Offshore windenergie - Internationale ontwikkelingen

KIVI

16-10-2003
afdeling voor
offshore techniek

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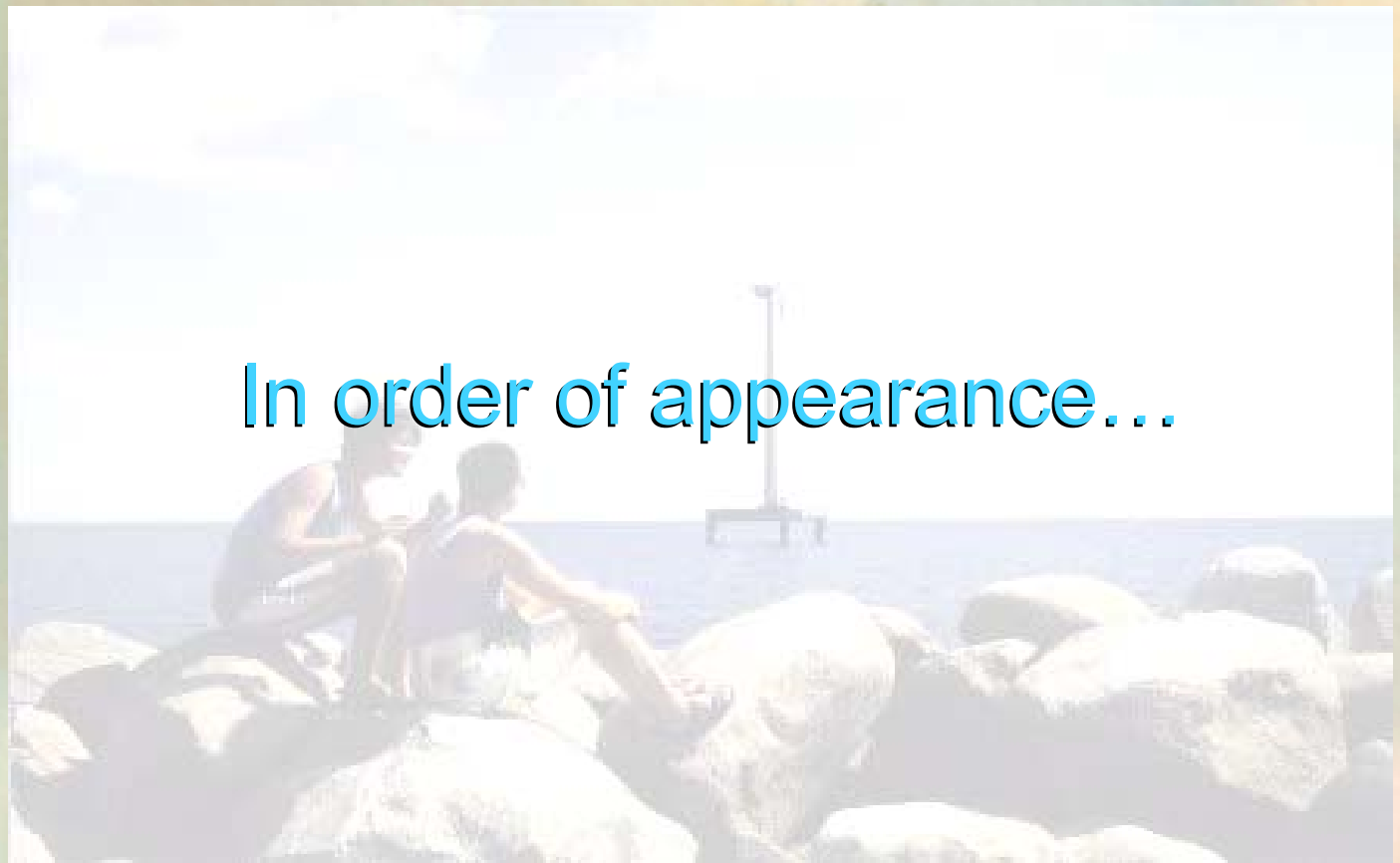
Onderzoeker offshore windenergie
Civiele Techniek en Geowetenschappen
TU Delft

Europe takes the plunge!

Europe takes the plunge!

- Where has it taken us?
- Support structures
- Turbine technology
- Installation and maintenance
- Electrical infrastructure
- Planning and strategy


