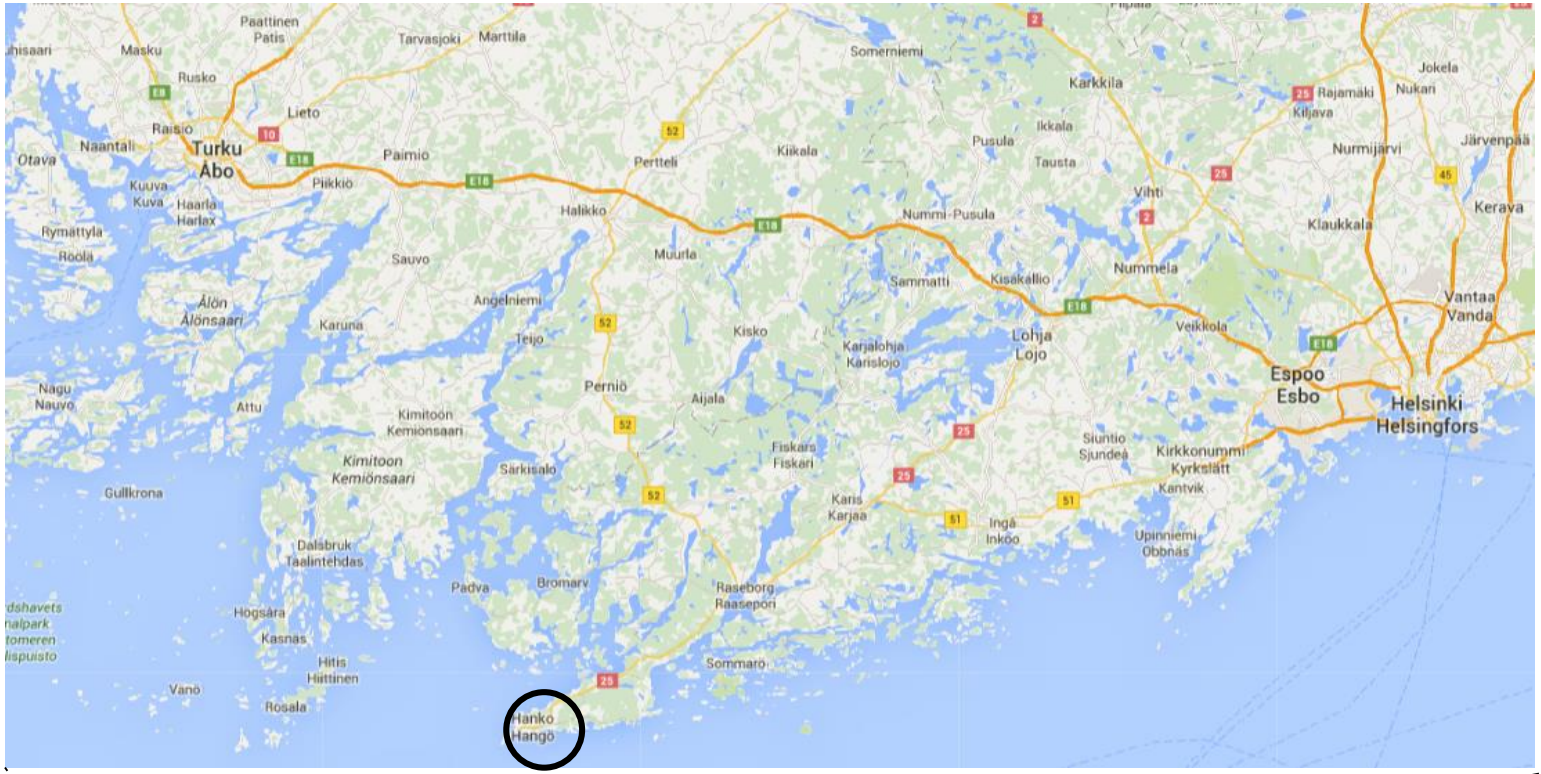
Excellent location for Data Center Campus in Hanko

CAMPUS LOCATION AND LOGISTICS

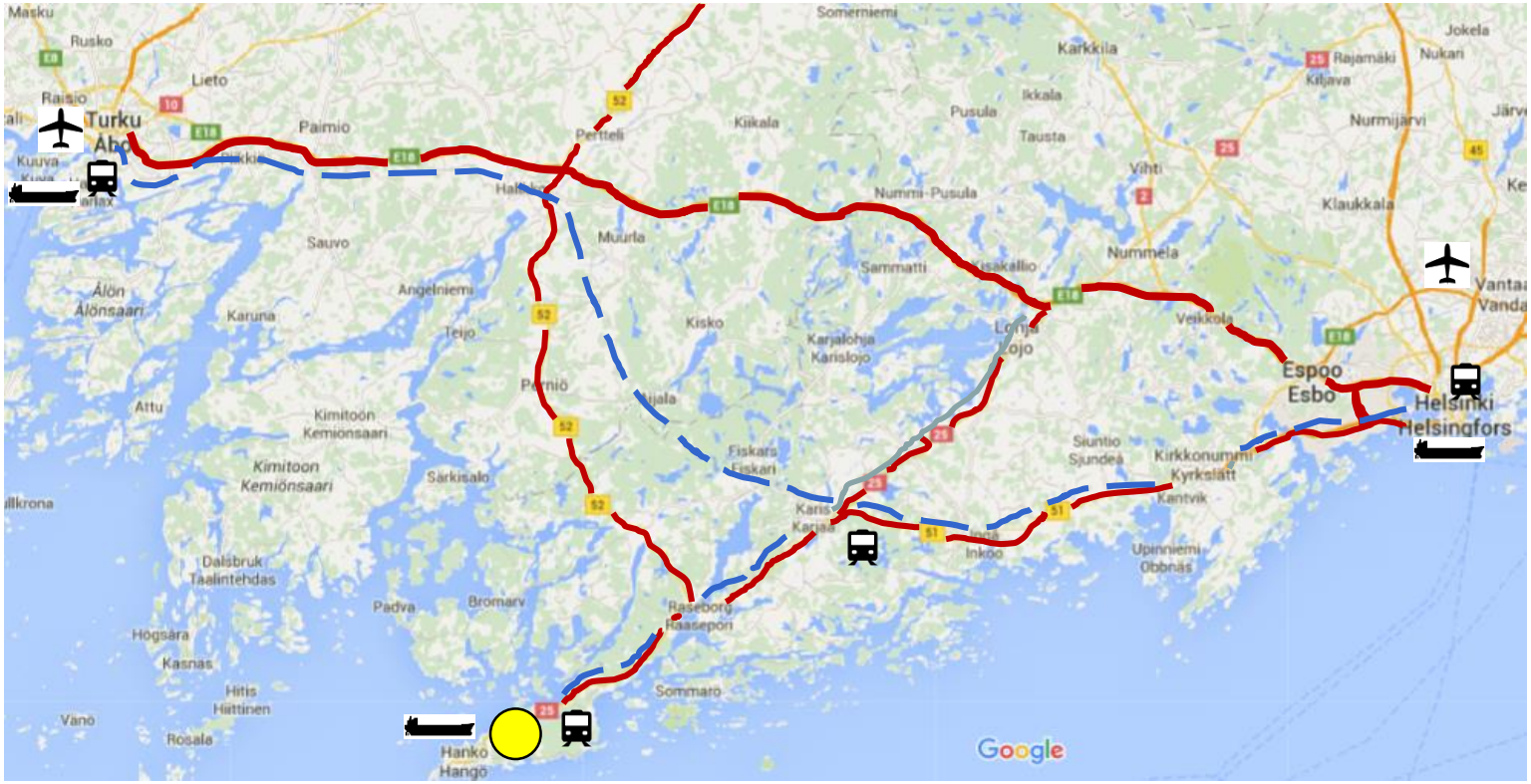
Ideal Data Center site location



Hanko Data Center campus is located in the City of Hanko, Southern Finland

The site is ideal for data center operations in terms of location, power, cooling, connectivity, fast track implementation and local support

