from Heat Roadmap Europe I 2012

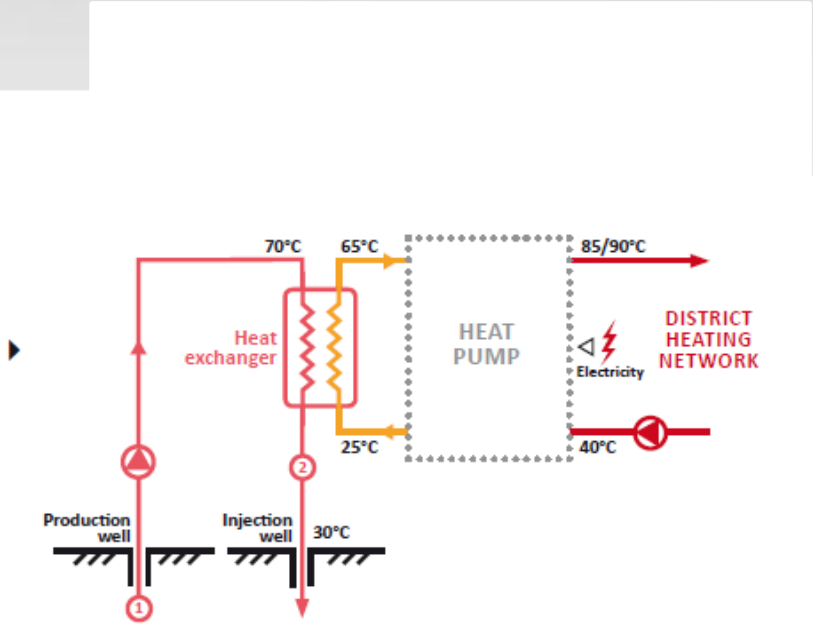
Real alternatives

Iceland Liechtenstein Norway grants

Role of large heat pumps



The share of large heat pumps in 2050 according to HRE scenario



Hentet fra ENEff 22 international trade fair and congress

Status of large heat pumps

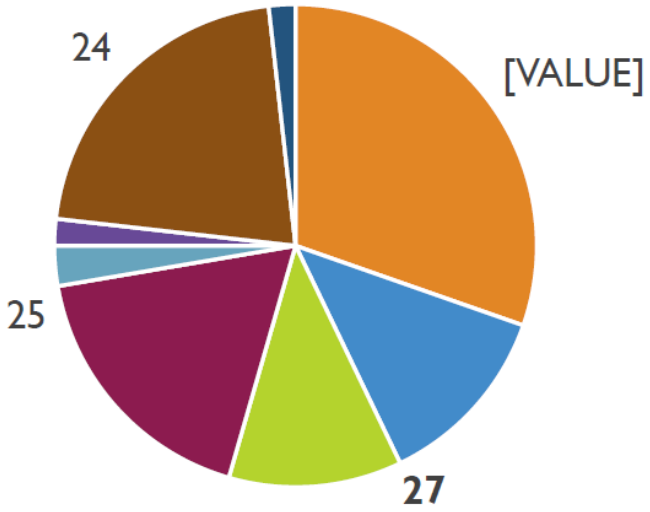
Iceland Liechtenstein Norway grants

Country	Power (MWth)	Heat plants	LHP units
Norway	84,5	8	15
Sweden	1022,3	13	43
Denmark	45	9	11
Finland	154,6	4	9
Italy	36,6	5	9
Switzerland	35,4	9	13

Country	Power (MWth)	Heat plants	LHP units
Austria	10,1	2	3
Lithuania	15	1	1
Slovakia	1,8	1	1
Czech Republic	6,4	1	1
Poland	3,7	1	2
France	5,5	2	3
Netherlands	1,2	1	1

Hentet fra ENEff 22 international trade fair and congress

Heat sources



- Sewage water
- Industrial waste heat
- Flue gas
- Sea water
- Lake water
- River water
- Geo-thermal
- Heat storage

#1 – Sewage water

#2 – Waste heat (including flue gas)