In order of appearance…

Nogersund

Vindeby

Lely

Tunø Knob

Irene Vorrink

Bockstigen

Blyth

Middelgrunden

Utgrunden

Yttre Stengrund

Horns Rev

Samsø

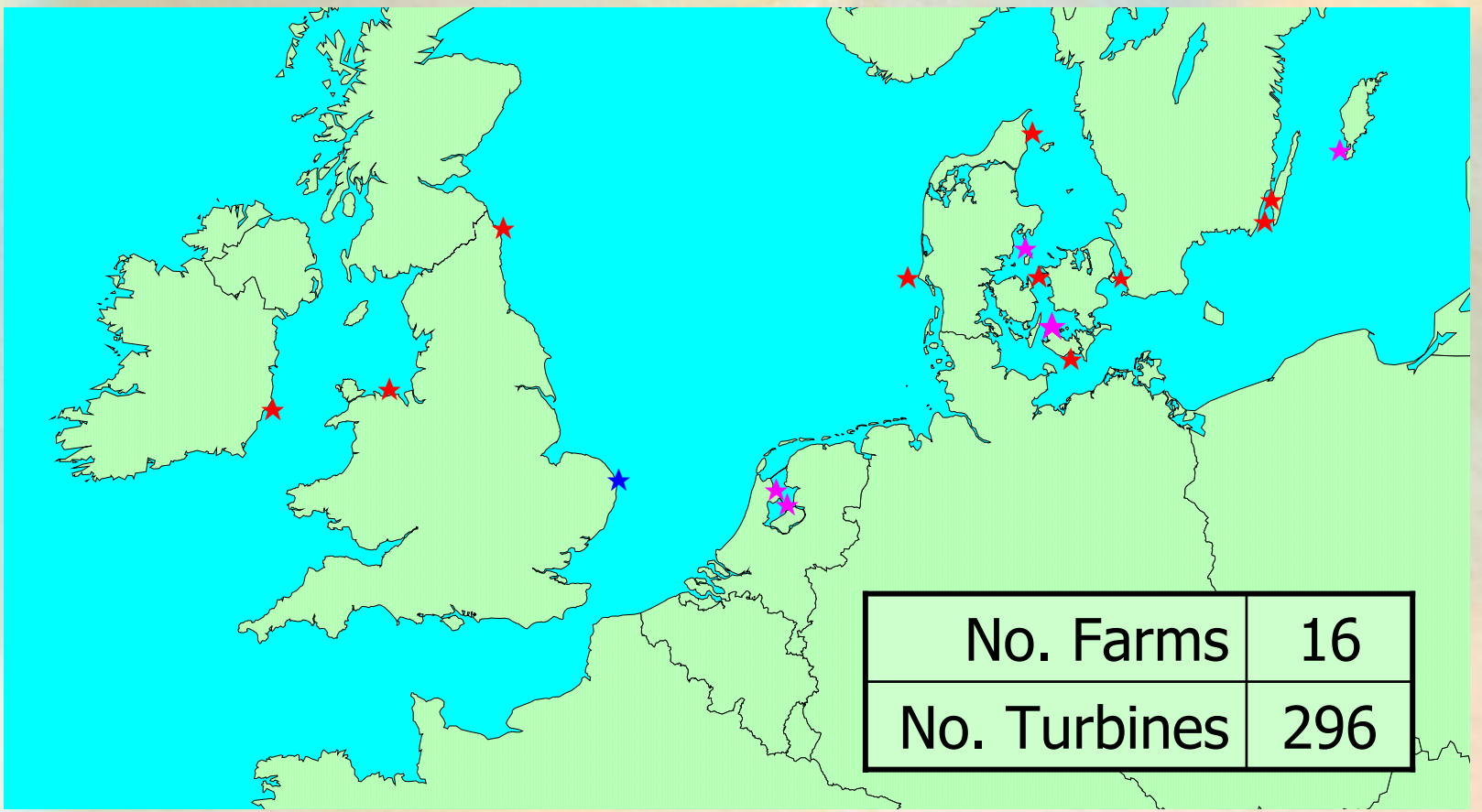
Frederikshavn

Nysted - Rødsand

North Hoyle

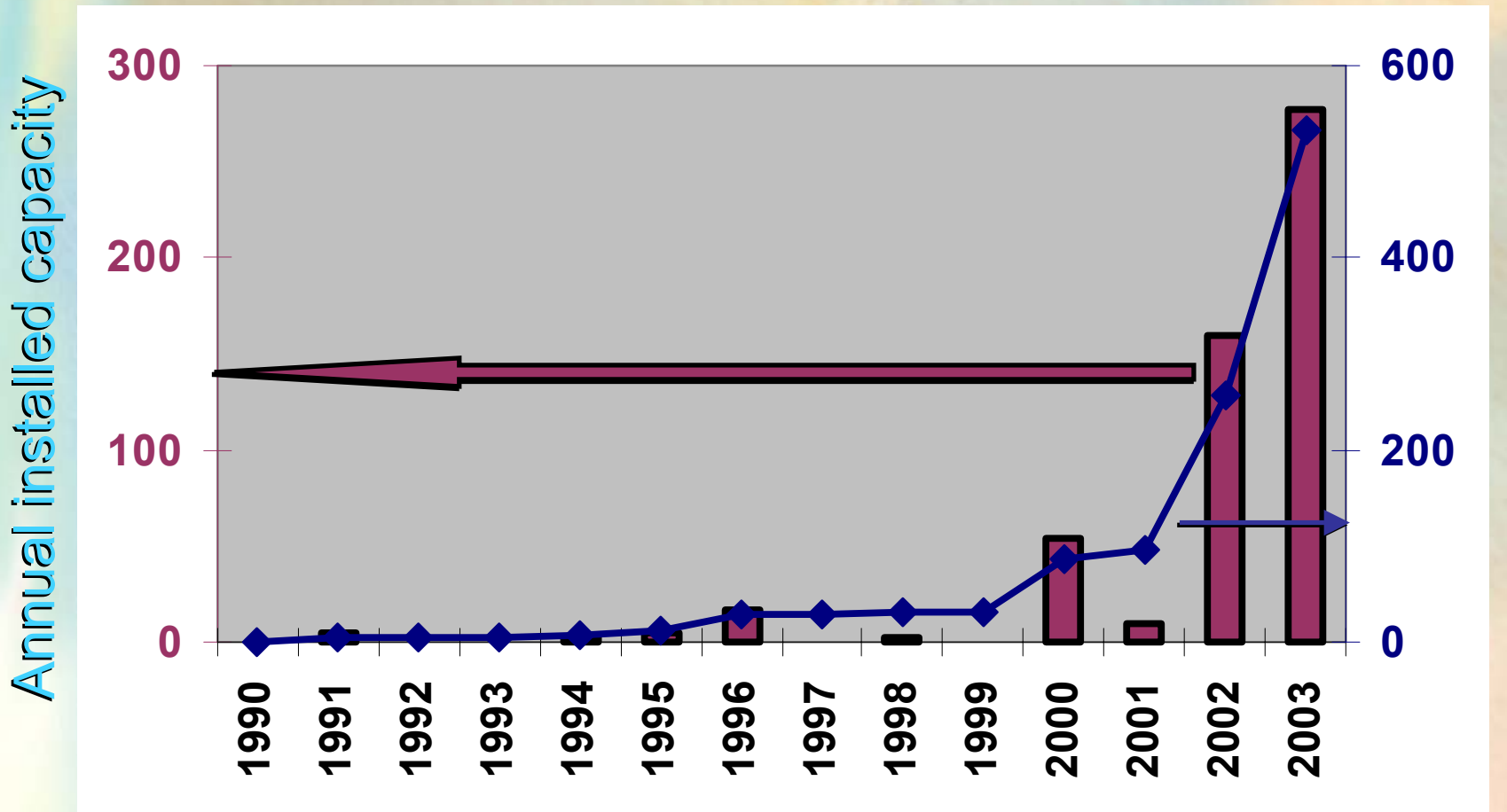
Arklow Bank

Wind farm locations



Installed capacity

Total anno 2003: 533 MW



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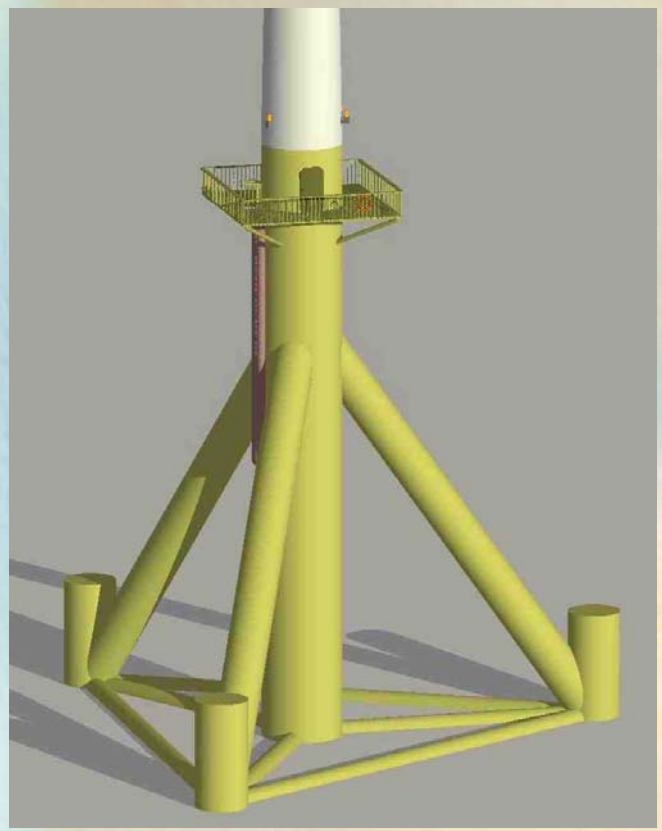
Tripod

