

The Norwegian Solution



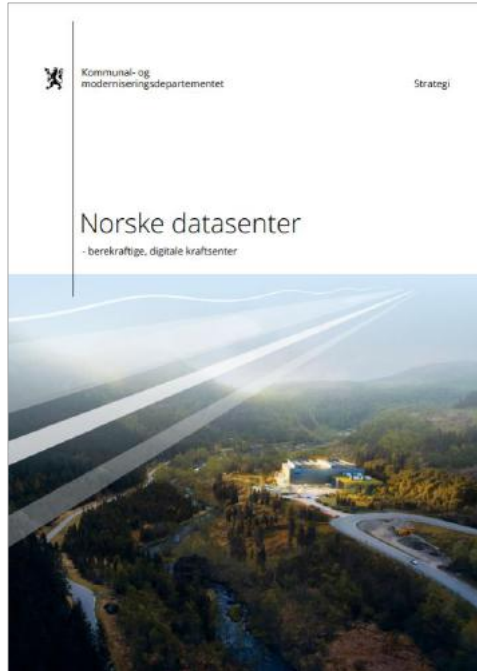
LEFDAL MINE
DATACENTER

EMPOWERING SUSTAINABILITY

Norway as a hub for green data center growth

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GOVERNMENTAL DC STRATEGY 2.0



«Dataentre er viktige byggesteiner i den moderne digitale infrastrukturen. Gjennom å styrke markedet for tjenester og mulighetene i Norge og videreutvikle den digitale infrastrukturen både nasjonalt og internasjonalt legger vi til rette for fortsatt vekst for norsk dataentreprenøring. Dette vil komme både næringsliv og folk i hele landet til gode, gjennom økt verdiskaping, nye arbeidsplasser i distriktene og digitale tjenester for alle.»

Linda Hofstad Helleland (H)
Distrikts- og digitaliseringsminister

Linda Hofstad Helleland

«It er regjeringens hovedkorrider for energipolitikk mot 2030 er næringsutvikling og verdiskaping gjennom effektiv utnyttelse av lønnsomme fornybarressurser. Effektiv tilknytning til strømnettet, studier av varmekraft for bedre ressursutnyttelse og krav om spilloveranalyse i dataentre vil øke konkuransen til den norske dataentreprenøringen. Dette bidrar til å realisere vekstpotensialet som denne nærings representerer.»

Tina Bru (H)
Olje- og energiminister

Tina Bru

«Vi må fortsette jobben med å videreutvikle den gode digitale infrastrukturen i Norge, og styrke vår posisjon som et attraktivt land for dataentre. Både vei og jernbane er viktige foringsveier for digital infrastruktur, og moderne transportløsninger er avgjørende for digitale løsninger. Vi må derfor legge til rette for god og effektiv utnyttelse av samferdselsinfrastruktur, som kan bidra til videre utbygging av fremdrøret og sikker digital infrastruktur i hele landet.»

Knut Arild Hareide (KR)
Samferdselsminister

Knut Arild Hareide

«Norge må utnytte mulighetene som ligger i data til økt verdiskaping. Både nye arbeidsplasser i hele landet, og en offentlig sektor som forsker for næringslivet. En utgangspunkt er sikker digital infrastruktur er nødvendig for at Norge skal lykkes med overgangen til et mer bærekraftig samfunn og en grønnere økonomi.»

Iselin Nyhø (V)
Næringsminister

Iselin Nyhø

«Det skal være lett å etablere bærekraftig industri og nye jobber i Norge. Effektiv saksbehandling og god informasjon er avgjørende for at vi skal lykkes med dette.»

