

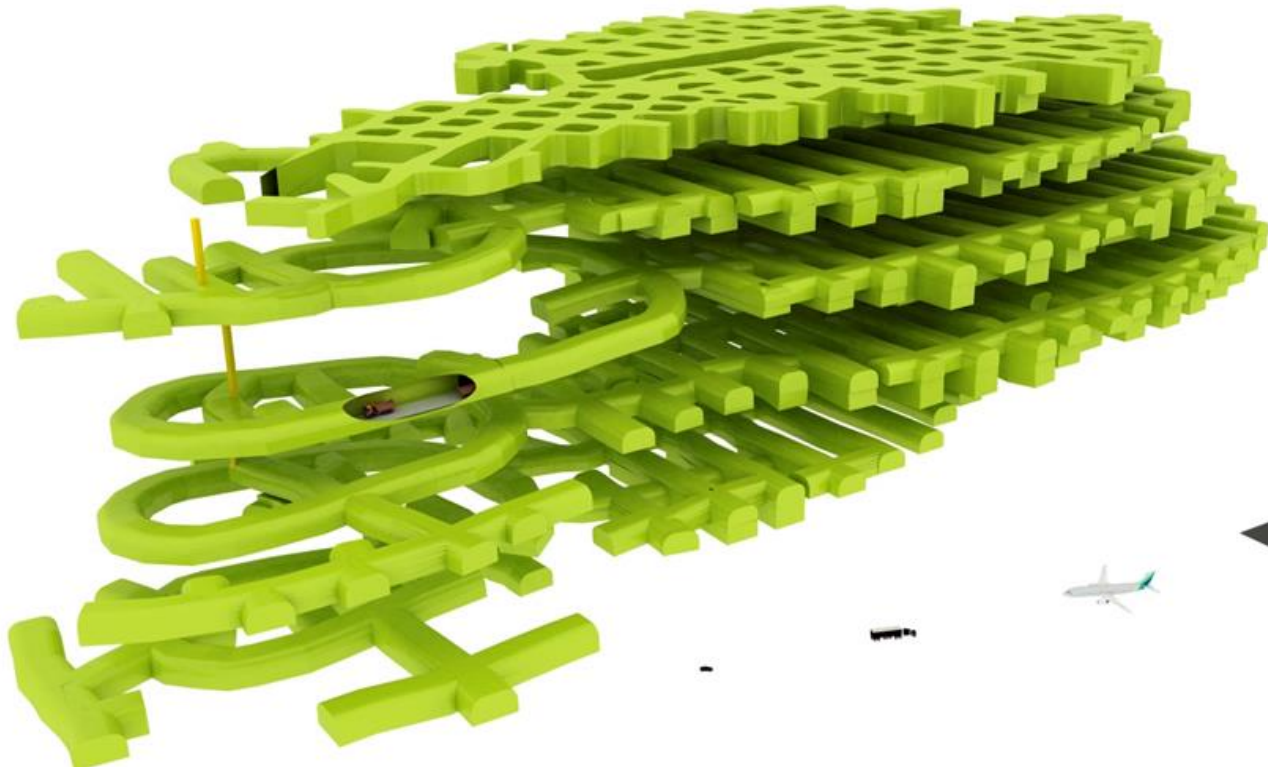


The Norwegian Solution

Lefdal Mine Datacenter

Mats Andersson





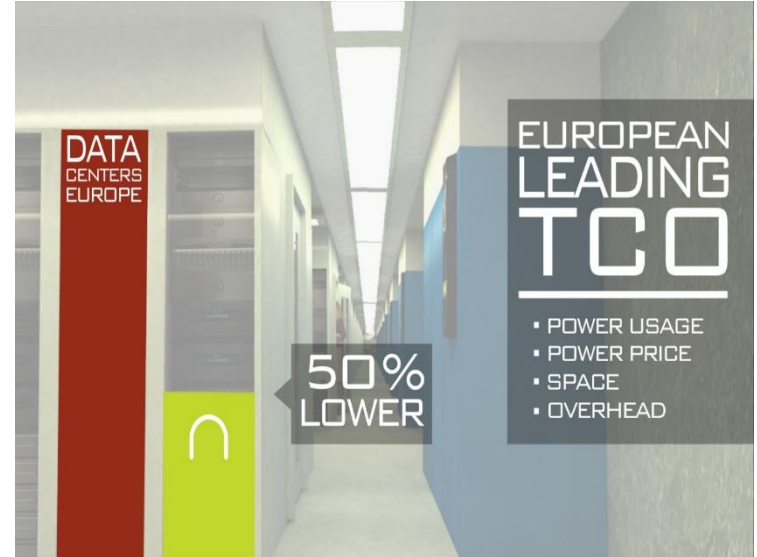
EUROPEAN LEADING TOTAL COST OF OPERATION

CAPEX - 50 % REDUCTION VS. STANDARD

- The building is already in place
- Low cost on constructions inside
- Low cost of land
- Low cost on “last mile” for power and fiber
- Effective cooling solution – low cost/MW
- Natural EMP security and perimeter fencing

OPEX – LEADING RUNNING COSTS IN EUROPE

- Low power usage – PUE 1.08
- Leading low power costs in Europe – 0,035 - 0,058 €/kWh



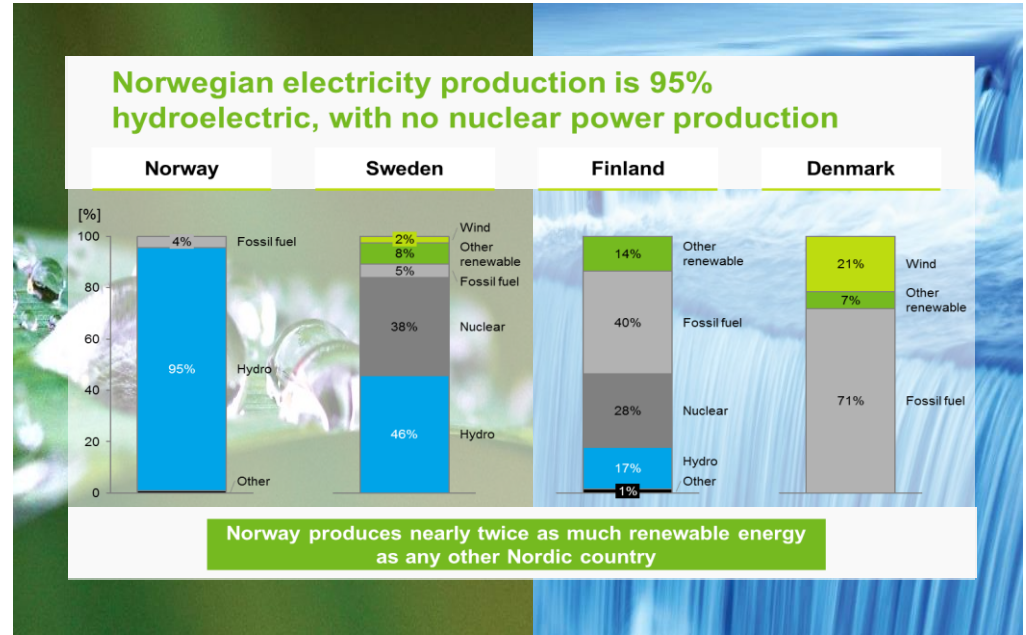
EUROPEAN LEADING SECURITY

- Mountain hall facility – 60+ meters below ground
- High-level monitoring and access control
- Two single points of entry above ground
- Security force and technical team - 24/7
- Facility split up in 3 security levels/6 security zones
- Tier 3 facility
- Natural EMP protection and perimeter fencing



THE GREENEST DATA CENTER IN EUROPE

- 95 % of all power production in Norway is renewable - Hydro power
- Minimum transmission losses – Short travelled
- Low power consumption – PUE of 1,08
- CO2-neutral – “0” carbon emissions
- The mine is already there – Limited footprint
- Limited visual impact
- No evaporative systems for cooling – “0” WUE
- Norwegian green code of conduct