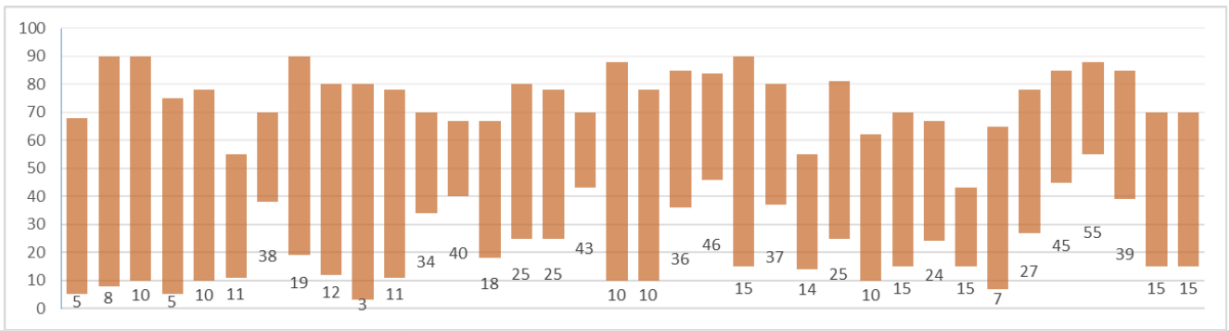
#3 – Sea, lake, river

#4 – Geo-thermal

2-9°C	10-20°C	11-40°C	14-46°C	10-40°C	15-74°C
Sea water	Sewage water	Flue gas	Waste heat (diverse industrial processes)	Heat storage (solar)	Geothermal (ground source)
Lake water					
River water					

Hentet fra ENEff 22 international trade fair and congress

Operating temperatures



DH t°C	41-50	51-60	61-70	71-80	81-90	91-100
# LHP units	1	2	22	36	35	1

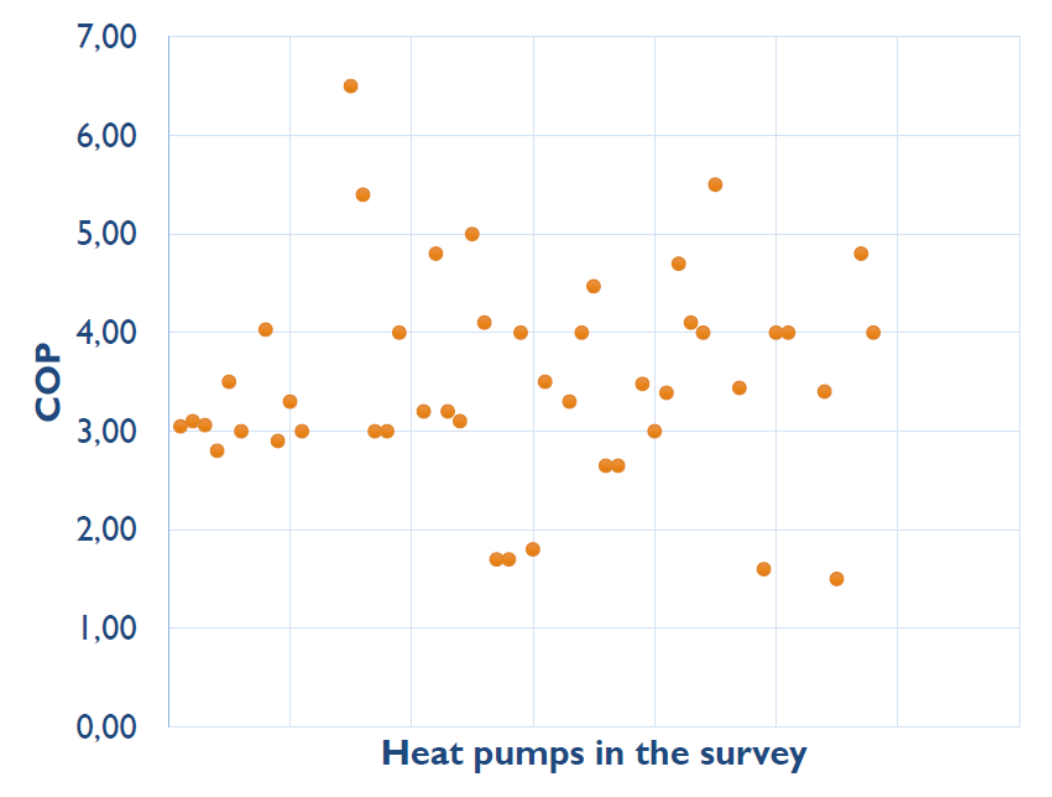
Application of heat pump in DH network

- < 70°C - as low temperature DH
- > 80°C with heat pump application: Drammen, Milan, Helsinki, Mantsala