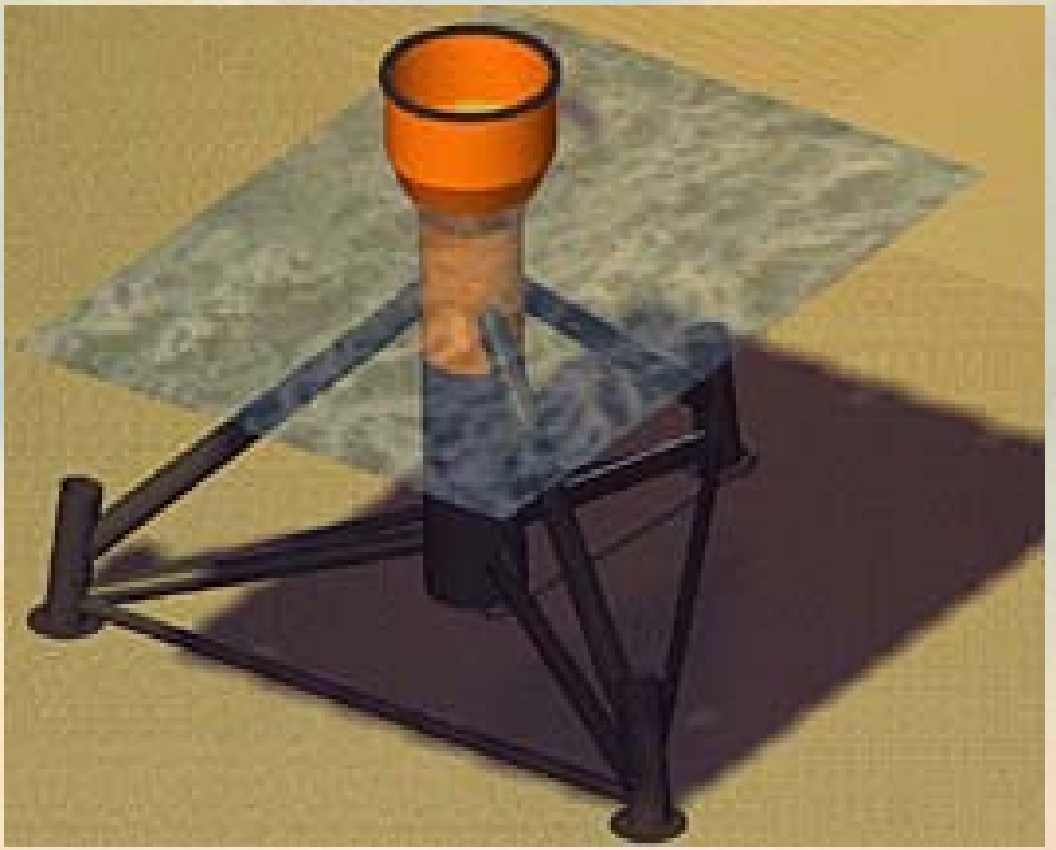


1 specimen

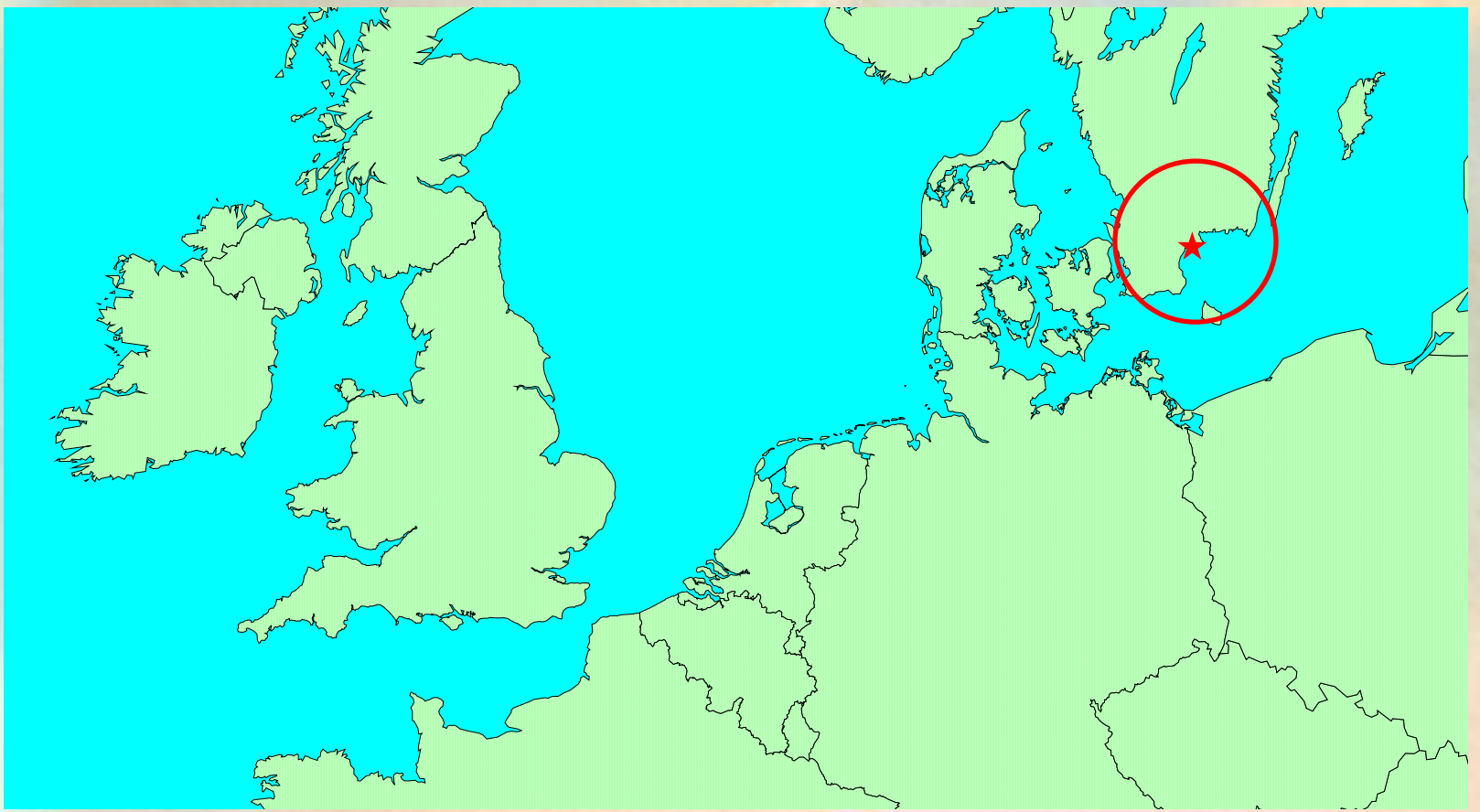
(first-ever offshore wind turbine)