Nikolai Astrup (H)
Kommunal- og moderniseringsminister

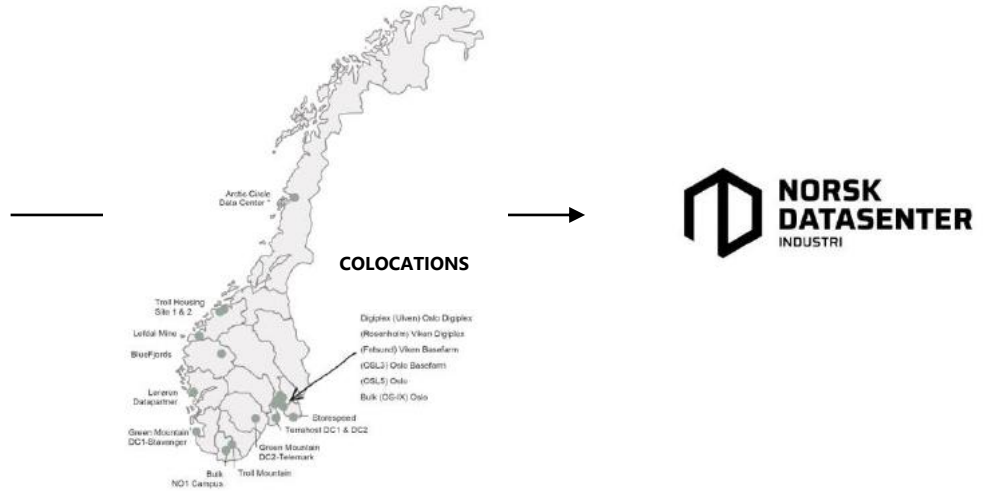
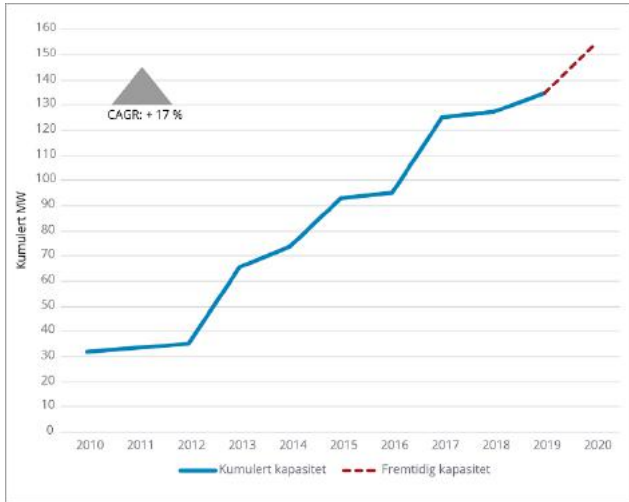
Nikolai Astrup

“Increase competitiveness and facilitate sustainable development...”

