

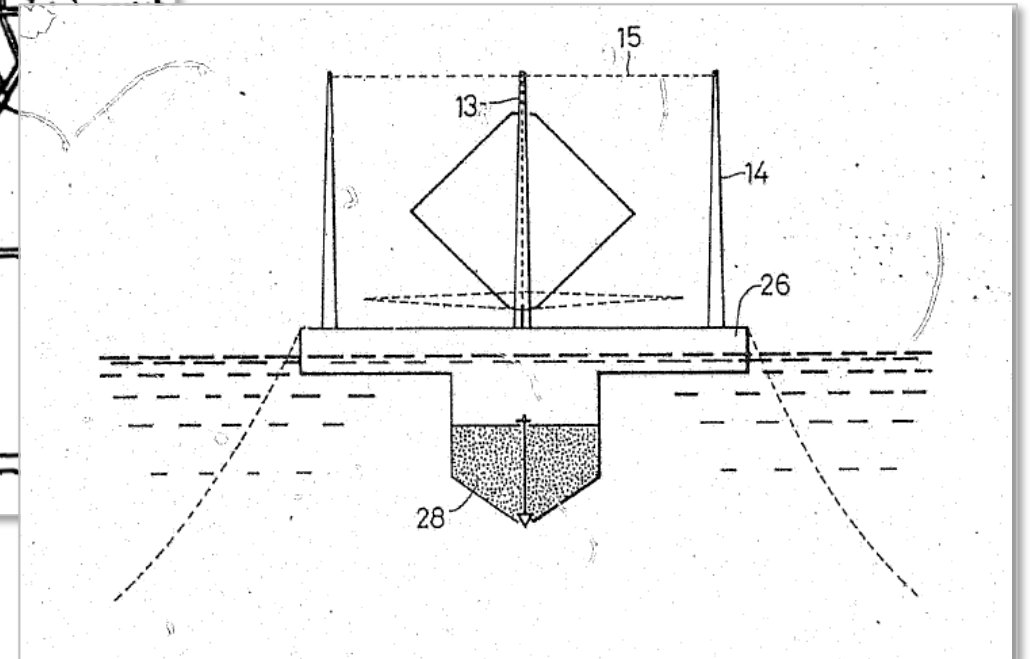
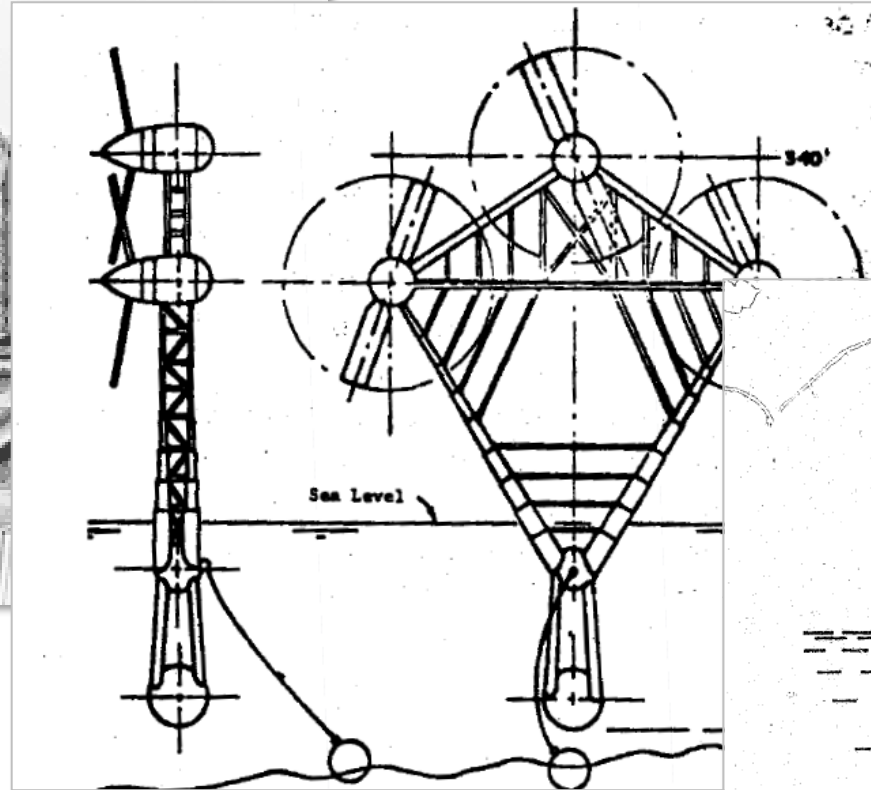
