Kajaani Datacenter

Peter Jenkins

System Specialist & Project Manager

CSC – IT Centre for Science


Chrome Web Store


Gmail


Gmail Offline

Google Calendar


Google+


Google Reader


YouTube


Google Drive


Revision3


TV


Angry Birds


Evernote Web


Google Maps

Flixster

TripIt - Travel Organizer

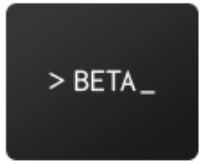

Hipmunk


TweetDeck

Chrome Remote Deskt...


Pixlr Editor


Google Play



Secure Shell


Cryptocat


Jolicloud

I'm from there

What I do a CSC

IT

- Rapid change
- New hardware challenging data centers

Facilities

- Traditionally very stable
- Disruptive innovations in last 5 years

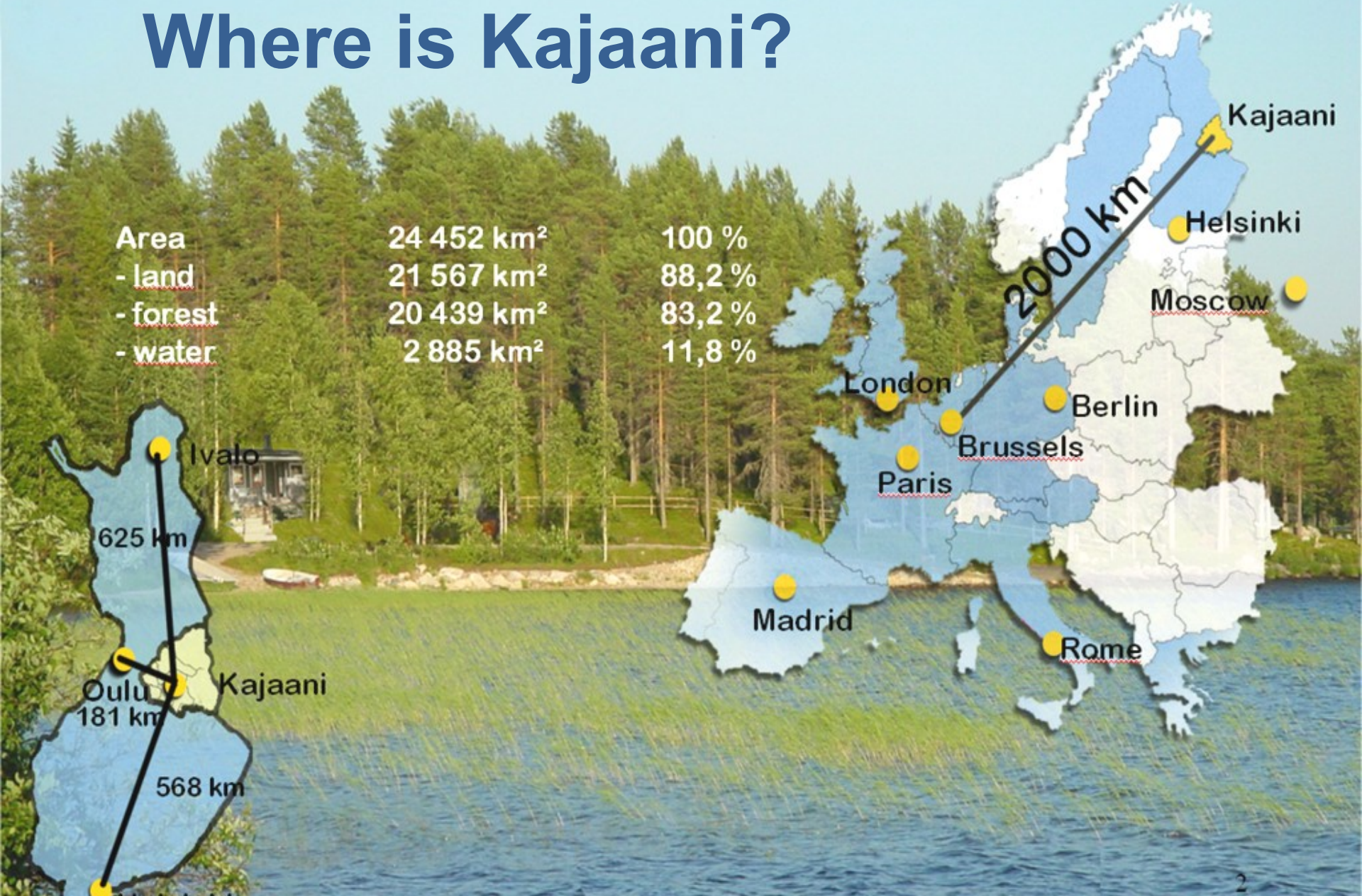
- Traditionally separate departments must now work together
- I try to bridge the gap

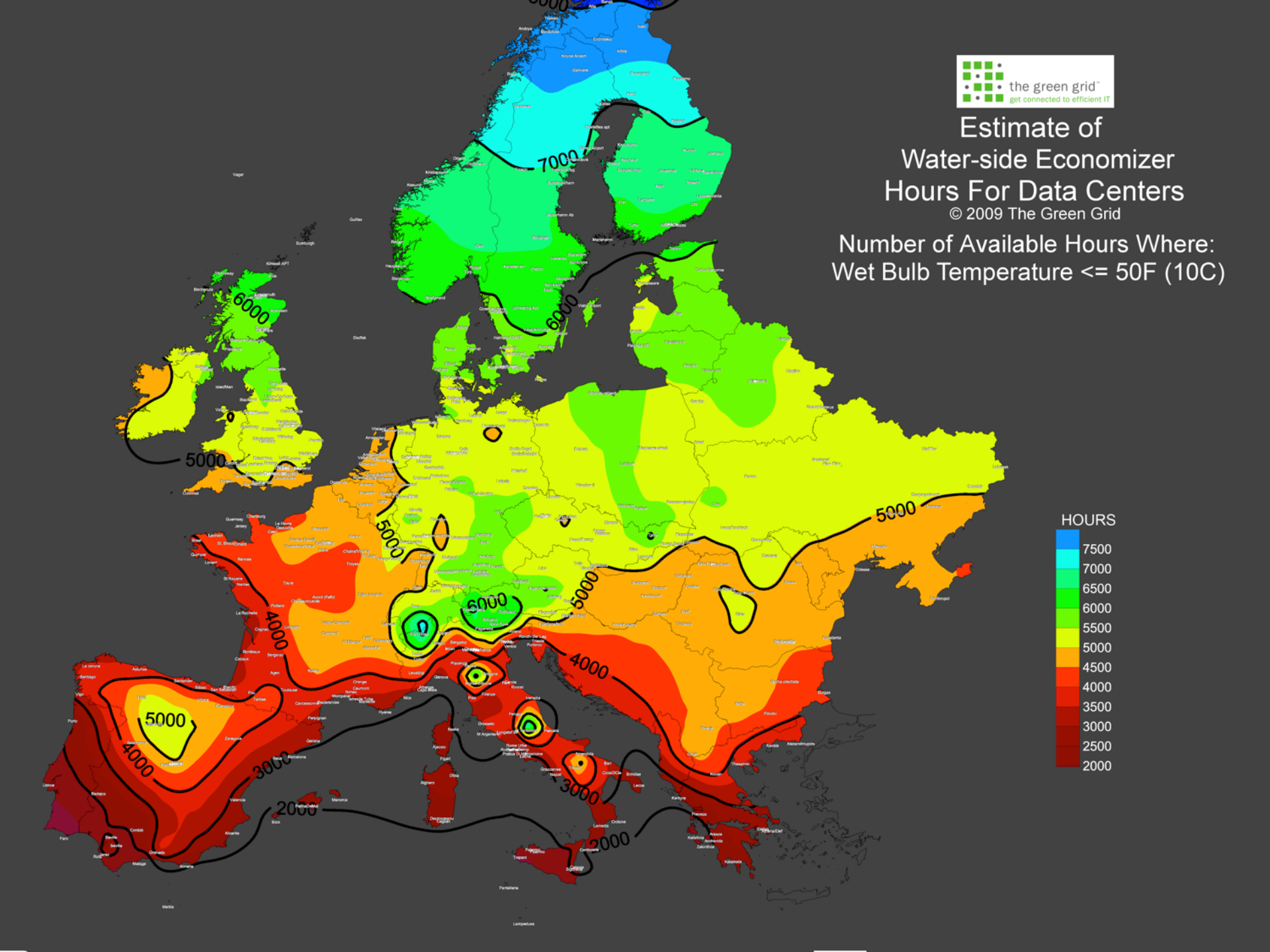
Topics

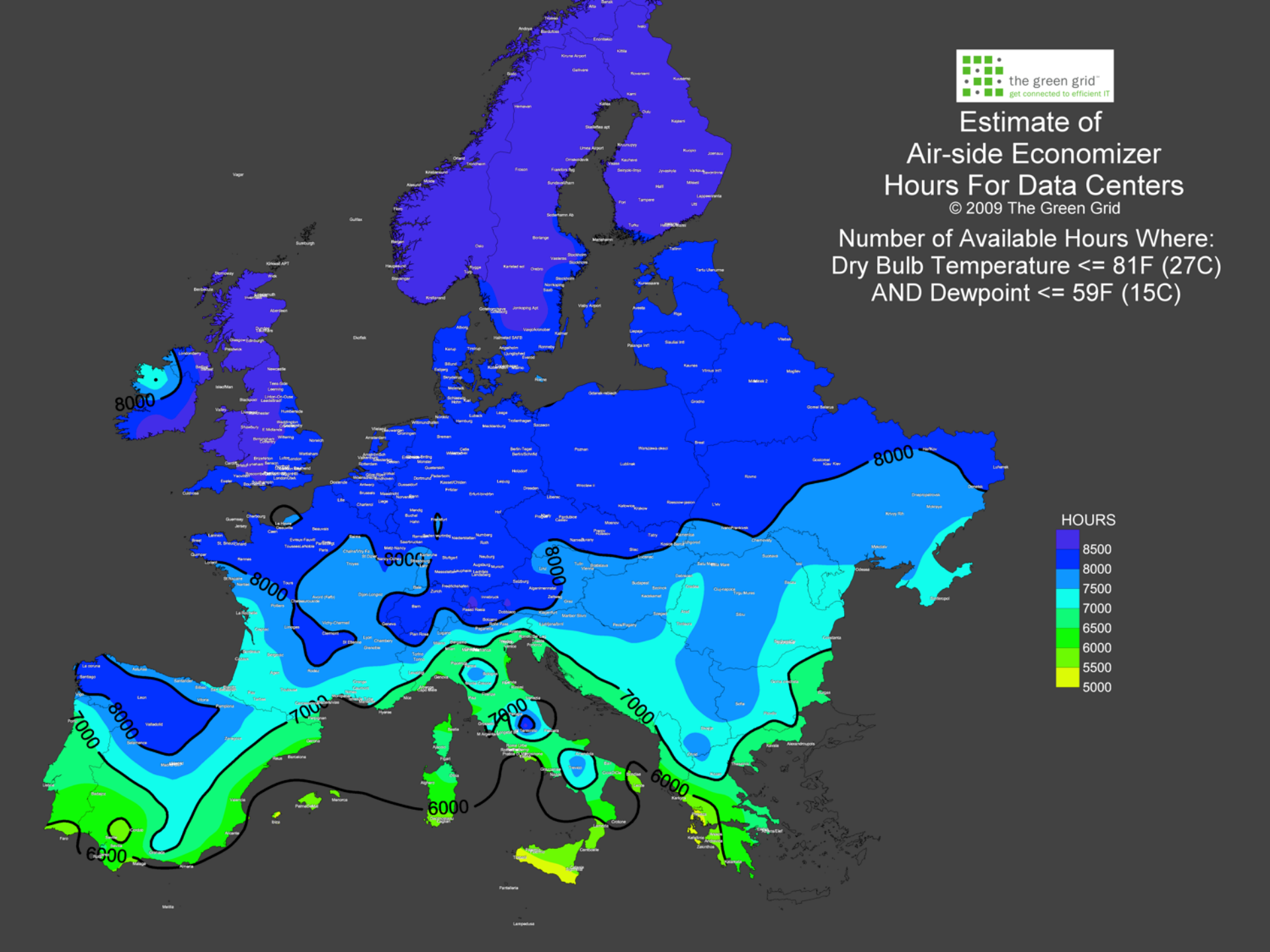
- Why Kajaani?
  - Energy efficiency
- Why so much power?
- Modular Data Center
  - What did we build?
- Timeline

WHY KAJAANI?