Hentet fra ENEff 22 international trade fair and congress

COP for Heat pump

- Average COP = 3,74



Hentet fra ENEff 22 international trade fair and congress

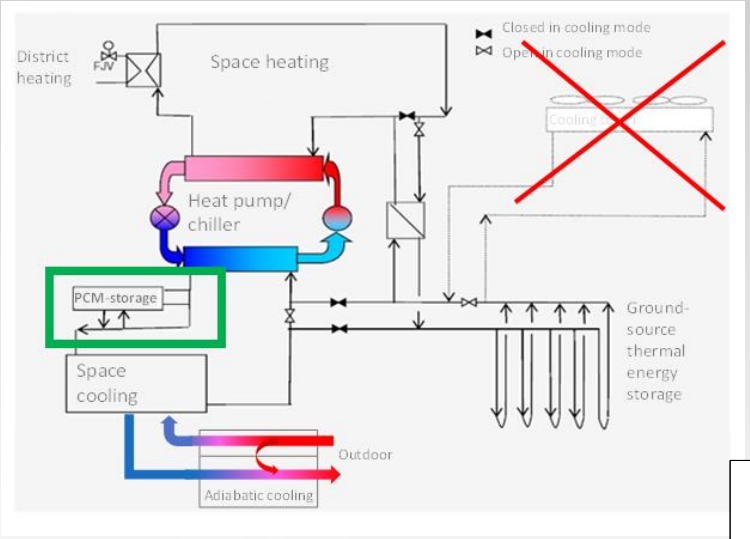
A case study(1)

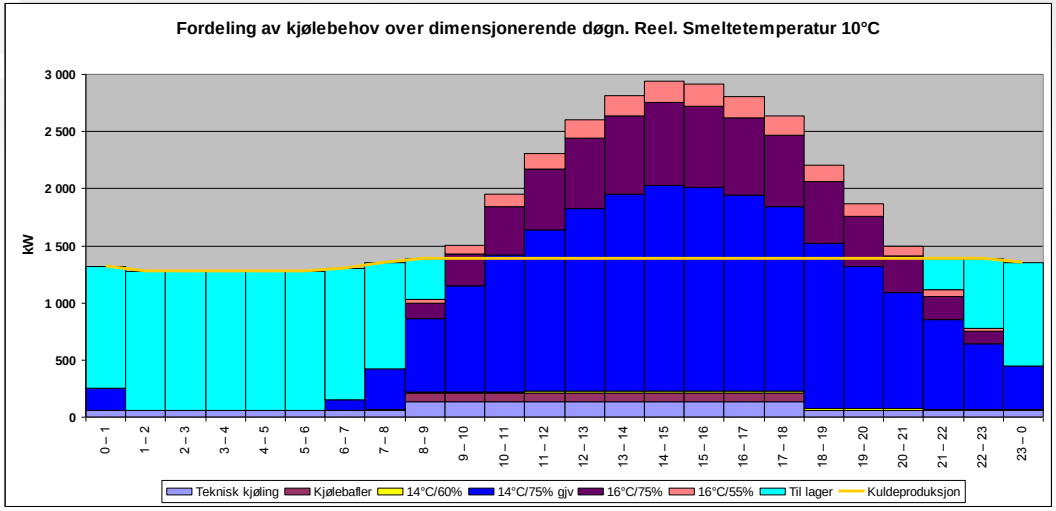
University college in Bergen
- Heated area 50 983 m²
- Design cooling effekt = 3 MW
- Cooling needs = 1 GWh
- Design heating effekt = 2,8 MW
- Heating needs = 2,6 GWh
- Low temperature distribution < 60°C

- Boreholes 81 x 220 deep
- Storage with phase change material 250 m³

Hentet fra ENEff 22 international trade fair and congress

A case study(2)





Hentet fra ENEff 22 international trade fair and congress

Summary

- District heating is key player in reaching climate goals
- Geothermal energy is key contributor to district heating in future
- Heat pump application in district heating increasing
- Geothermal heat pump applications dependent on temperatures
- Increasing trend for heat pump application in Norway
- Work in progress

Iceland
Liechtenstein
Norway grants

Thank you!