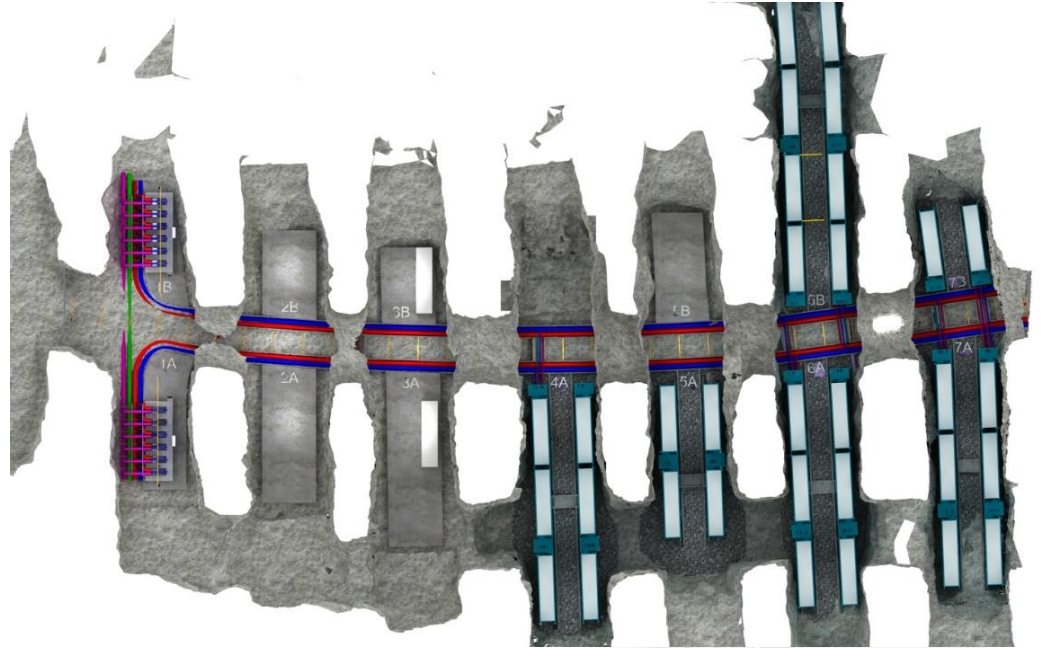
POWER GRID AND CAPACITY

- 350 MW local power production
- Four hydropower plants
- One windmill park – 2 more in 2018/19
- National grid in area – 2 500 MW
- No transmission loss
- Redundant power feeds – Tier 3
- Leading price of power – Europe
- Long term contracts available
- Future sea cable – blue line in picture – will be able to guarantee secure power delivery from two hydro power stations inside a mountain



COOLING INFRASTRUCTURE

- Water from 500 meter deep fjord - 8 C – 24/7/365
- A+B pipelines from the fjord to heat exchangers
- A+B closed fresh water pipelines from heat exchangers to each designated area
- Capacity phase 1 – 45 MW
- PUE of 1.08 – high UPS efficiency
- Water leads heat 4000 times more efficient than air
- High density environment. Can run up to 30 KW/rack with regular 2,5 m2/rack density
- Low construction cost. One system – one temperature. No warm days or polluted air
- The cooling system runs in existing facility with 1,8 kWh power for cooling 100 kWh IT load