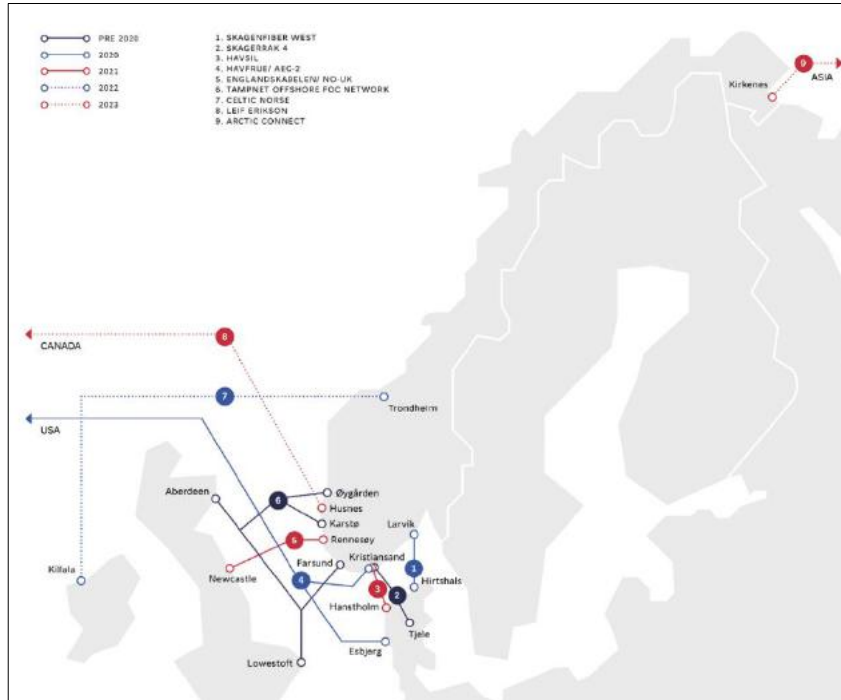


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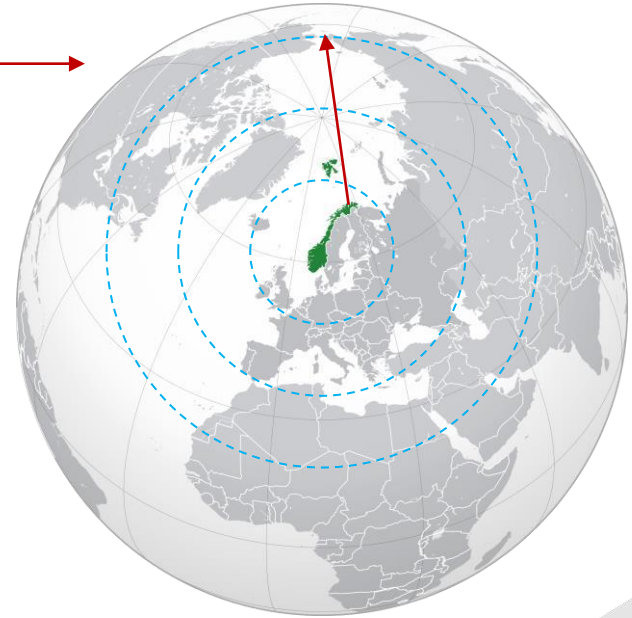
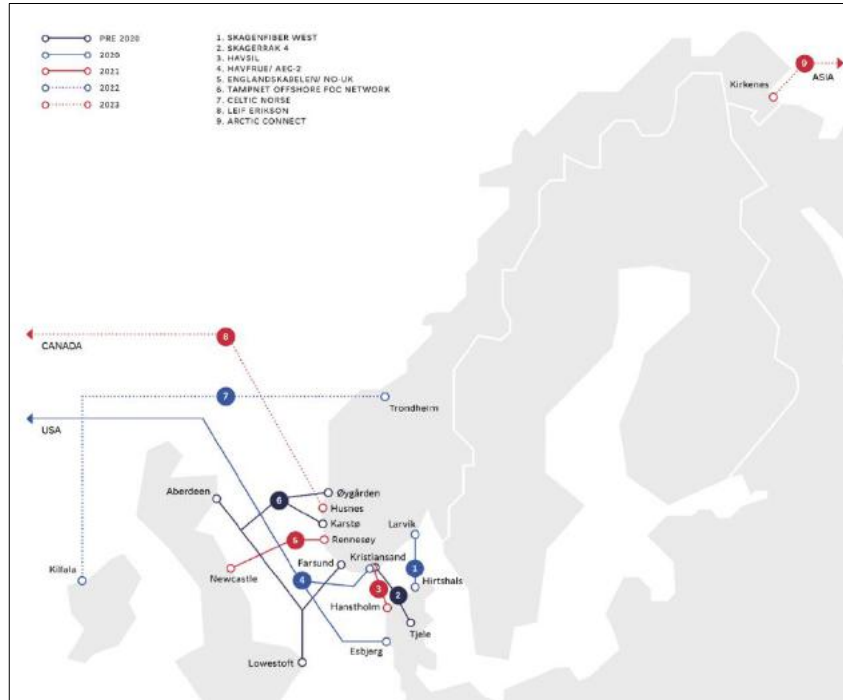
RAPID GROWTH IN NORWEGIAN DC CAPACITY



INVESTMENTS IN NETWORK INFRASTRUCTURE



INVESTMENTS IN NETWORK INFRASTRUCTURE



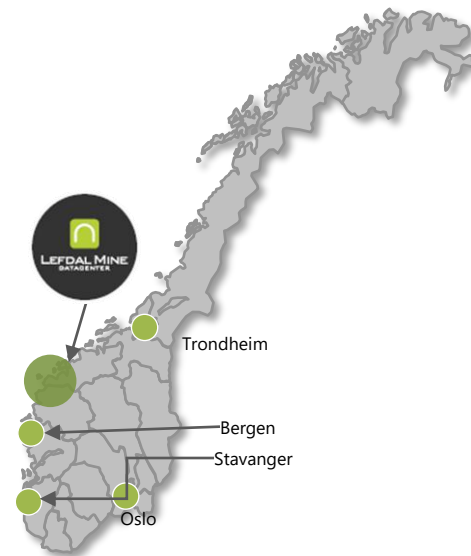
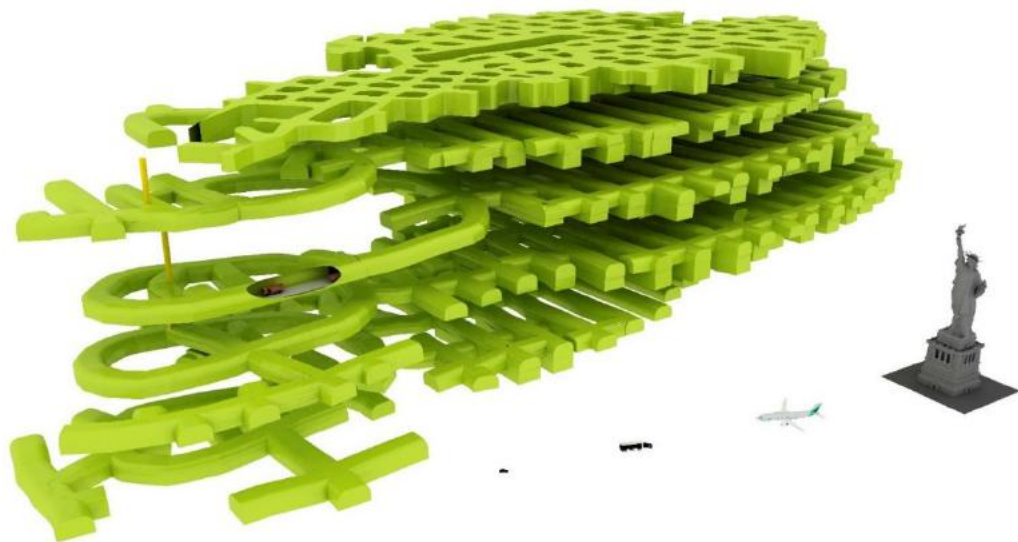
INTERNATIONAL CUSTOMERS CONTRACT IN NORWAY