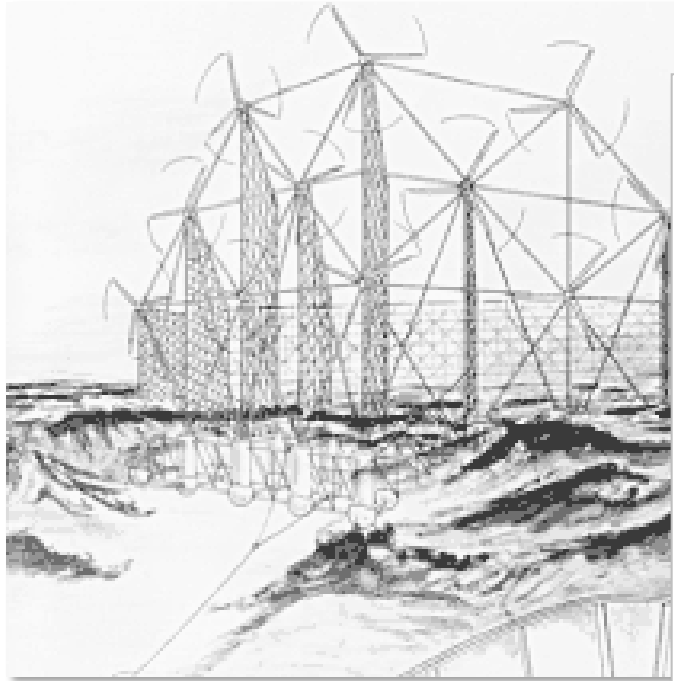
Offshore wind potential and challenges in the North Sea