Dismantled

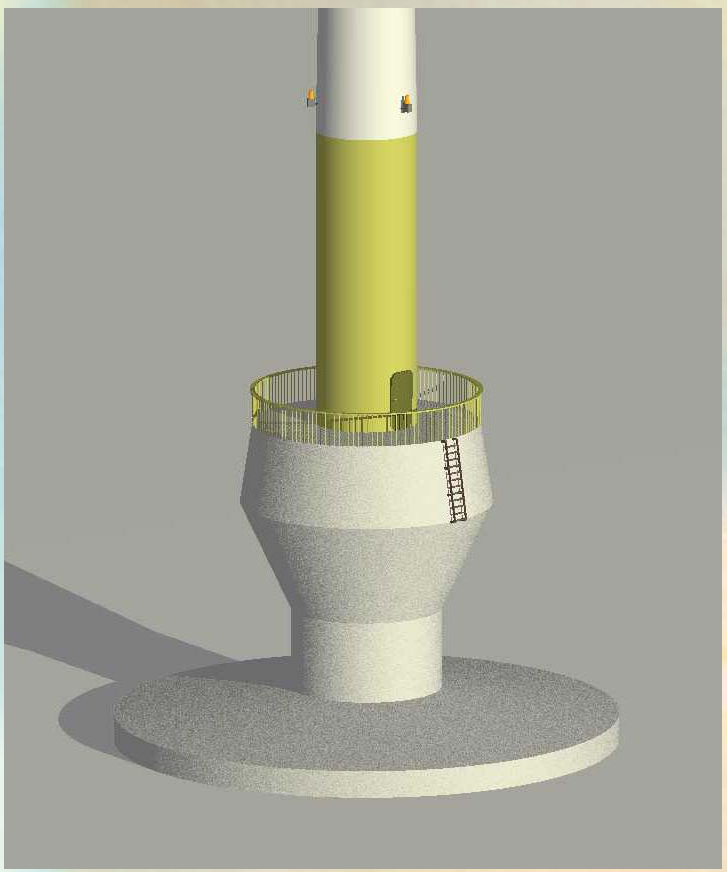
Tripod



Tripod: where?