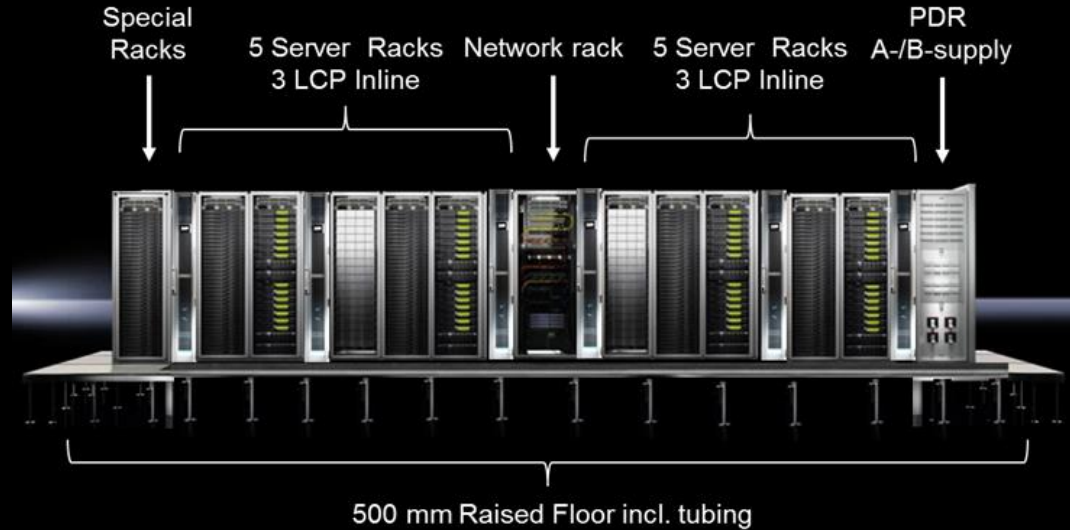


COOLING INFRASTRUCTURE



STANDARDIZATION – KEY BENEFITS

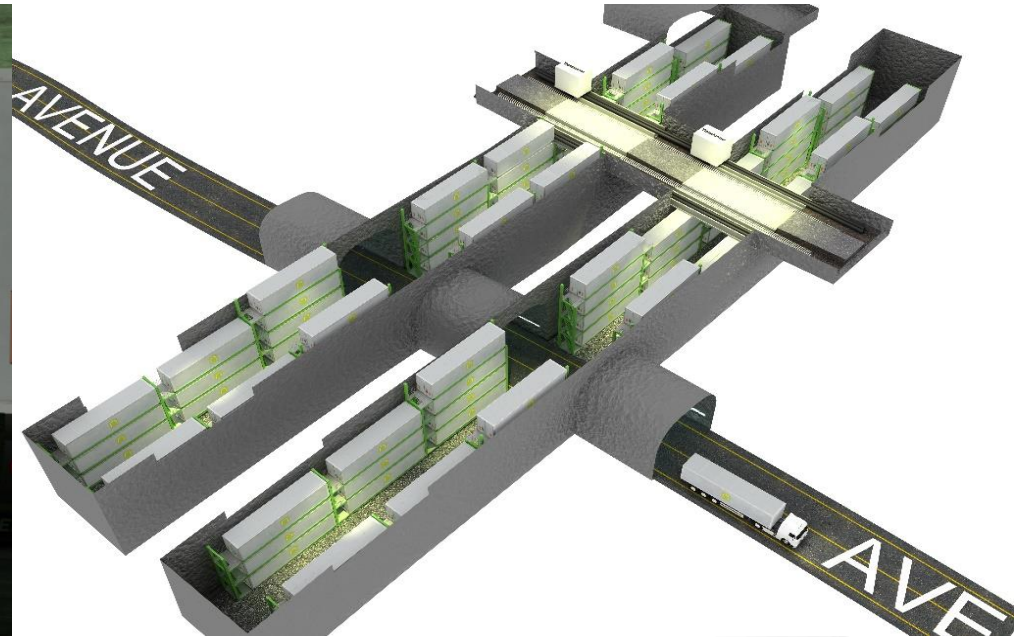
- Simple planning
- Low investment and operating costs
- Calculable, guaranteed PUE
- Ease of expansion
- Short delivery time
- Future-proofing