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INVESTOR INTEREST - ACQUISITIONS





KEY FIGURES - MINE

Length	500 m
Width	350 m
Depth	160 m
Avenue length	330 m
Street length	30-100 m
Street width	13 m
Street height	16 m
Spiral	2 000 m

BUILD OUT - PHASES

- Level 1** – Power/Network infrastructure
- Level 2** – Data center – Phase 3
- Level 3** – Data center – Phase 1 – 40 MW – Tier III / 80 MW non-redundant
- Level 4** – Data center – Phase 2
- Level 5** – Future development



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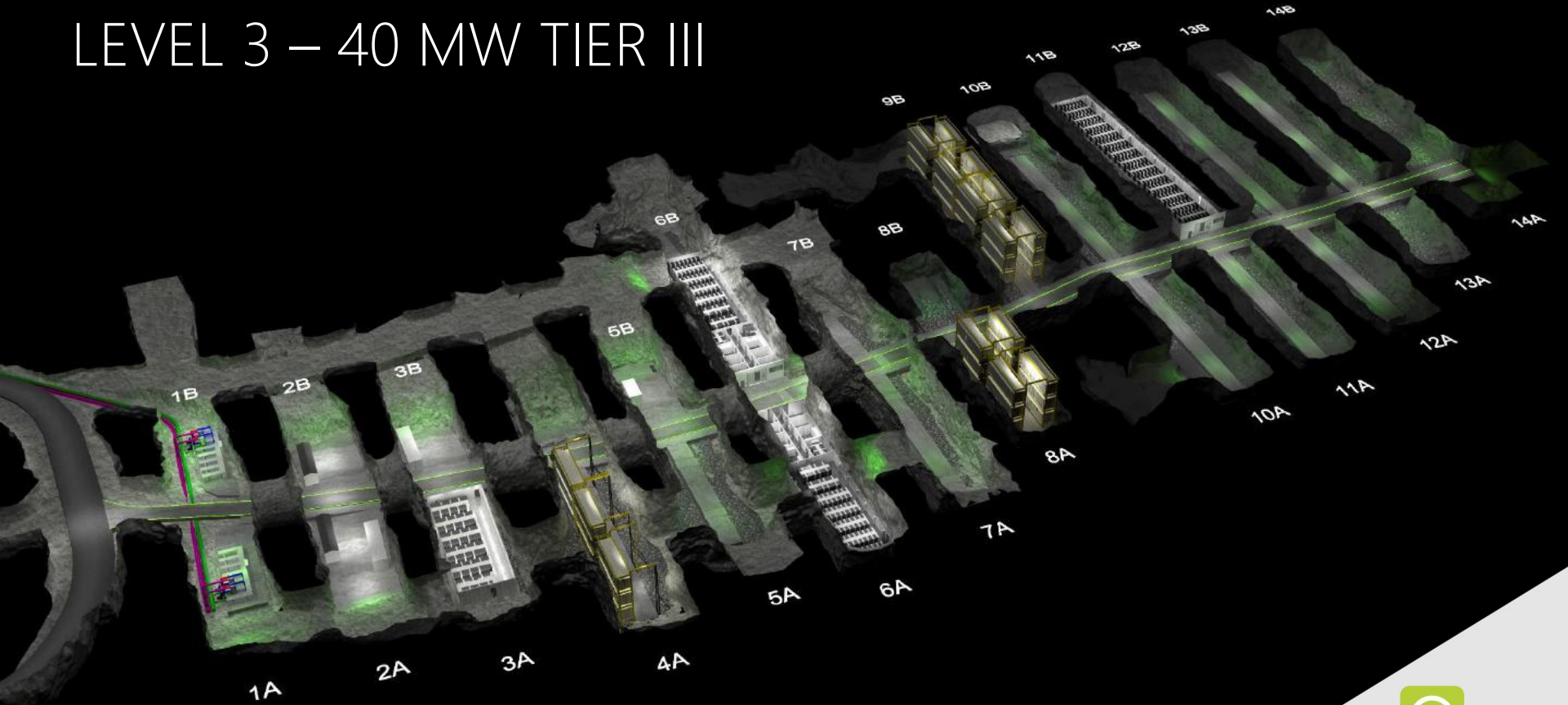
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ENTRANCE - LEVEL 3