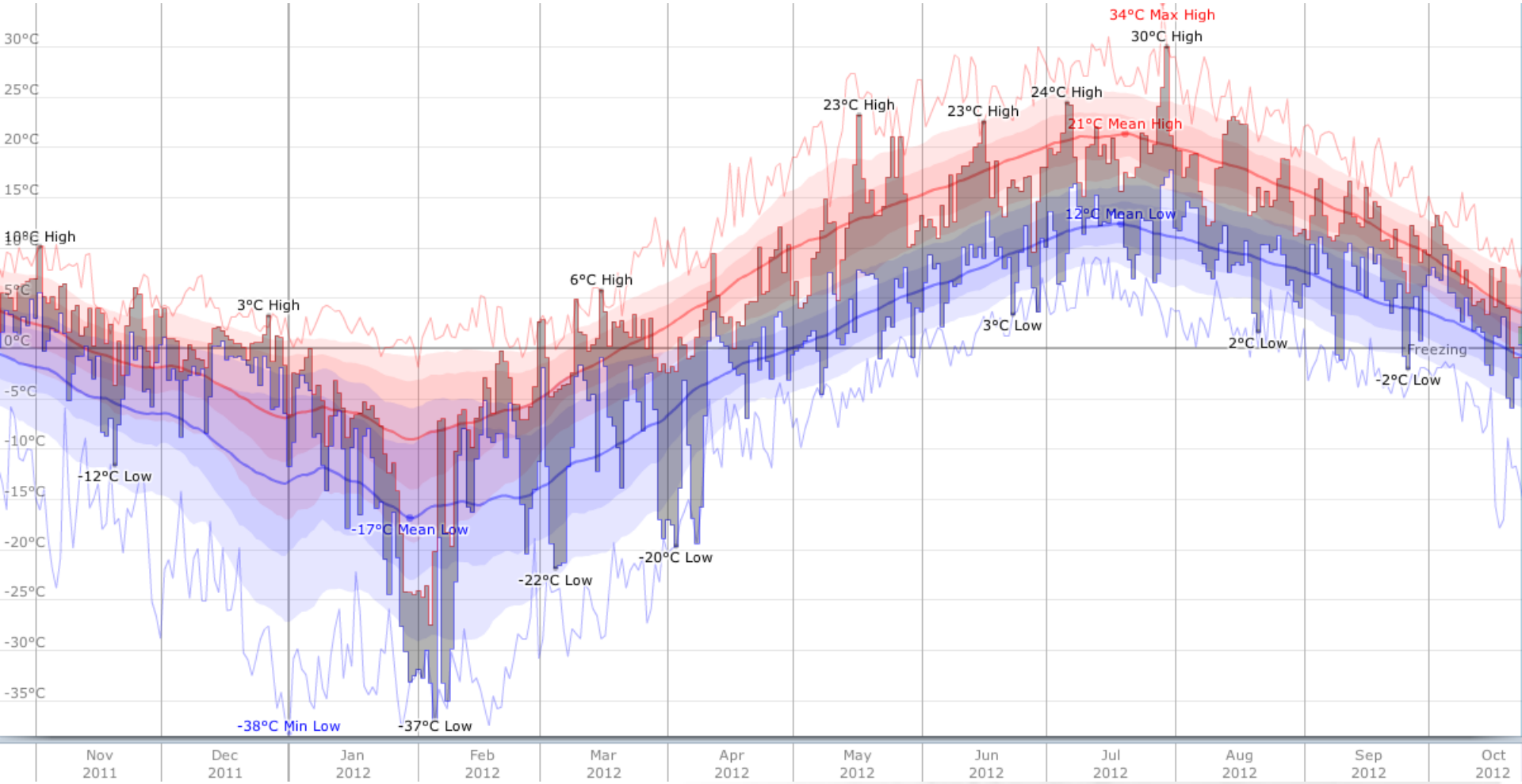
Where is Kajaani?



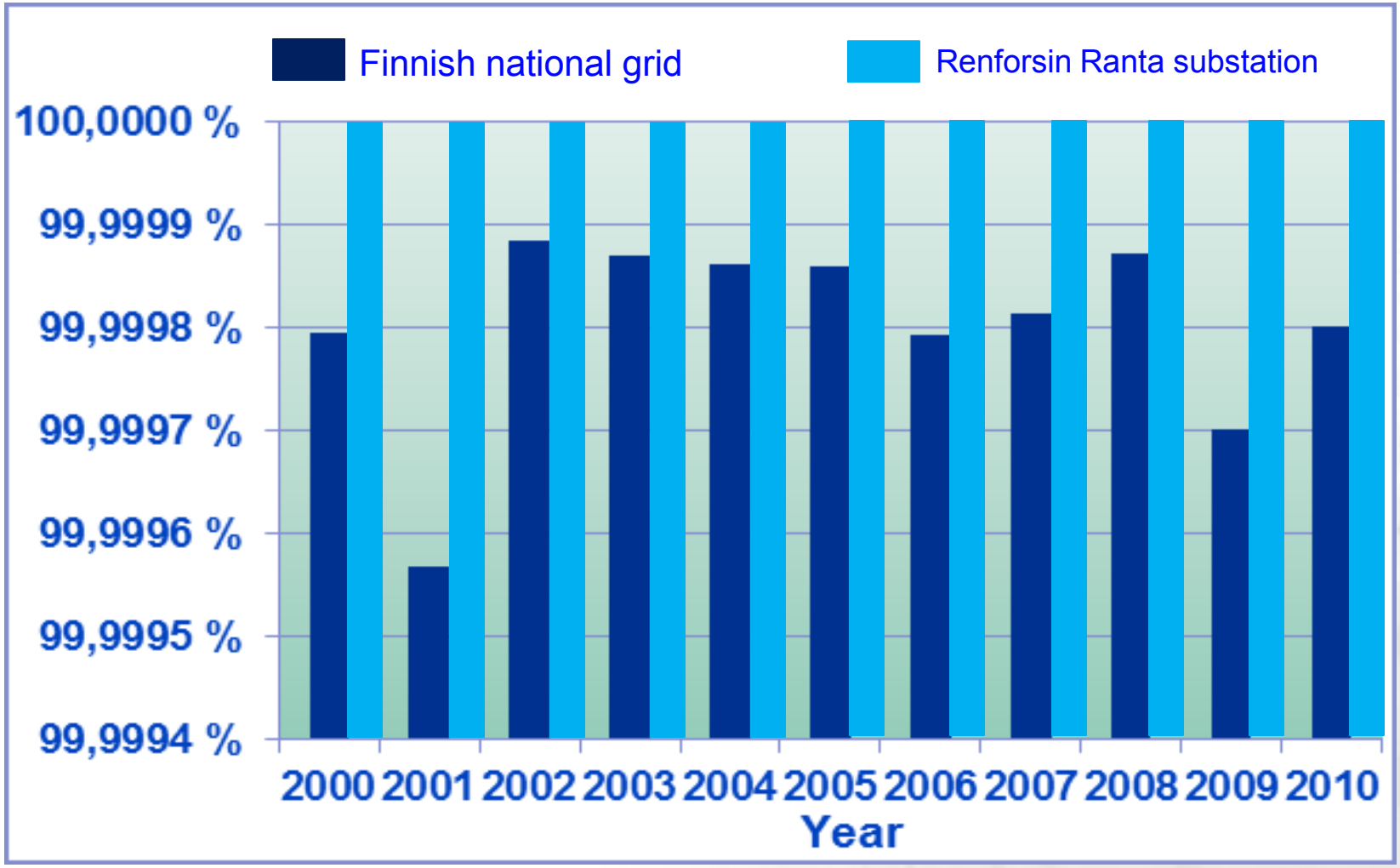

the green grid
get connected to efficient IT
Estimate of
Water-side Economizer
Hours For Data Centers
© 2009 The Green Grid
Number of Available Hours Where:
Wet Bulb Temperature <= 50F (10C)
HOURS
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
7000
6000
5000
4000
3000
2000


the green grid
get connected to efficient IT
Estimate of
Air-side Economizer
Hours For Data Centers
© 2009 The Green Grid
Number of Available Hours Where:
Dry Bulb Temperature <= 81F (27C)
AND Dewpoint <= 59F (15C)
HOURS
8500
8000
7500
7000
6500
6000
5500
5000
8000
8000
8000
8000
8000
7000
7000
7000
7000
6000
6000
6000

