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ABO WIND

ABB

ELTEL

EMPOWER

GE Renewable Energy

LUT University

outokumpu

SPINVERSE

SSAB

st1

TESI

WÄRTSILÄ

WICETEC Ice Prevention Systems

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The Global Energy Challenge

Current carbon cycle is unsustainable

Carbon in the atmosphere increases due to

1. Deforestation and land use change which result in carbon release from ground
2. Increasing use of fossil energy and resources

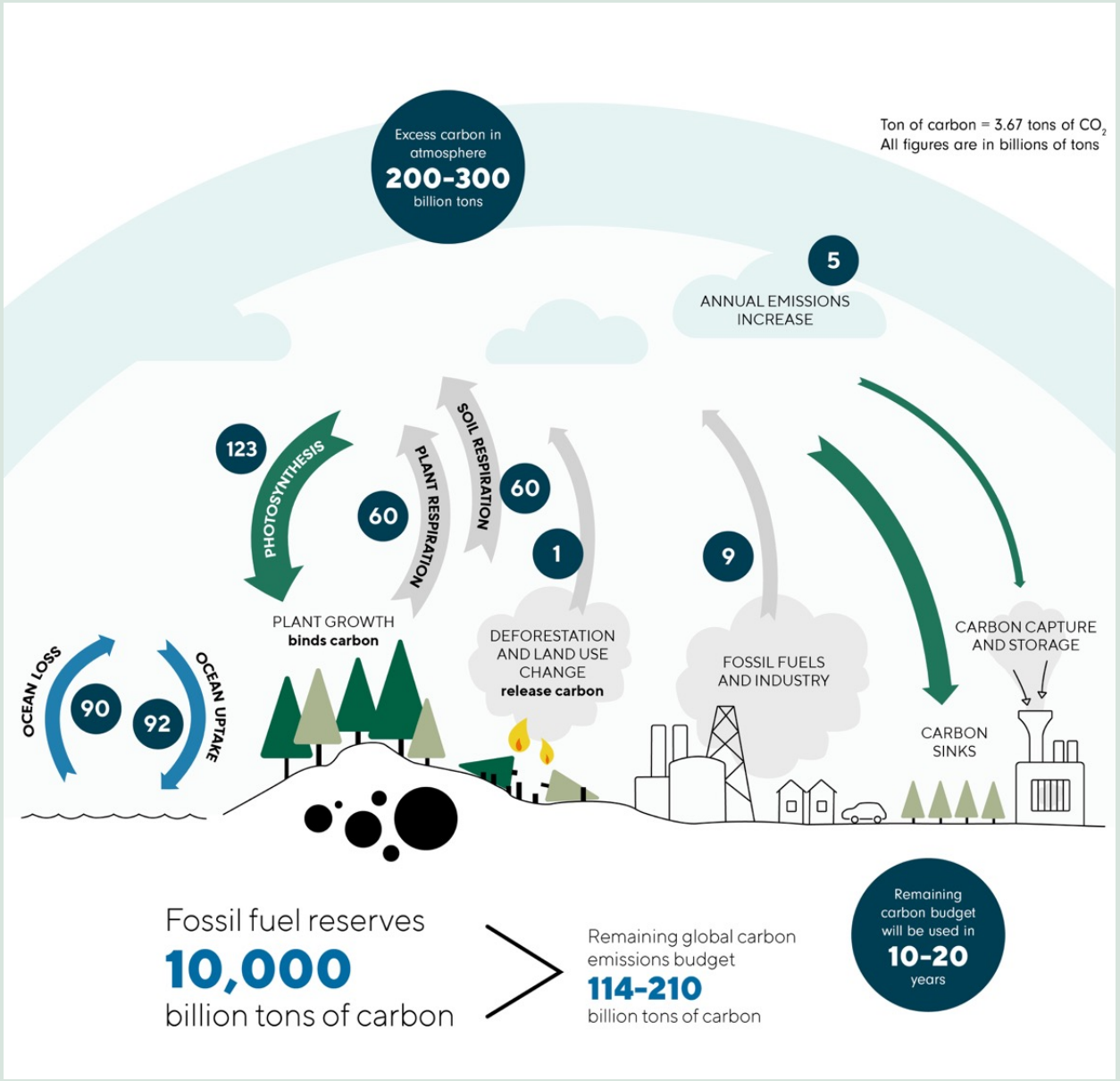
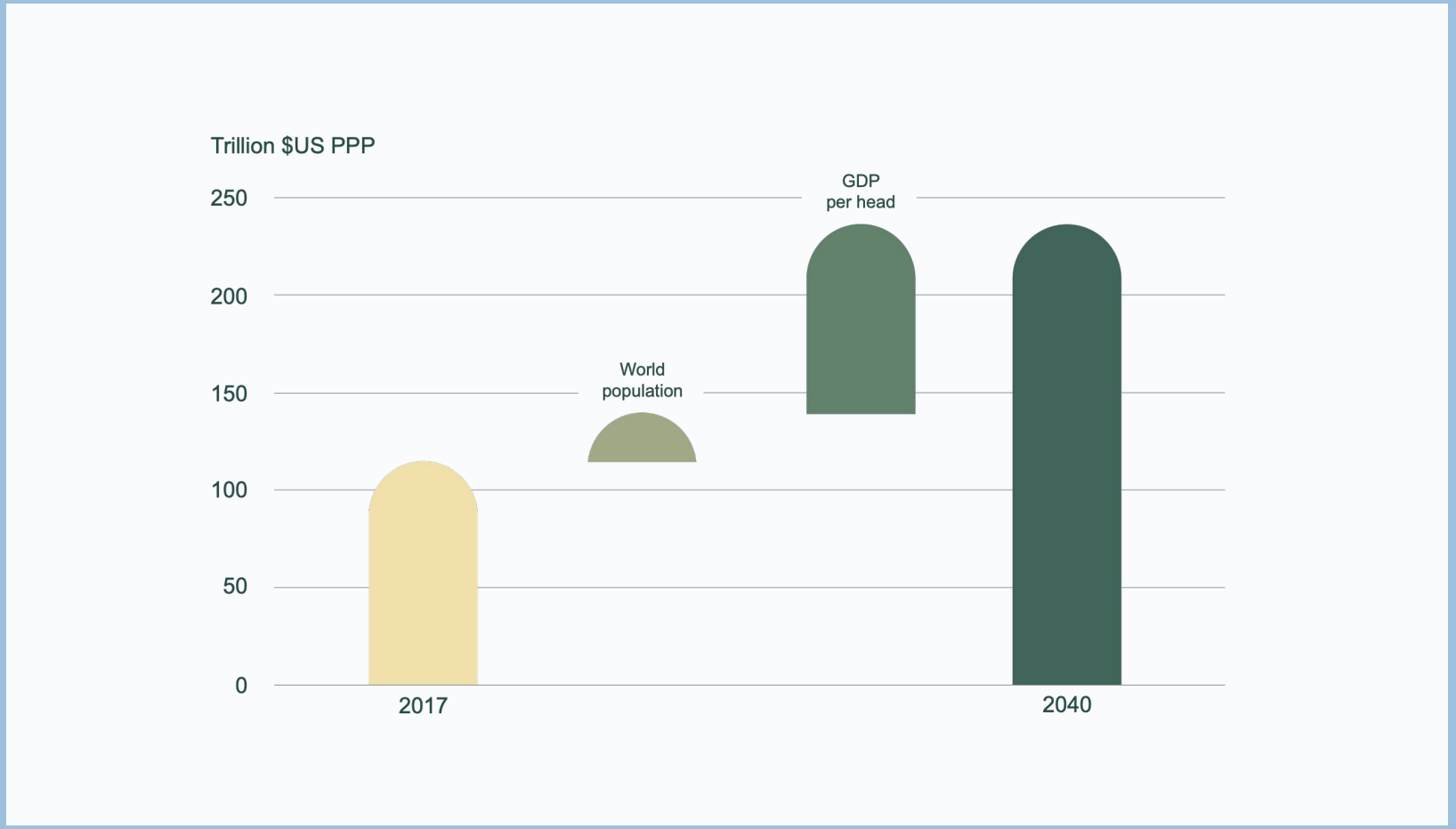


Image FROM St1 Oy / NEOT.