Gravity base structure

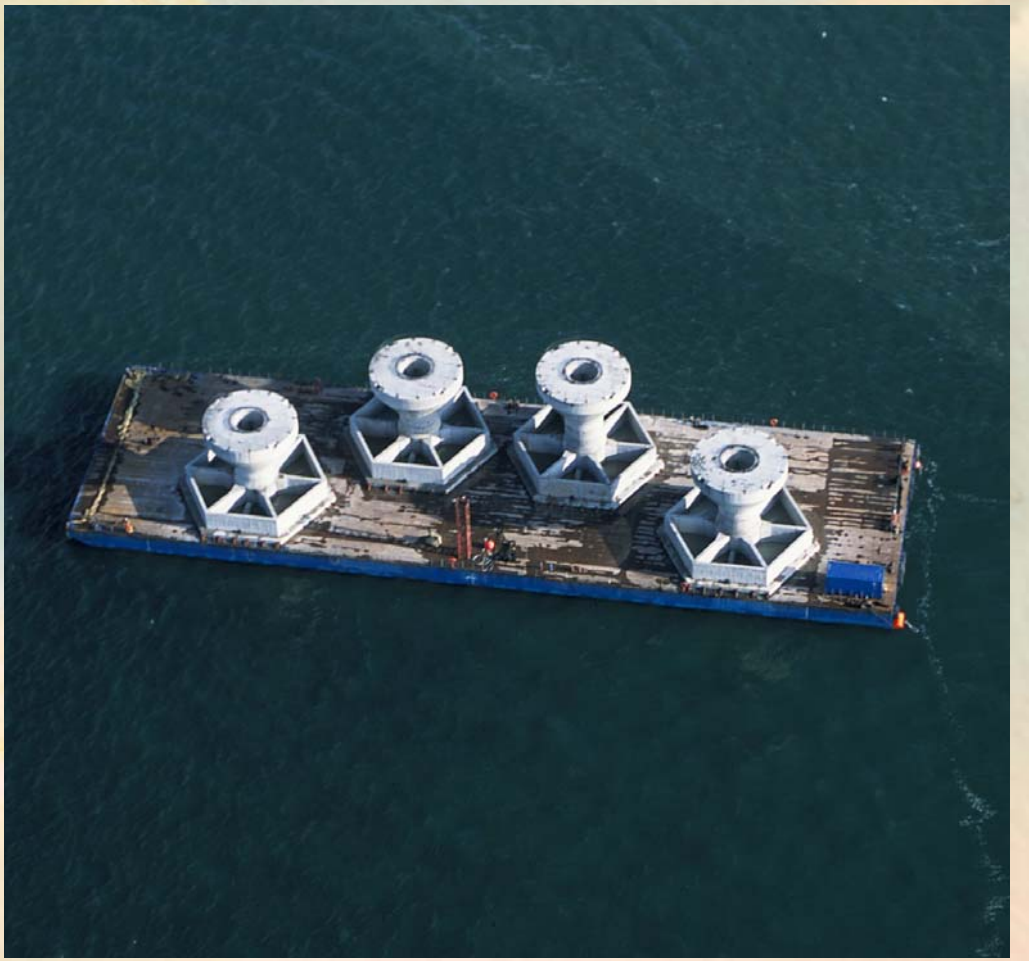


4 Farms

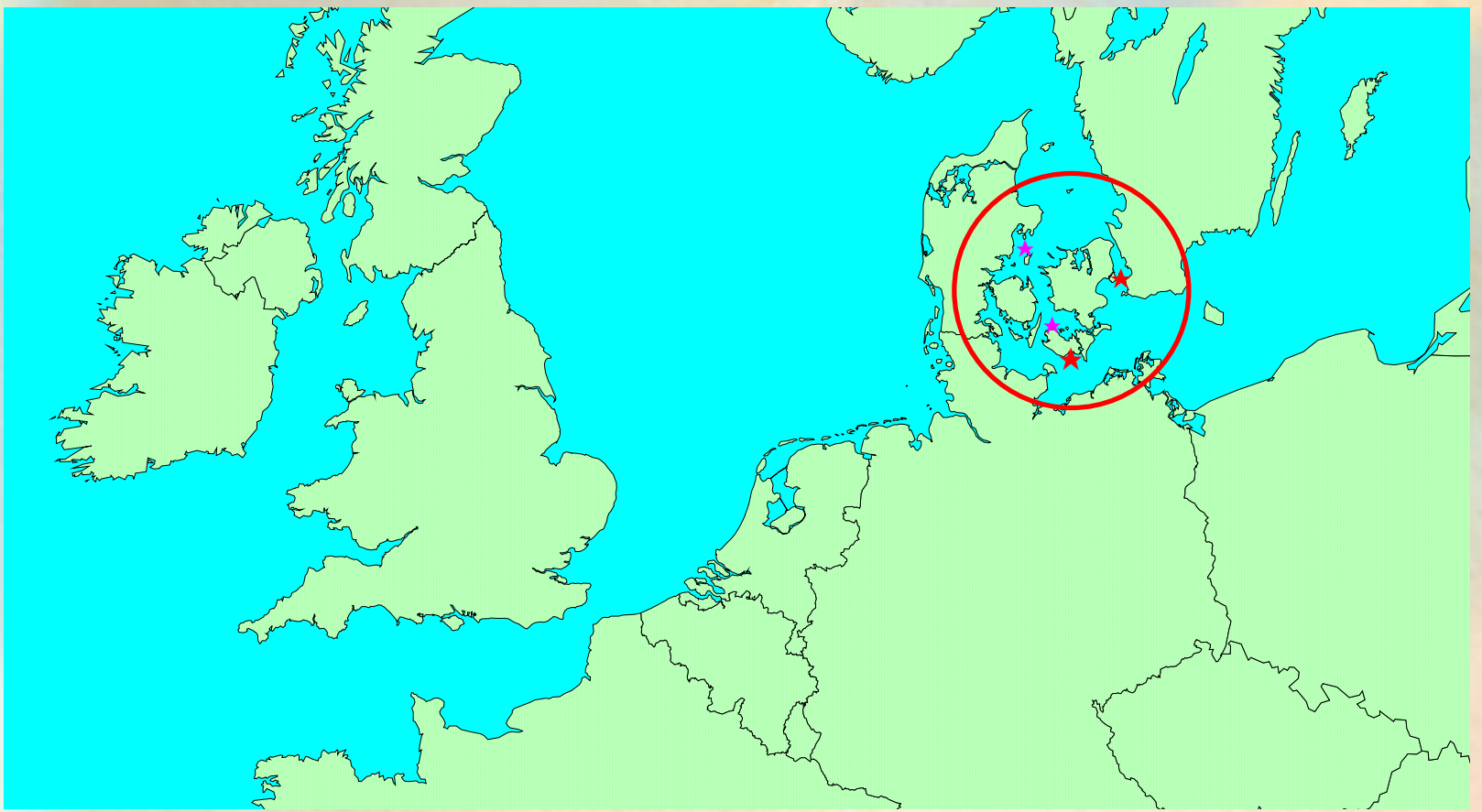
113 Turbines

Each in concrete

Gravity base structure



Gravity base structure: where?



Monopile

Driven:	8 Farms
	139 Turbines
Drilled:	3 Farms
	12 Turbines
Mixed:	1 Farm
	30 Turbines

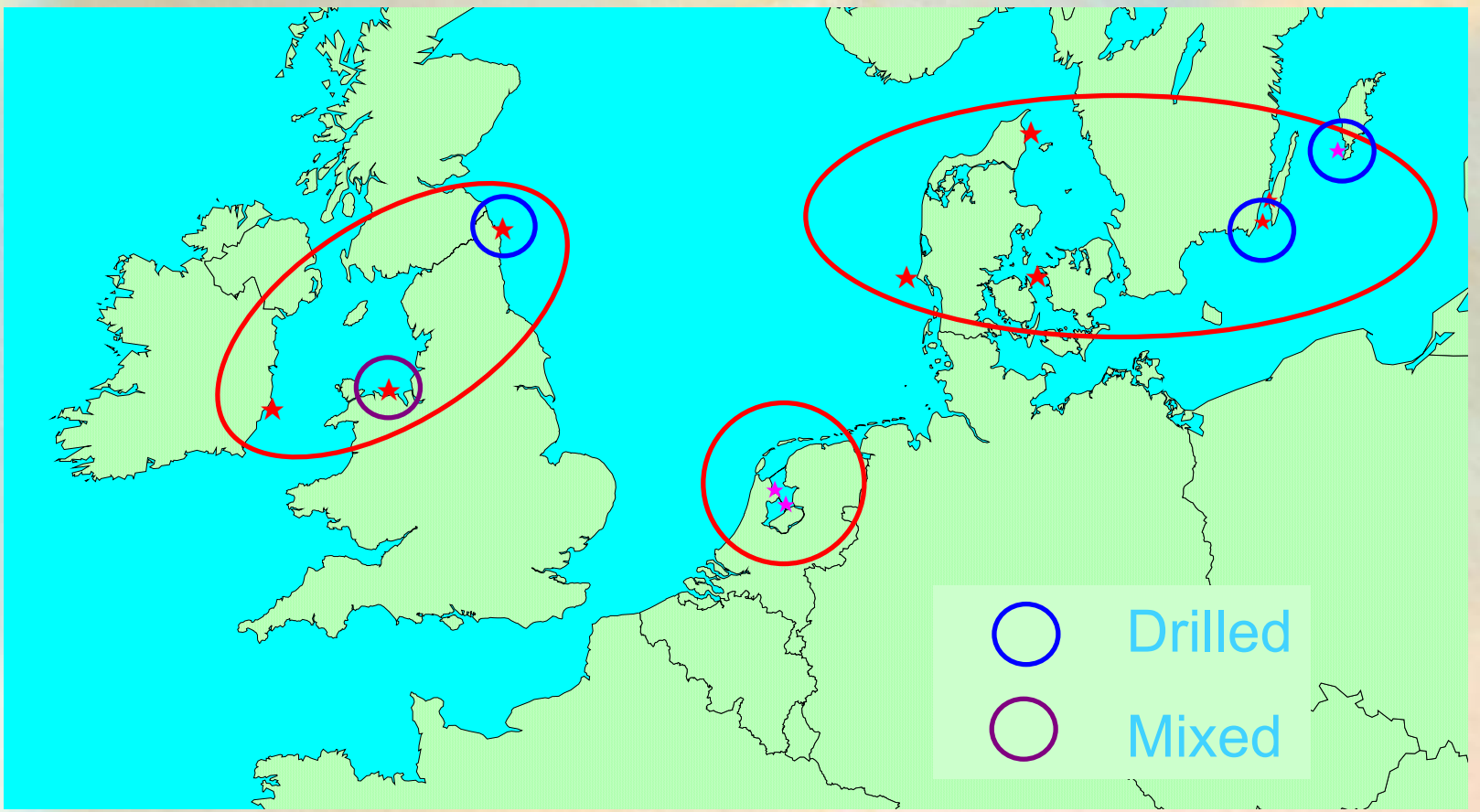
Monopile

Driven monopile

Drilled monopile

Mixed drilled and driven monopile

Monopile: where?