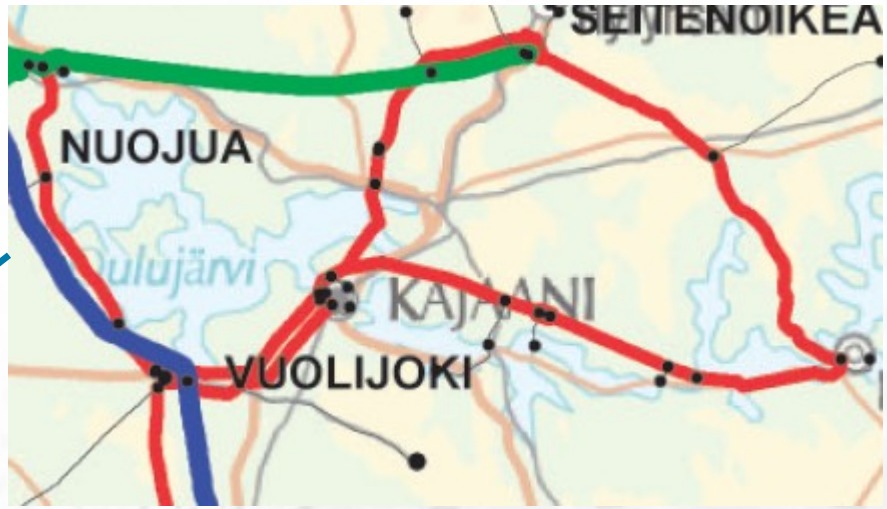
Kajaani climate in past 12 months



Electricity reliability



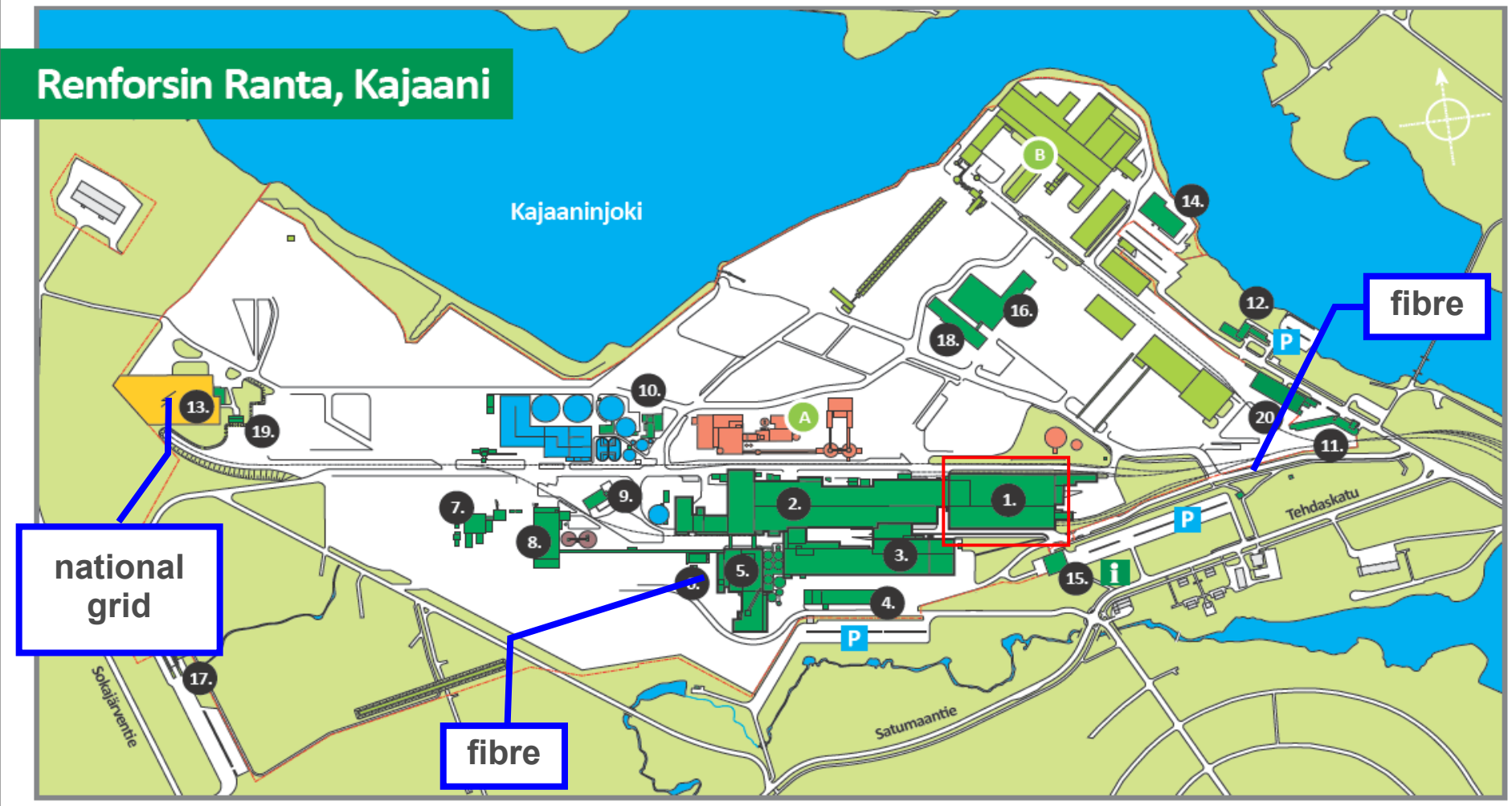
Fingrid connections to Kajaani



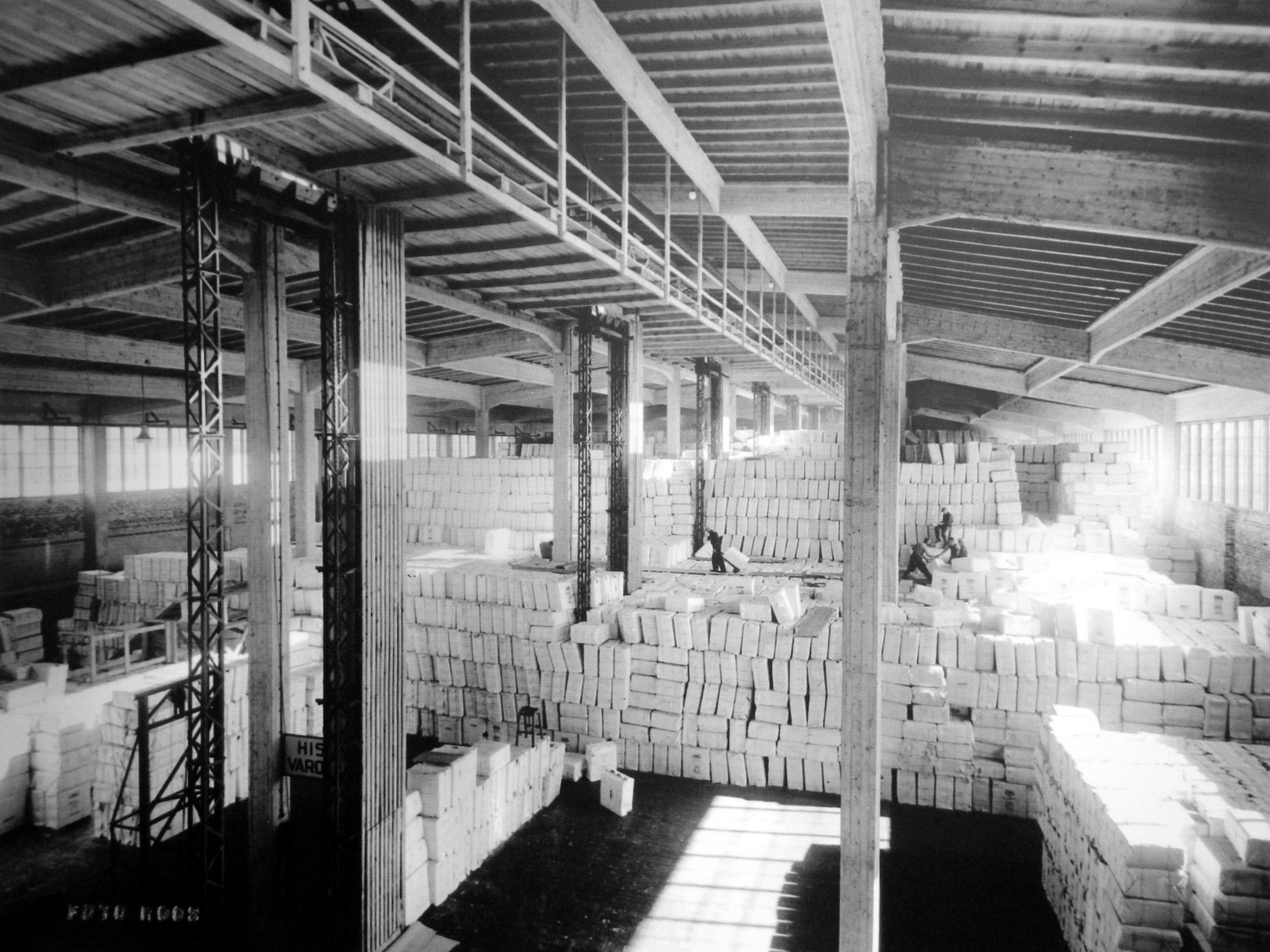
400 kV
220 kV
110 kV

Power capabilities

- Within perimeter fence:
  - National grid connection access to 340 MW
  - 110 kV / 10 kV main transformer capacity
    - Current capacity 240 MW
  - Biopower on site
- Green power options
  - 3 hydro power plants within 3 km
    - feeding directly to site.
- Diverse power supply = reliable power