It’s getting crowded

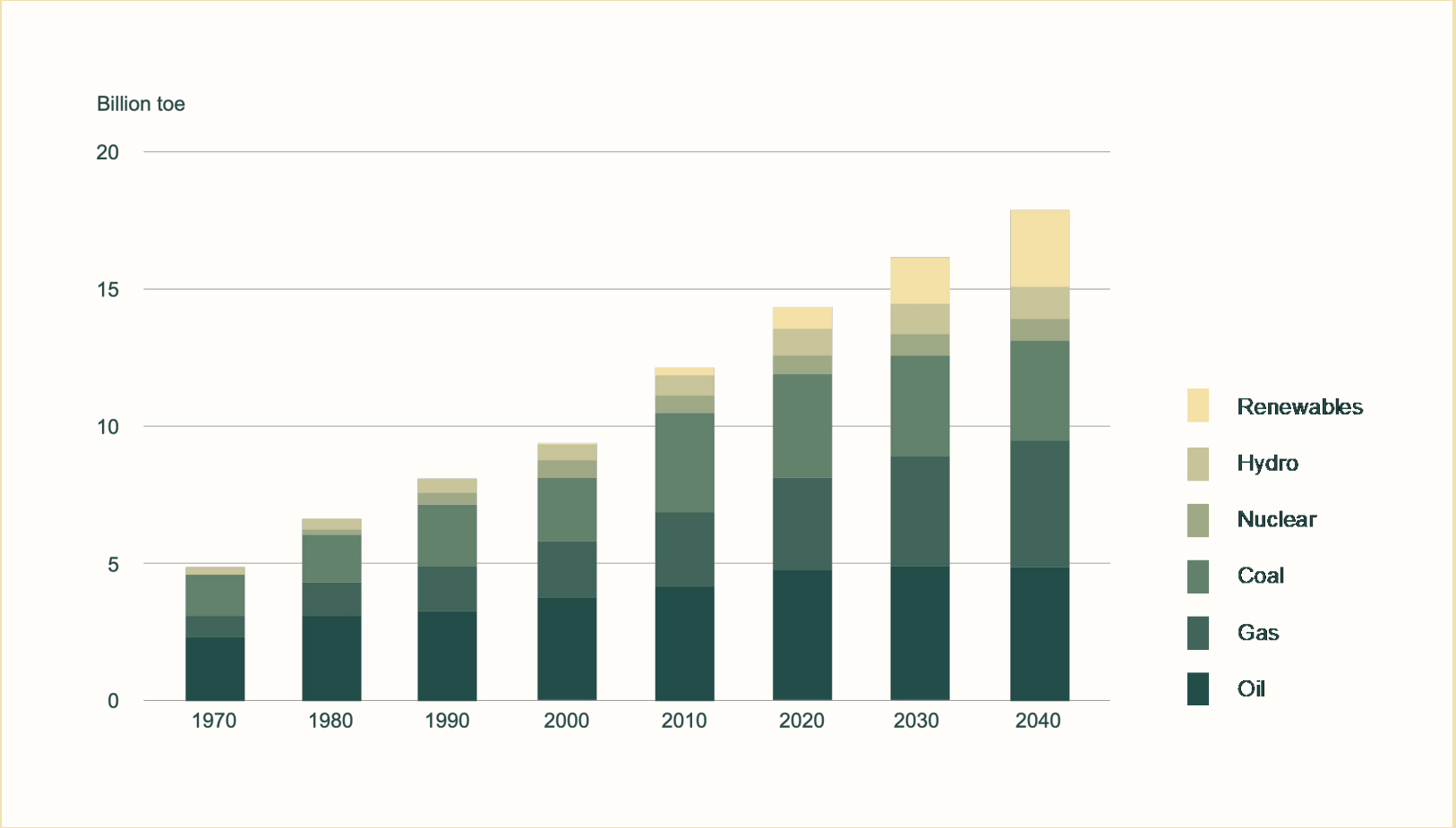
Projected world population in 2100.

Standard of living keeps improving



Increase in global GDP, 2017-2040.

And we’re using more energy



Primary energy consumption by fuel.

We need to reduce carbon emissions yet consumption keeps increasing.

This is the global energy challenge.

We need to meet our growing demand for energy and at the same time reduce our dependency on fossil energy sources.

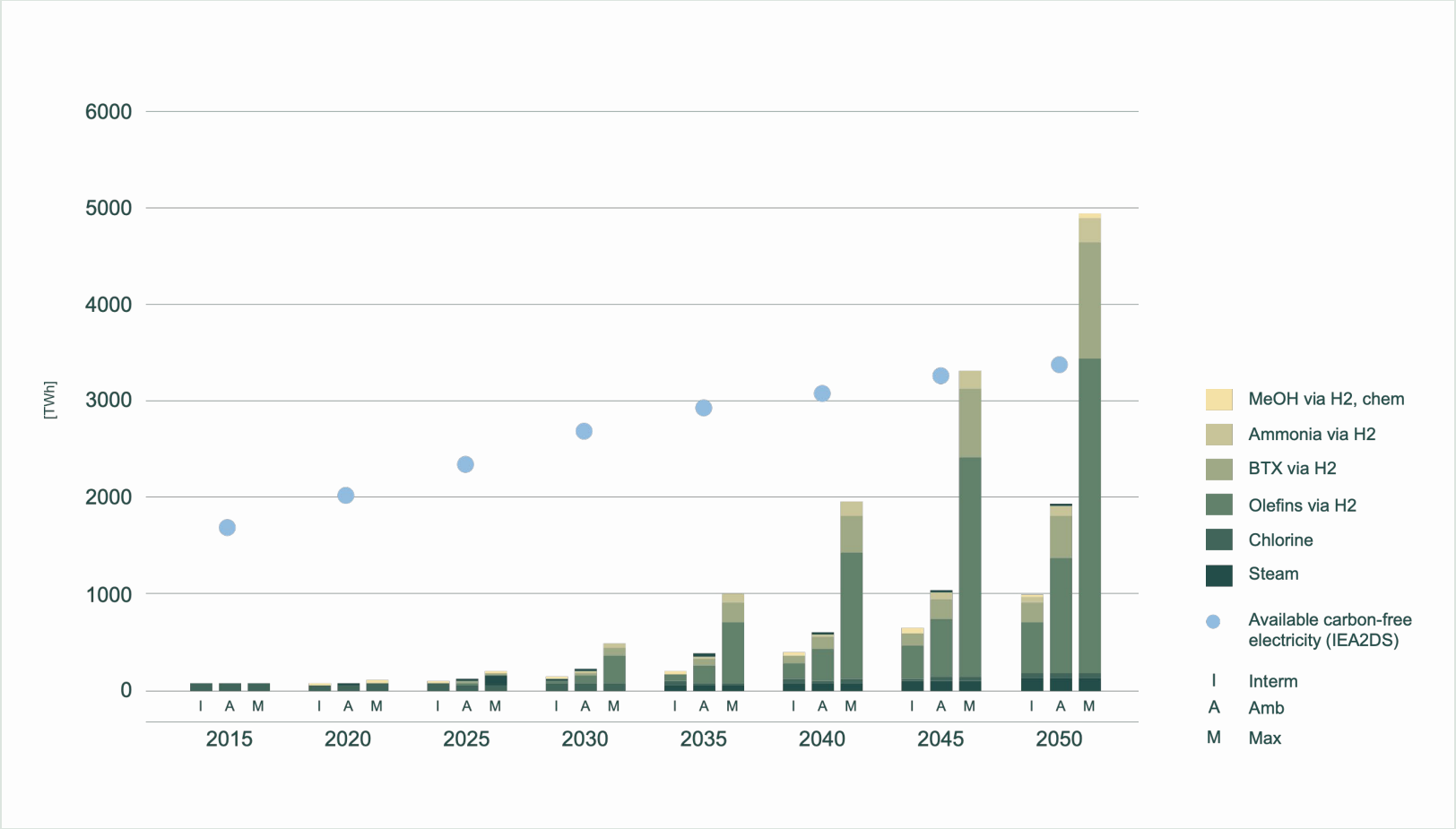
We need more renewable energy.

So, how much renewable power is needed?

A lot.

To illustrate: We need a lot more renewable electricity to decarbonize the European chemical industry.

The demand for low-carbon electricity greatly exceeds projected availability.



In Europe alone, 350 gigawatts of wind is needed by 2030.

This corresponds to 60 000 5-MW wind turbines and 5 000 12-MW wind turbines.

That’s four 1000 MW wind parks every month in Europe from now until 2030.

And yet we still end up at 2.5 degrees.

This is a challenge, but also an opportunity.

Because, in a world that demands CO_2-efficient value chains, those who are able to produce low-carbon intensity products **will win in the marketplace.**

The regions that manage to offer low-carbon energy solutions **will attract the CO_2-aware industry of the future.**

How can the Nordics reduce its dependency on fossil energy and create a competitive advantage for our industries in a world of growing energy demand?

Arctic Energy Initiative

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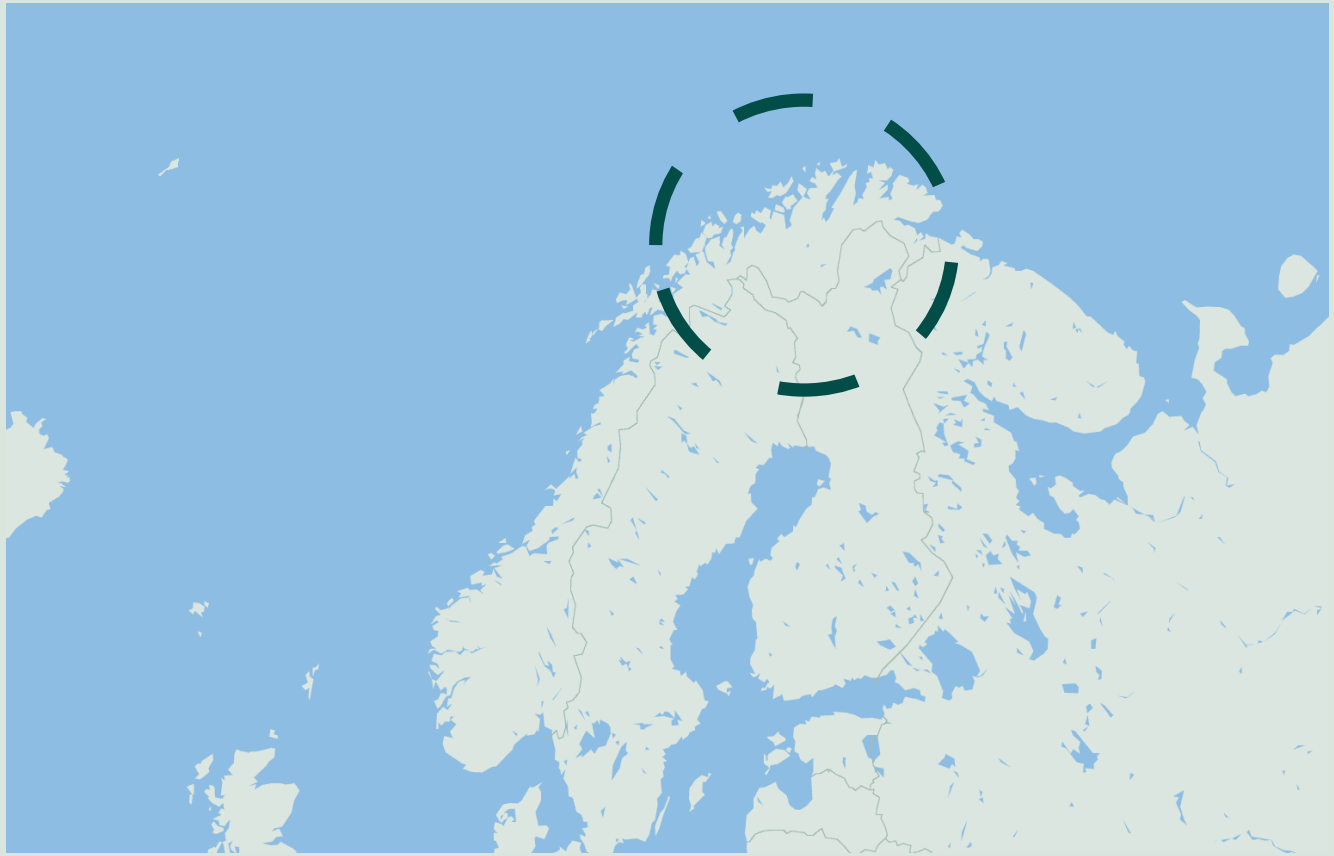
Let’s take a closer look at the Arctic region.