Only 1h 30 min from Helsinki-Vantaa airport to Hanko

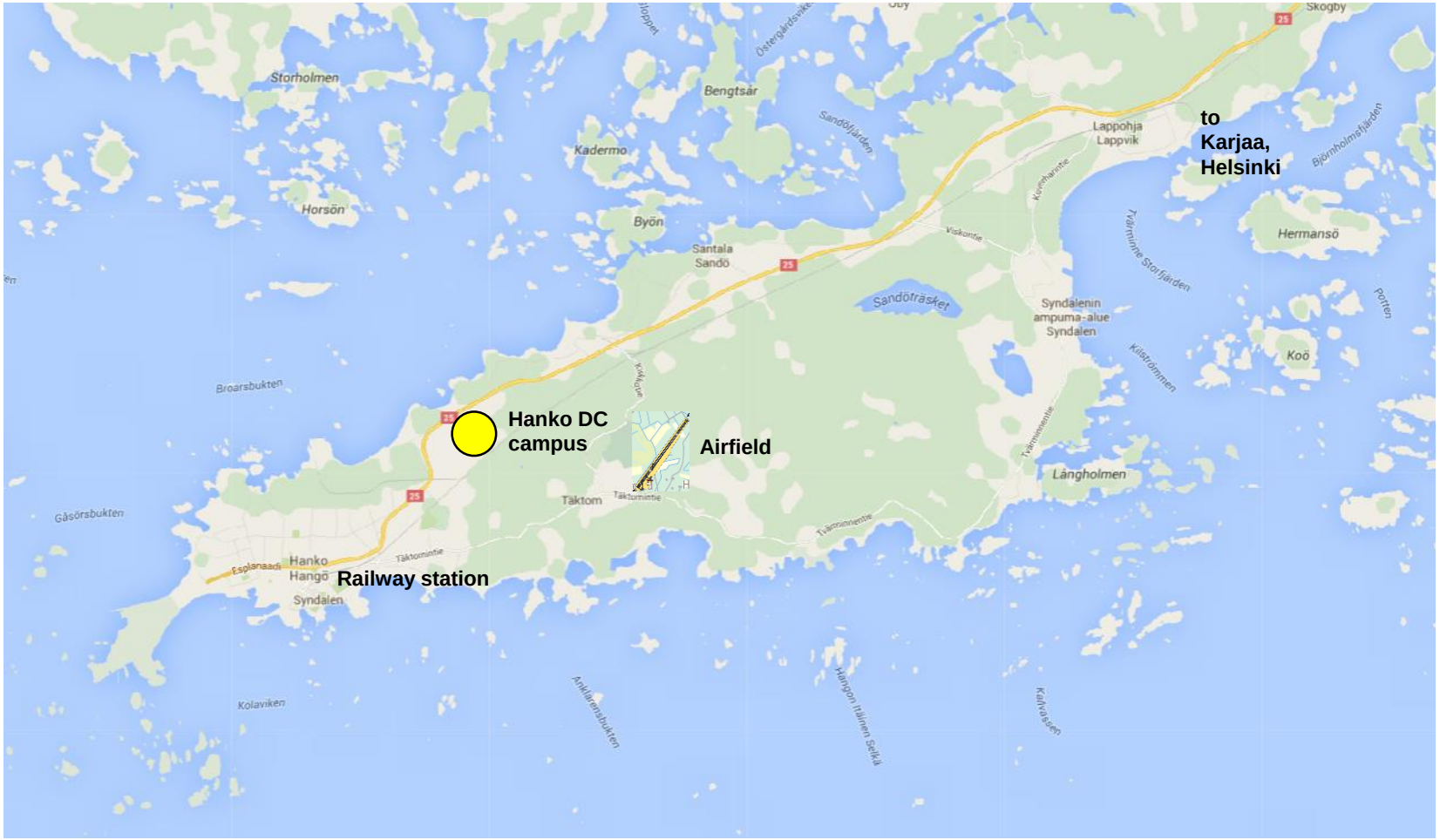


Distances from DC site:

Railroad: 2 km
To highway: 0,5 km
Port of Helsinki: 130 km
Hki-Vantaa Intl. airport: 125 km
Turku : 140 km

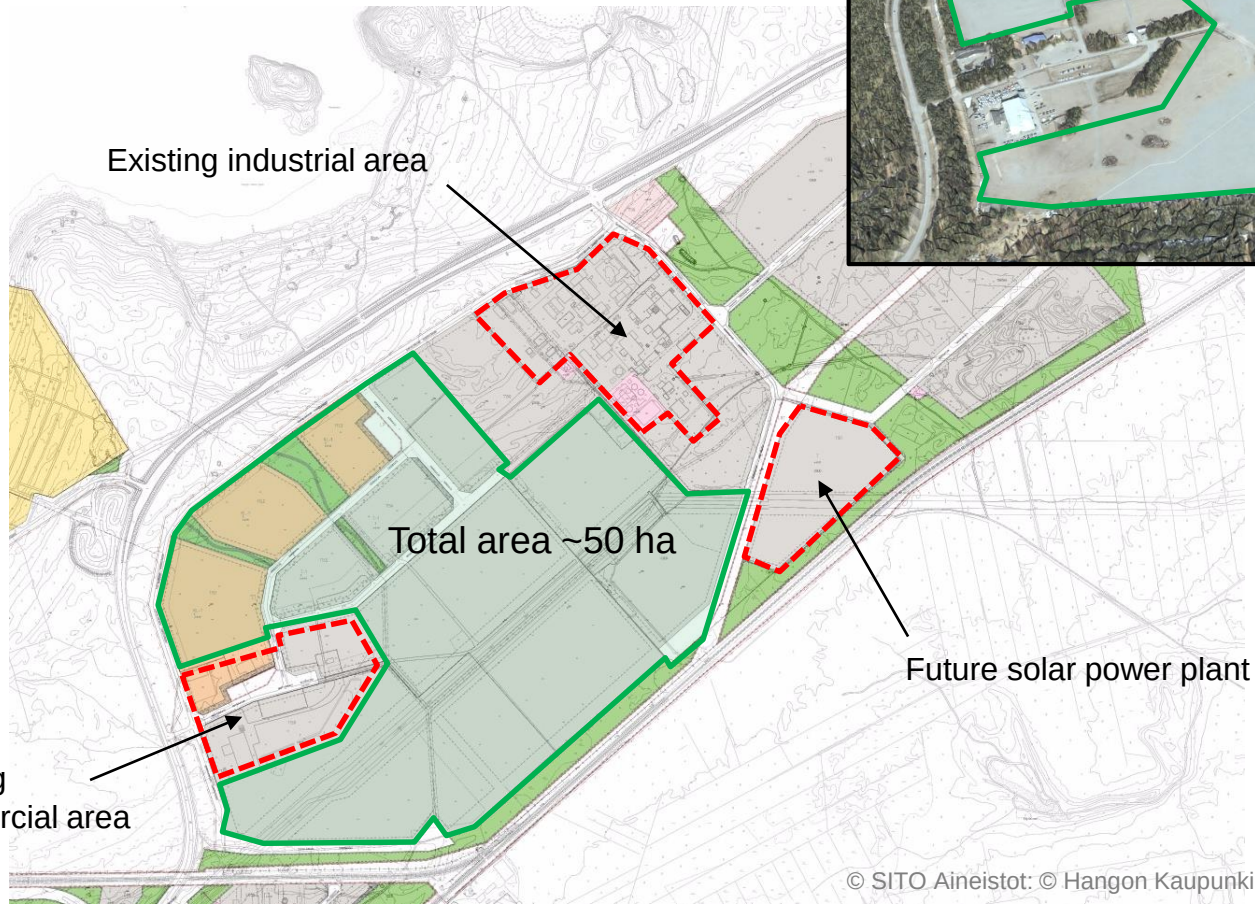
Port/Harbour
4- lane motorway
Main roads
Railroad
Intl. airport
Railway station
Hanko DC campus

Data Center Campus in Hanko



Easy-to-build area for Data Center

- Flat landscape
- Partially used as storage area for imported cars
- Easy to build



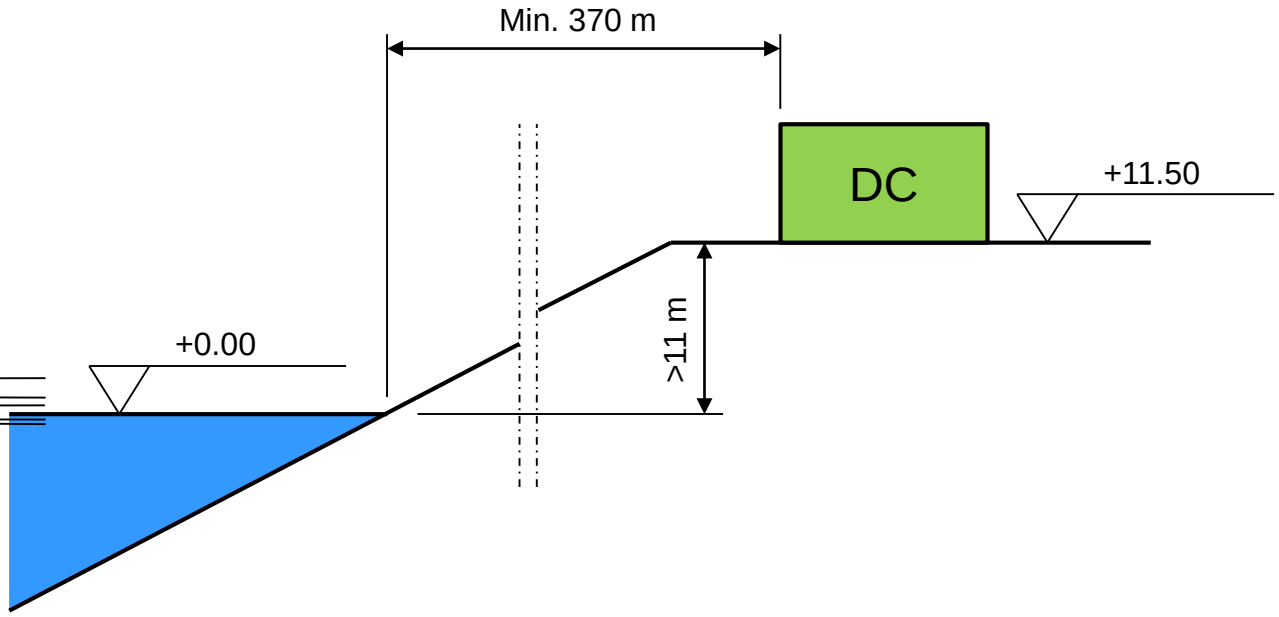
Location in relation to the sea,

and minimum recommended building elevation

Statistics since establishing of
Hanko mareograph in 1887:

- Min. building elevation +2.50
- Maximum +1.32
- Average of annual max. +0.74
- Average of annual min. -0.49
- Minimum -0.79

→ No flooding possibility

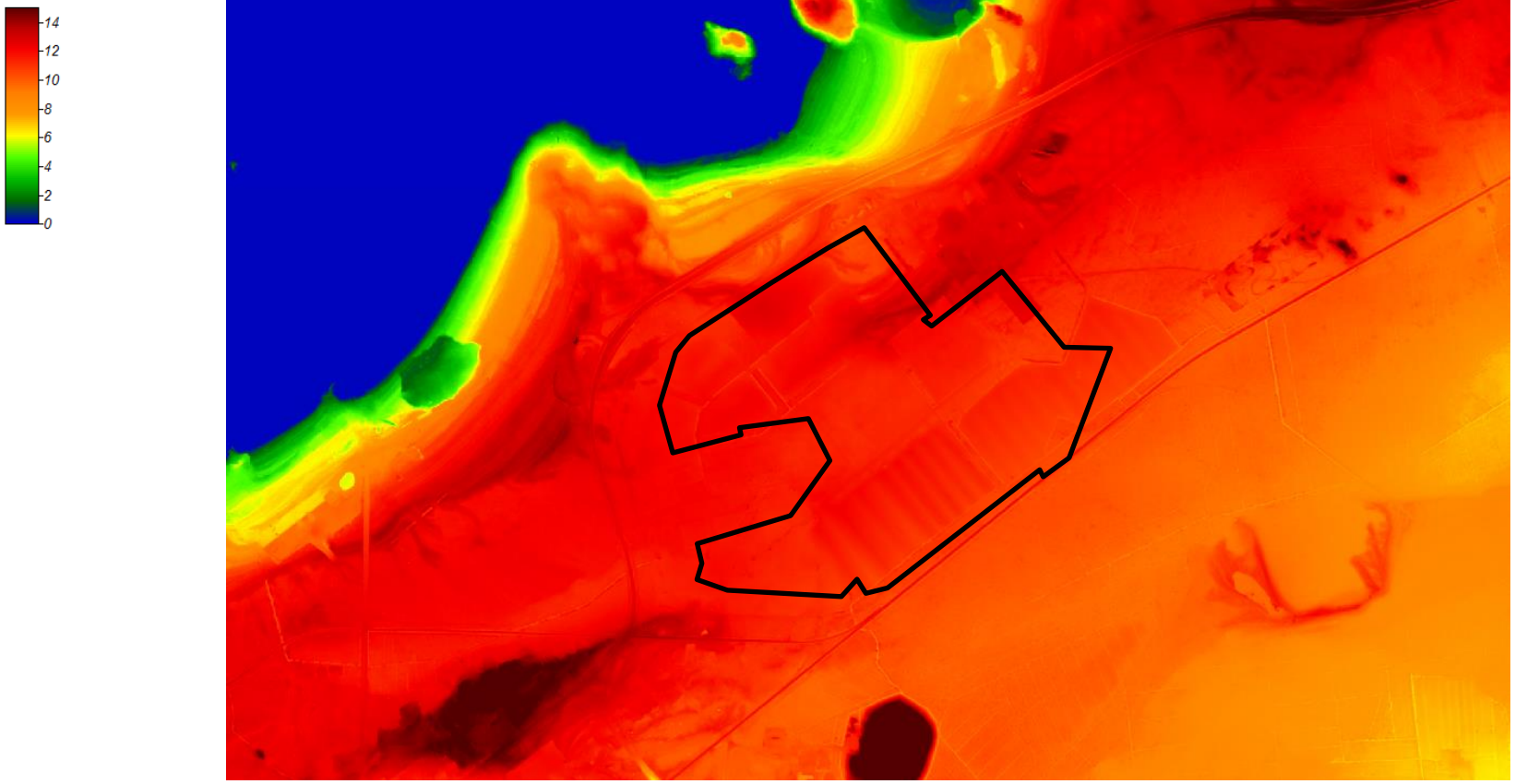


A publication by Finnish Meteorological Institute; “Long-term flooding risks and recommendations for minimum building elevations on the Finnish coast”, June 2014

The minimum recommended building elevations are based on the sea level in 2100 with an exceedance frequency of one event per 250 years.

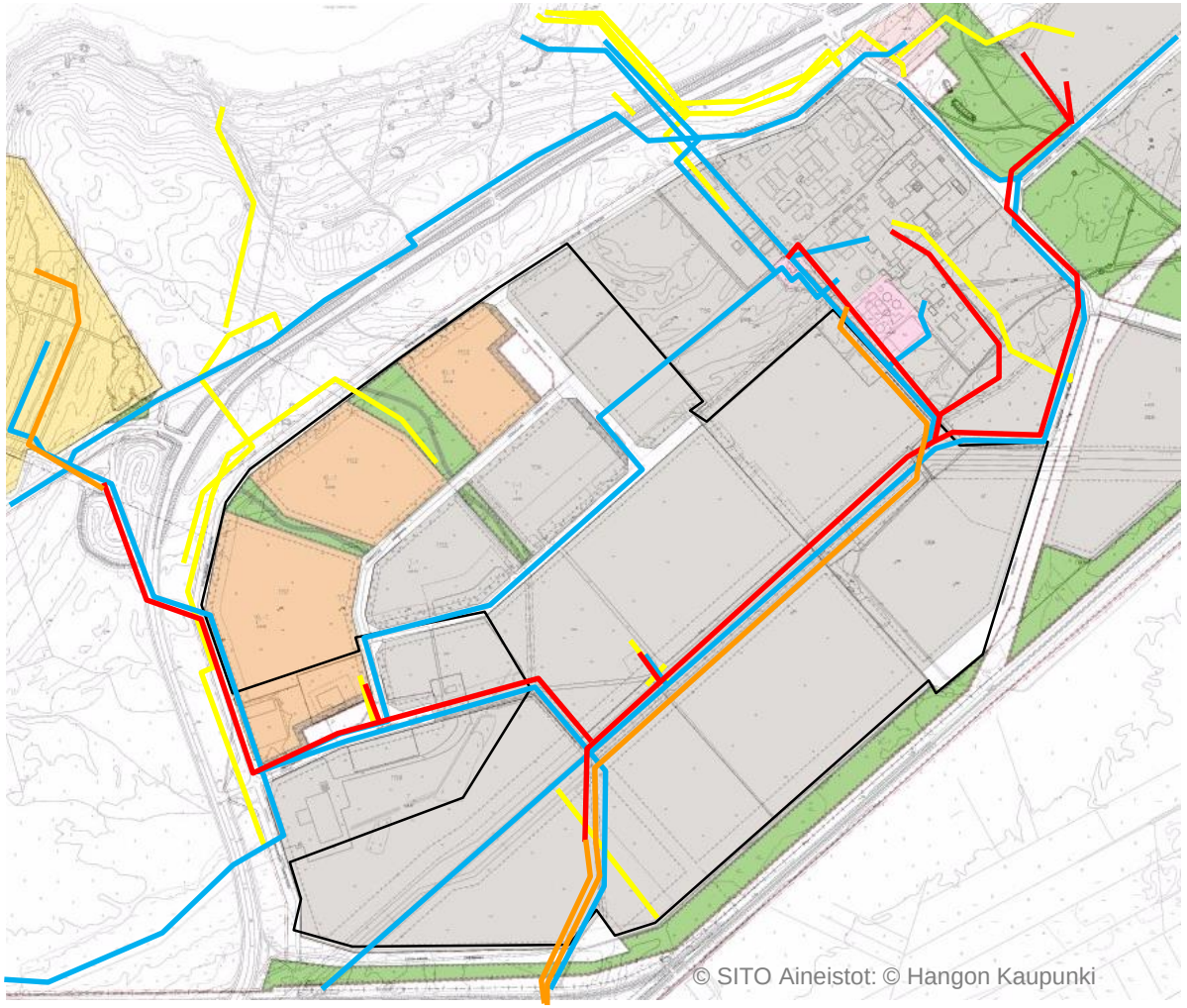
Minimum recommended building elevation without wave compensation in Hanko is +2.50 m above sea level.

