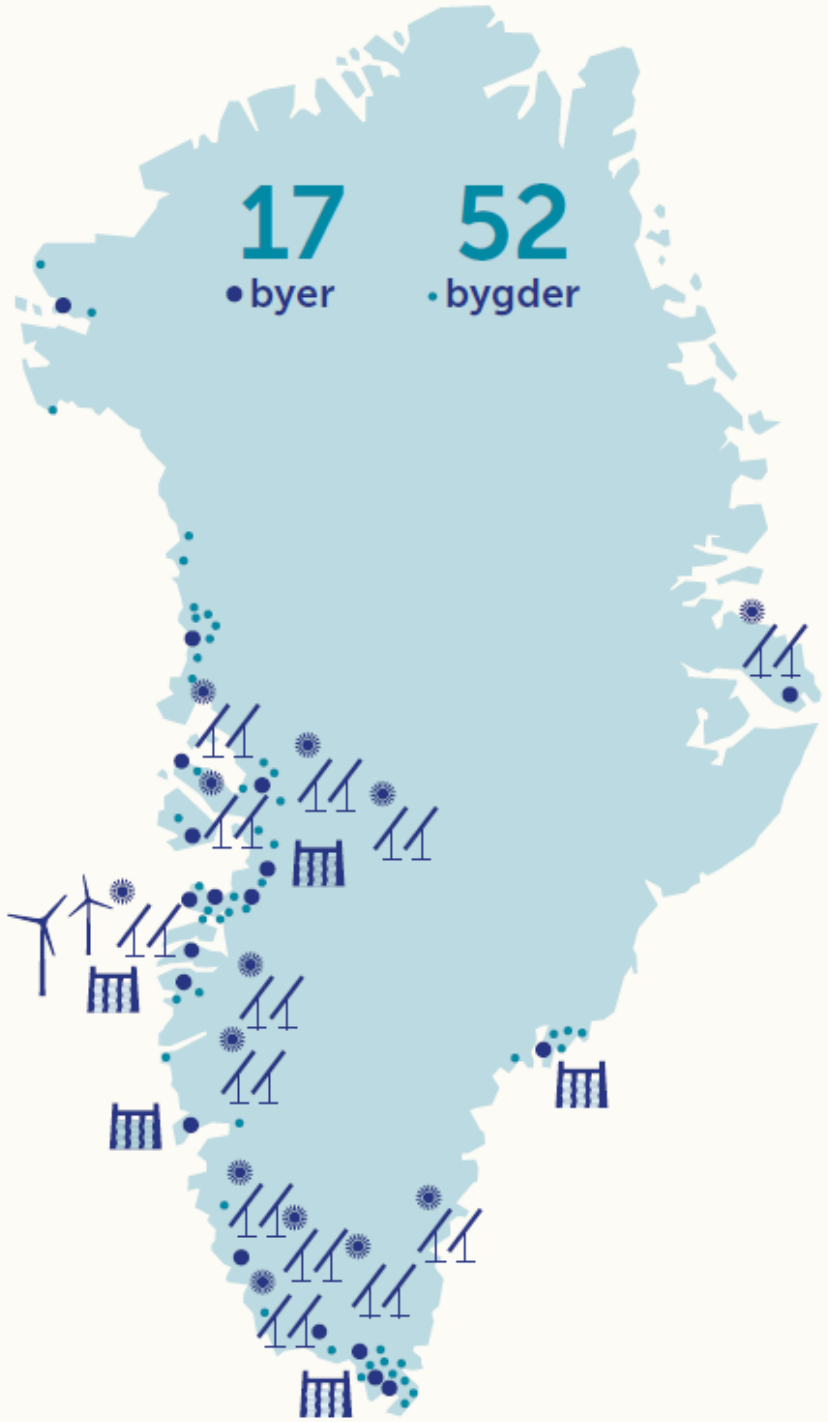

NUKISSIORFIIT
It’s about our own energy – and to utilize it

Introduction to Nukissiorfiit

Nukissiorfiit delivers electricity, drinking water and heat in Greenland

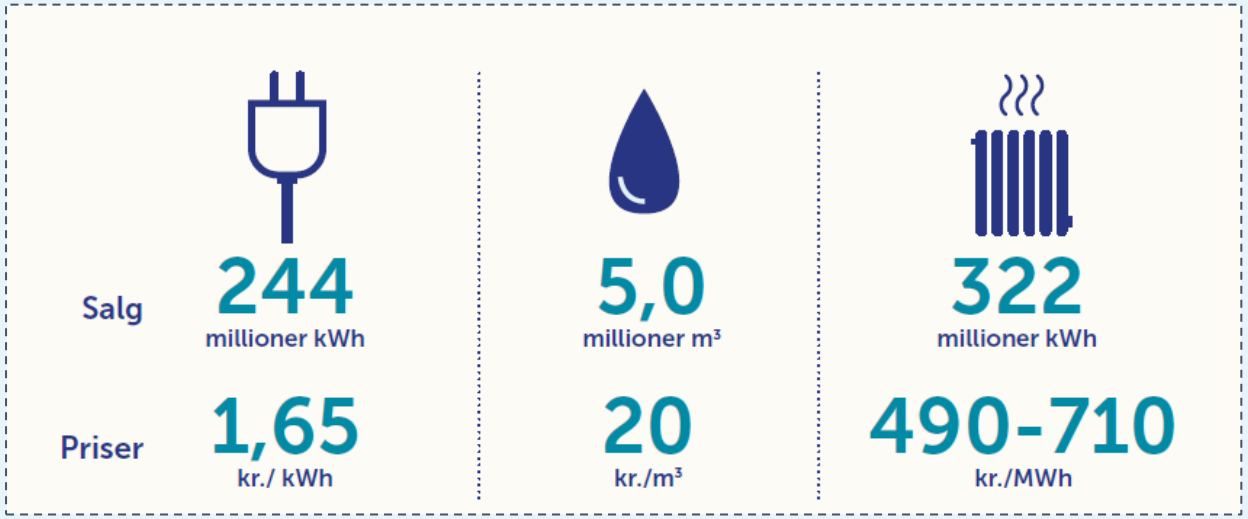
- Utility Company with the responsibility to produce and deliver electricity and water to all Greenland
- Present in 69 places - headquarter in Nuuk
- Part of ”Grønlands Selvstyre”
- Referer to Ministry for Agrculture, Self-Sufficiency, Energy and Environment