STANDARDIZATION – KEY BENEFITS

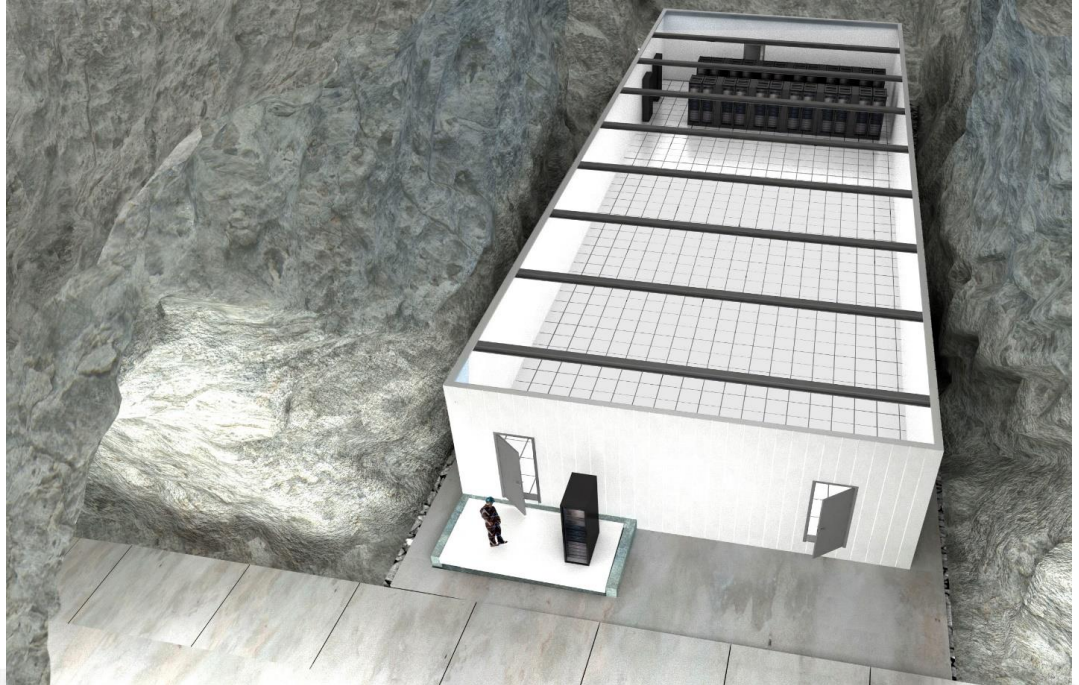
STANDARD MODULES	Tier	Power/rack	Cooling/cont.	Server Racks	Netw. Racks	Piping Sys.	LCP Units
Module 1	N+1	5 KW	60 KW	12	1	1	4
Module 2	N+N	5 KW	50 KW	10	1	2	6
Module 3	N+1	10 KW	100 KW	10	1	1	6
Module 4	N+N	10 KW	100 KW	10	1	2	6
Module 5	N+1	20 KW	200 KW	10	1	1	6
Module 6	N+1	30 KW	270 KW	9	1	1	7

CONTAINERS

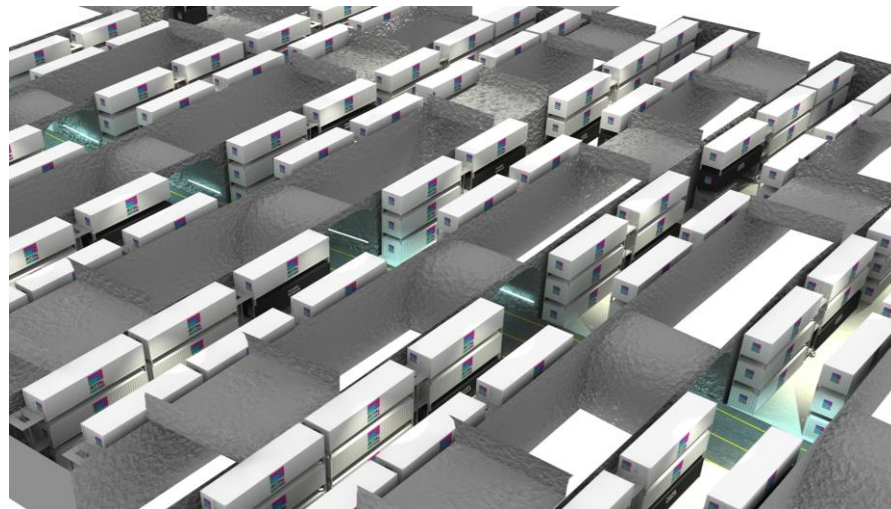
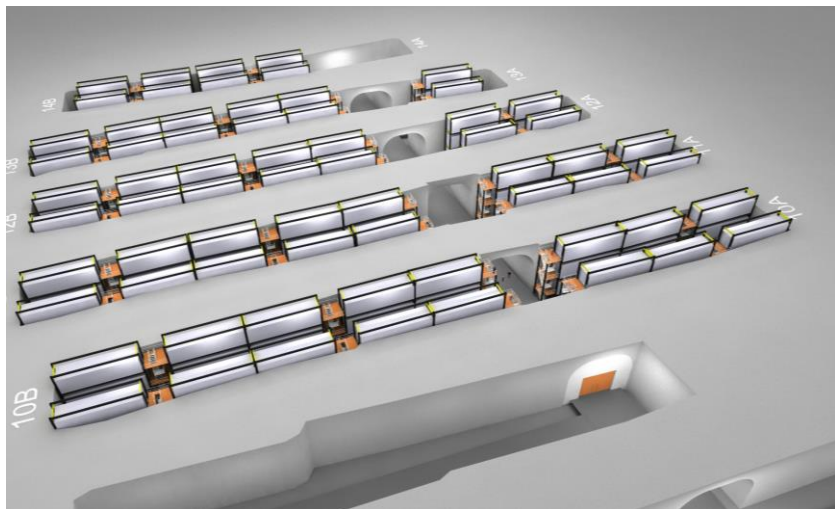