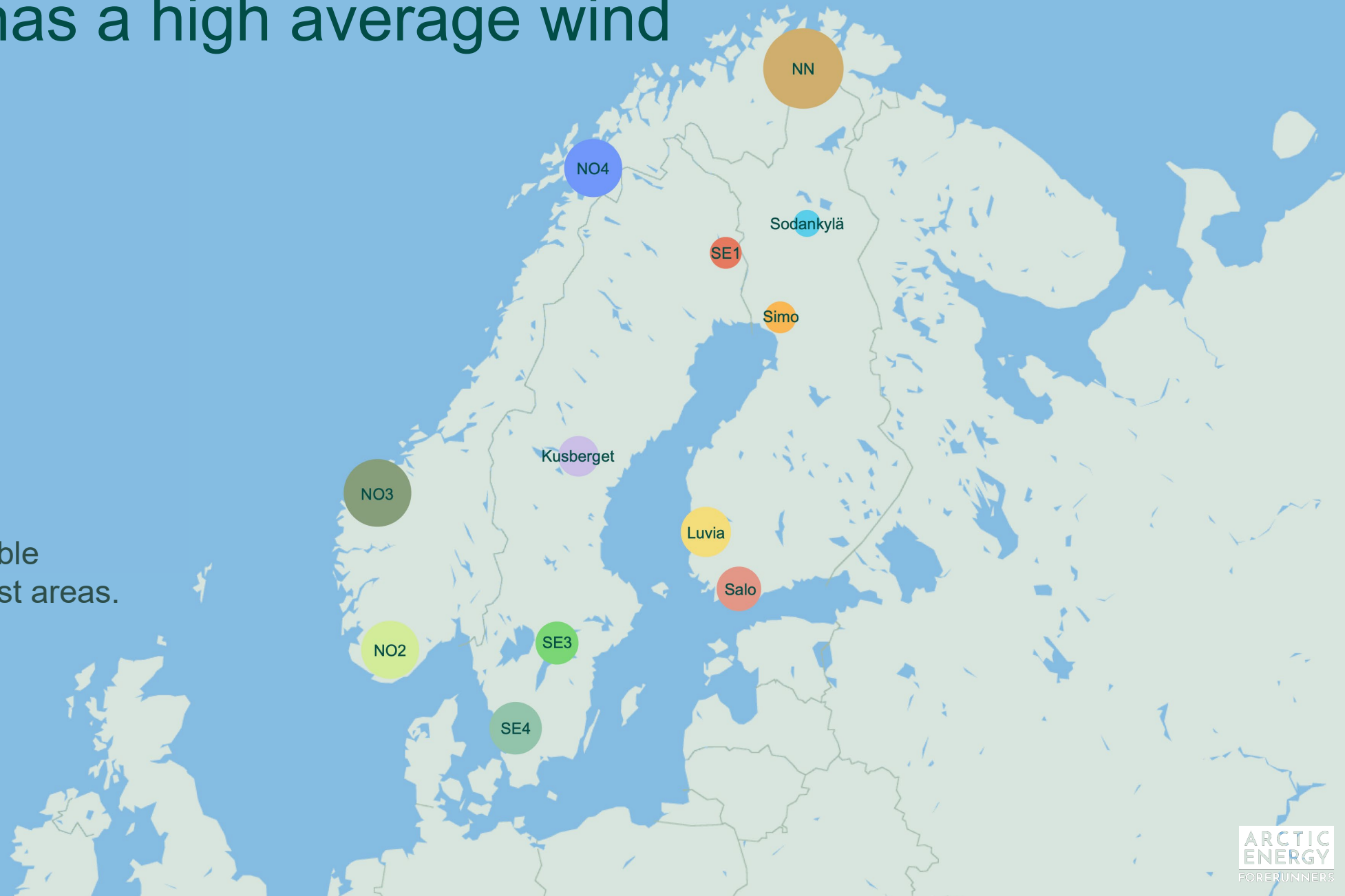
We know that the region has Europe’s best energy resources.



The region has a high average wind production.

1,49	2,15
1,52	2,52
1,61	2,88
1,93	2,93
2,00	3,02
2,03	3,43

Production in NN is double compared to inland forest areas.



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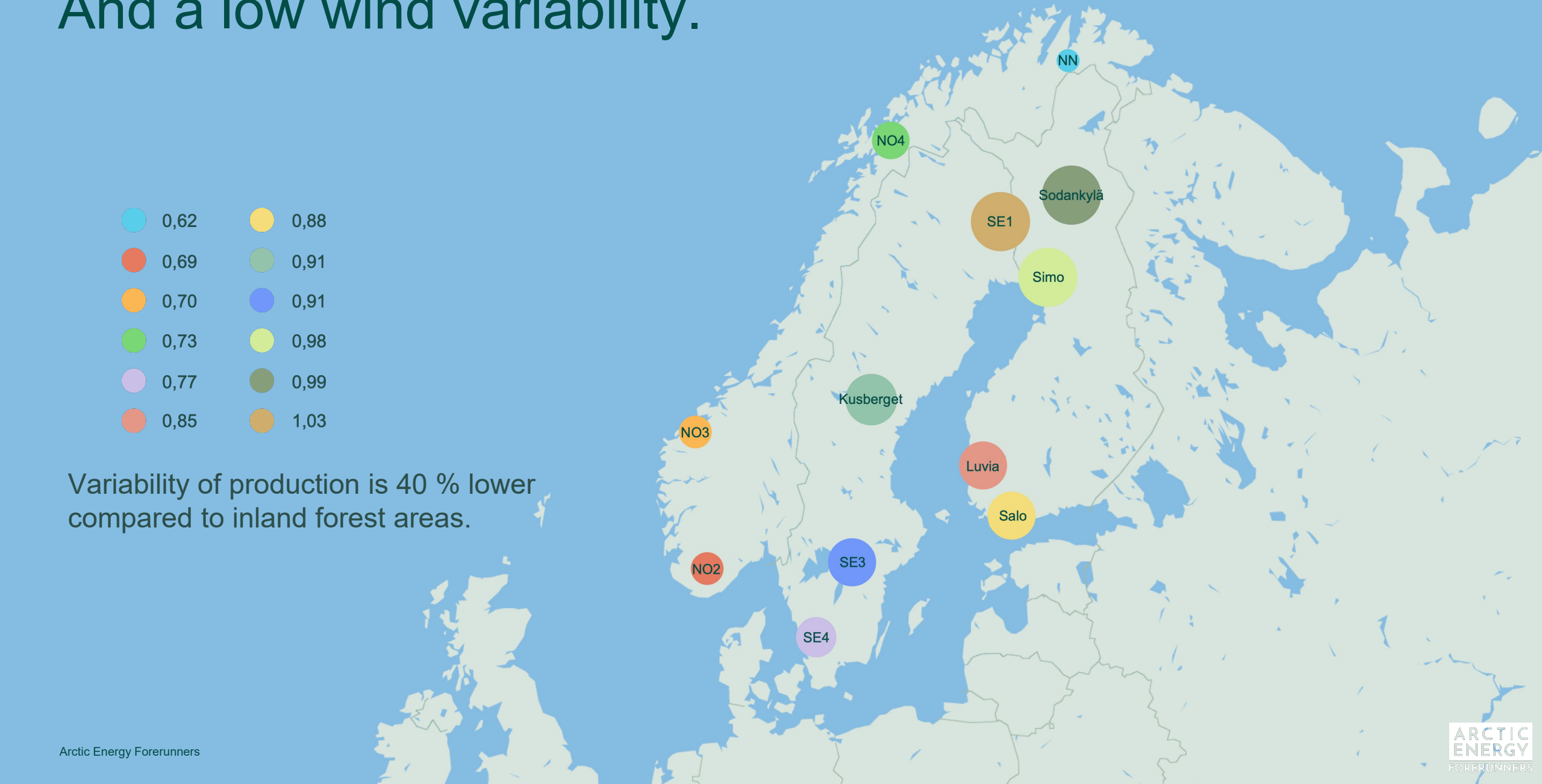
And a low wind variability.