Henrik Stiesdal, 19.11.24



The two oil crises of the 1970s triggered all kinds of ideas

Offshore wind was widely discussed in the 1970s and 1980s – but with no action



The transition from ideas to reality took place in Denmark

It took bold action to get traction

1989

- Danish government announces intent to build two 5 MW demonstration plants

1991

- Vindeby installation – 11 Bonus 450 kW

1995

- Tunø Knob installation – 10 Vestas 500 kW

2000

- Middelgrunden installation – 20 Bonus 2 MW

2002

- Horns Rev installation – 80 Vestas 2 MW

2003

- Nysted installation – 72 Bonus 2.3 MW



Stiesdal®

The world's first offshore wind project

Vindeby, 5 MW, 1991



The world's second offshore wind project

Tunø Knob, 5 MW, 1995



The world's first offshore wind farm with MW-scale turbines

Middelgrunden, 40 MW, 2000



The first North Sea project

Horns Rev 1, 160 MW, 2002



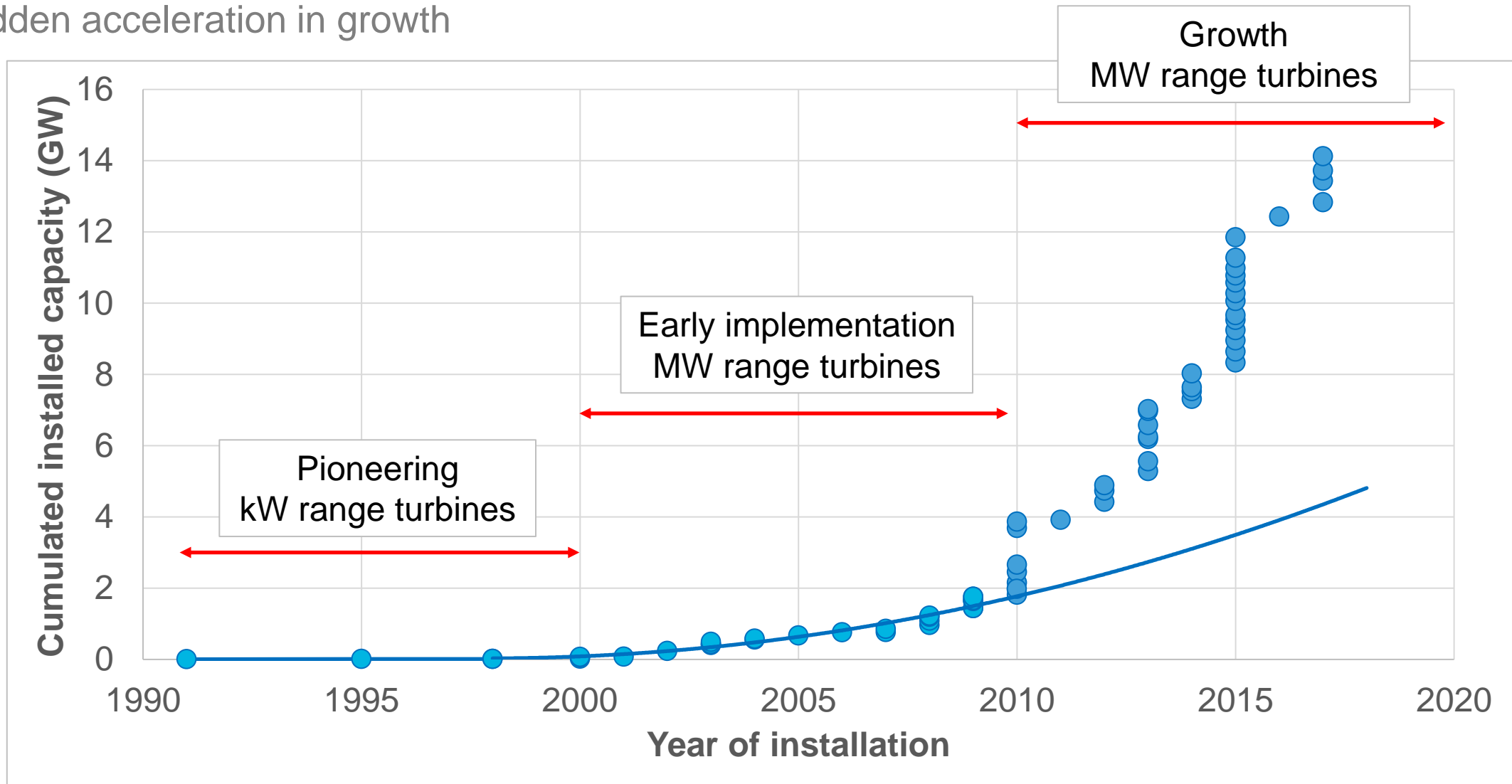
The project that defined the best practice

Nysted, 165 MW, 2003



The first 25 years in European offshore wind

A sudden acceleration in growth



The primary reason for the acceleration

The DONG-Siemens “Six Pack” deal created the market expansion

Independent coverage of power generation since 1981



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Largest ever offshore wind turbine supply agreement

Staff Writer March 6, 2009

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Siemens is to supply up to 500 wind turbines to DONG Energy’s prospective offshore wind farms in Northern Europe. The machines to be delivered under the newly signed supply agreement have a combined capacity of 1800 MW. Permitting procedures and country specific wind regime economics will