Current landscape elevations



Existing utility services

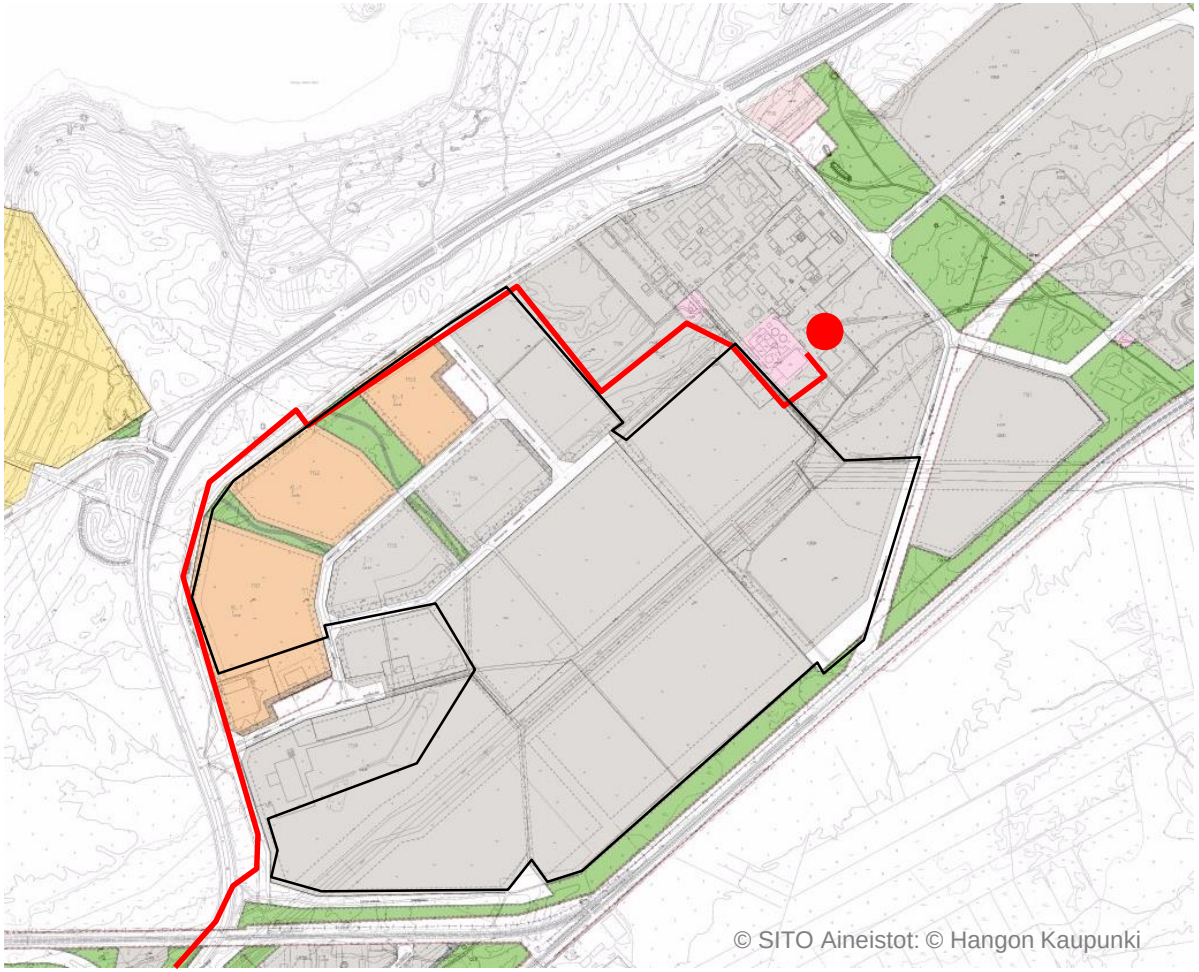
- Potable water
- Sewer
- Pressure sewer
- Rain water



Existing district heating network

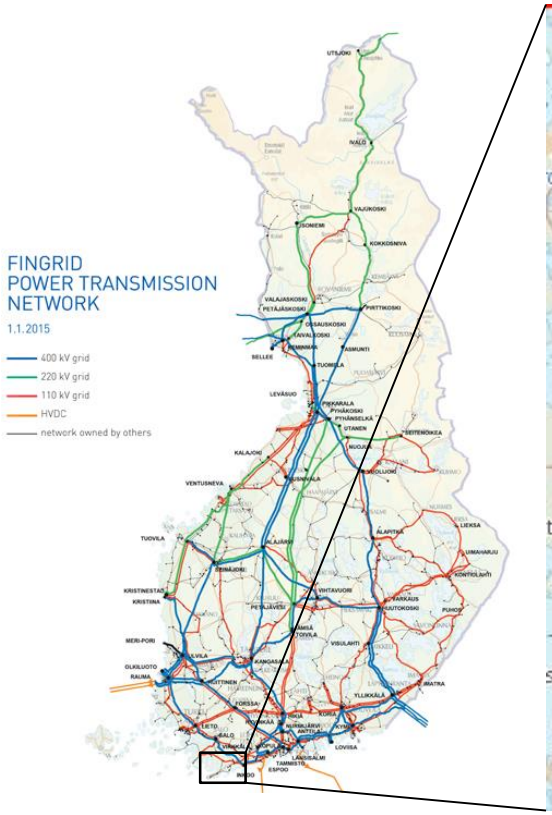
18 MW Power plant

District heating pipe



POWER SUPPLY

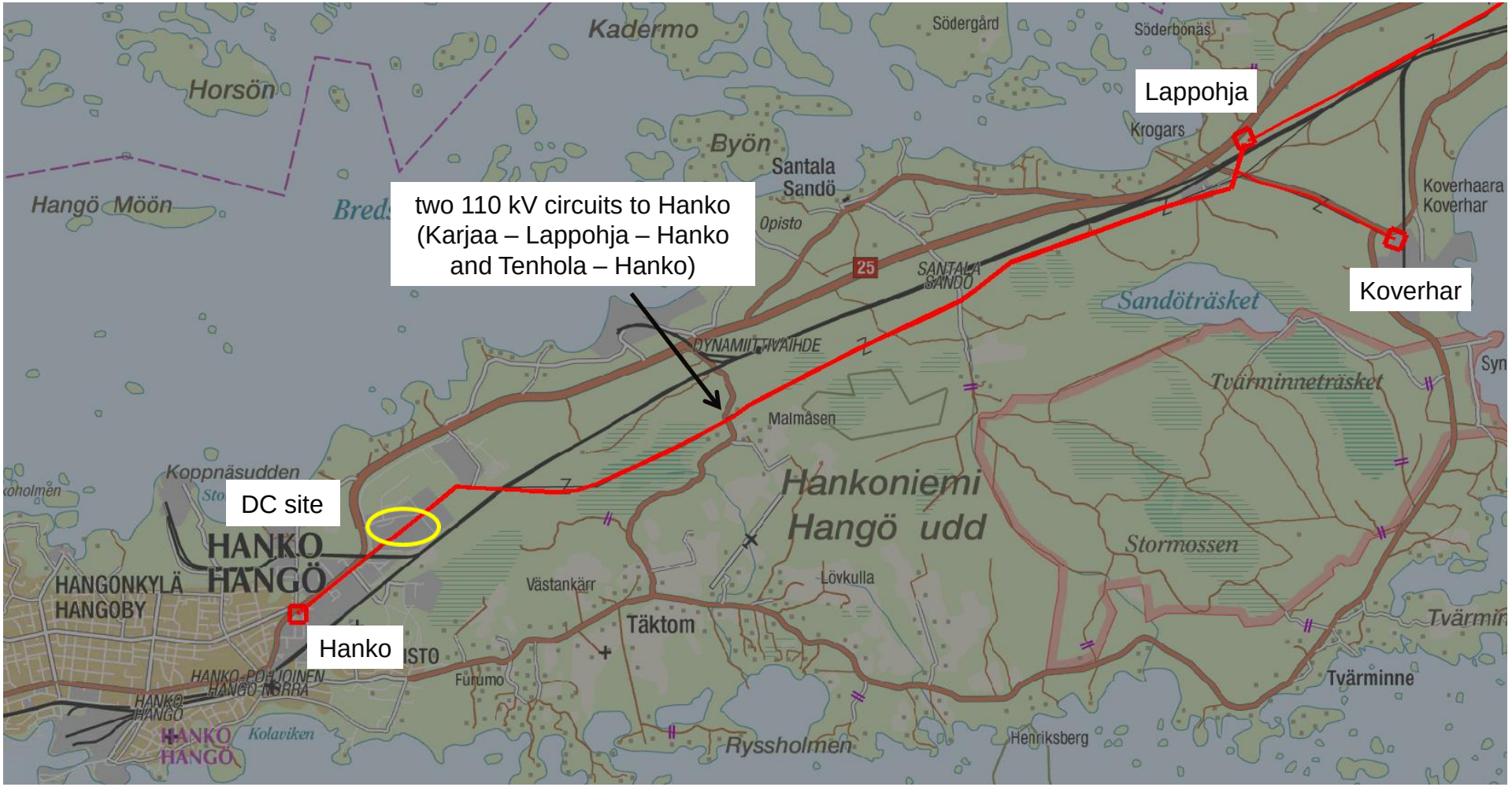
National power grid connection (110 and 400 kV)



Source Fingrid

110 kV regional network in Hanko-Raasepori area (ongoing upgrade in yellow colour)

Hanko electrical grid



Power ramp up to Hanko DC site, phase 1

Phase 1

- 15 MW double supply 20 kV

Time needed 6 months

Power ramp up to Hanko DC site, phase 2

Phase 2

- 30 MW supply from Hanko 110 kV + phase 1
- New 110/20 kV transformer and 110 kV overhead line

Time needed 12 months

Power ramp up to Hanko DC site, phase 3

Phase 3

- External 110 kV network upgrade app. 25 km between Karjaa and Tenhola
- 100 MW double supply 110 kV

Time needed 2,5-3 years

A unique location for Green Data Center

A **solar power** plant for Data Center is planned close to the site. It is possible to feed AC and DC power and if needed also store energy for Data Center use.