REGULAR WHITESPACE

- Modular room specially design for LMD
- 11,4 m wide, 4 m high with flexible length
- Raised floor - 30 m2 units
- Loading ramp
- Short time to market – 12-14 weeks from PO
- Up to 30 KW/rack



SCALABILITY



NETWORK – EUROPE

ROUND-TRIP

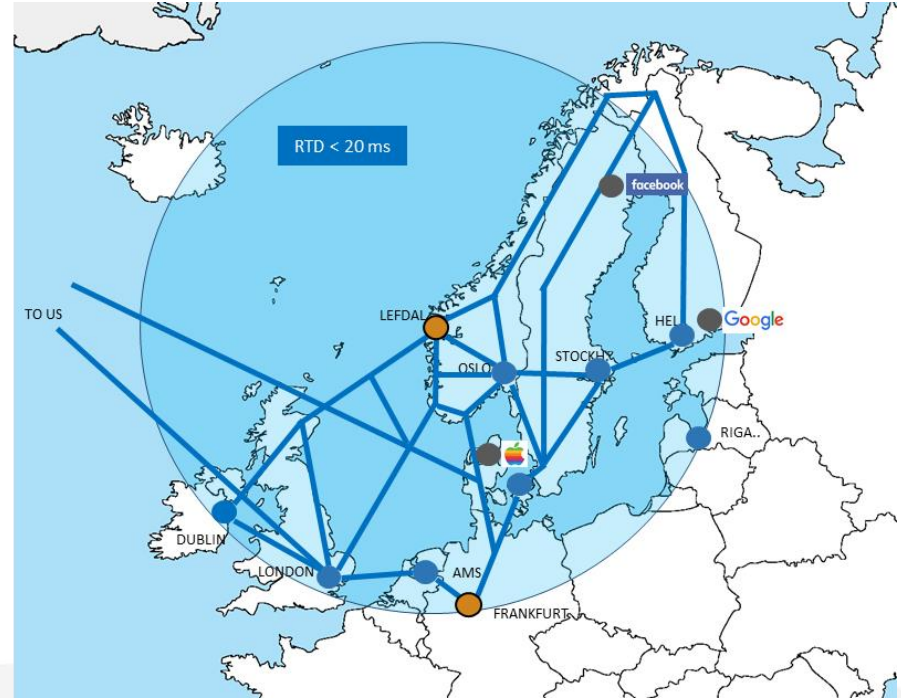
OSLO	7 ms
STOCKHOLM	13 ms
HELSINKI	19 ms
COPENHAGEN	15 ms
LONDON	17 ms
DUBLIN	20 ms
FRANKFURT	17 ms
AMSTERDAM	20 ms



BROAD|NET



Statnett



TECHNOLOGY PARTNER AND TENANT



PRE-PROJECT

DETAILED DESIGN

PROGRAM MANAGEMENT

VERIFICATION

TENANT



WAY FORWARD



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