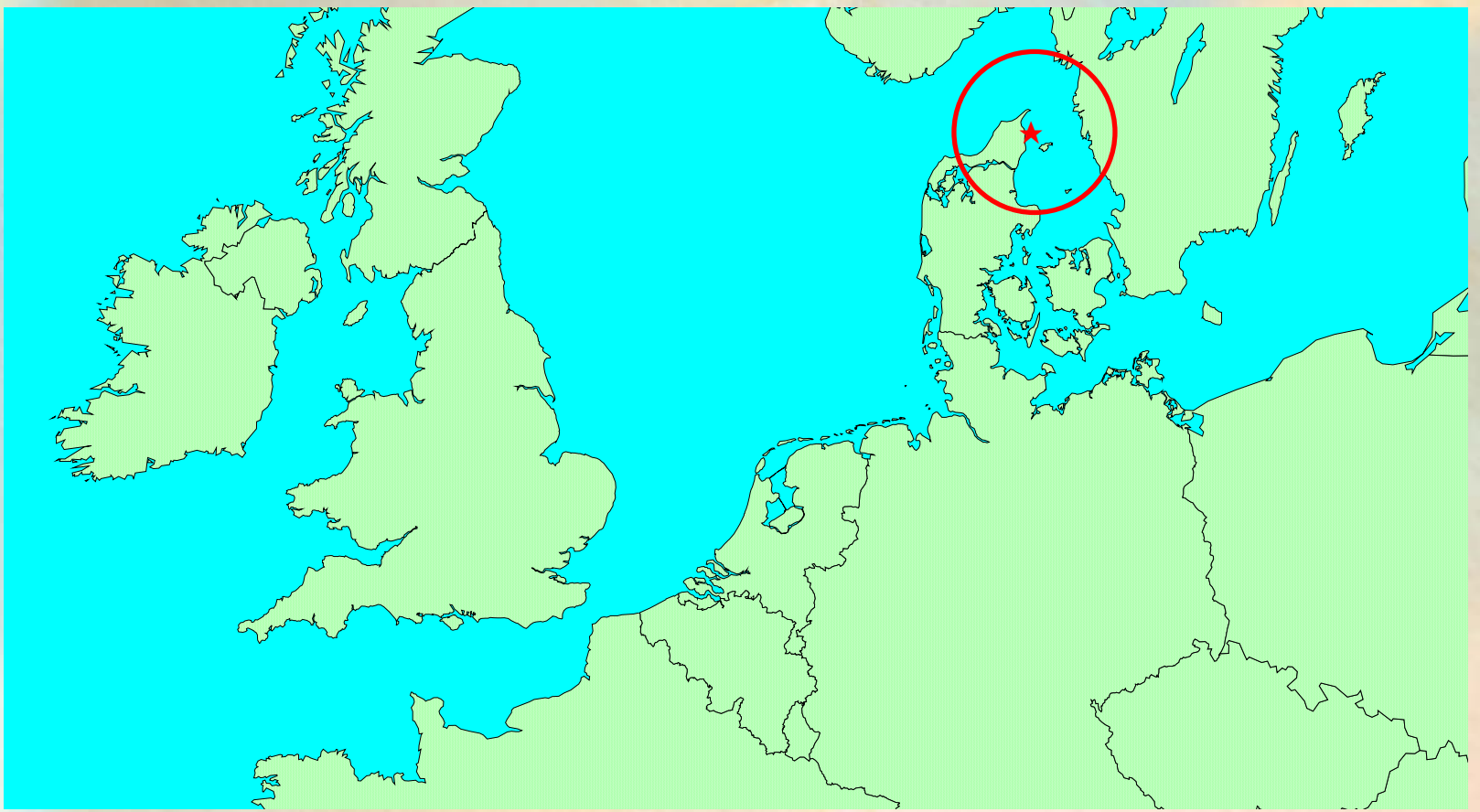


Suction bucket (mono)

1 Specimen

Dry installation!

Suction bucket (mono): where?