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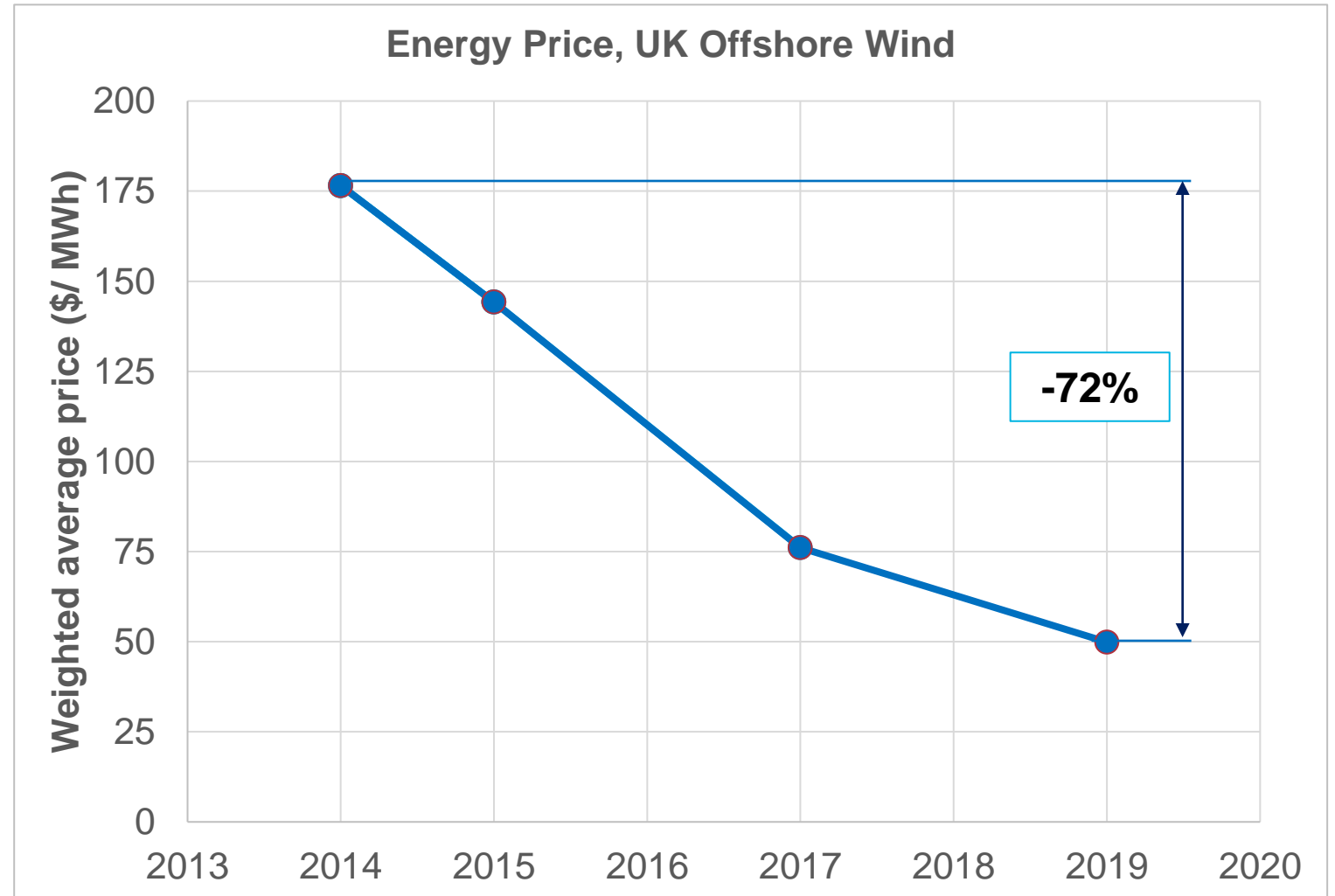
Competition was the driver, industrialization was the main tool

Cost development

- Offshore wind power has developed from a costly alternative to a competitive source of electricity

The reasons:

- Competition
- Industrialization
- Large turbines
- Low cost of capital
- Low steel prices