RENFORSIN RANTA
YRITYSALUE · KAJAANI



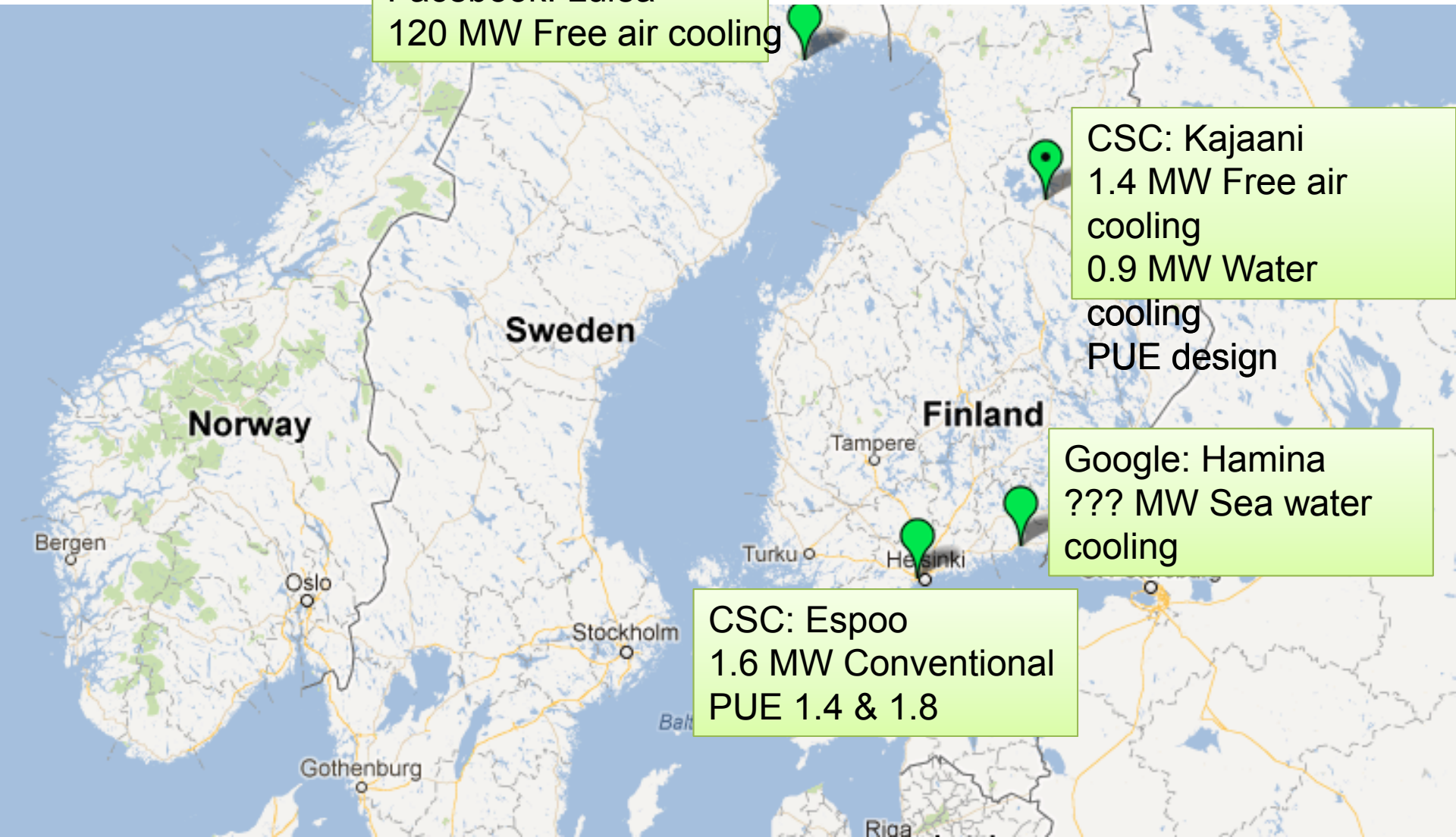

343


321
322
JCB
LK
WAL
60 70
D
HRO KM 713
KRONE

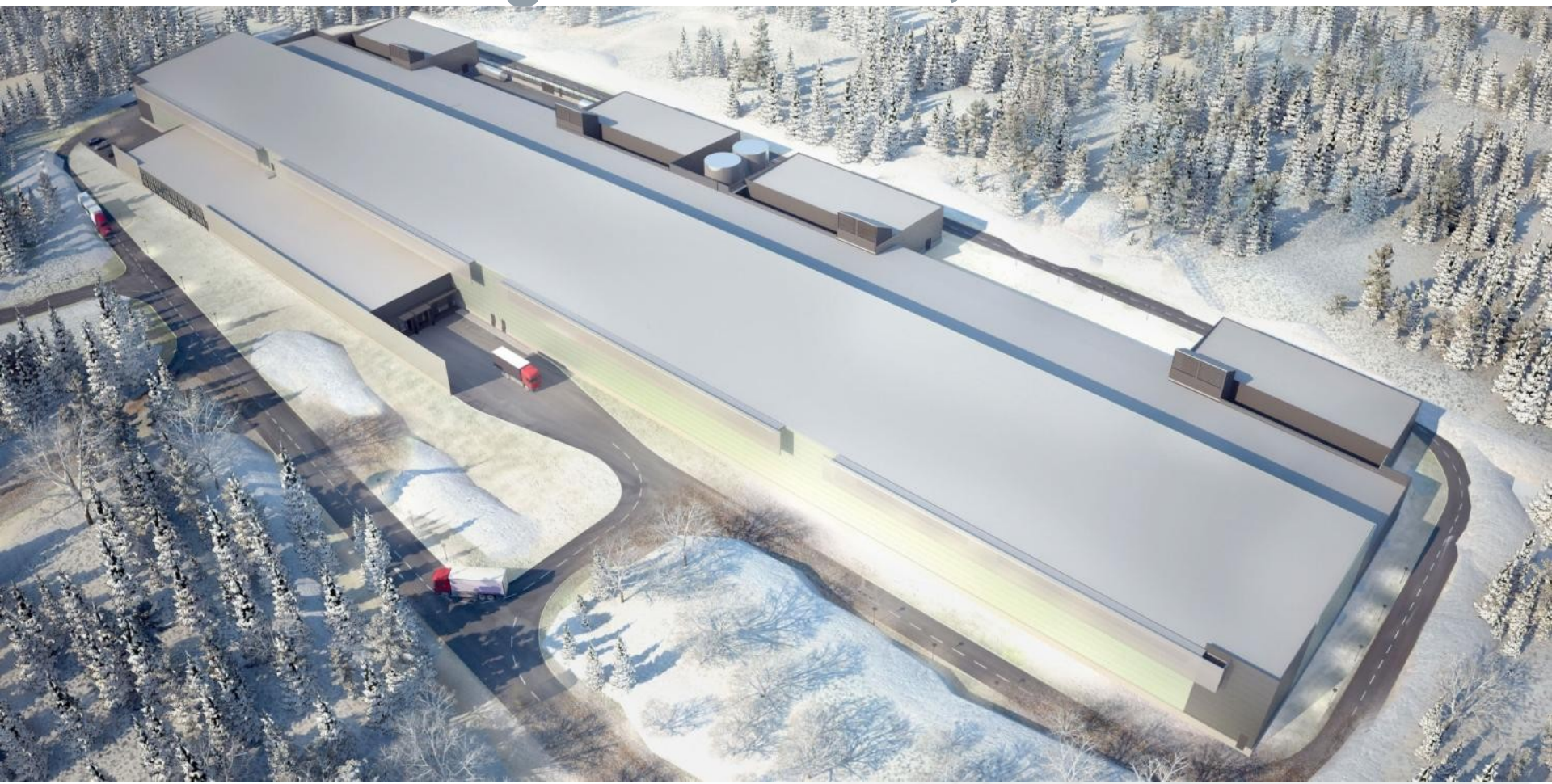

FUNET
CONNECTIONS 2010
CSC
FIBER CONNECTIONS
TRANSMISSION CONNECTIONS
NORDUNET
INTERNATIONAL CONNECTIONS
IP- and fiber network connection sites
Fiber network connection sites
NORDUnet
Sodankylä
Rovaniemi
Oulu
Kajaani
Kokkola
Vaasa
Kuopio
Joensuu
Jyväskylä
Tampere
Mikkeli
Pori
Lappeenranta
Hämeenlinna
Rauma
Lahti
Kouvola
Turku
Kotka
St. Petersburg
Oslo
Stockholm
Helsinki
GLORIAD
RUNNet
Internet
New York
London
Hamburg
Amsterdam
GLORIAD
GÉANT
Poznan


Sodankylä
Rovaniemi
Kemi
Oulu
Kajaani
Pietarsaari
Kokkola
Vaasa
Seinäjoki
Kuopio
Joensuu
Jyväskylä
Savonlinna
Mikkeli
Tampere
Pori
Lappeenranta
Hämeenlinna
Rauma
Lahti
Kouvola
Turku
Salo
Espoo
Helsinki
Kotka
Venäjä
RUNNet
Pohjoismaat
NORDUnet
Internet
Kansainväliset tutkimusverkot
Eurooppa
GÉANT

Related datacenter sites



Facebook goes to Lulea, Sweden




CSC
OPEN
Compute Project

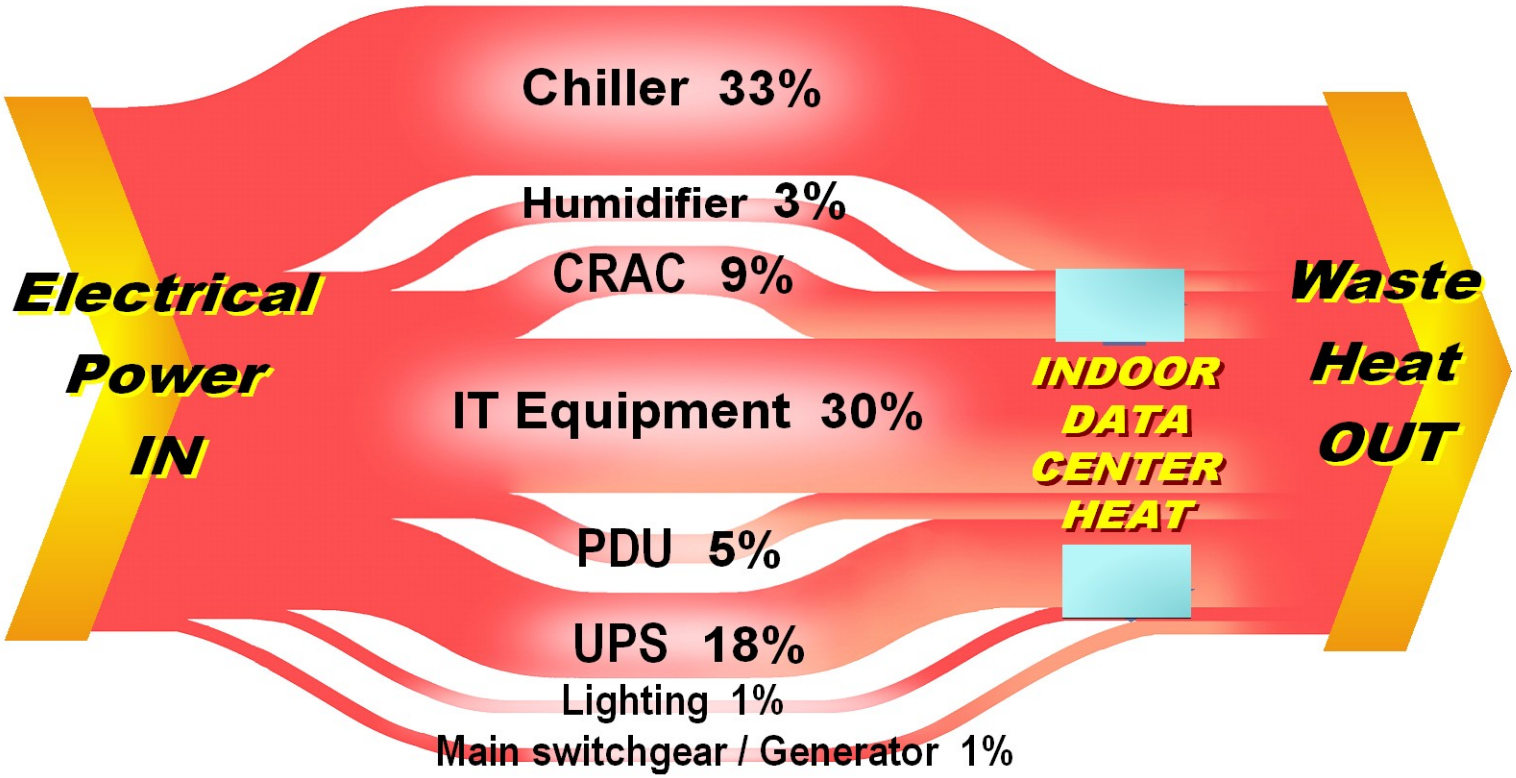
Government support

- Google Hamina = wakeup call
  - Unused assets ideal for fast growing industry
  - Jobs, skills, international competitiveness
- Government acted
  - Regional development money
  - Extra money to CSC to build a new site
- Site selection: long story short
  - Initial concept study 2010
  - Several former paper mills considered
  - Kajaani was successful in bidding


DEMAG HC 130

WHY SO MUCH POWER?

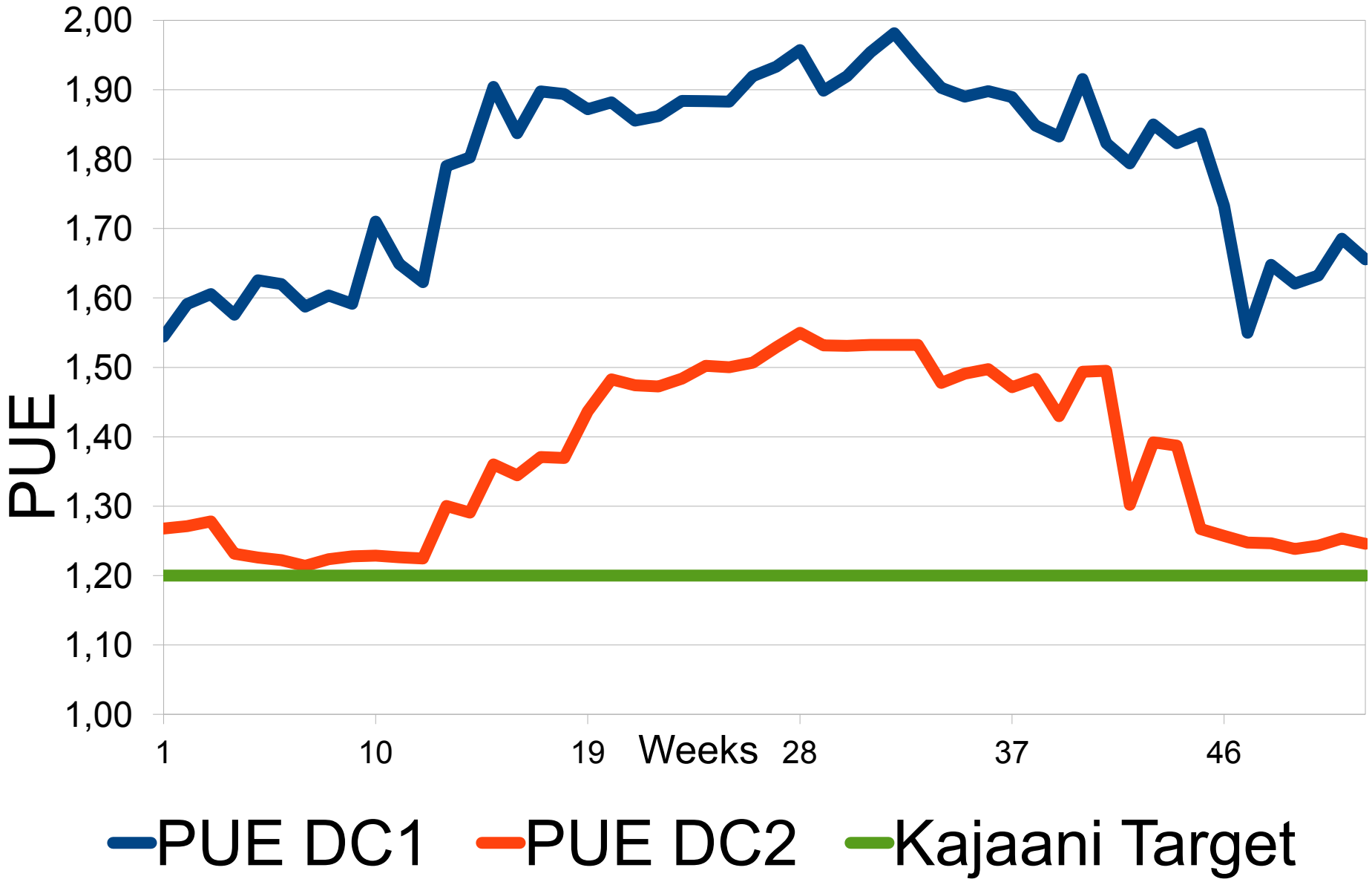
Where is all the power going?