Smart tower

In development

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Enercon – E-112

4.5 MW

114 m rotor

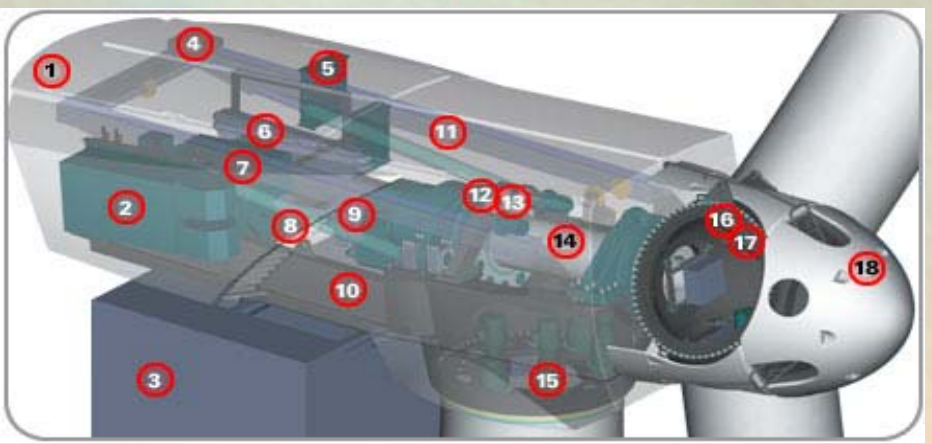
Direct drive

GE Wind Energy – 3.6 s offshore

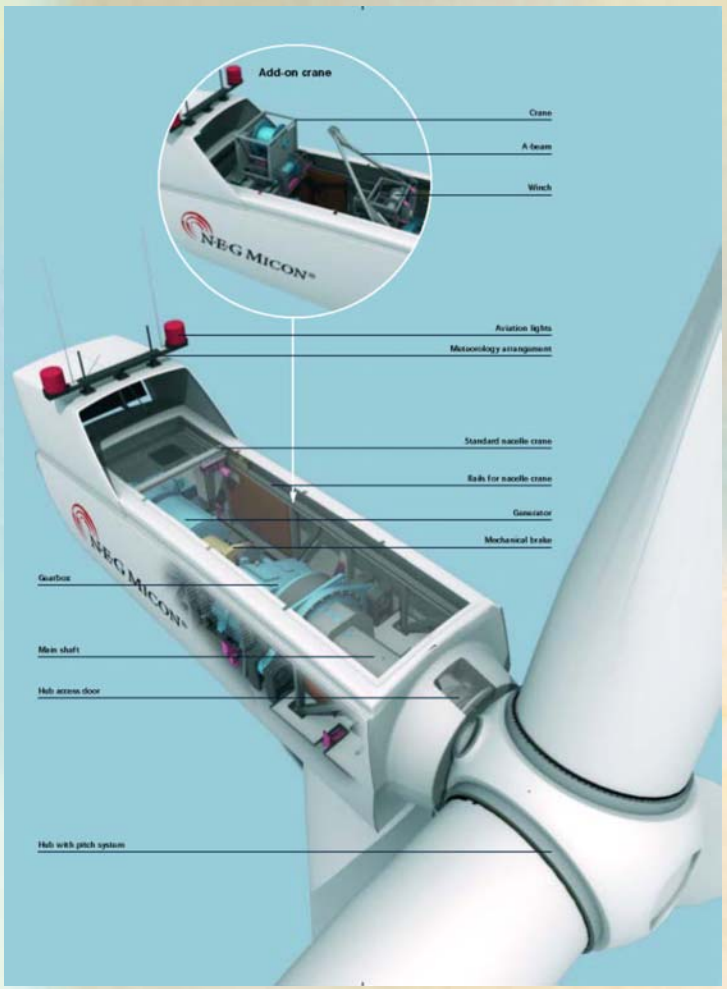
3.6 MW

104 m rotor

Built-in heavy duty crane



NEG Micon – NM92/2750

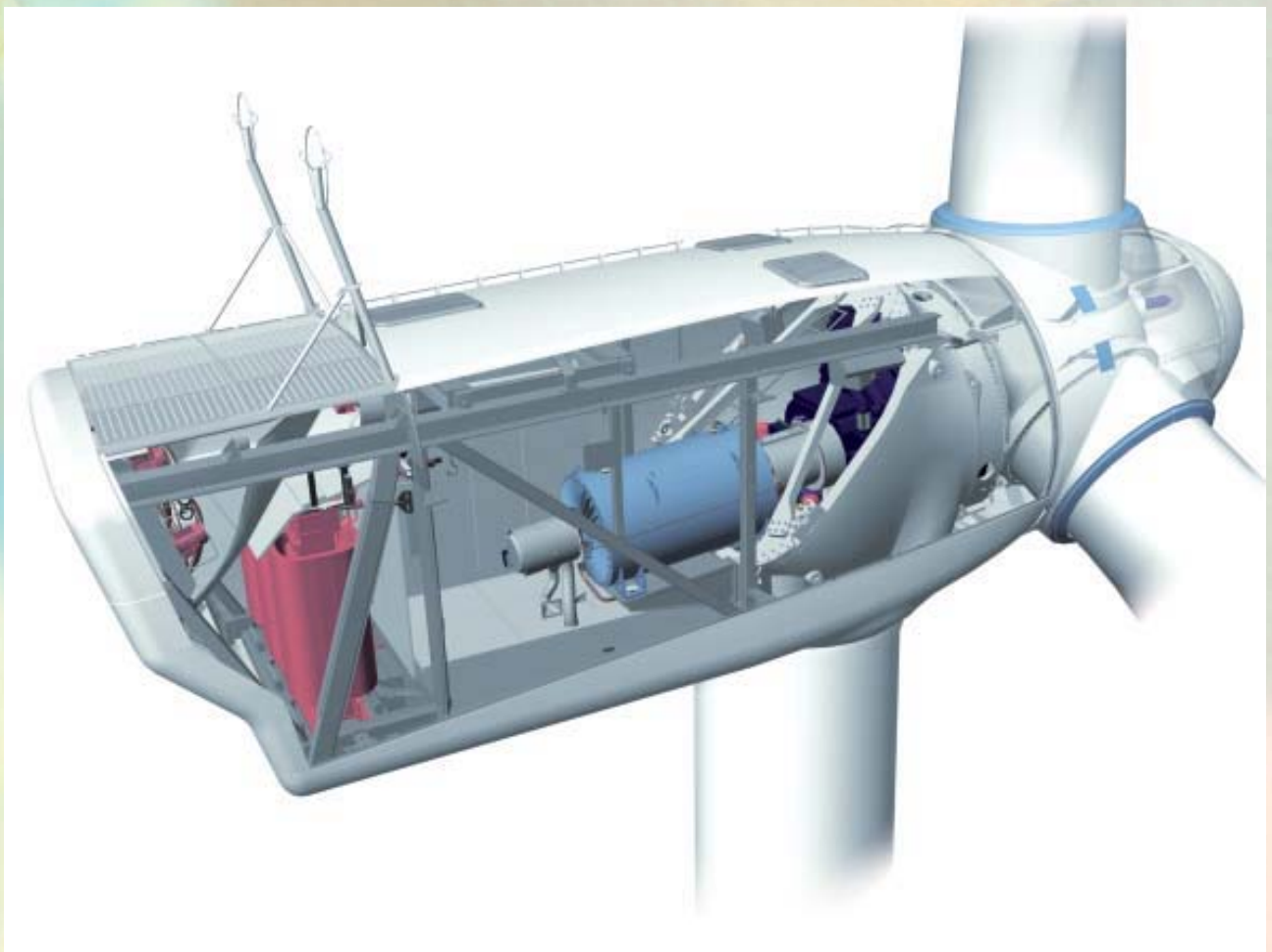


2.75 MW

92 m rotor

Dutch invention!