Modern offshore turbines are LARGE

Offshore wind turbines are the largest rotating machines ever made



Modern offshore turbines are LARGE

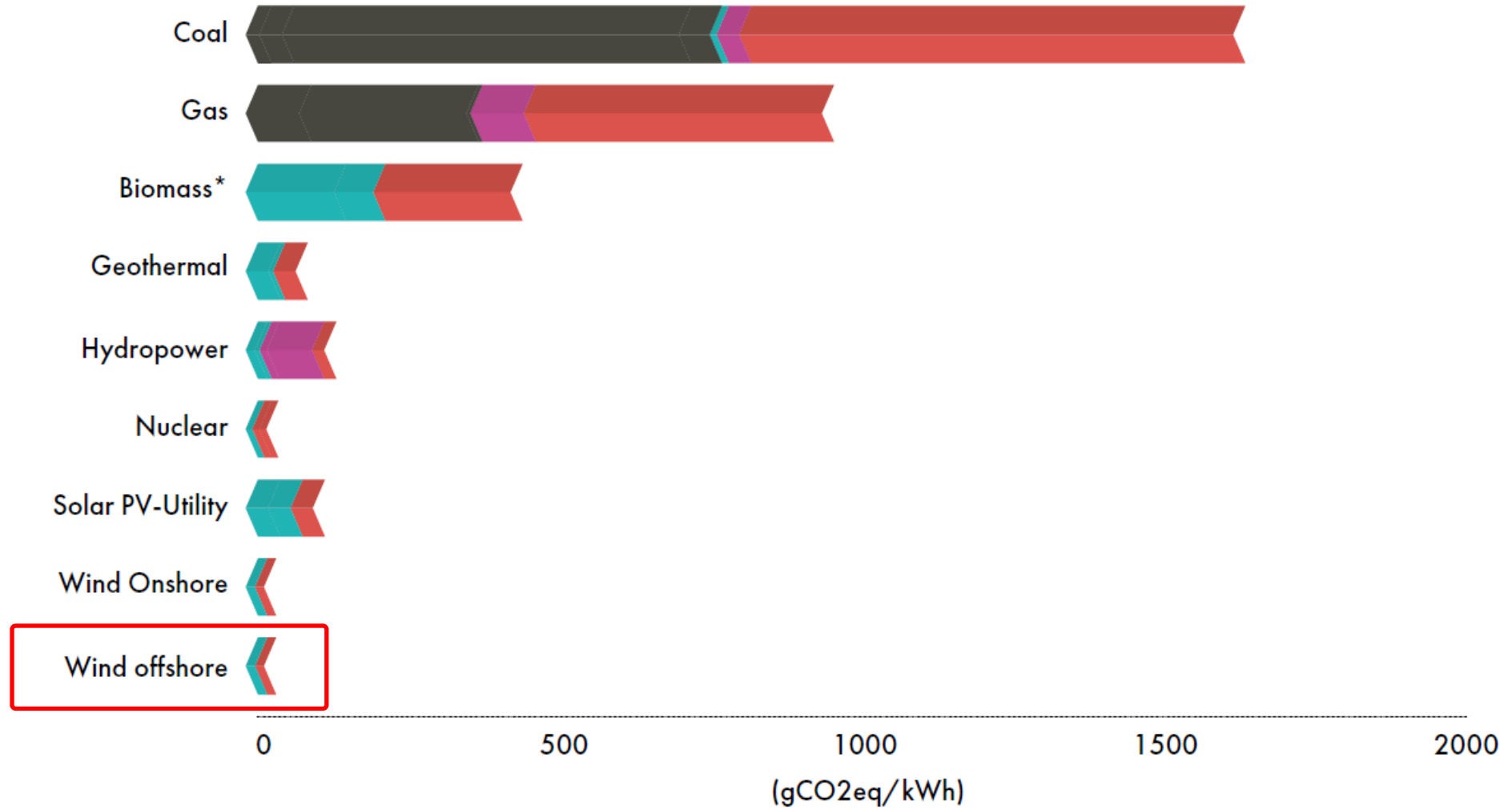
Scaling a floating offshore foundation with reference to the local neighborhood



Copenhagen Central Square, Rådhuspladsen

Is offshore wind actually good for the climate?