Power Usage Effectiveness

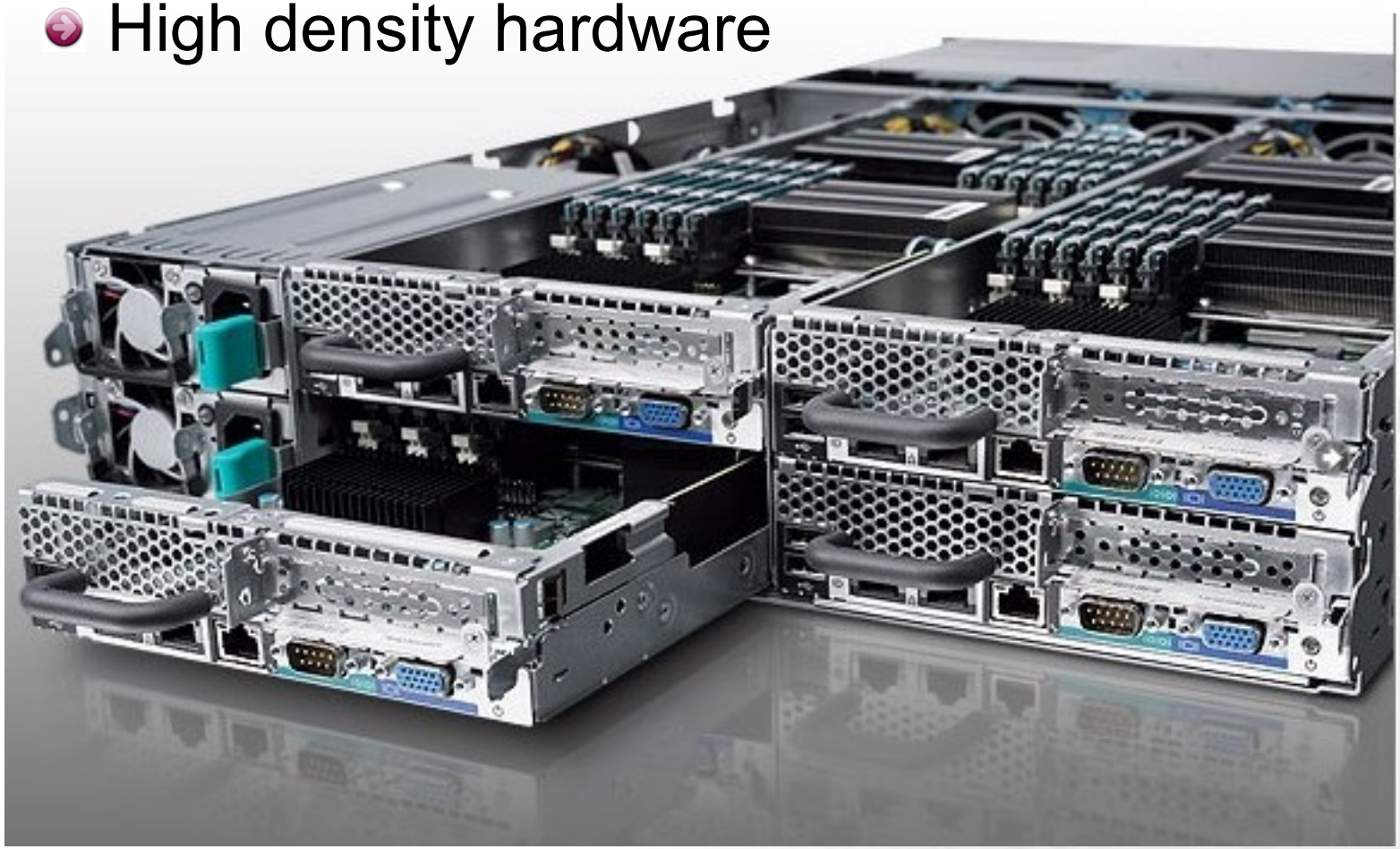
$$PUE = \frac{\text{Total Facility Power}}{\text{IT Equipment Power}}$$

Current PUE vs. Kajaani goal



Why so much power?

- High density hardware



1U servers in 2008

- 32 servers in a rack
- 10-15kW
- Already a problem to cool

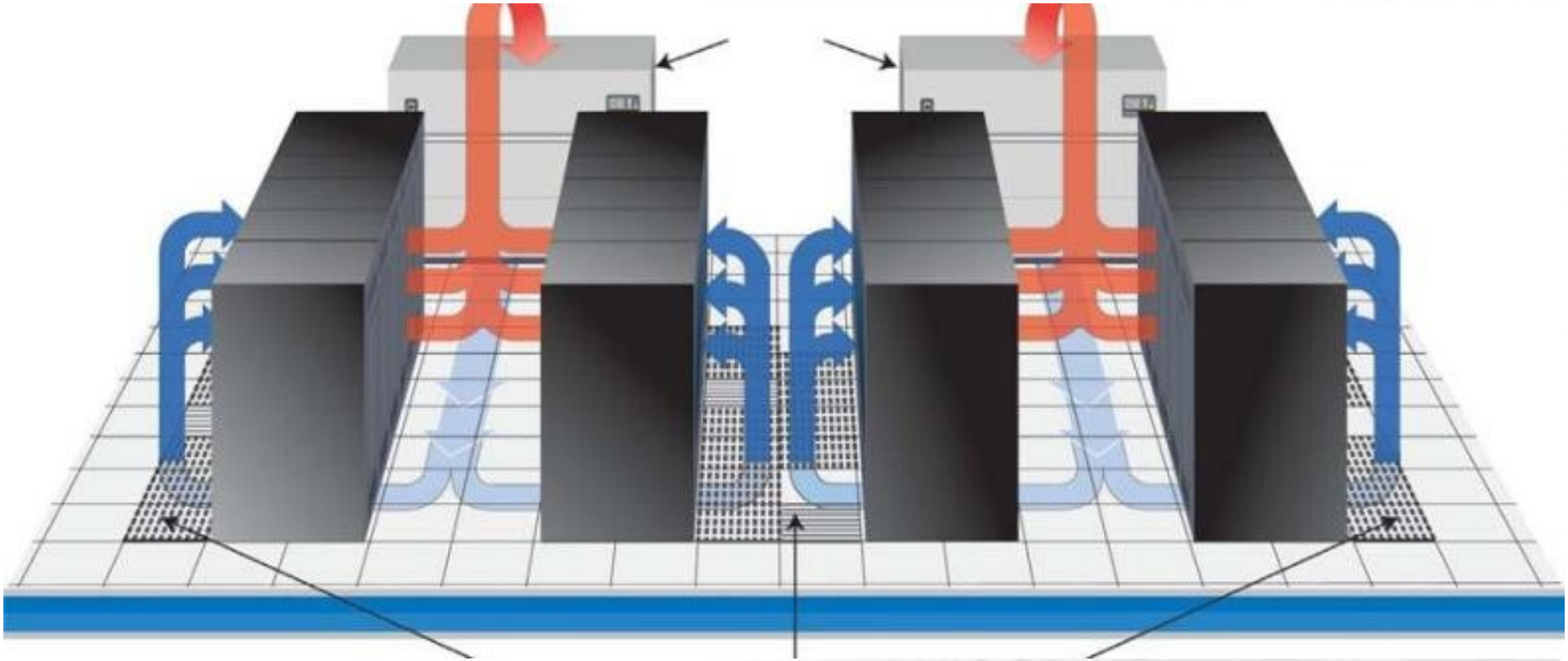
It all adds up …

- ‘standard rackmount servers’ = 30kW in a rack
  - 72 x 2 socket servers, 128GB memory

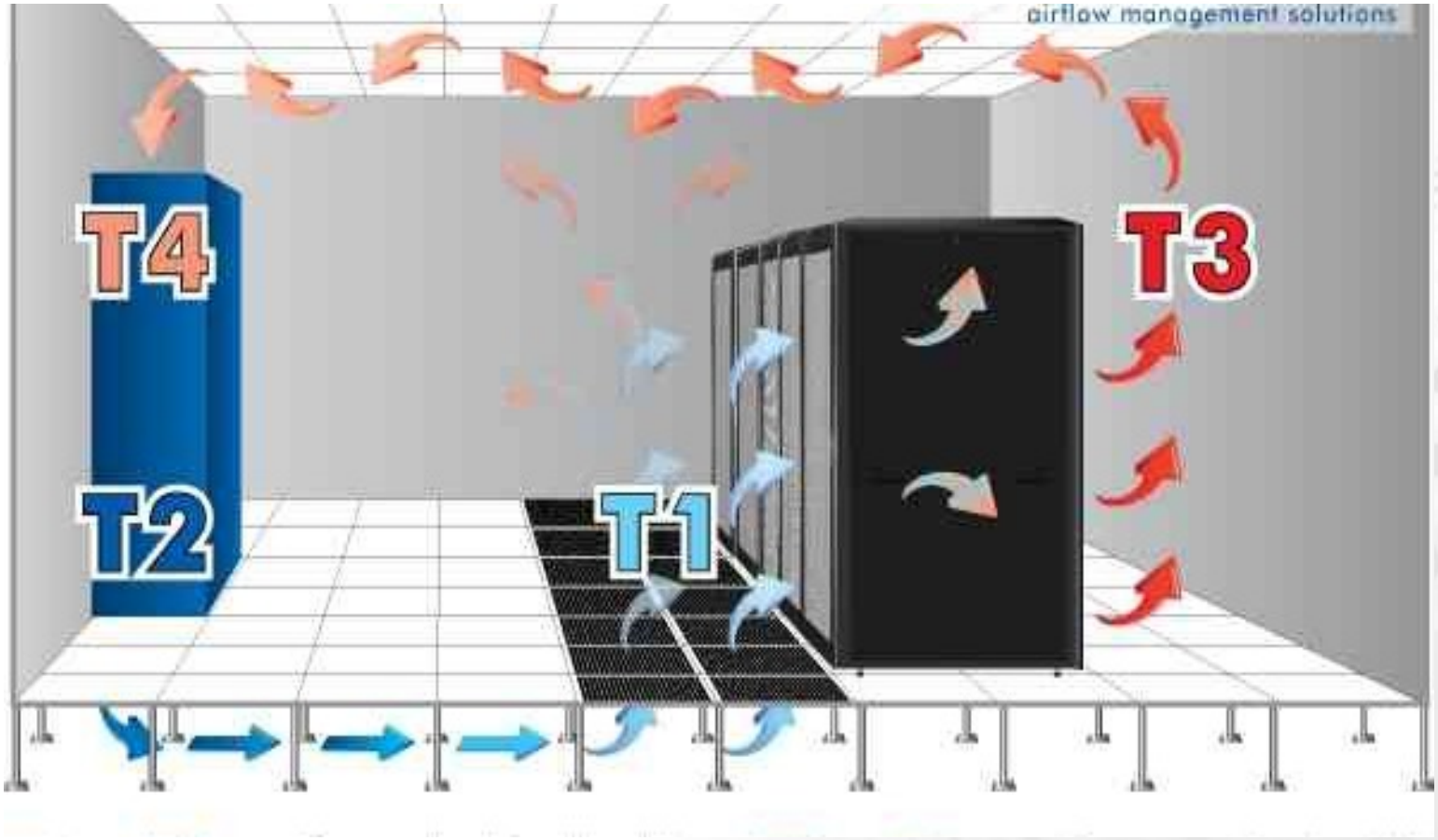
A 20kW Electric heater

Image source: http://www.wichtowski.pl/en/products/13/46/77/Indirect_fired_heaters_Model_BV_77_E