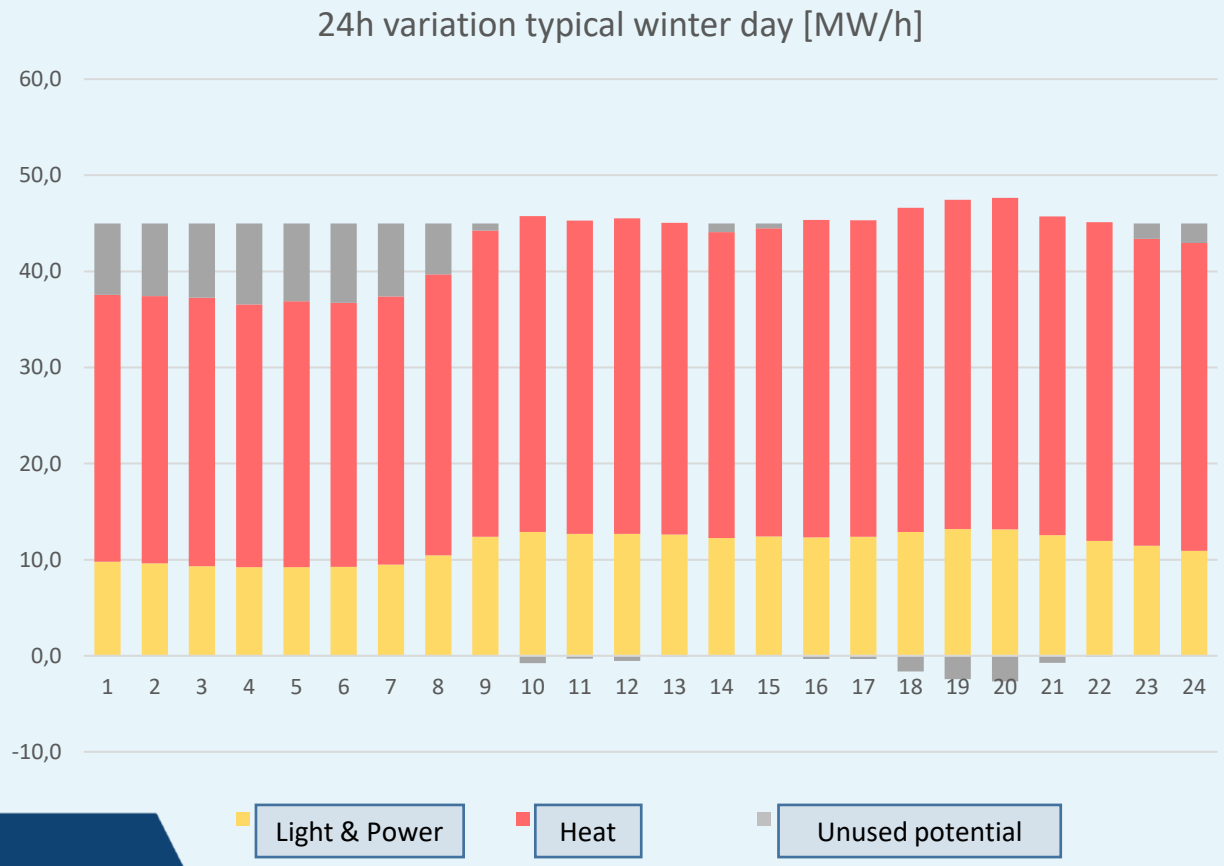
KEYNUMBERS OF GREENLANDIC SUPPLY TO THE PUBLIC

Nukissiorfiit deliver with homogenized prices and as monopolist

- No extra taxes
- No division into production, distribution and seller



Supply possibilities exemplified by Nuuk
3 x 15MW turbines = 45 MW installed power



- There is an unused potential
- The unused potential is biggest in summer
- “Light and power” is only a small fraction of the used energy

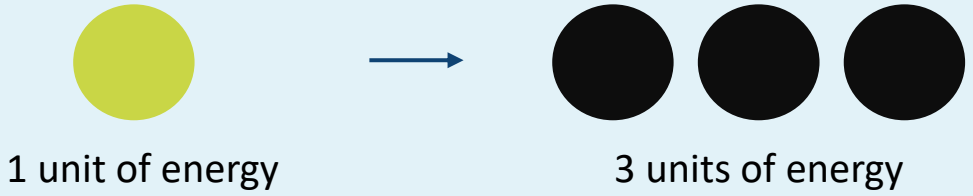
- High demand of energy in winter
- High demand of energy in daytime
- *Heat* “saves” less CO2 than *power*

-> see next slide

Optimal use of hydro power

Hydro for energy generation:

Displacing diesel-based energy production,
Efficiency for diesel engine 30-40 %

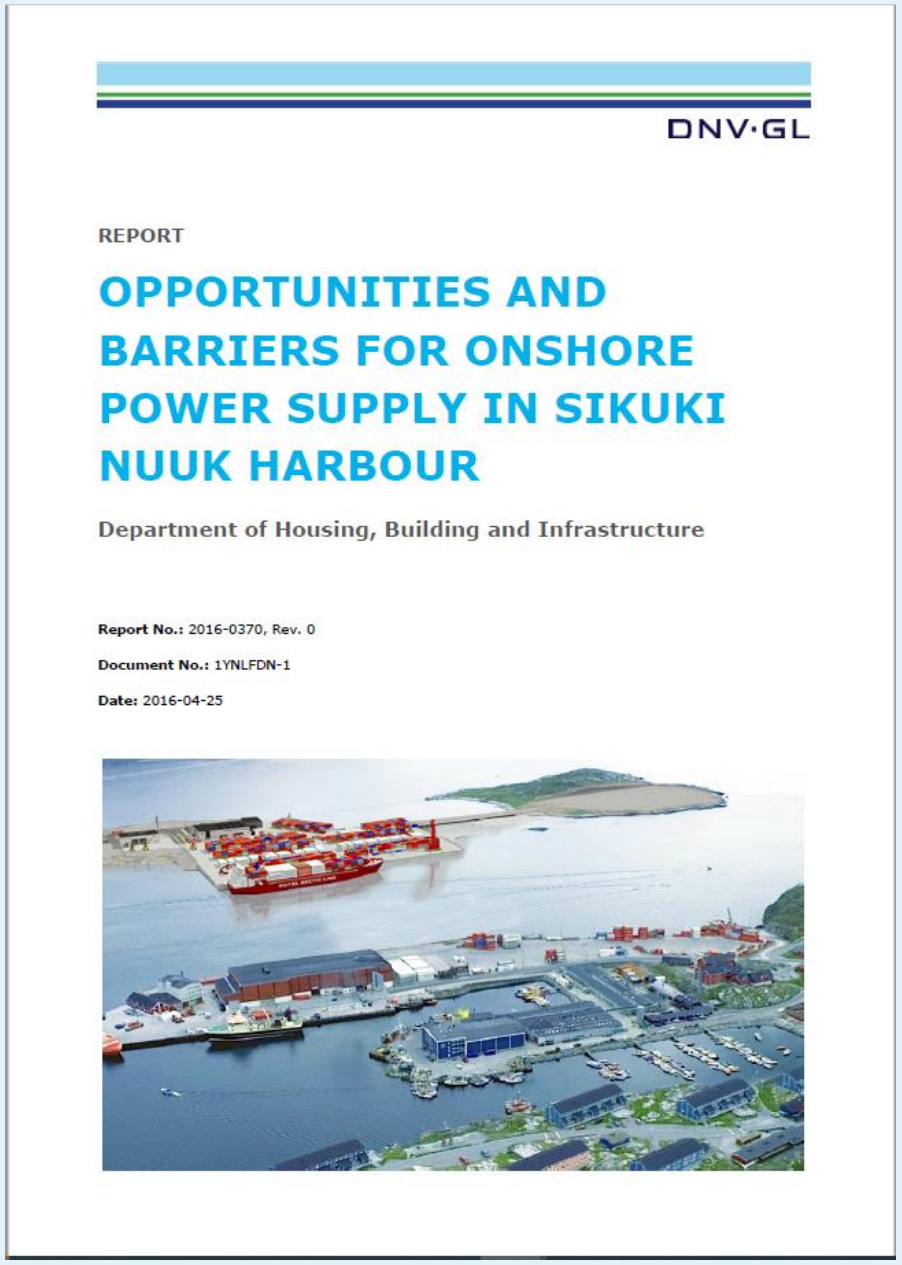


Hydro for heating:

Displacing oil-based heating,
Efficiency for oil boiler 85-95 %

Hydro for synthetic fuels (P2X):

Production of synthetic fuels,
Efficiency in the process ~50 %



Norsk Veritas Rapport, 2016:

Three identified solutions:

Solution 1: Cold ironing in new the container quay
The solution comprises facilitation for cold ironing for Conteinerkaj and Nordkaj. It will cover offshore power supply for 5 vessels and give an emission reduction of 1 182 tons of CO2.

Solution 2: Cold ironing in the oil terminal
The solution comprises facilitation of cold ironing in the Olieterminal quay. It will cover offshore power supply for two vessels (Oratank and Orasila) and give an emission reduction of 799 tons of CO2.

Solution 3: Cold ironing for the new and old Atlantkaj
The solution comprises facilitation of cold ironing for Ny atlantkaj, Feerderkaj, Skonnertkaj and Gl. Atlantkaj. It will cover offshore power supply for 38 vessels and give an emission reduction of 1 241 tons of CO2.