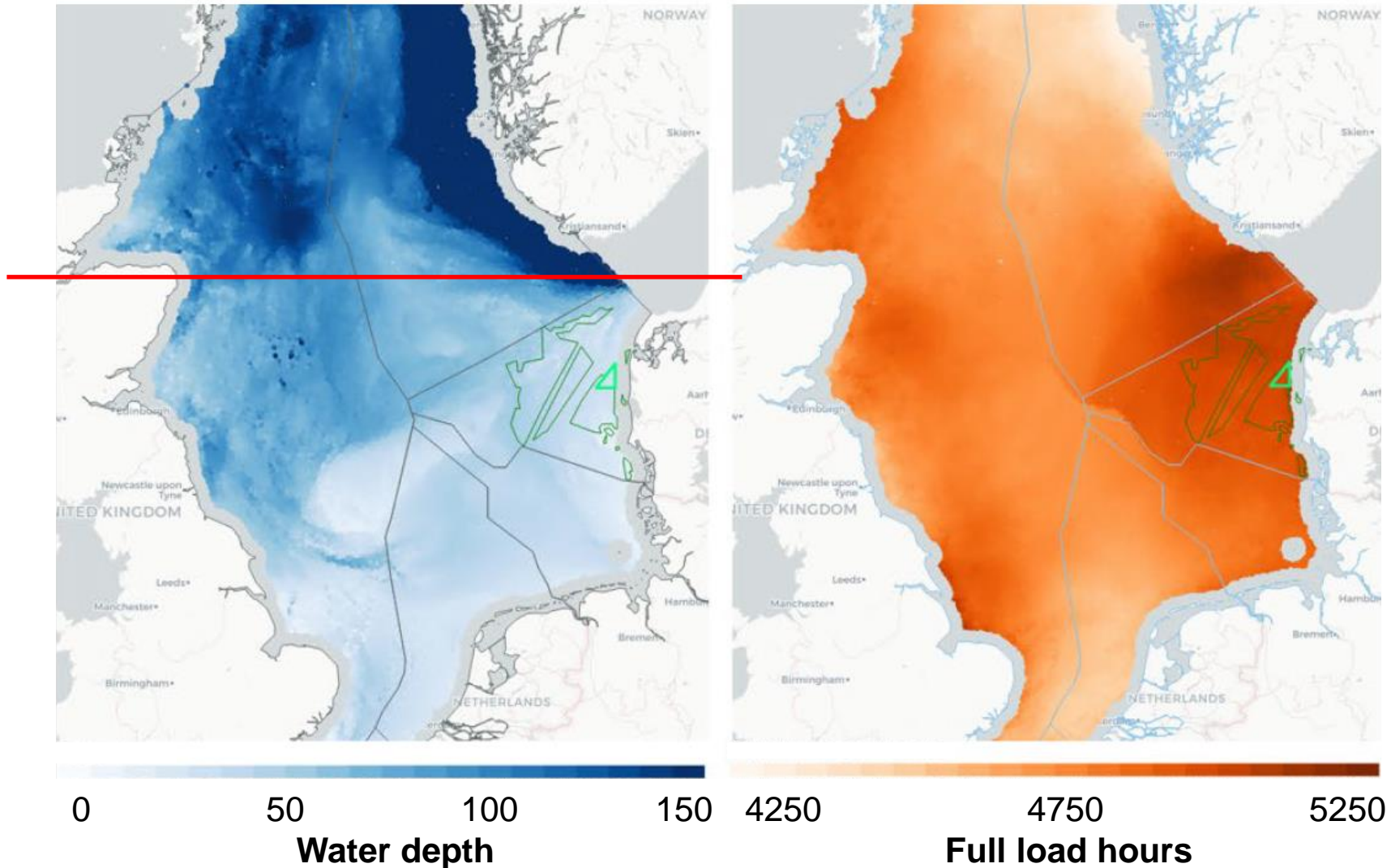
CO₂ emissions for different sources of electricity



● Direct Emissions ● Infrastructure and supply Chain Emissions ● Methane ● Lifecycle Emissions as estimated in AR5

The North Sea is eminently suited for offshore wind

Shallow water, excellent wind resources and proximity to large load centres make a perfect fit



The 2023 Ostend Declaration – up to 300 GW by 2050

Abundant resources, low costs, ultralow emissions, local jobs ... what's not to like?



OSTEND DECLARATION

ON

THE NORTH SEAS AS EUROPE'S GREEN POWER PLANT

DELIVERING CROSS-BORDER PROJECTS

AND ANCHORING THE RENEWABLE OFFSHORE INDUSTRY IN EUROPE

Reality is rather different

Inflation, slow permitting processes, grid infrastructure constraints, supply chain bottlenecks ...