Raised floor cooling: theory



In practice: bypass air



THE PROJECT

Approach

- Design goal: multi-MW facility PUE <1.2
- Leverage features of site
  - Matched to business requirements
  - Avoid redundancy and backup
- Only 100kW UPS from day one
- No generators day one
- Option to add 100% UPS and generators

Approach continued

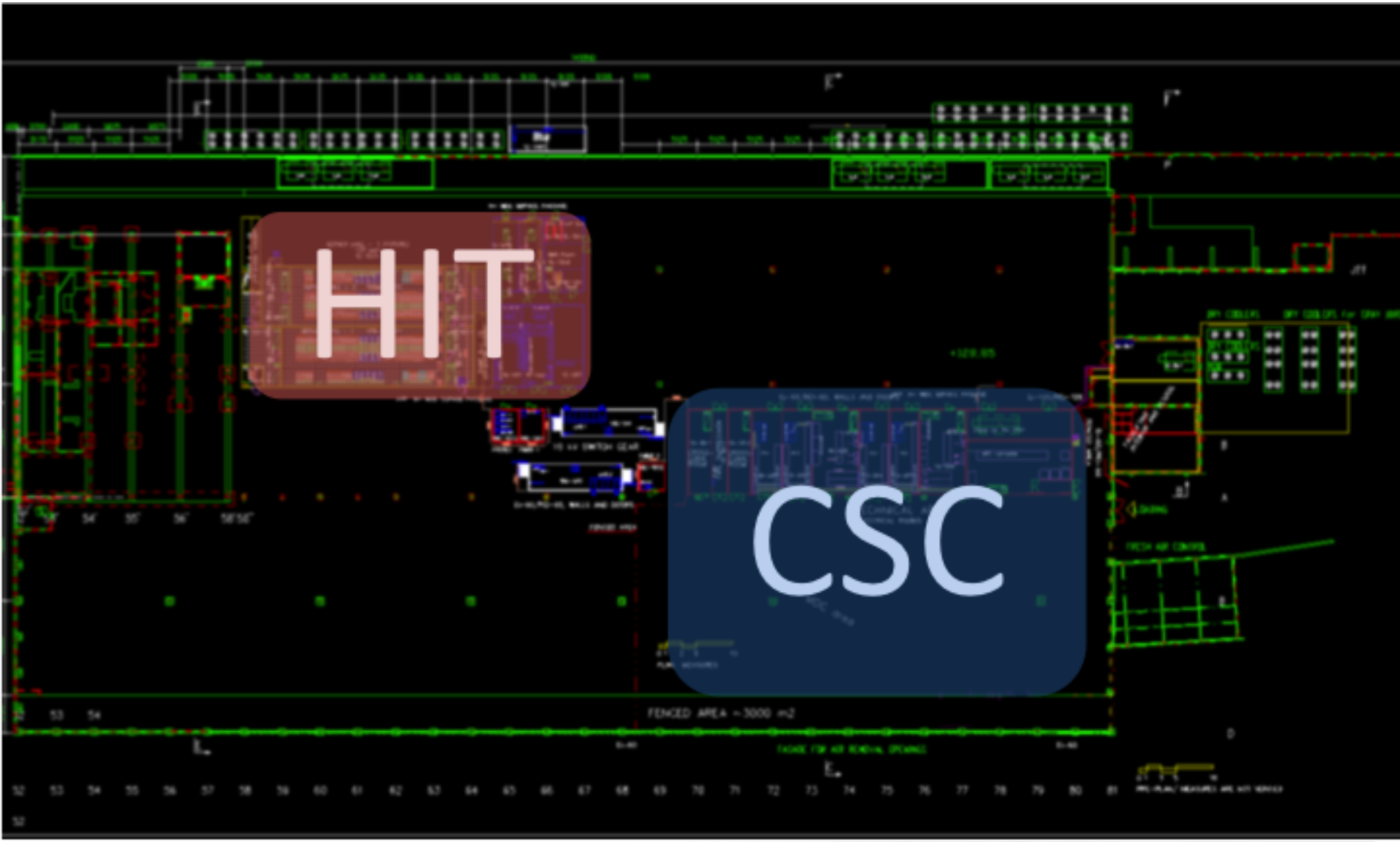
- Free cooling year round
- Use modular to right-size and scale quickly
- Green
  - CSC buys certificates of carbon neutral energy
  - 100% Finnish hydro power
- Leverage:
  - TGG DCMM and EU CoC
  - ASHREA TC 9.9
  - IT operating environment relaxations

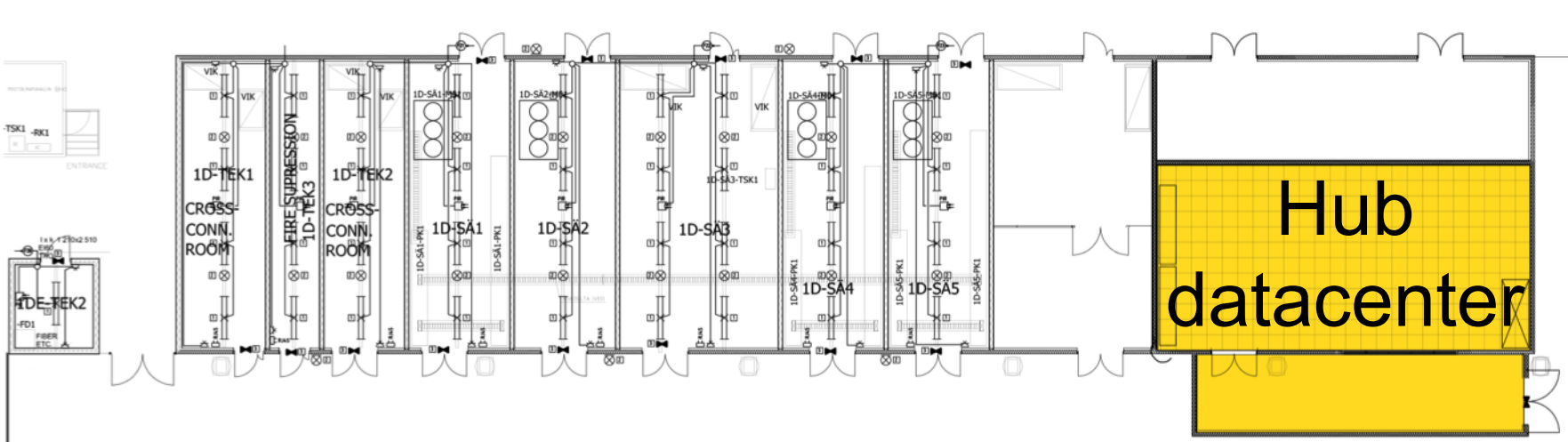
WHAT DID WE BUILD?

CSC's new Kajaani datacenter

- Renovated paper warehouse
- 12 000 m2 of space
- ~ 1.7 x Old Trafford football ground

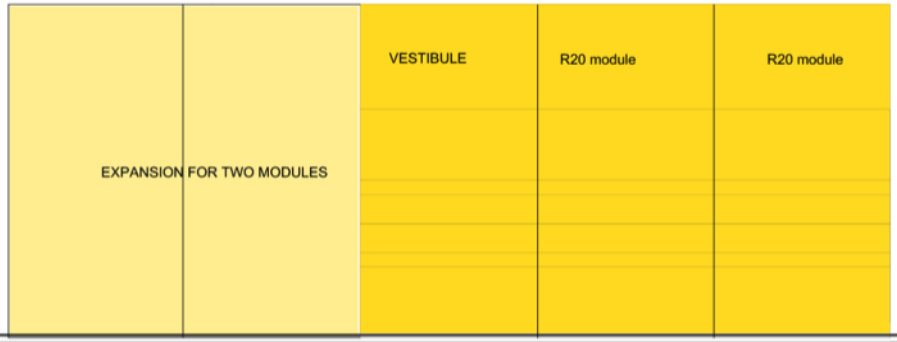
Opening day


HIT
CSC



TWO DATACENTERS IN ONE

SGI Ice Cube R80



0 1 3 5 10

PLAN MEASURES

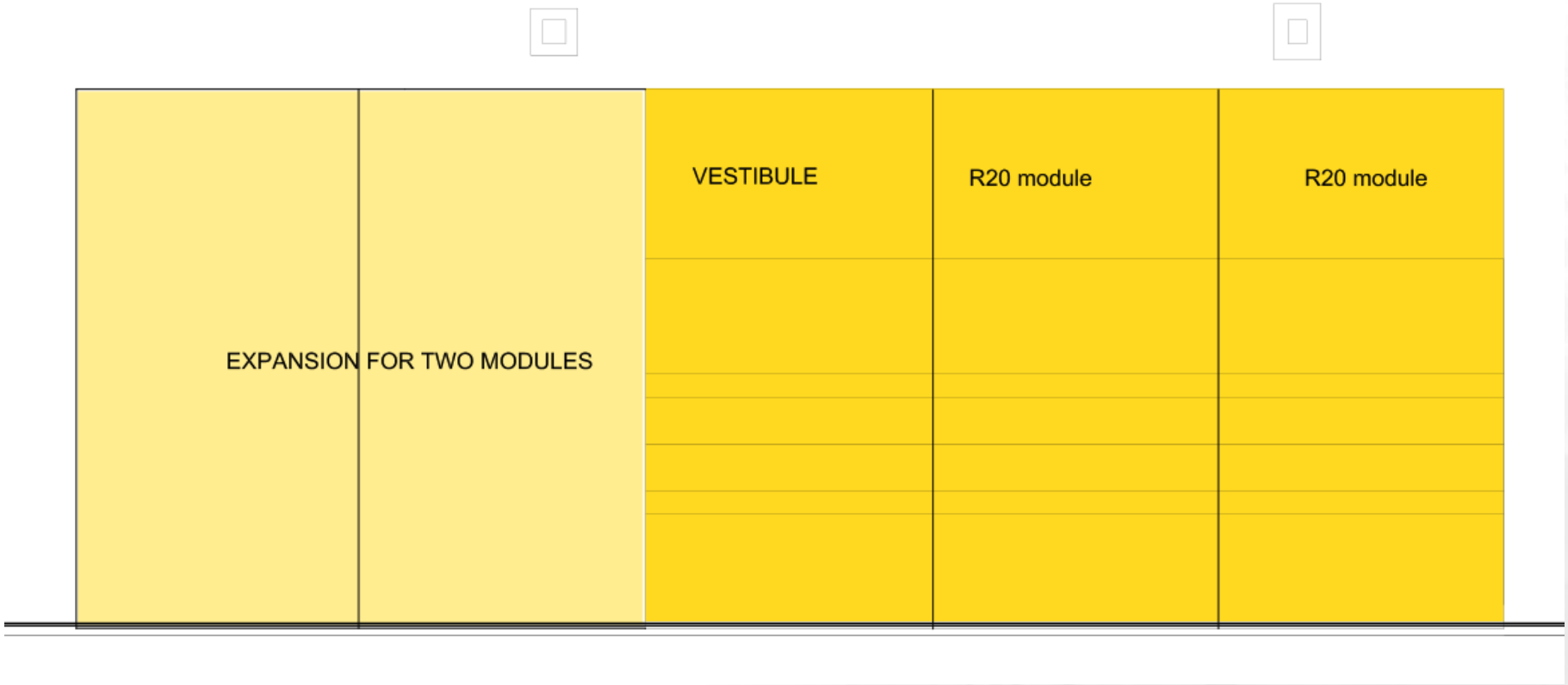
FENCED AREA ~3000 m2

3D WALKTHROUGH VIDEO

Specification

- 2.4 MW combined hybrid capacity
- 1.4 MW modular free air cooled datacenter
  - Upgradable in 700kW factory built modules
  - Order to acceptance in 5 months
  - 35kW per extra tall racks – 12kW common in industry
  - PUE forecast < 1.08 ($pPUE_{L2,YC}$)
- 1MW HPC datacenter
  - Optimised for Cray super & T-Platforms prototype
  - 90% Water cooling