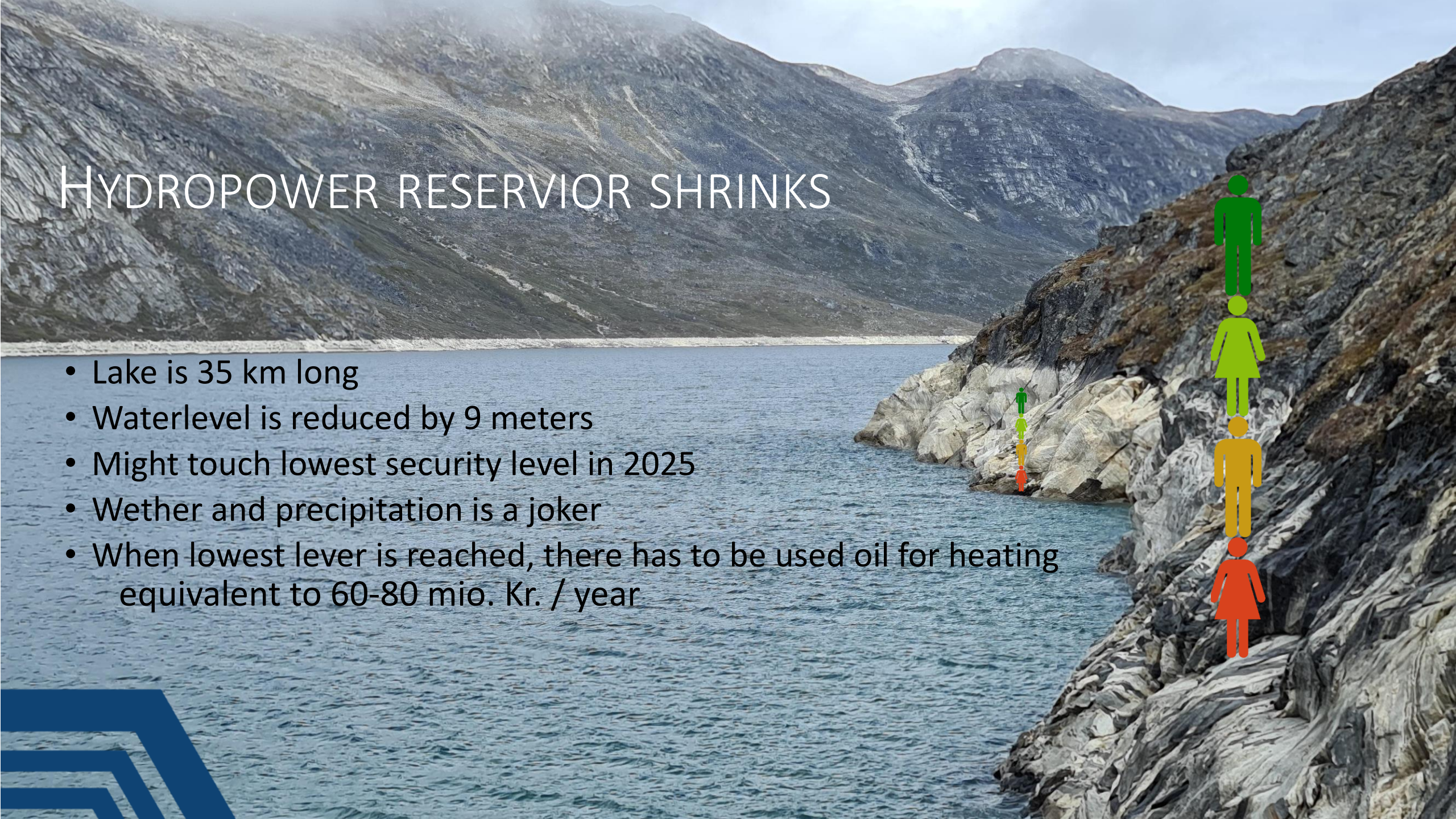
Norsk Veritas Rapport, 2016:

Results from socioeconomic analysis in NPV2, rounded MDKK and 2015-kr

Criteria	Solution 1	Solution 2	Solution 3
Investment cost	18	7	9
Vessel adaption	*10*	*3*	*6*
Cold ironing System	*3*	*1*	*2*
Grid connection	*6*	*3*	*1*
System maintenance	2	2	2
Fuel costs	-21	-14	-22
Cost of delivered power	46	31	48
CO2 costs EU ETS	-8	-5	-8
Sum quantified effects	**36**	**20**	**28**
Qualitative evaluation of effects			
Local emissions	+	+	+
Noise	+	+	+
Environmental reputation/image	+	+	+
Stimulate local economic activity	+	+	+

None of the three identified solutions have a negative net present value of the quantified effects. This means that in monetary terms you can expect a socioeconomic cost compared to the reference alternative of no cold ironing in Nuuk. All of the qualitative effects are positive, which means that all the solutions are considered more favourable than the reference alternative for these four indicators.