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LEVEL 3 – 40 MW TIER III



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POWER GRID

- 350 MW local renewable power production
- Four hydropower plants
- One windmill park – 2 more in progress
- National grid in area – 2 500 MW
- Limited transmission loss
- Two new 132 KV lines – 100+ MW caapcity

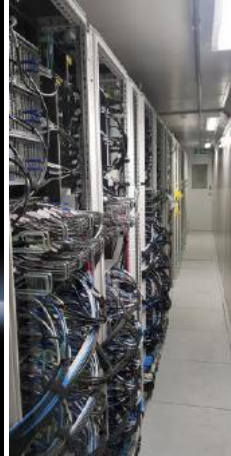




**HOUSING SOLUTIONS ARE
OFFERED BOTH IN
CONTAINERS AND DATA HALLS**



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CONTAINERS - 40 FEET

- Turnkey solution - Ready for servers
- Simple planning
- Low investment and operating costs
- Calculable, guaranteed PUE – efficient solution
- Ease of expansion – Modular design
- Time to market 6-8 weeks
- Reliability – High quality
- Standard modules or customized solutions – 50 to 300 KW, N/2N
- Low carbon footprint
- Preferred partner – Rittal – Design & interfaces



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CONTAINERS - LOGISTICS

- Production at Rittal – Haiger – Germany
- 6-8 weeks production including transportation to LMD
- Hardware integration at Rittal or Customer address or at LMD
- Container is loaded from truck to electronic transportation vehicle
- Transported to designated container rack in facility
- Connecting power, cooling, network, BMS and fire extinguishing
- Acceptance test
- Hand over



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PURPOSE BUILT DATA HALLS PRIVATE SUITS, CAGES OR RACKS

- Data halls from 360 to 800 m2 – Cost effective “room in room” solution
- 12 meters wide - 4 meters high – 30-70 meters long (depending on length of street)
- Can rent entire halls or custom cages/cabinets/pods (min 50m2 or 300 KW)
- Cooling provided with 2N chilled water under raised floor
- Direct Chip Cooling (100 KW/rack), Inline (<60 KW/rack) , ZUCS (<12 KW/rack) or CRAH (<7 KW/rack)
- Time to market 12-20 weeks - built to suit
- Delivery models are slab floor, raised floor or racks ready for servers