SGI Ice Cube R80

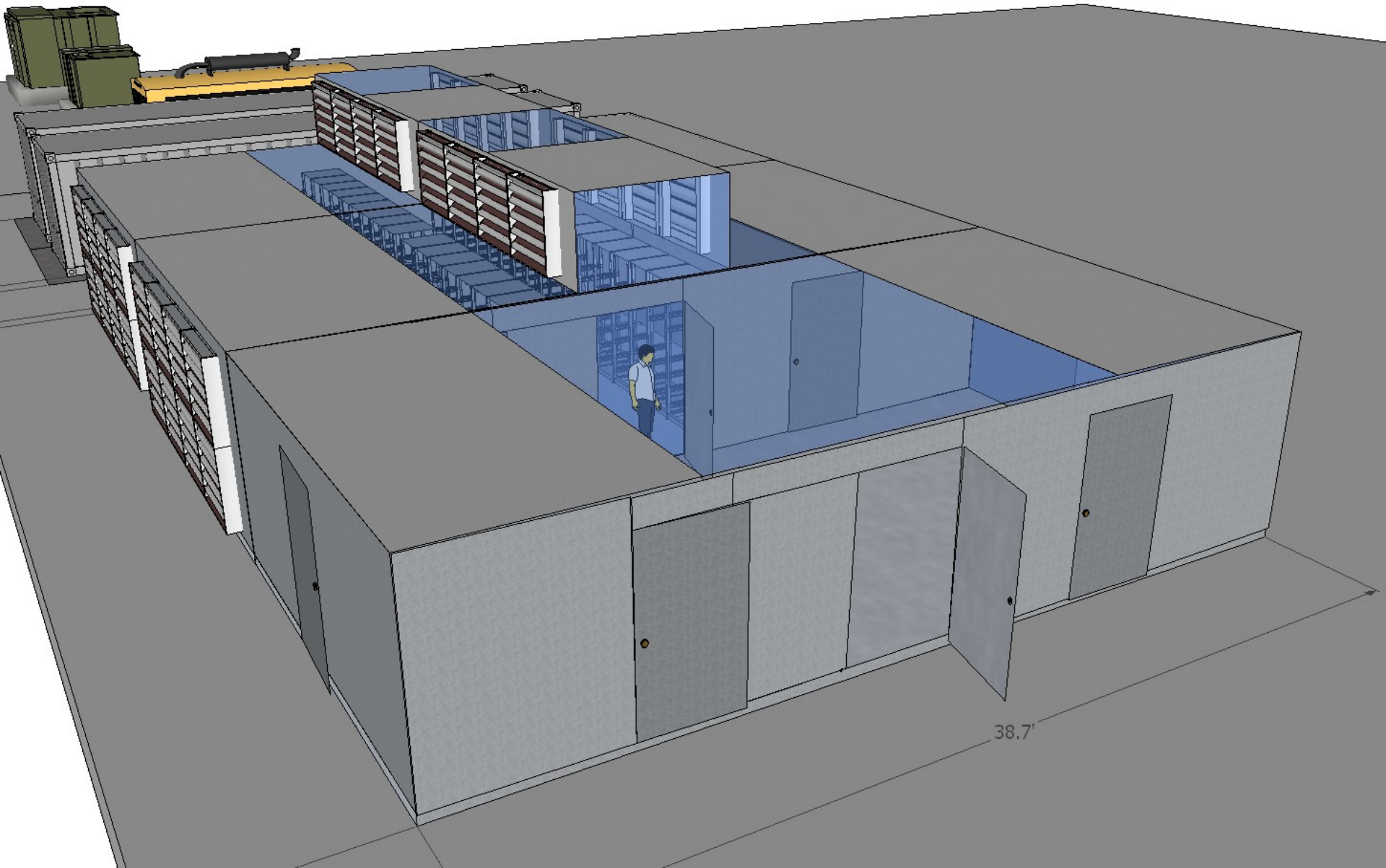


Site in January 2012

MDC TIME LAPSE VIDEO


ICE Cube Air® R8 O
sgi

SGI Ice Cube R80

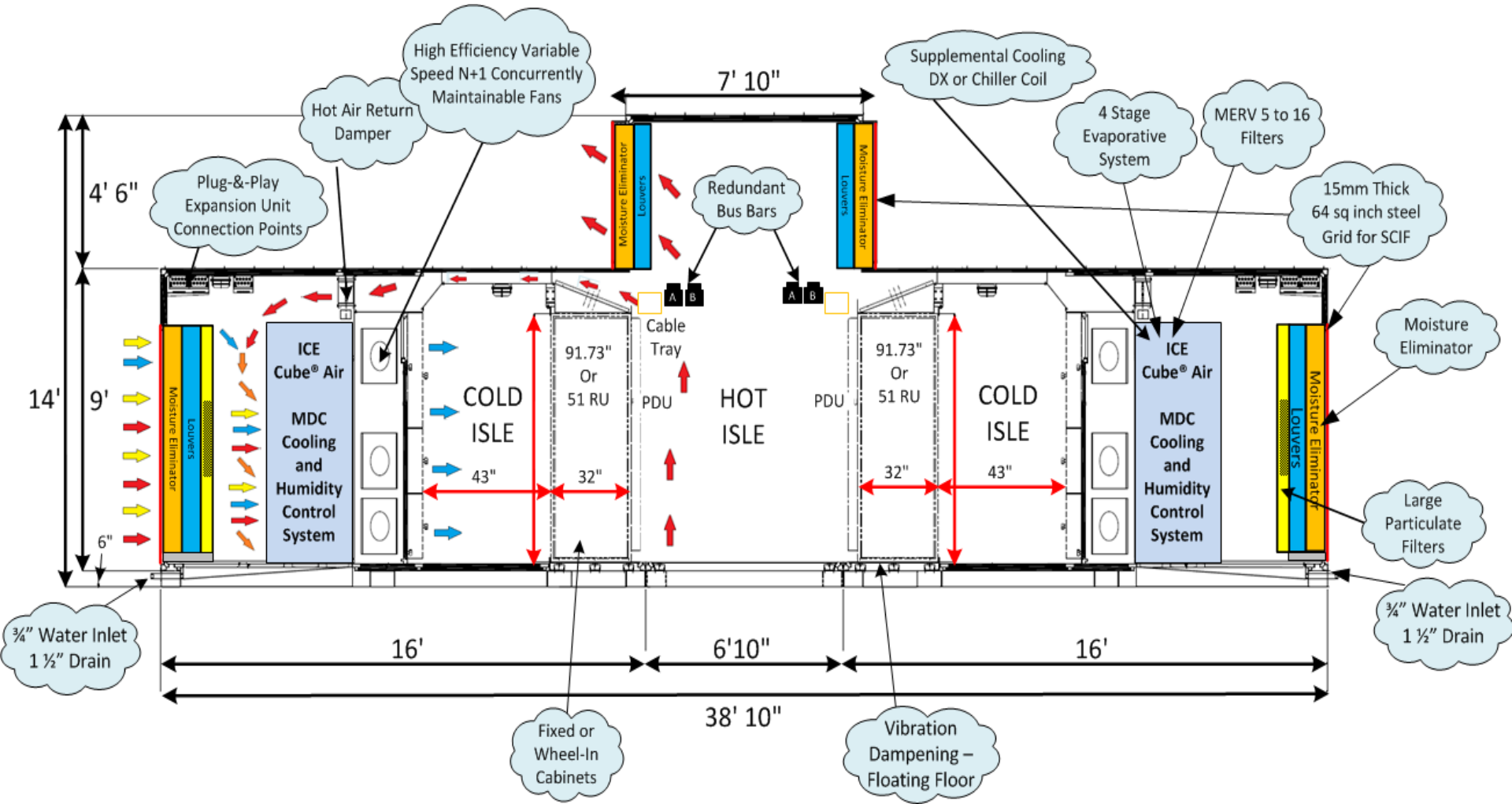


SGI Ice Cube R80

- One head unit and two expansion modules
- More modules can be added
- Fully automated free cooling system
  - Dozens of cooling fans, louvers and sensors
- Extremely energy efficient – pPUE 1.08
- Set point allowed to vary (10-27C for us)
- Adiabatic cooling on warm days
- Exhaust heat used to warm incoming air