Hydropower reservior shrinks

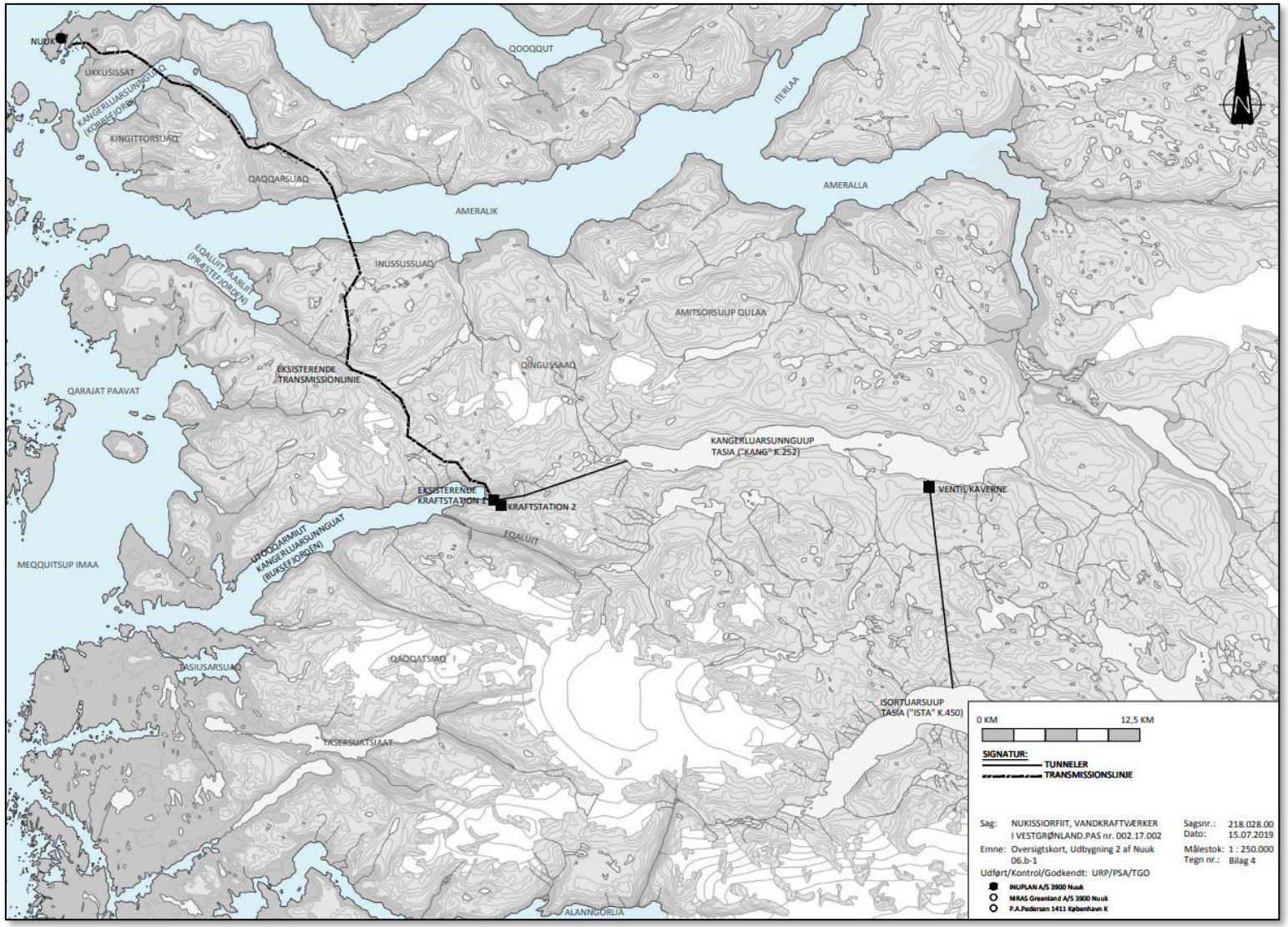


- Lake is 35 km long
- Waterlevel is reduced by 9 meters
- Might touch lowest security level in 2025
- Wether and precipitation is a joker
- When lowest lever is reached, there has to be used oil for heating equivalent to 60-80 mio. Kr. / year