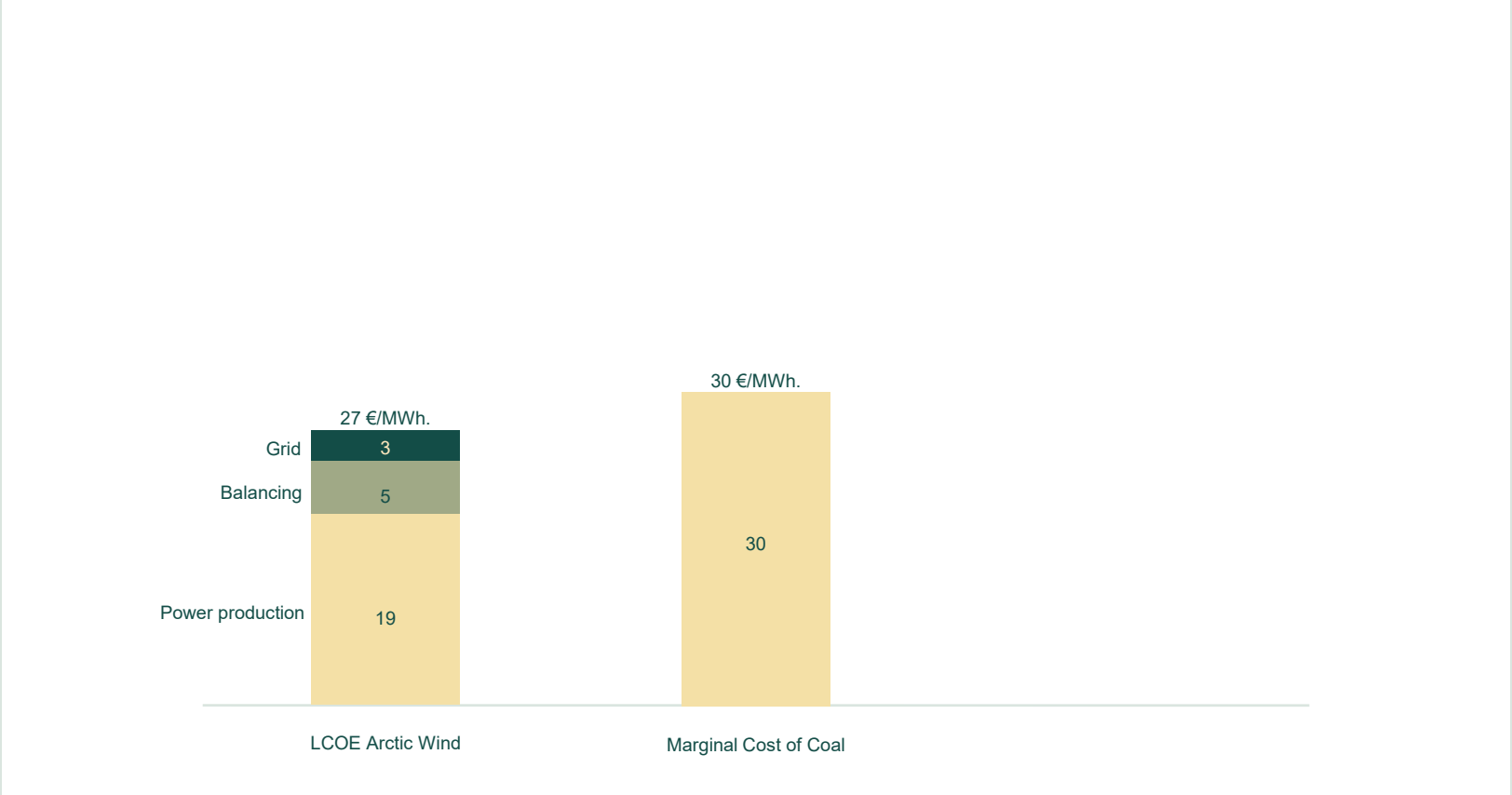


Variability of production is 40 % lower compared to inland forest areas.

The wind resources make this region the best suited for *power production* in Europe.

Arctic energy can deliver on our climate goals and make our industries competitive in a world that demands low carbon products.

Even accounting for balancing and grid, the cost of energy for Arctic wind power is very low.



Davvi has an estimated yearly direct CO_2 reduction of **1 200 000 – 1 500 000** million tons.

But this number does not take the ripple effects made by an LCOE of **19 €/MWh** into consideration.

The combination of clean and cheap electricity leads to CO_2-reductions beyond the power produced by Davvi alone.

Let’s look at these ripple effects in the context of two different industries.

Steel

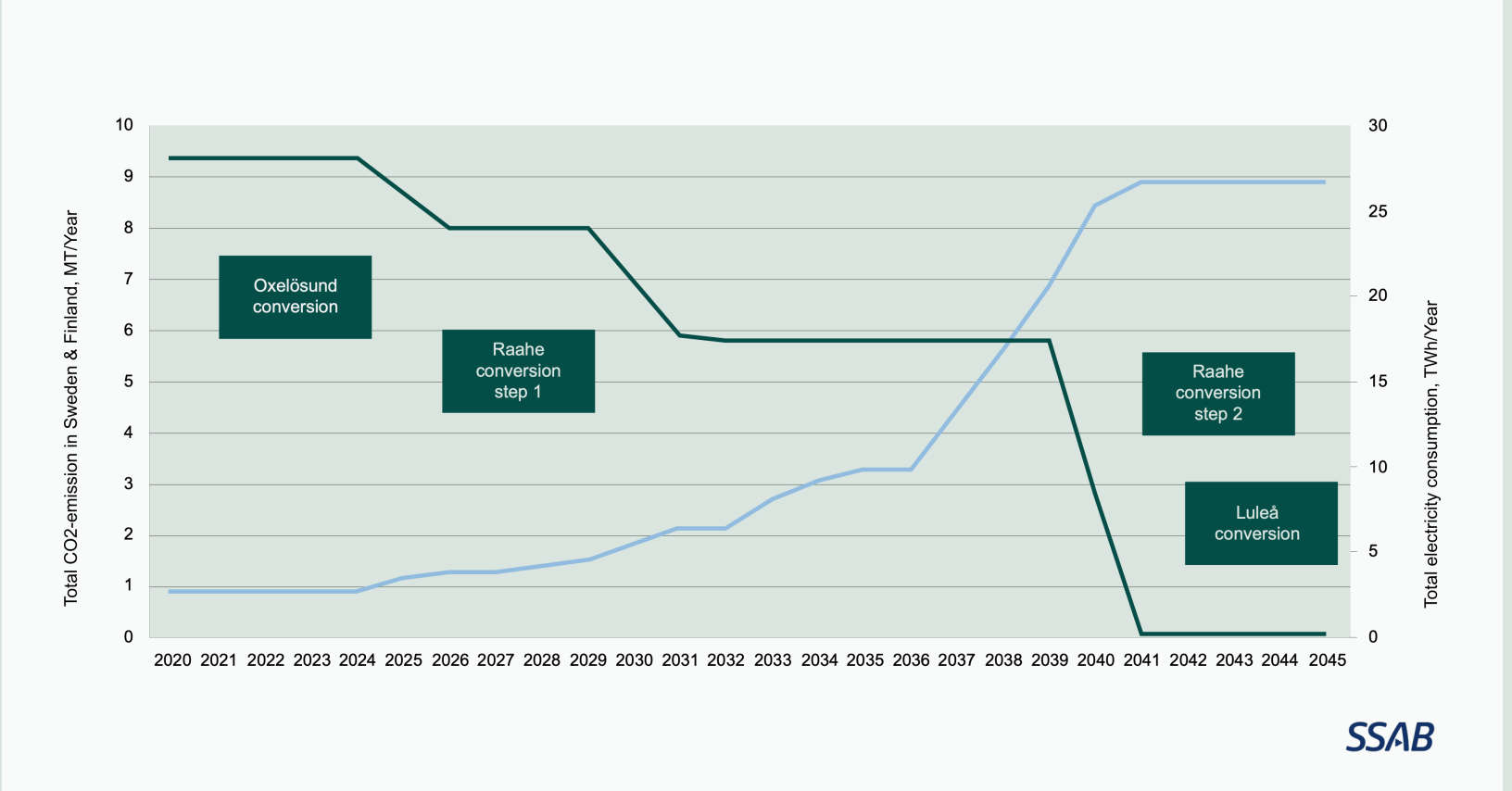
Data centers

Example 1: Steel

As an investor in an energy intensive industry like steel production, there are two parameters you are particularly interested in:

1. Price of electricity
2. CO_2 intensity

Why is steel production relevant?



Fossil-free electricity replaces coal & coke.

Over the lifetime of a wind farm, a steel plant producing 6 million tons of steel would pay **€ 3.9 billion** in electricity costs.

And that power generation would emit **1 500 000** tons of CO_2.

In South Korea, a steel plant producing 6 million tons of steel would pay **€ 9.4 billion** in electricity costs.

And the power generation it would emit **65 500 000** tons CO_2.

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Over the lifetime of a wind farm, the difference on the electricity bill amounts to **€ 5.6 billion**.

And the steel factory in the Arctic emits **64 000 000** tons of CO_2 less than the steel factory in South Korea.