ICE Cube Air® R80
sgi

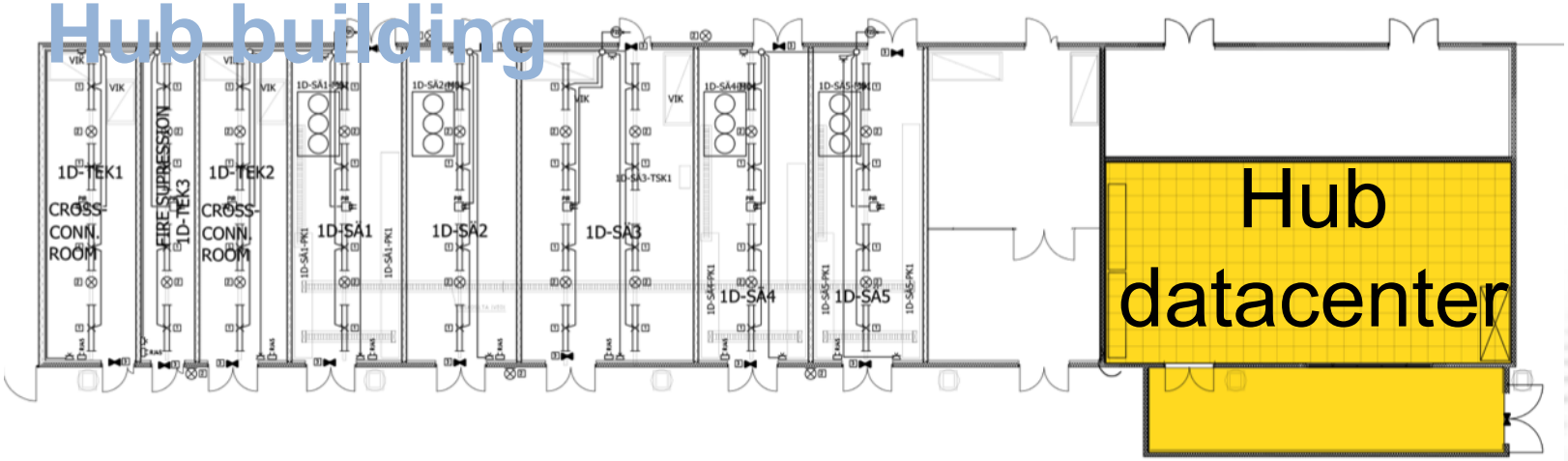
SGI ICE Cube® Air R80



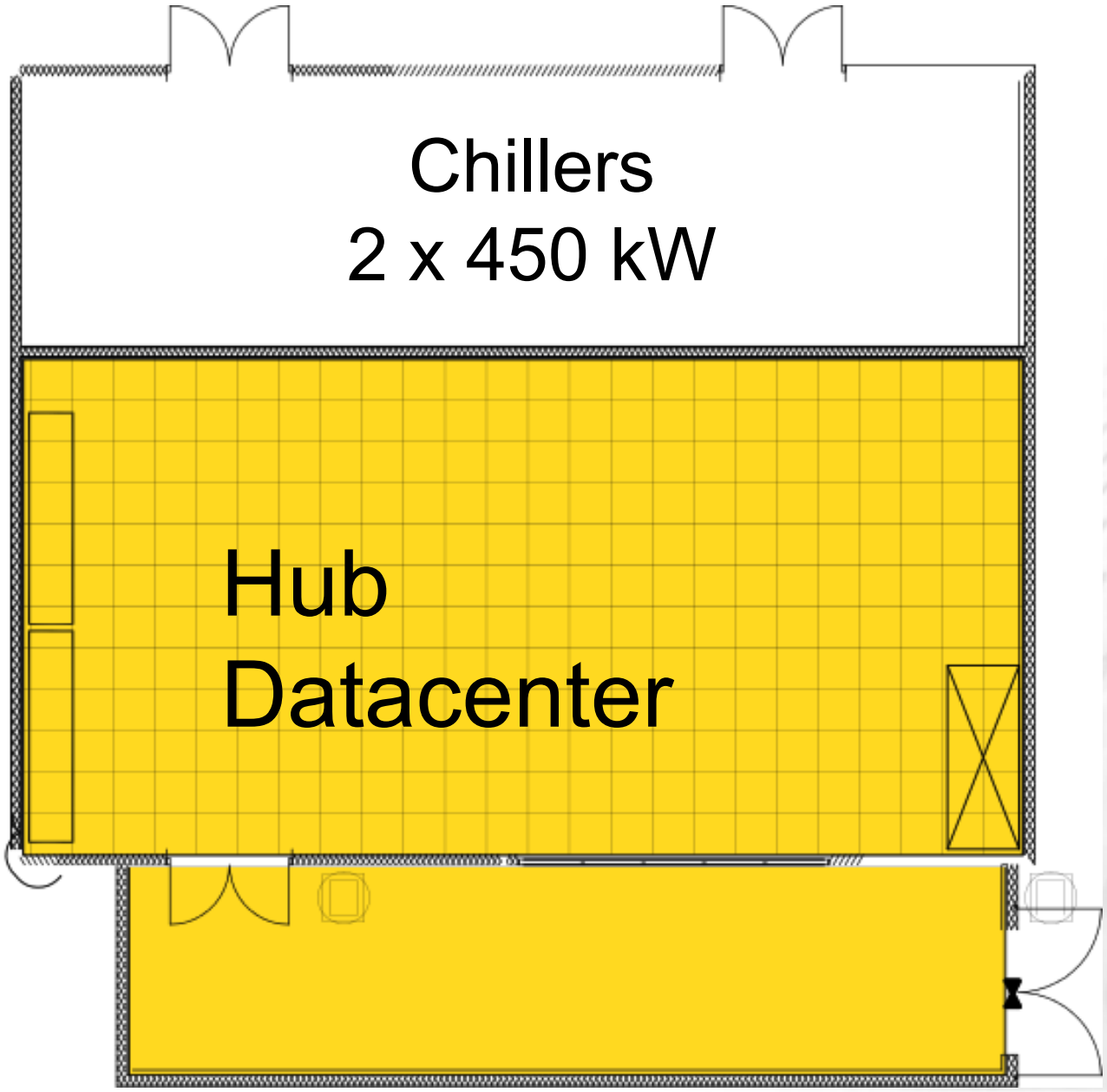
Gauss theorem
(Divergence theorem)
$\iiint_V (\nabla \cdot \mathbf{F})\, dV = \oiint_S (\mathbf{F} \cdot \mathbf{n})\, dS$

Hub building and DC

Hub building



- Redundant network rooms
- 100kW UPS – upgradable to MW's
- 10KV switchgear
- Fire suppression
- Storage rooms – warehouse is cold
- Hub Datacenter

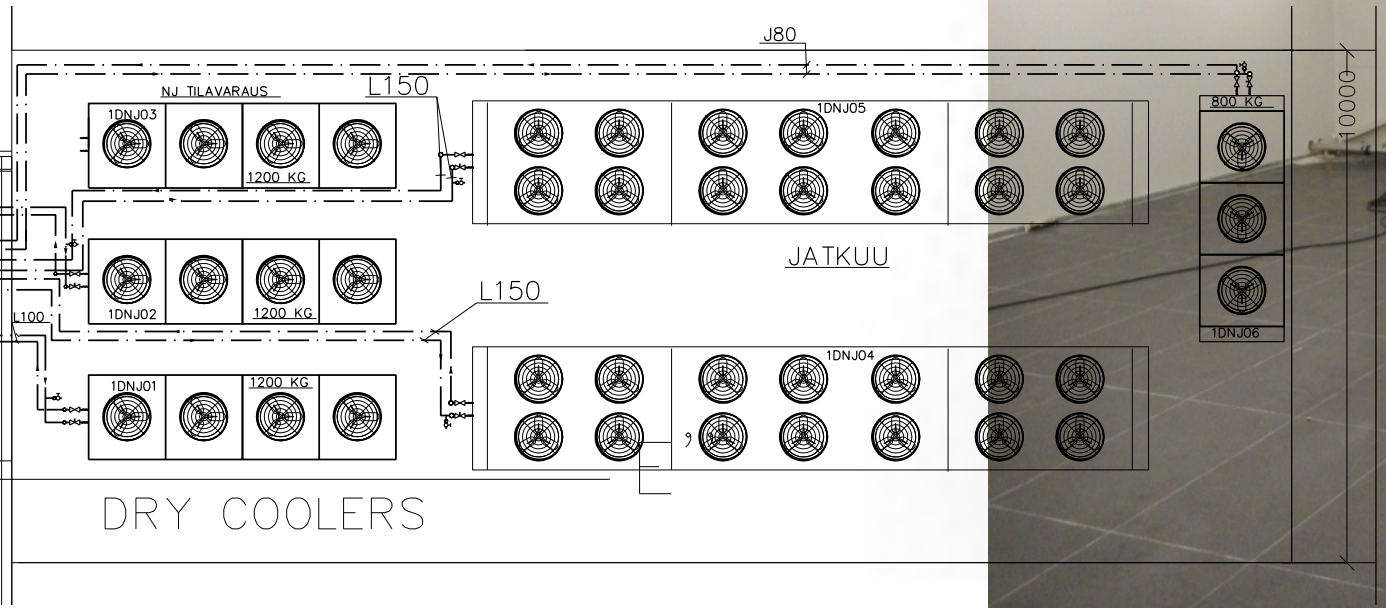


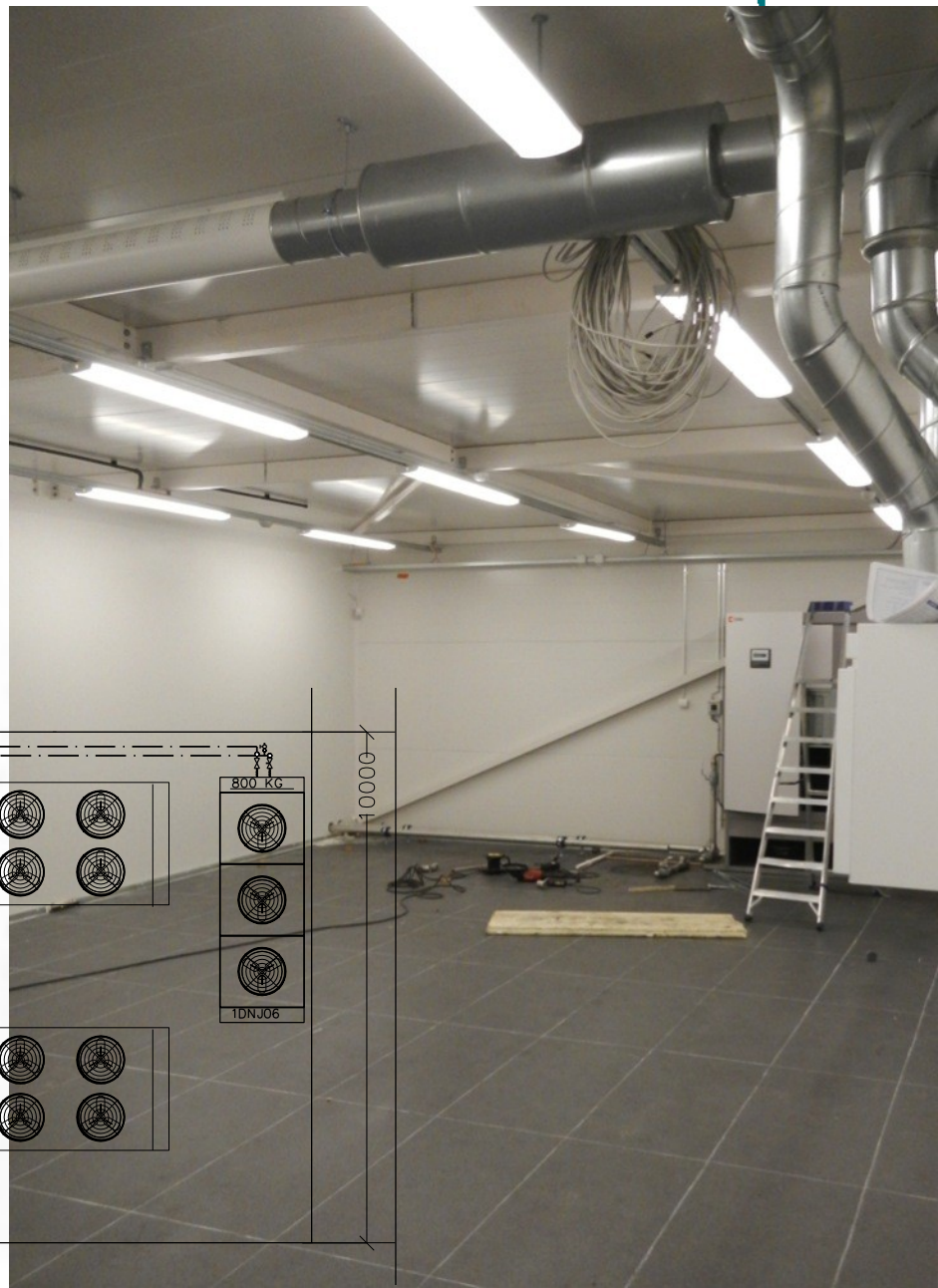
External dry coolers


80
81

Hub DC facts

- Due November
- 900kW water cooling
  - + 100kW air from hub
- Purpose built for water cooled HPC

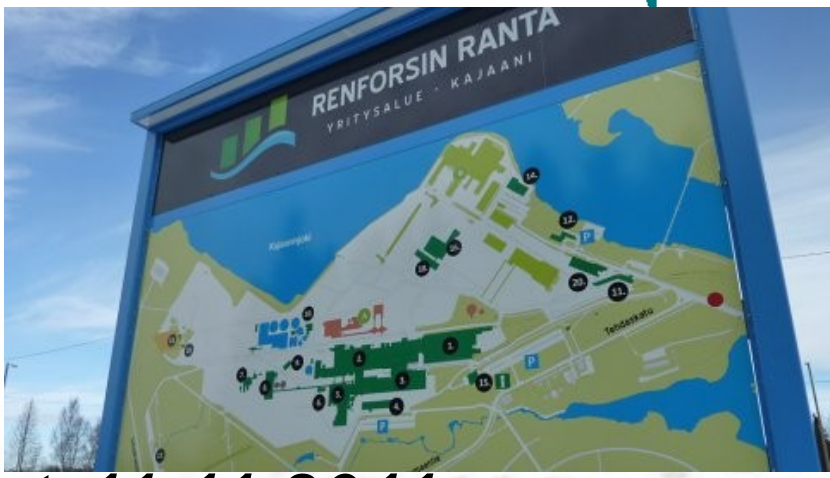




Head load test

- 700kW of load banks
  - 20 racks
  - 120 x 6kW load banks
  - 2 days to rack mount
  - Half MDC capacity
- pPUE 1.05
- Very useful

Kajaani project timeline



- CSC and UPM sign Kajaani data park agreement ***11.11.2011***
- MDCs built in factory **Summer**
- MDCs delivered to Kajaani **September**
- MDCs accepted in **October**
- HPC systems arrived **October**
- HPC service pilot **December**
- Cloud and Grid services in 2013

End.

QUESTIONS?