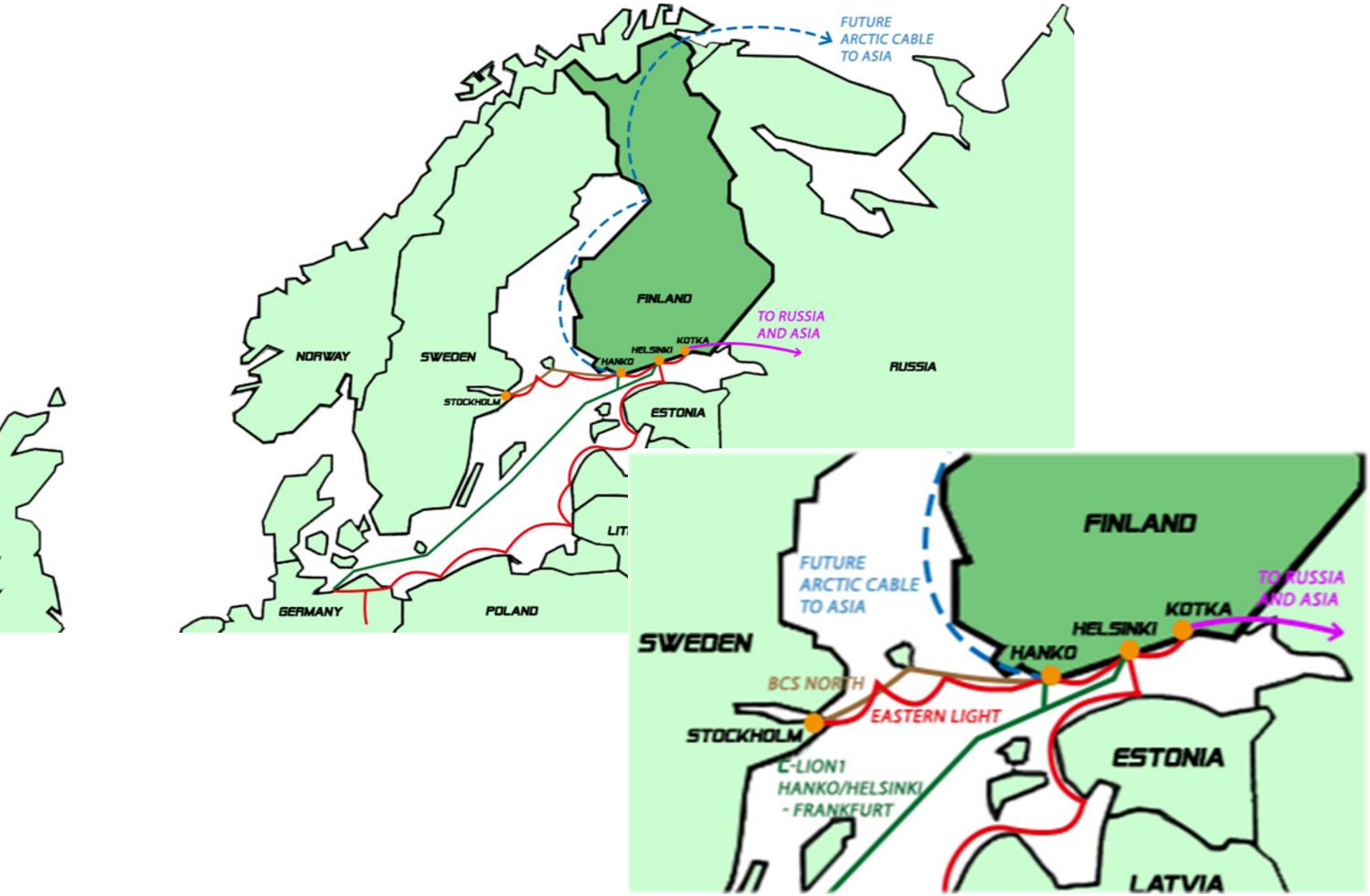
Locally produced **wind- and bioenergy** is also available to allow carbon free Data Center operation.

In Finland it is possible to purchase part or all energy as **Certified Green Energy** from energy distribution and selling companies.

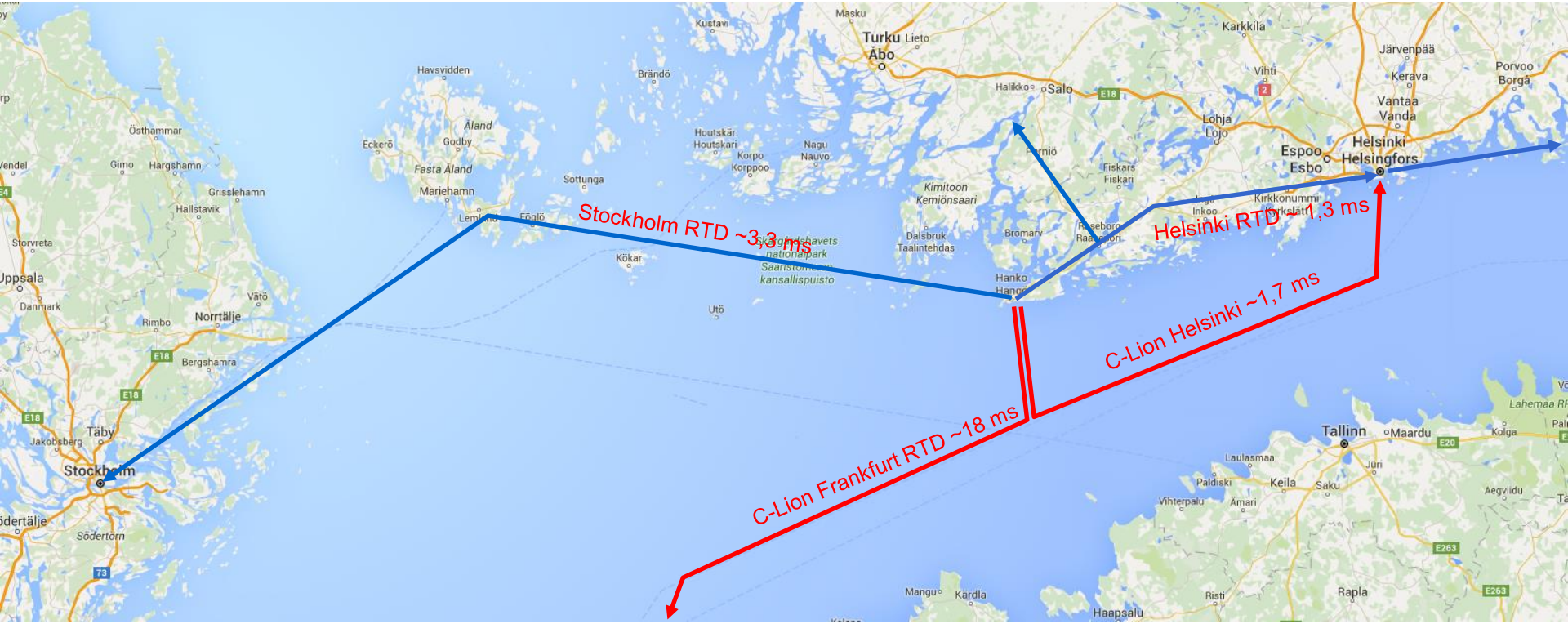
HELEN (former named Helsingin Energia) is planning to build the biggest solar power plant in Finland just at the corner of Hanko's Data Center campus area. The plant will consist of 2000 solar panels.