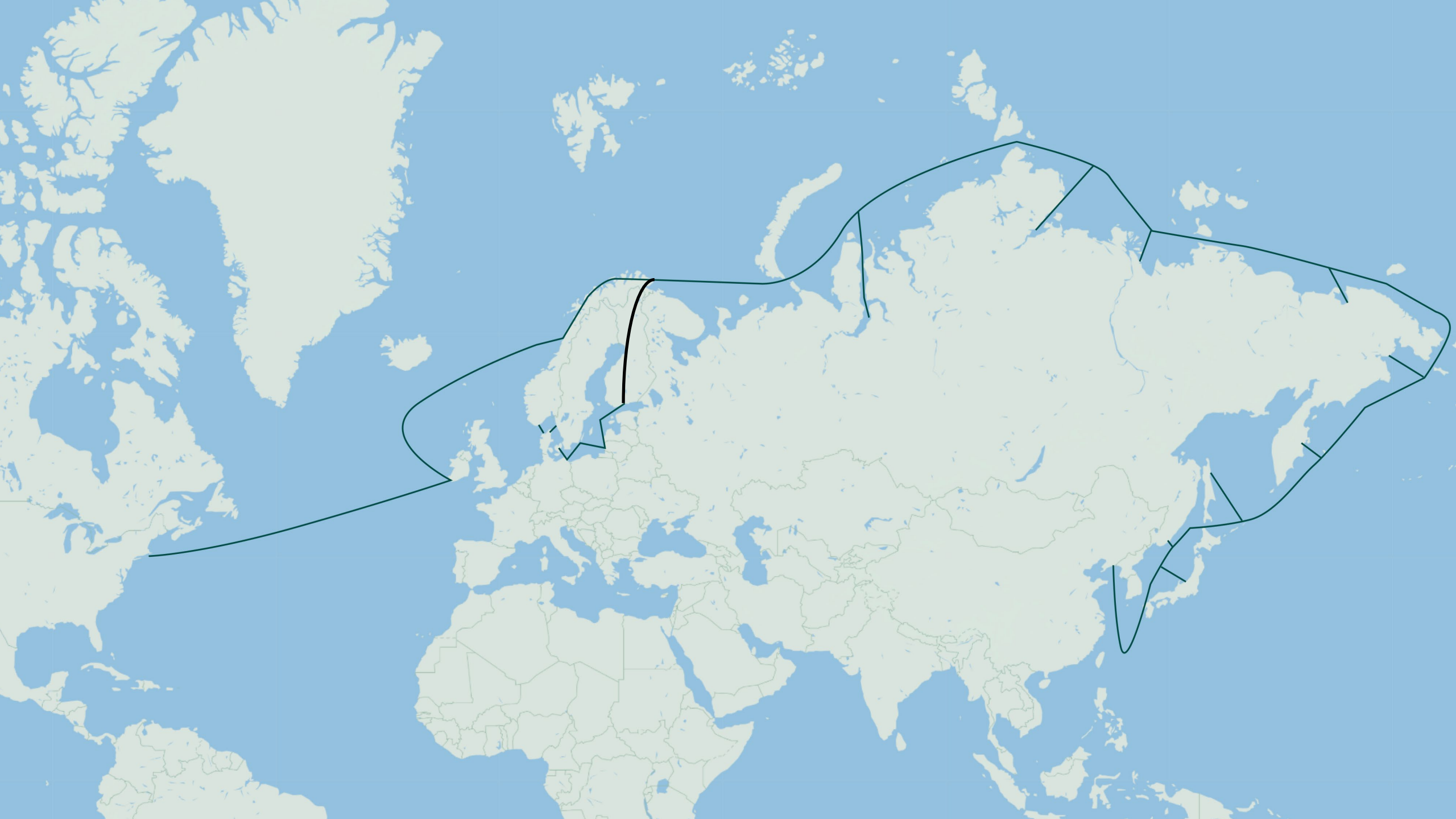
Example 2: Data centers

As an investor in an energy intensive industry like data centers, there are two parameters you are particularly interested in:

1. Price of electricity
2. CO_2 intensity

Why are data centers relevant?

Because the Nordics are well positioned for new data centers for several reasons.



The data cable Arctic Connect would open a new fast channel between Asia and Europe.

On the European side, the connection would land through the Nordics to the Continent.

The “landing point” of the Arctic Connect would attract new data centers in the Nordics as it would have several benefits:

- Data centers close to the connection point.
- Cold climate, safe environment and good infrastructure.
- Educated workforce.
- Cheap renewable energy in the North.

Over the lifetime of a wind farm, a data center cluster in the Arctic using 5 TWh would emit **1 500 000** tons of CO_2..

In California, a data center cluster using 5 TWh would emit **39 600 000** tons of CO_2.

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That’s a difference of more than **38 000 000** tons of CO_2.

Put the same data center cluster in Poland, and the CO_2 savings of the Arctic solution is almost **85 000 000** tons of CO_2.

The point is this:

The Arctic Energy Initiative has ripple effects beyond just bringing renewable energy to the grid.

The cost of onshore wind power in the Arctic is the entire basis for these ripple effects.

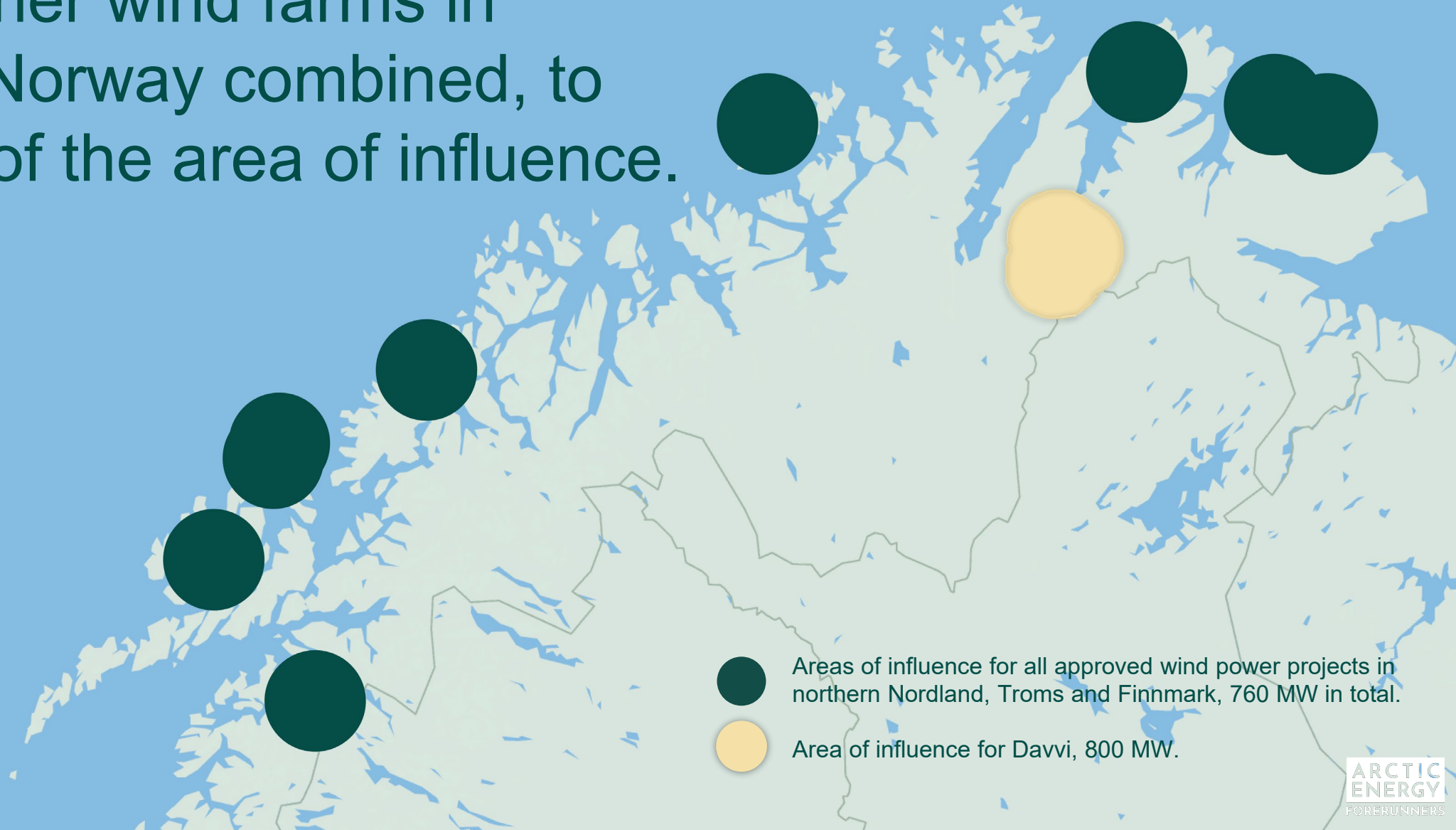
The Arctic Energy Initiative will displace CO_2-intensive value chains elsewhere.

For decades we have been waiting for renewable energy to be competitive with fossil energy. Because we know that once that happens, the money will go green.

The energy intensive industries of the future will need to deliver on CO_2 and €.

The Arctic Energy Initiative delivers on both.

Davvi produces more energy than all other wind farms in Northern Norway combined, to one sixth of the area of influence.