BUKSEFJORD EXPANSION

HYDROPOWER OF THE CAPITAL NUUK

In 2021 were 264 GWh electricity delivered to Nuuk from Buksefjord. This is about 117 % of the theoretical potential, which is only possible as long as there is enough water in the lake.



Buksefjord extension possibilities to supply Nuuk and possible ekstra industry	
Installed effect + poss. ext.	45 → 100 → 190 MW
Poss. Energy production and poss. extensions	225 → 660 → 1200 GWh/år
Energy demand Nuuk (estimate)	GWh/år
2020	260 GWh
Possible extra green heat potential	+160 GWh
2026	430 GWh
2040	520 GWh
2050	600 GWh
Status of the project	
From 45 MW to 100 MW	2024-2026
Related infrastructure	2023-2028
From 100 MW to 190 MW	pending
Energy from hydropower	99,9 %

Nukissiorfiits Hydropower Plants

Paakitsoq
2012
22,5 MW.

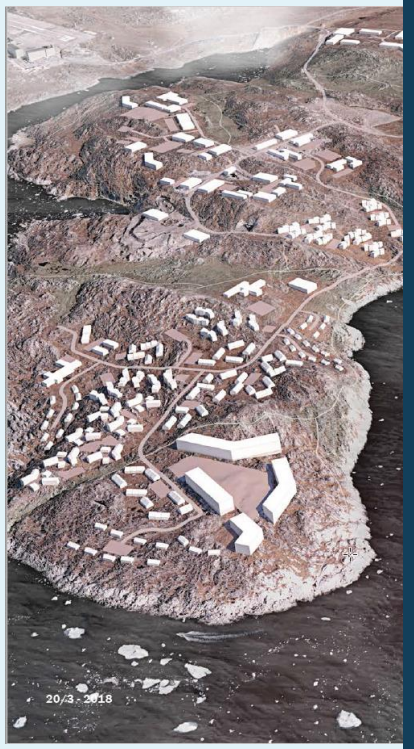
Sisimiut
2010
15 MW.

Tasiilaq
2005
1,2 MW.

Utoqqarmiut Kangerluarsunnguat
1993
45 MW.

Qorlortorsuaq
2007
7,2 MW.

ILULISSAT



Tusarniaaneq | Høring

IMMEKKOORTORTAQ 1200-C19 Itisuarsuk, Ilulissat
DELOMRÅDE 1200-C19 Hollænderhavnen, Ilulissat

Itisuarsummi talittarfiliornissami ataatsimoortitlugit iliuliassat sanaartorneqarnissaannut suliniutissatut qinnuteqaat
Projektansøgning for havnekompleks ved Hollænderhavnen