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Environment Climate crisis Wildlife Energy Pollution

Wind power

'Biggest clean energy disaster' as UK auction secures no offshore windfarms

Lack of interest was widely expected after government failed to heed warnings about soaring costs

- What went wrong at UK's offshore wind auction?
- Nils Pratley: does the government still have an offshore wind strategy?

11/17/24, 8:47 AM RWE lawyer 'shocked' at UK planning delay to \$9bn Dogger Bank South wind farm over seabirds

RECHARGE

Wind

RWE lawyer 'shocked' at UK planning delay to \$9bn Dogger Bank South wind farm over seabirds

Solicitor claims 'you're making a mistake' as opening of examination delayed on 3GW North Sea project



11/17/24, 9:25 AM The wind-turbine industry should be booming. Why isn't it?

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Business | Awaiting a second wind

The wind-turbine industry should be booming. Why isn't it?

Stiff competition has combined with rising costs and other burdens




IMAGE: EYEVINE

How do we change this? How do we make big things happen?

The history of the Danish wind industry is a good example

The Danish “wind adventure” had four key driving elements

1. The government wanted it to happen

- Since the late 1970s, the wind industry has enjoyed the support of a strong political majority.

2. A demand was created through the establishment of long-term frame conditions

- A 30% investment subsidy was implemented.
- The government imposed a grid connection mandate on the utilities.
- Electricity supply rates offered customers decent project economies.
- Planning constraints were mitigated by rapid action.

3. Selected demonstration projects received subsidies

- The world’s first offshore wind farms received specific subsidies

4. Strong links were established between industry and research

- The interaction was a side effect of the investment subsidy

The sequence matters

The classical sequence “supply and demand” does not reflect what makes things happen

It is really about a different sequence

1. A generic demand – society wants something to happen, e.g. reduction in dependency of energy imports (as in Denmark in the 1970s) or climate change mitigation (as now).
2. The establishment of a specific demand – the government translates the generic demand into a specific demand that creates a market for specific products (wind electricity, hydrogen, etc.).
3. The subsequent, independent establishment of a supply offering for the desired products.

Key takeaway

- Demand drives supply, not the other way around.
- Once demand has created supply, competition among suppliers will drive innovation and cost reductions.

The necessary focus of government subsidies and incentives

- Governments should establish long-term frame conditions that create a demand.
- Governments should not subsidize suppliers – they get their chance when the market is created.

So, where are with regarding offshore wind in the North Sea?

Assessing status with reference to the solution elements

The four elements of the solutions

- ✓ The government must want it to happen
- ? A demand must be created through the establishment of long-term frame conditions
- ✓ Selected demonstration projects should received subsidies
- ✓ Strong links must be established between industry and research

This is the core of the matter

- A demand must be created through the establishment of long-term frame conditions

We do not have long-term frame conditions for offshore wind power in the North Sea!

- National targets are shaky
- Offtake opportunities are often unknown
- Planning processes are slow
- Energy market structures are often unsuited for the purposes of the energy transition

The long-term frame conditions that are needed

Fortunately, the requirements are simple – but implementation may not be

The long-term frame conditions needed

- Establishment of the generic demand - binding national commitments for the build-out of offshore wind.
- Establishment of the specific demand – assuring developers and investors that there is a market pull for the products from wind projects:
 - establishment of electrical grids, where relevant supplemented with hydrogen pipelines and/or transport corridors for liquid downstream derivatives of hydrogen, and
 - markets and trading mechanisms that support the establishment of long-term viable supplier-customer relations.
- Removal of project planning constraints, including rationalization of the planning processes, primarily by establishing arrangements where the process steps are carried out in parallel, not sequentially.
- Positive approaches to establishment of supply chains, including the removal of factory planning constraints in the same way as for the actual implementation projects.
- Societal support to the other relevant elements of energy projects – financing, workforce development, etc.

Not easy! But nobody said it would be so

When tackling the world's largest problem, we can take inspiration from Chinese Mandarin language

Crisis

Weijī

危 机

Danger

Opportunity

Thanks for your attention



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