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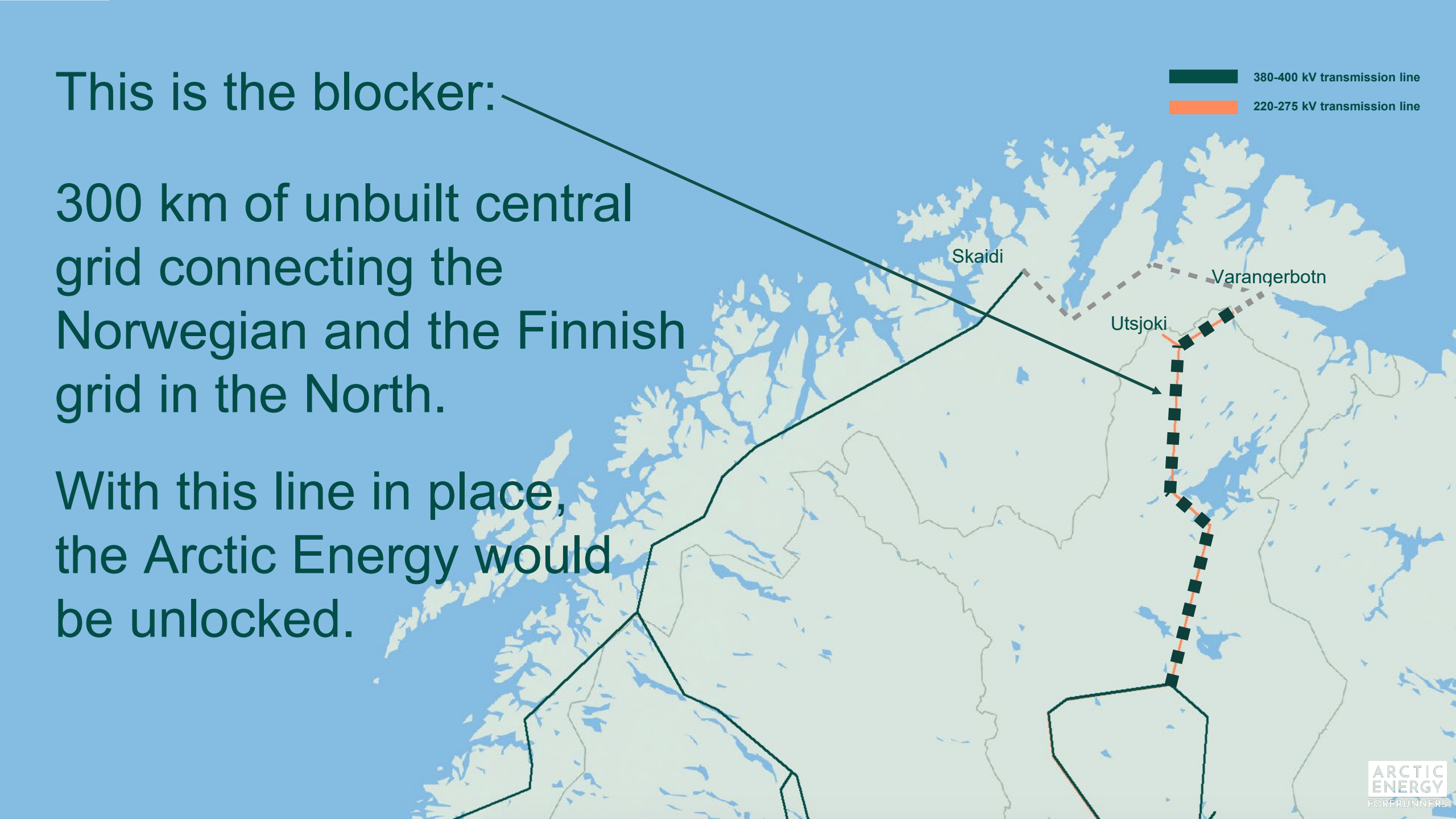
So, what is holding back the utilization of Arctic Energy?

The region lacks a central grid.

This is the blocker:

300 km of unbuilt central grid connecting the Norwegian and the Finnish grid in the North.

With this line in place, the Arctic Energy would be unlocked.



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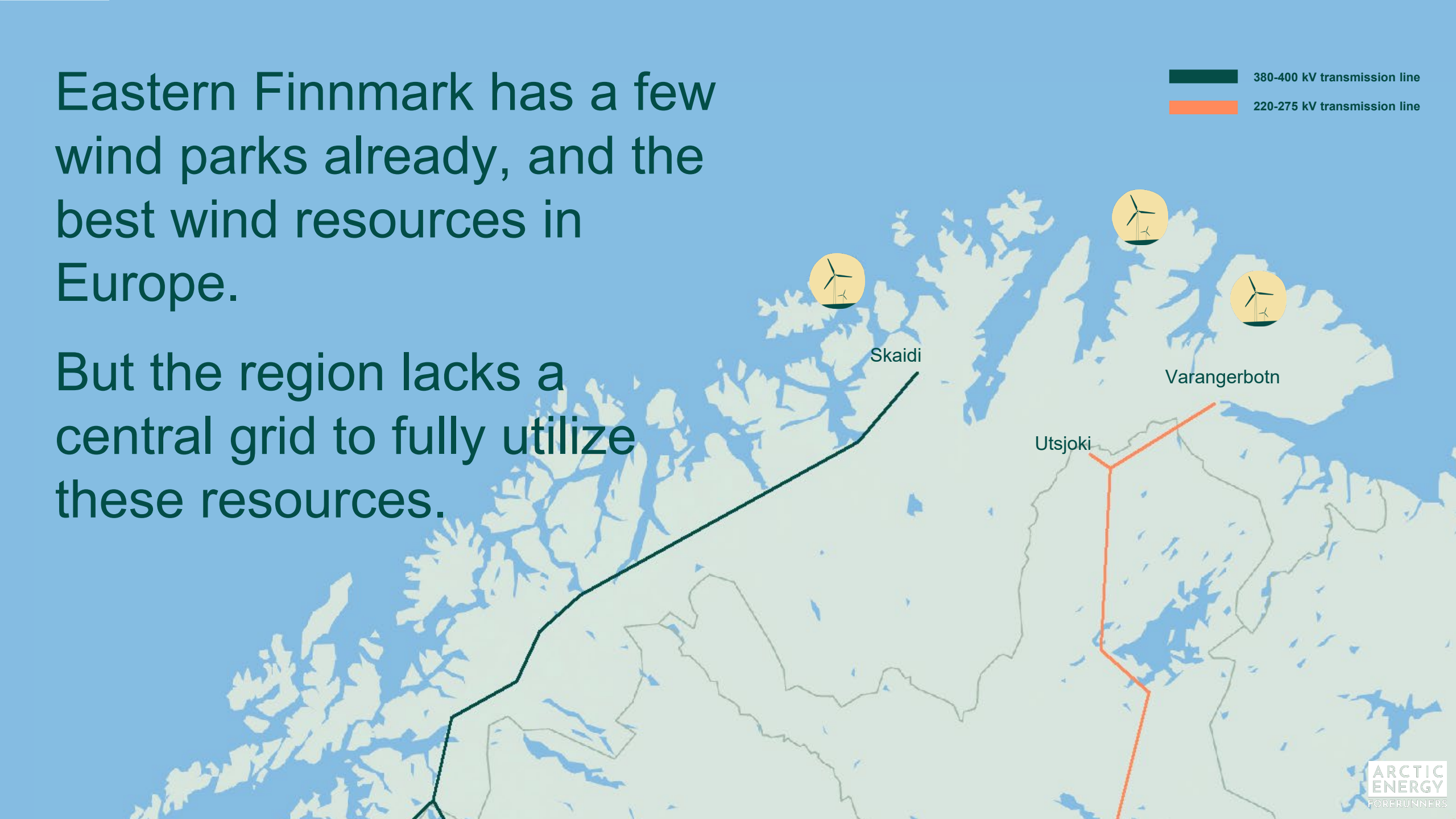
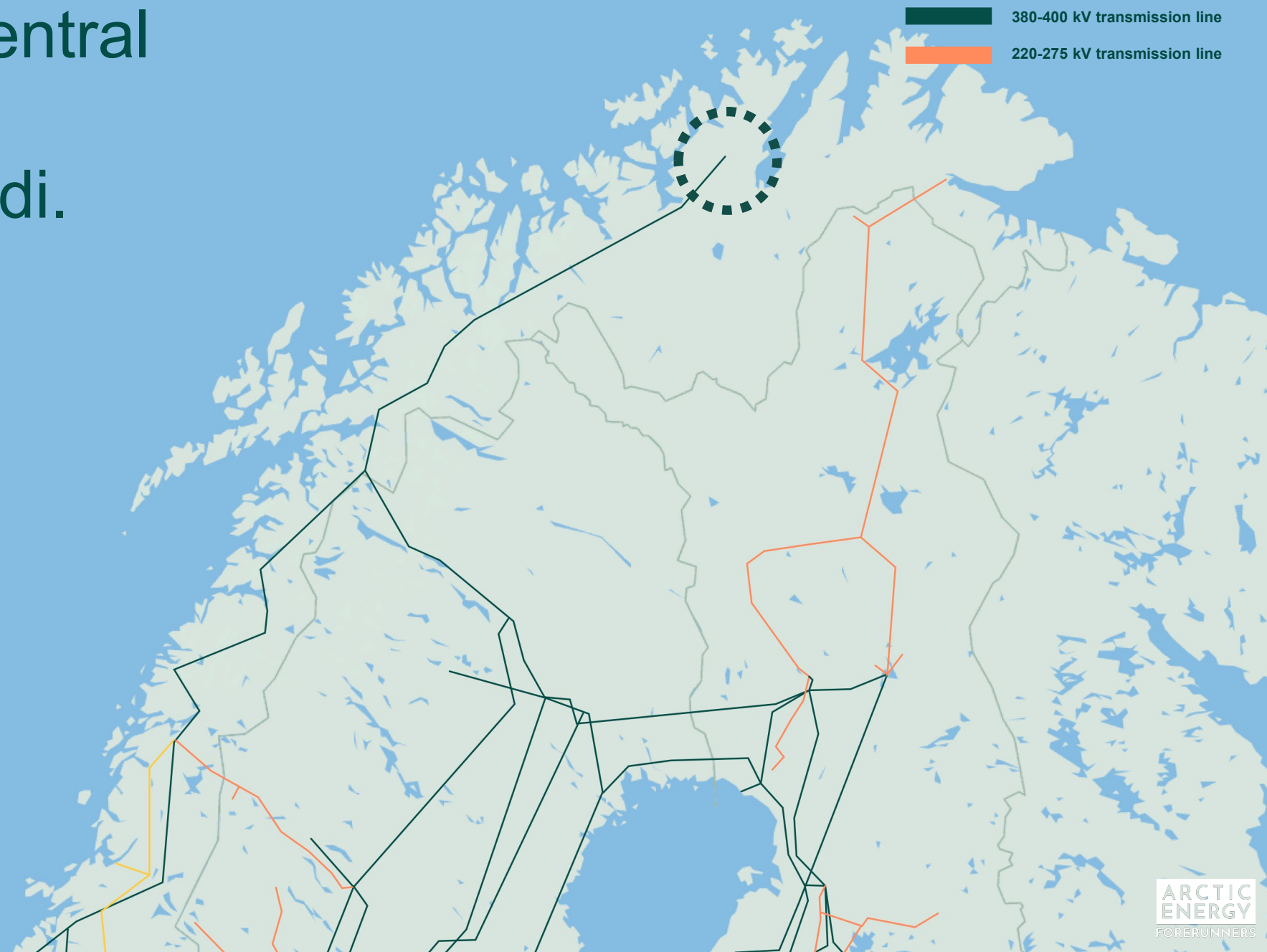
Let’s go back a bit.