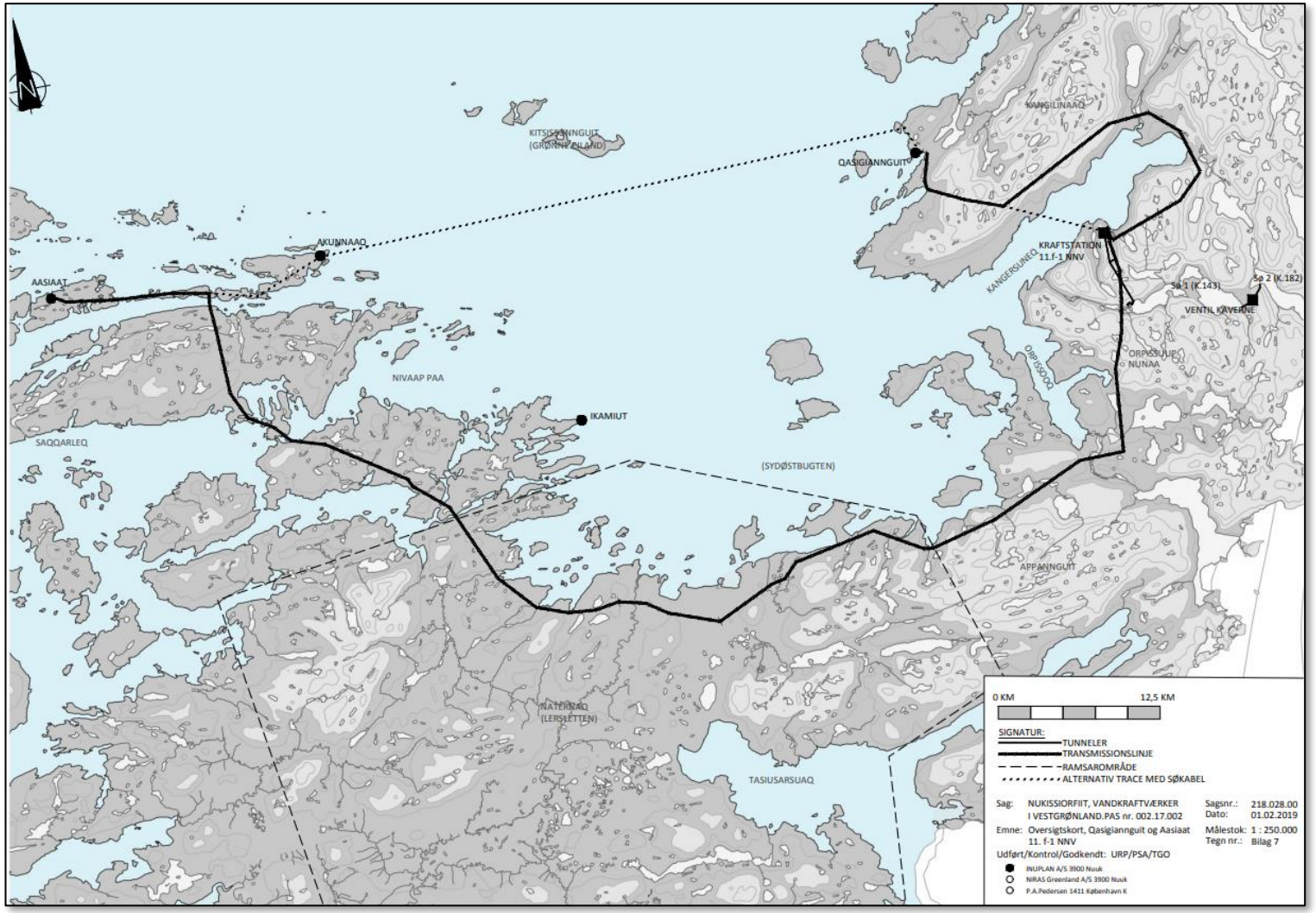
Sanaartugassanut pilersaarut | Bebyggelsesplan

Qinnuteqarfigisaq | Ansøgte område

Uimarsualivfup nutaap 3D-mik takussuslarinera | 3D visualisering af ny havn

Qasigiannguit Hydropower

For Aasiaat and Qasigiannguit



Energyproduction	94 GWh
Turbine size	22,5 MW 3 x 7,5 MW
Buidling time Related infrastucture inv.	~2026-2030 ~2025-2030
Population	4.500
Energy from hydropower (inklusive all heating)	85%
Transmission	116 km
Technical challanges	Permafrost

- Cruise ships (approx. 3000 passengers) use 10 times more energy than cargo ships
  - Usually, 5-6 x 9-15 MW (45-90 MW) installed power
  - Short time in harbor (if at all)
  - High installed power, large infrastructure investments, long payback time
  - Environmental issues (exhaust)
  - Grid frequency conversion for ships with running other than 50Hz.
  - Necessity to differentiate ship type, harbor, location

- Efficient Power to X needs big size – specially step after H2 (methanol, ammonia)
- Power to X is an expensive use of energy – start with "direct use".
- Cold ironing requires special installations on the ships.
- Best efficient energy use would be on harbor installations (pumps, cranes, vehicles)
- Is it possible to use heat of cooling units for heating, drying etc.?