CONNECTIVITY

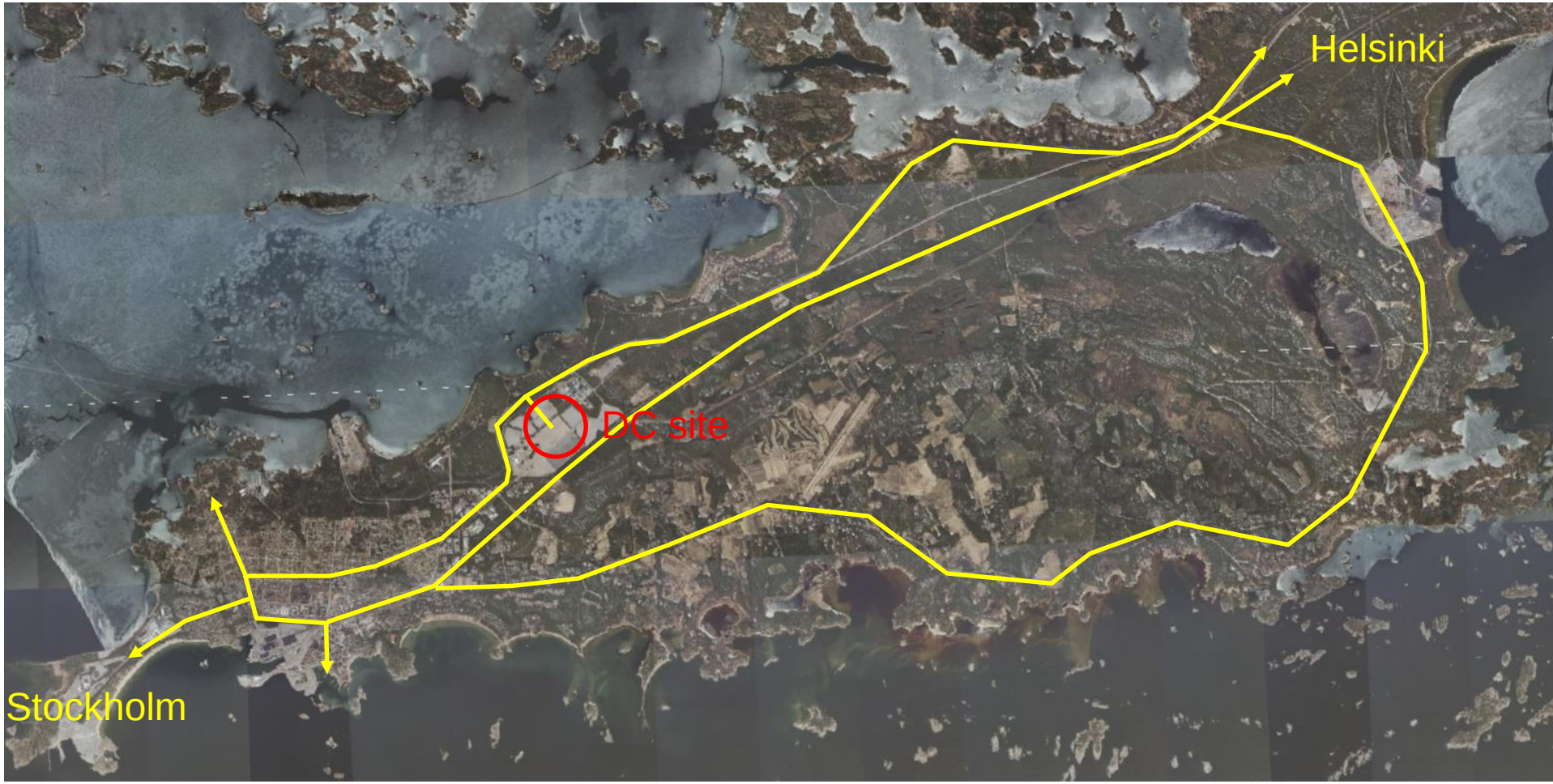
Hanko Data Center global connectivity



Hanko Data Center global connectivity



Hanko Data Center local connectivity

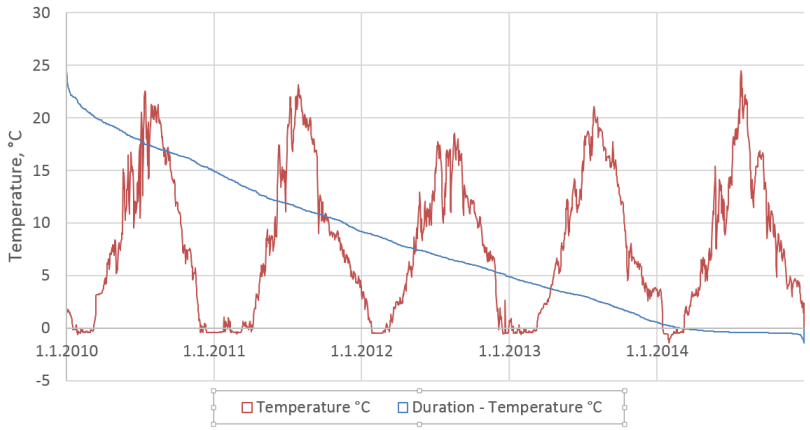


COOLING AND SECONDARY HEAT REUSE

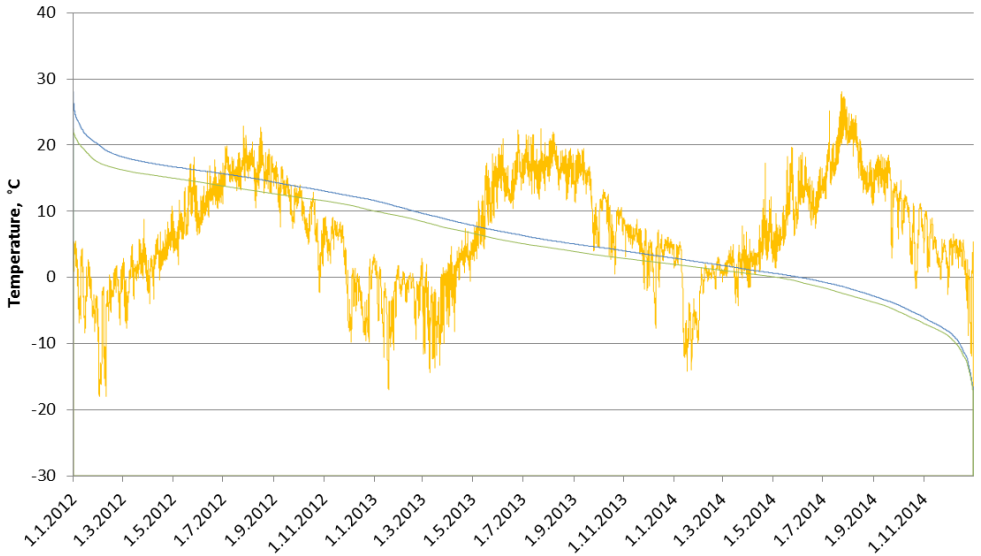
Conditions support effective cooling

- Ambient conditions suitable for free cooling
- Ambient air >25 °C <19 h/year (average 2012 – 2014)
- Potential cooling methods: direct air cooling with or without adiabatic cooling, cooling towers, sea water
- Energy re-use possible

Sea water temperature and temperature stability,
Data: daily averages, Hanko/Pikku Kolalahti 2010-2014,
Missing data replaced by annual average of existing data



Ambient air: dry temperature and
duration of dry and wet bulb temperatures
Air data: hourly averages, Hanko/Tullinimi 2012-2014 by FMI



Environmental data source: © Finnish Meteorological Institute

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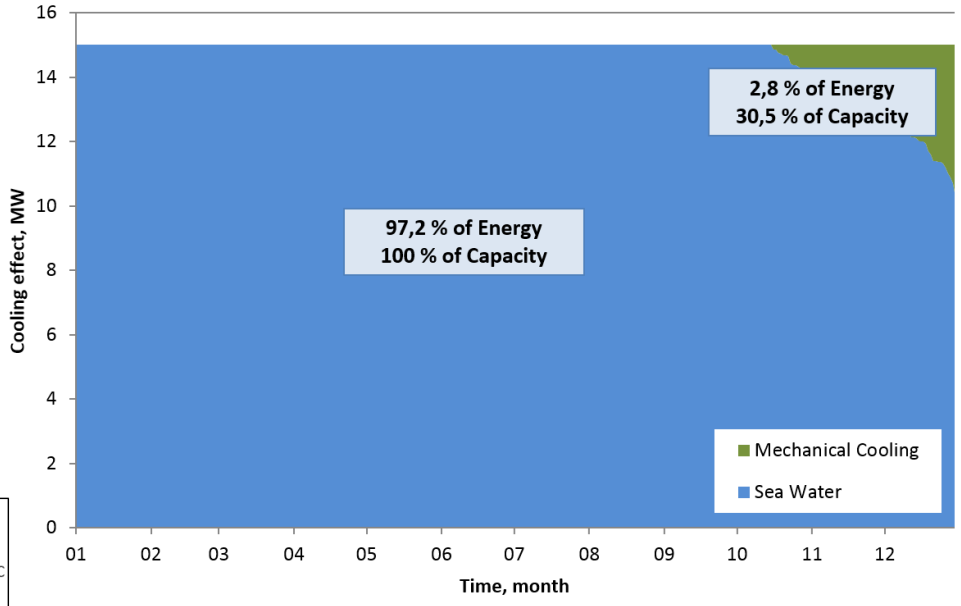
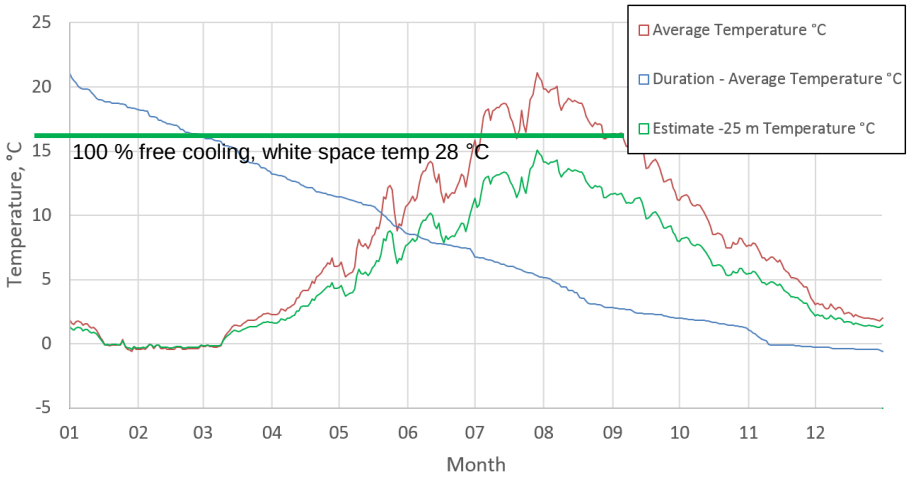
Cooling by Sea Water

- High free cooling share for white space temperature 21ºC and above
- Cool sea water available from basin near the sea shore
- Sea water stays reasonably cool also in summer. Thus high free cooling energy share.