Eastern Finnmark has a few wind parks already, and the best wind resources in Europe.

But the region lacks a central grid to fully utilize these resources.



In Norway, the central grid is now being extended to Skaidi.



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The Norwegian TSO Statnett has confirmed it will strengthen the main grid from Skaidi to Varangerbotn.

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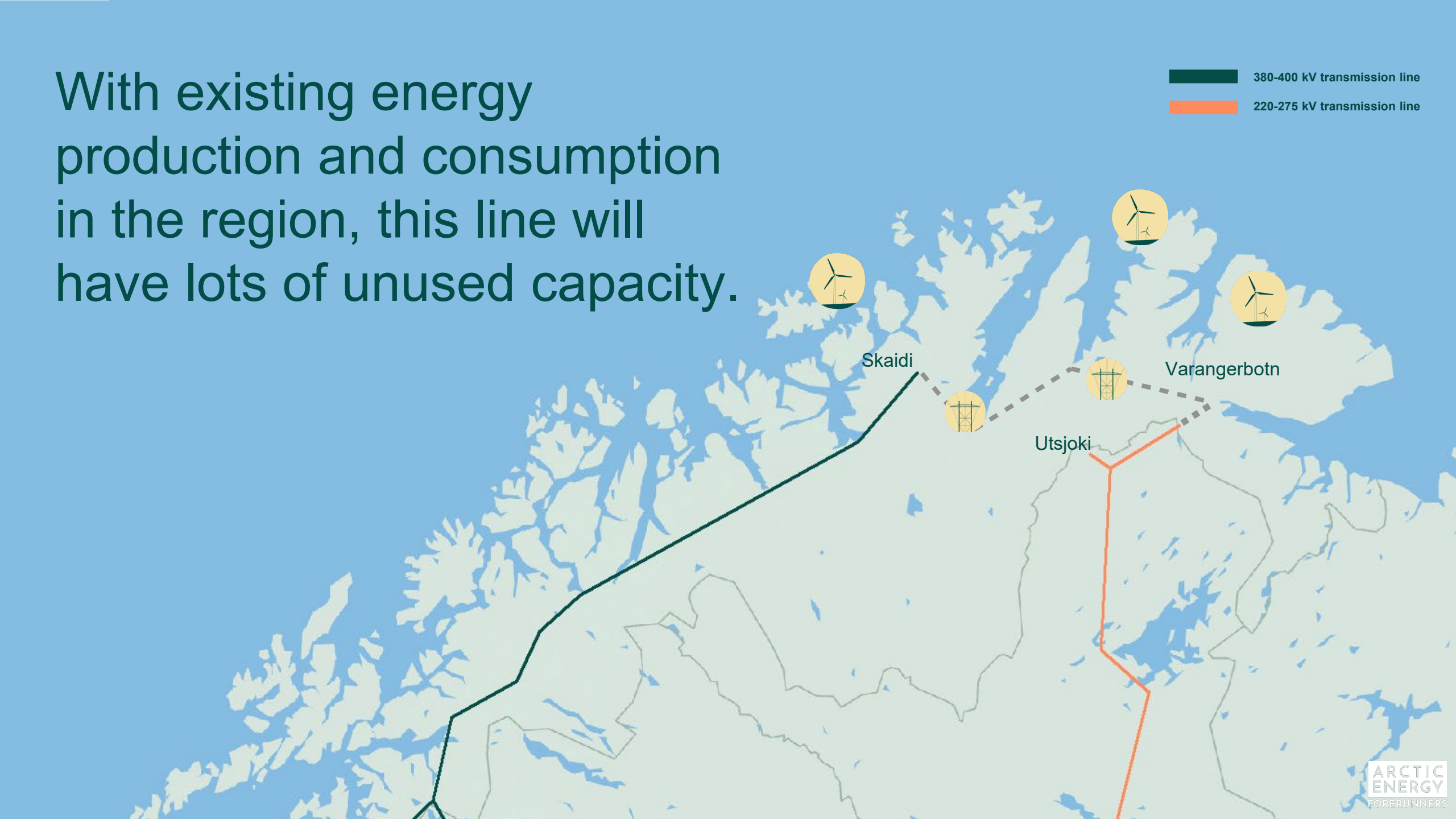
With existing energy production and consumption in the region, this line will have lots of unused capacity.



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Statnett knows this. And Statnett also knows that there are several projects in the pipeline.

And the grid is an absolute requirement for these to be viable.

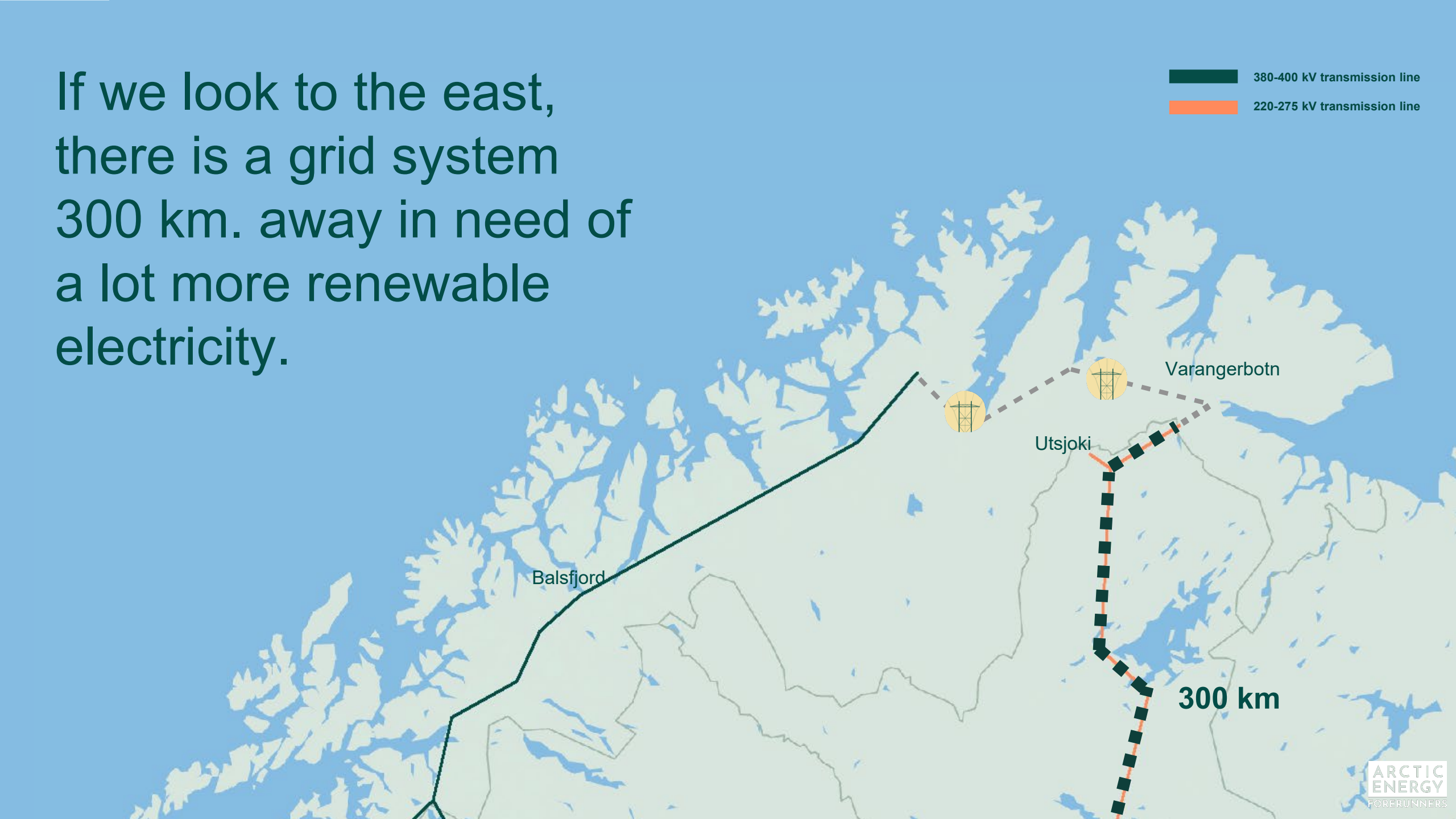
When the line is built, the electricity from the wind farms may fill up the new line.