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SUSTAINABILITY

CORE OF OUR MISSIONS AND VALUES

ONE OF THE GREENEST
DATA CENTERS IN THE WORLD

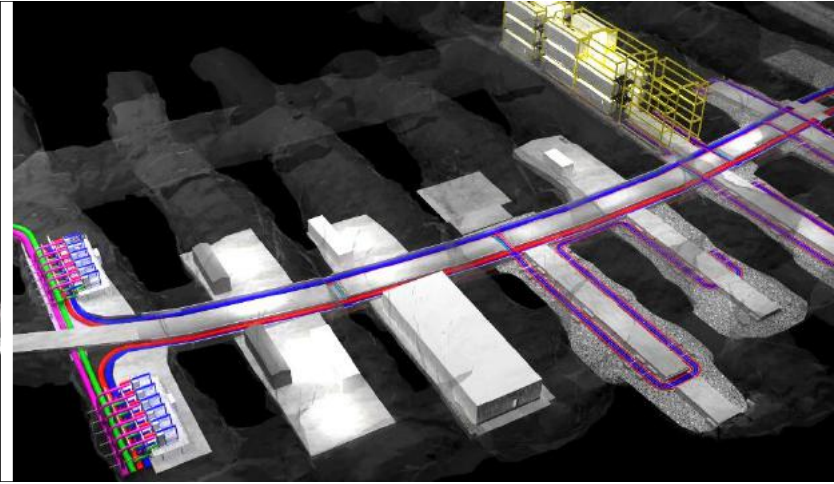
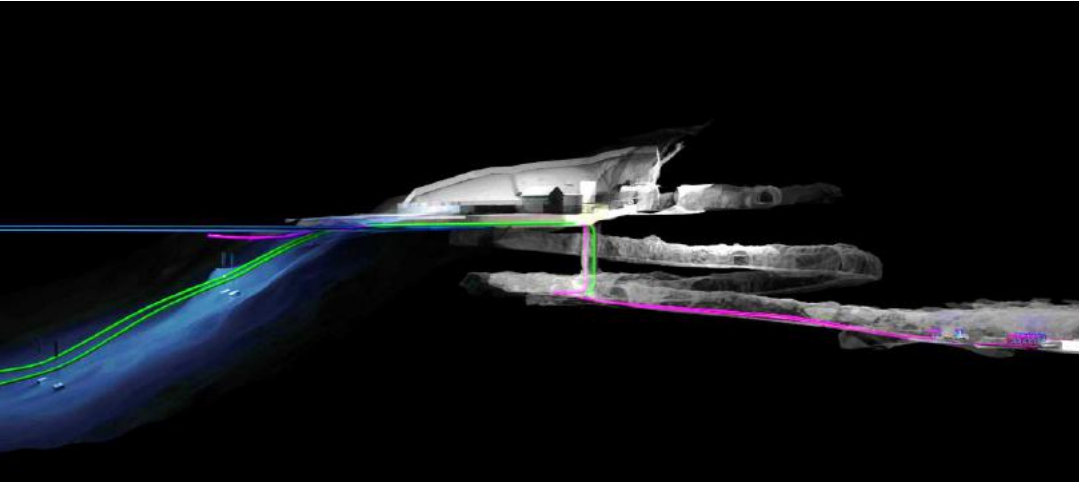


- 98,5 % of all power production in Norway is renewable - Hydro power
- Minimum transmission losses – Short travelled power
- PUE guaranteed at 1.15
- CO2-neutral
- The mine is already there
- Limited footprint, materials and visual impact
- No evaporative systems for cooling – “0” WUE
- Certified NS-EN ISO 14001:2015 – Environmental Standard
- Reuse of heated water



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LMD COOLING SOLUTION



- Water from a 500-meter-deep fjord – stable cold water at 9C - 24/7/365
- A+B pipelines from the fjord to heat exchangers (2N)
- A+B closed freshwater pipelines from heat exchangers to each designated IT area (2N)
- Current water temperature going out is 20C – will increase
- Industry leading PUE ranging from 1.10 to 1.15
- No warm days or polluted air



RE-USE OF HEATED WATER



- Heated water transported from LMD to Sjømatstaden
- 50 GWh increasing to 700 GWh – Sjømatstaden need all the heated water LMD can provide
- 15.000 ton of salmon/year (closed containment), 6 mill. smolt/year, drying of sludge
- Production of species requiring warm water



OPTIMAL LOCATION - HPC



- Lowest total cost of operation (TCO) in Europe
- Renewable power at leading low cost
- Water cooling up to 50 KW/rack – Direct liquid cooling up to 100 KW/rack
- Guaranteed PUE of 1.15 (Tier III) – Lower with about UPS (1.10)
- High secure facility - EMP protection
- Customized products – Tier level and design/configurations
- One of the greenest data centers in the world
- High quality services through experienced staff running HPC for International customers





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THE NORWEGIAN SOLUTION

WHY NORWAY

In a world of rapidly increasing carbon emissions from the ICT industry, Norway offers a sustainable solution. Norway has a 98,5% share of renewables in its power production. One foresees a significant surplus in the production and extremely competitive price forecasts for the years to come. Long term power prices in Norway are expected to be the lowest in the Nordics.

- Ranked 2nd worldwide in the Cushman & Wakefield 2016 Data Center Risk Index
- Abundant renewable power, strong grid and world leading long term power prices
- Competitive tax regime, strong economy, competent workforce
- Stable political situation, EU-compatible framework

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SALES INQUIRY

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