Cooling production by sea water and mechanical cooling
White space temperature 28 °C,
Data: Average surface temp. from available data, 2010-2014



Sea water average temperature and temperature duration and estimated temperature in 25 m depth.
Annual averages Hanko/Pikku Kolalahti 2010 – 2014



Target white space temp	**28 ºC**	**25 ºC**	**21 ºC**
Primary water circ temp.	**18 ºC**	**15 ºC**	**11 ºC**
Free cooling, energy	**97%**	**94%**	**86%**
Mech. cooling capacity	**31%**	**45%**	**66%**

Environmental data source: © Finnish Meteorological Institute

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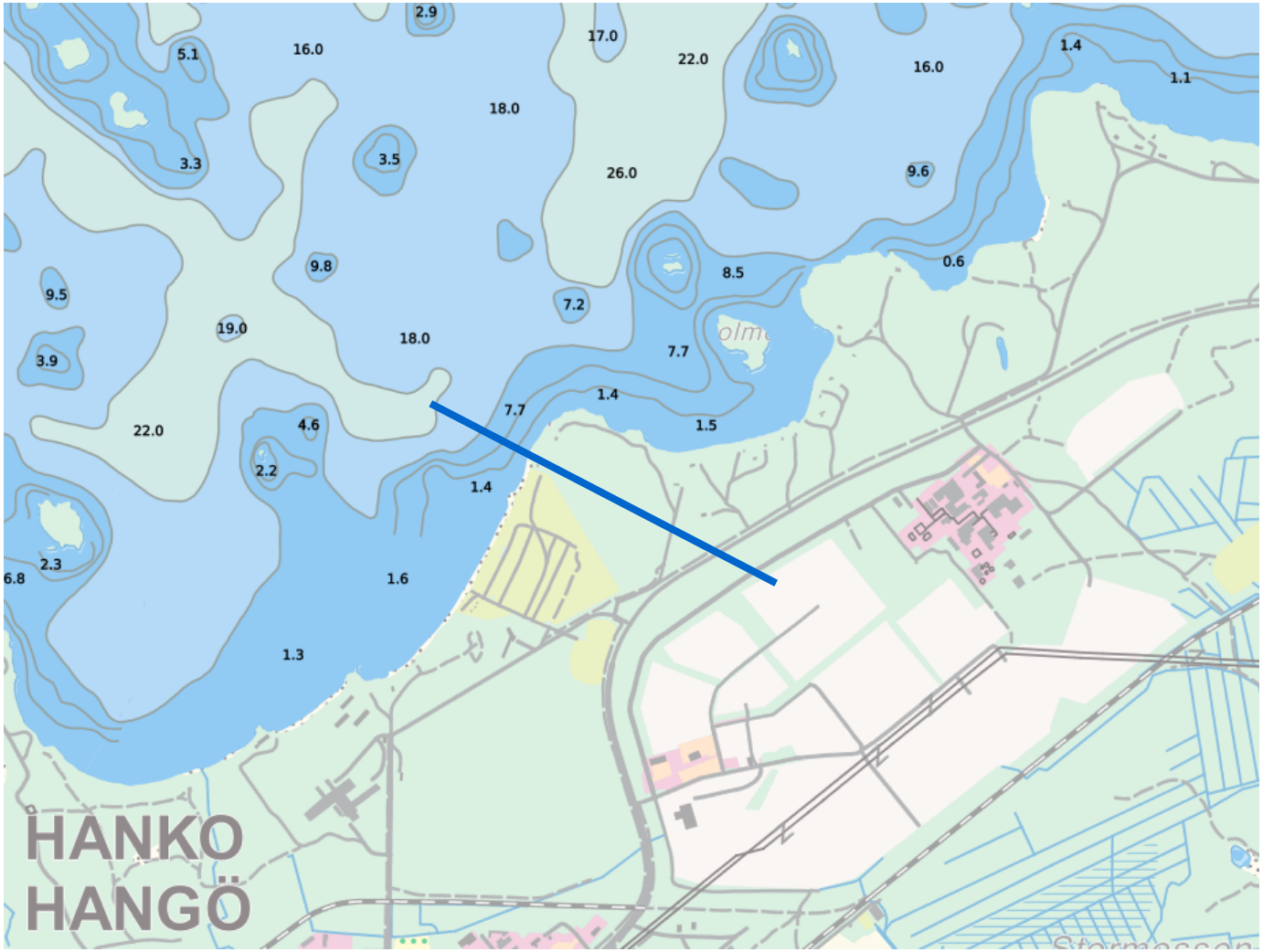
100% free cooling possibility with sea water cooling



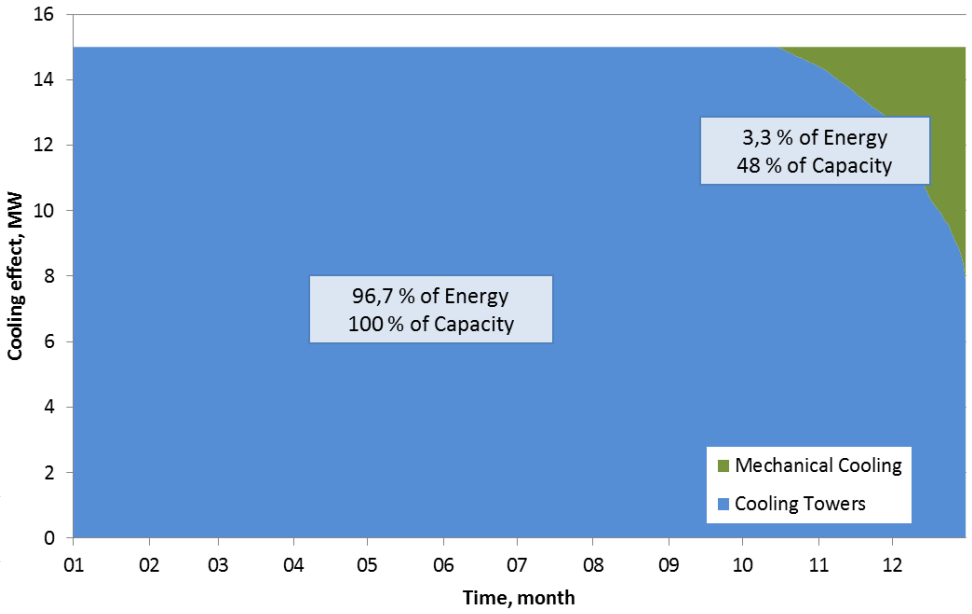
The depth chart of the nearby sea looks very promising for achieving 100% free cooling by using cold sea water for data center cooling.

Includes nautical chart database material of
Finnish Transport Agency 11/2015

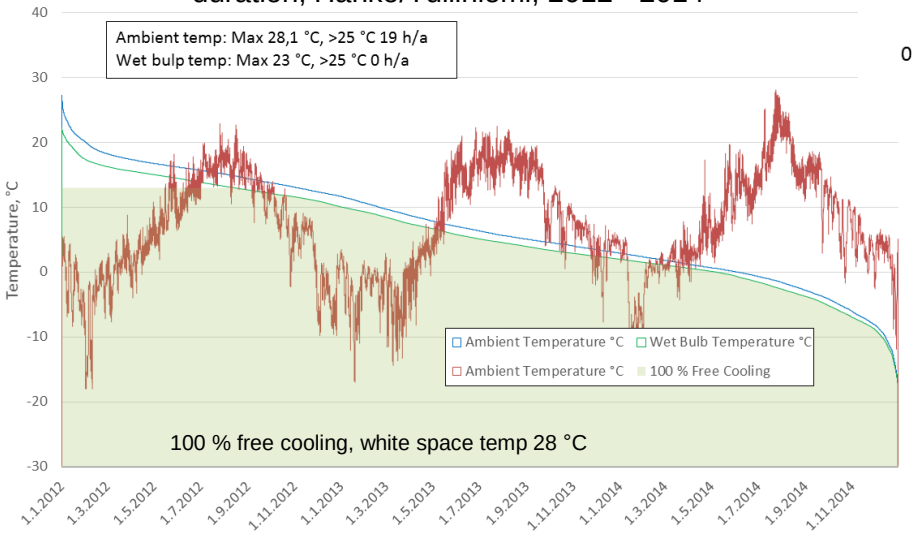
Cooling Towers and Mechanical Cooling

- Wet bulb temperature favors cooling towers
- High free cooling share for white space temp. 21ºC and above
- Make-up water is available from sea
- Tower excess water led to storm water system without treatment or via oil-separation

Cooling production by cooling towers and mechanical cooling
White space temperature 28 °C Temp Data 2014



Ambient air temperature and dry and wet bulb temperature duration, Hanko/Tulliniemi, 2012 - 2014



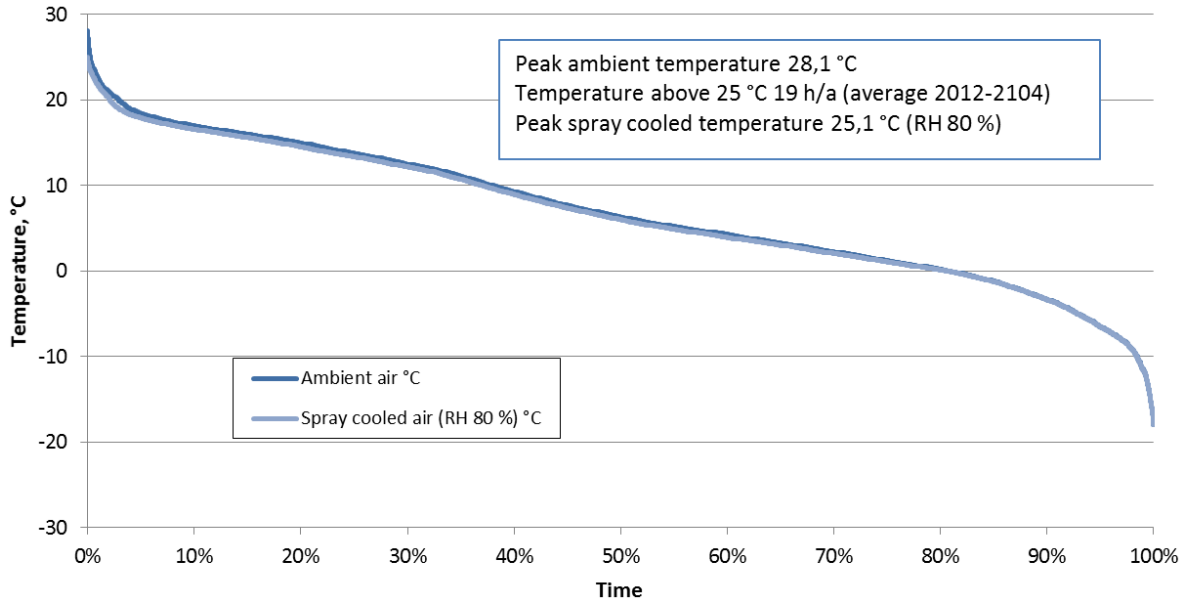
Target white space temp	28 ºC	25 ºC	21 ºC
Primary water circ temp.	18 ºC	15 ºC	11 ºC
Free cooling, energy	97%	93%	85%
Mech. cooling capacity	48%	63%	82%