But the line from Balsfjord and further south in Norway is already full, so the electricity produced in the north is stuck without any outlet.

The reason it is full, is that there is already a lot of electricity production further south.

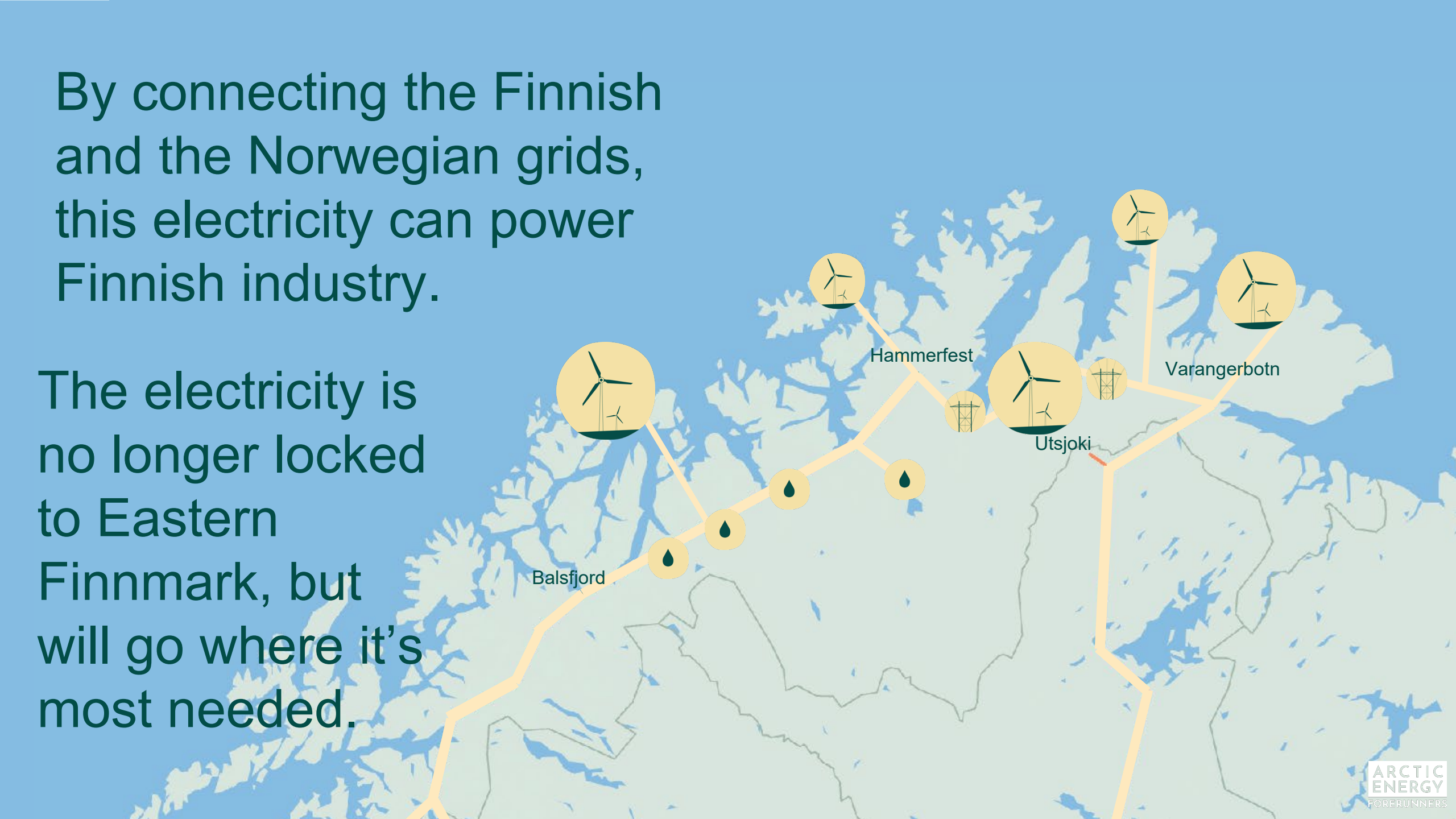
For the line to Eastern Finnmark to make sense, there is another piece of grid that must be realized.

If we look to the east, there is a grid system 300 km. away in need of a lot more renewable electricity.



By connecting the Finnish and the Norwegian grids, this electricity can power Finnish industry.

The electricity is no longer locked to Eastern Finnmark, but will go where it's most needed.



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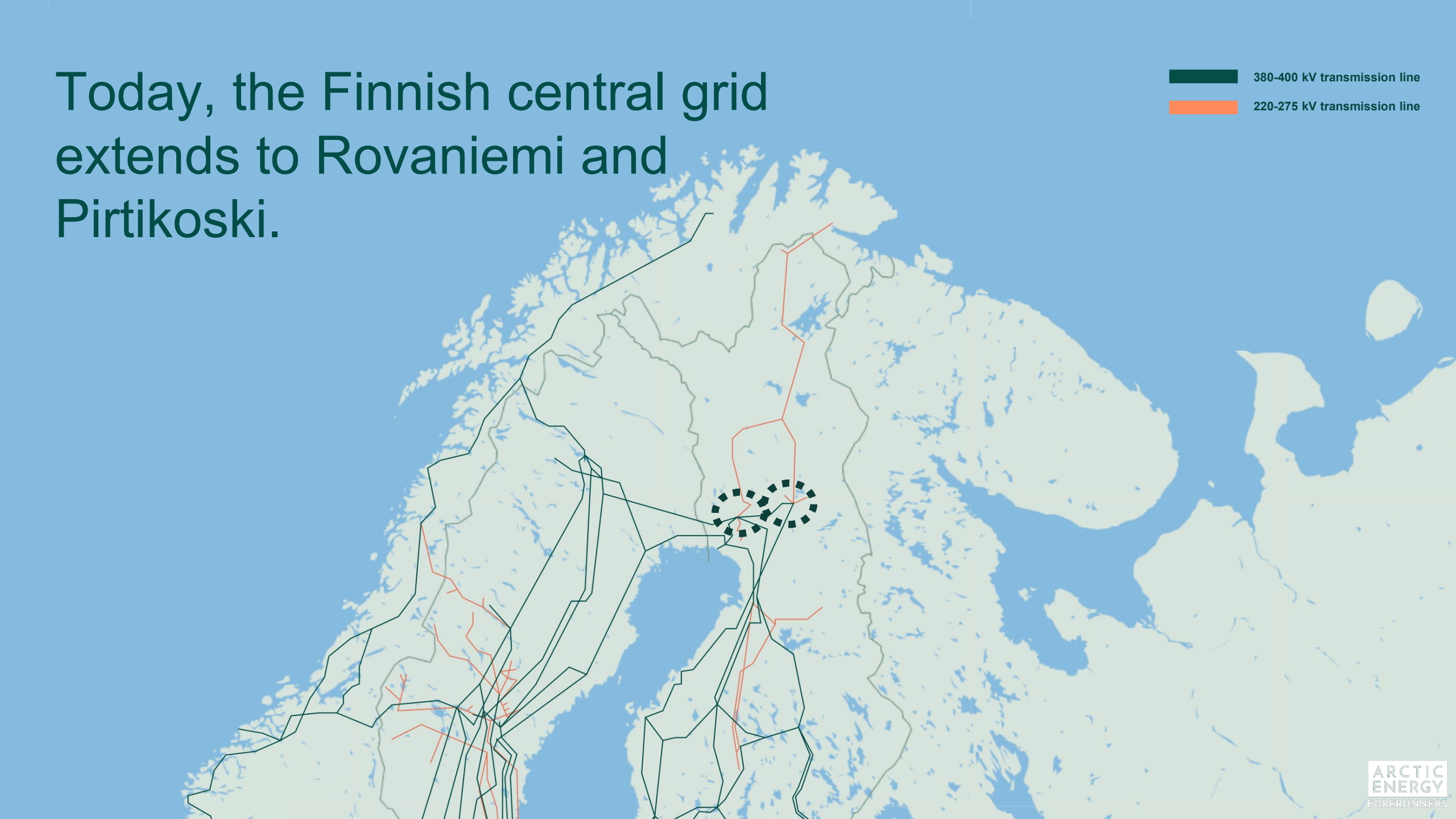
Today, the Finnish central grid extends to Rovaniemi and Pirtikoski.



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And in its 10-year plan, the Finnish TSO Fingrid extends the central grid to Vajukoski.

Connecting the Finnish and the Norwegian grid will strengthen the energy security in the entire region.

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Clean and cheap electricity + secure power supply enables development of energy intensive industry in Eastern Finnmark, Finland and Sweden.

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This is the vision of the Arctic Energy Forerunners.

Clean and cheap wind power and a grid connection between Norway and Finland will pave the way for industrial development and the decarbonization of our economies.

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