Ambient air data source © Finnish Meteorological Institute

Direct Air Cooling

- Ambient conditions suitable for free cooling
- Maximum ambient air temperature 28,1 °C
- Ambient temperature >25 °C <19 h/a (average 2012 - 2014)
  - Longest continuous period 13 h, average peak duration 5,2 h
- With adiabatic cooling (RH 80 %) max temp 25,1 °C

Temperature duration of ambient and
spray cooled (RH 80%) air.
Air data: hourly averages, Hanko/Tulliniemi 2012-2014 by FMI



Ambient air data source © Finnish Meteorological Institute

Mechanical Cooling

- Mechanical cooling (heat pumps/compressors) is necessary
  - Covering summer temperature peaks
  - Backup
  - Raising heat temperature for energy re-use
- Potential heat sinks for heat pumps/compressors
  - Local district heating network (energy re-use)
  - Building heating (energy re-use)
  - Ambient air
  - Sea water
  - Cooling tower circulation
- Dimensioning for summer peak demands or as full backup
- Mechanical cooling energy production share is low even though capacity need can be quite high
- Mechanical cooling EER from 3 up to >7 depending on heat sink
- Potential for energy re-use up to 1,3 x DC power consumption

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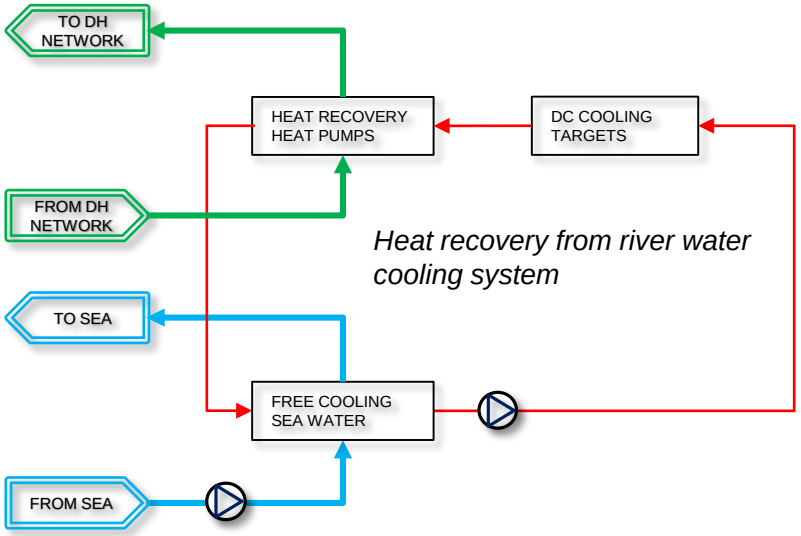
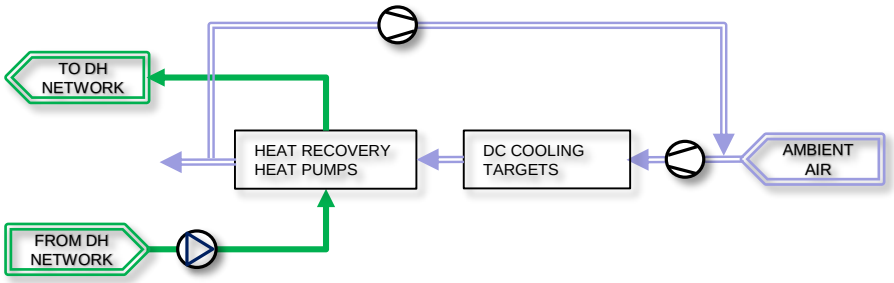
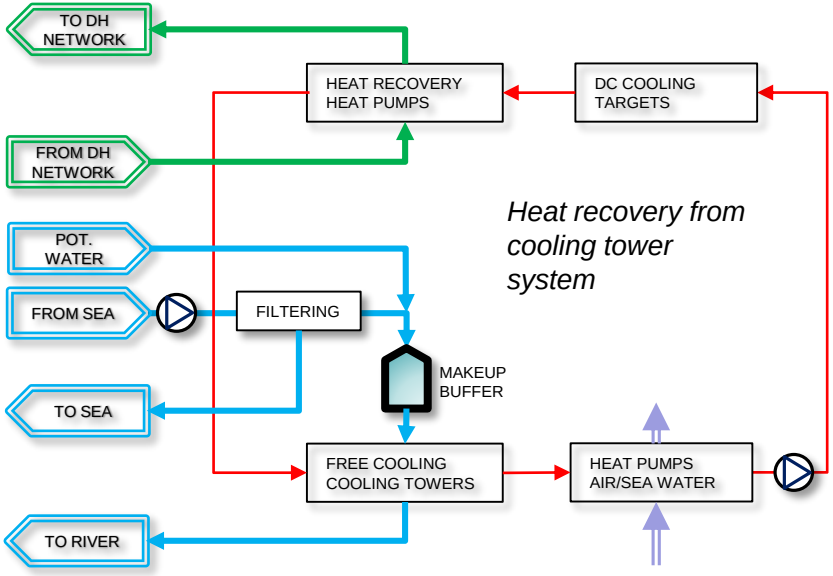
Examples of Secondary Heat Re-use Arrangements



Heat recovery from river water cooling system



Heat recovery from adiabatic cooling system



Heat recovery from cooling tower system

SITE UTILIZATION

1st phase, utilization example

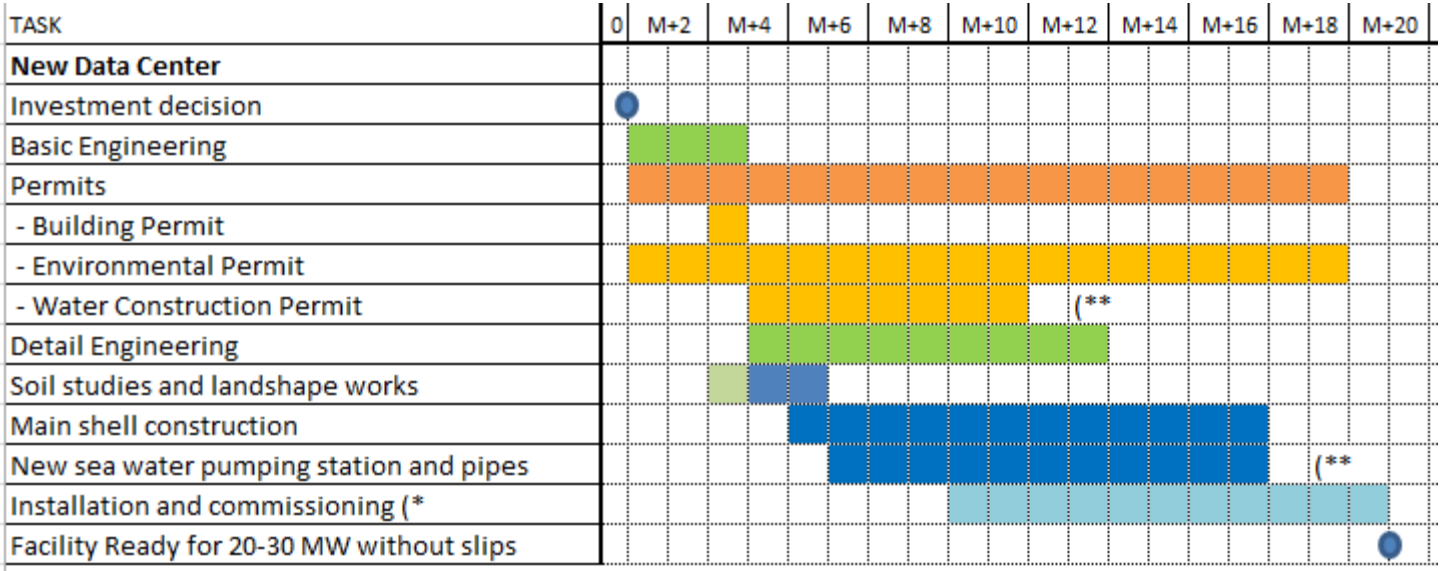
Maximum building area for 1st phase approx. 120 MW

Construction phase completed, visualisation example

IMPLEMENTATION PLAN

Implementation schedule

- Example schedule for data center investment in Finland



(* Includes 1,5-2 month period for inquiries, tender comparisons, POs

(** If it is decided to have sea water cooling system