Vestas – V90 - 3.0 MW



3.0 MW

90 m rotor

Compact gearbox

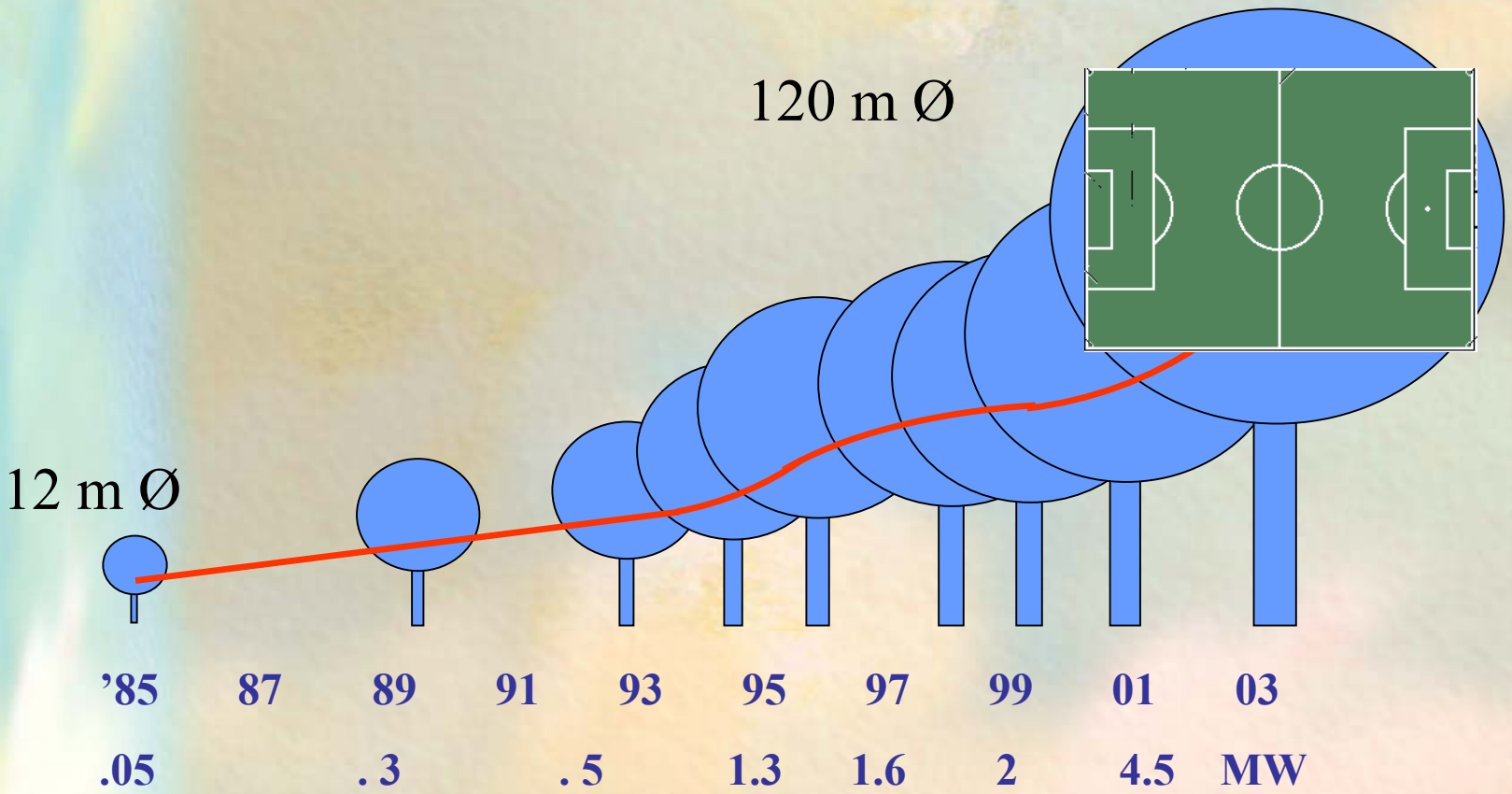
and bedplate

Coming soon...

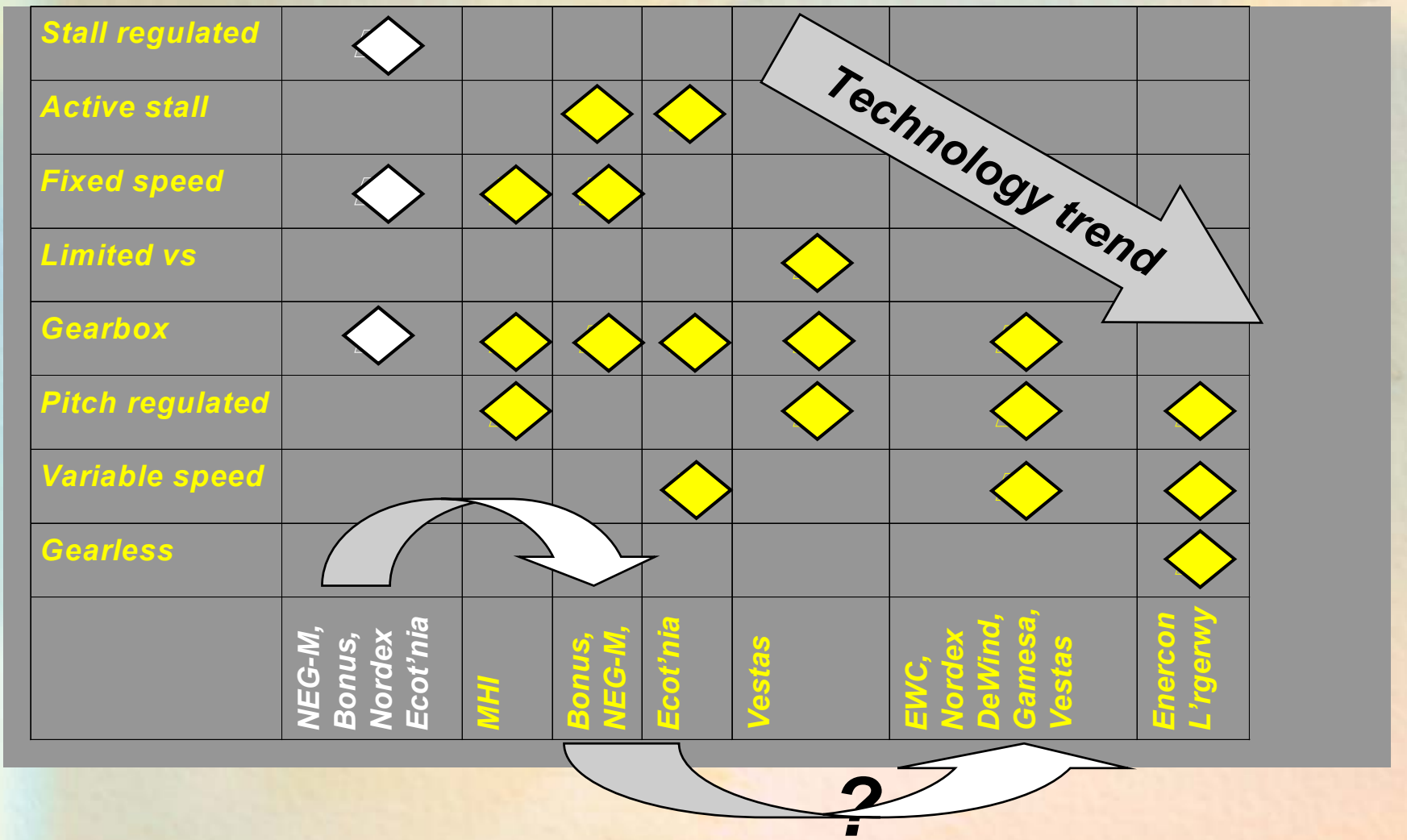
Planned end this year or early next year

Company	Type	Power
NEG-Micon	NM110/4200	4.2 MW
RePower	5M	5 MW
Pfleiderer/Aerodyn	Multibrid	5 MW

Growth of commercial turbines



Concept development



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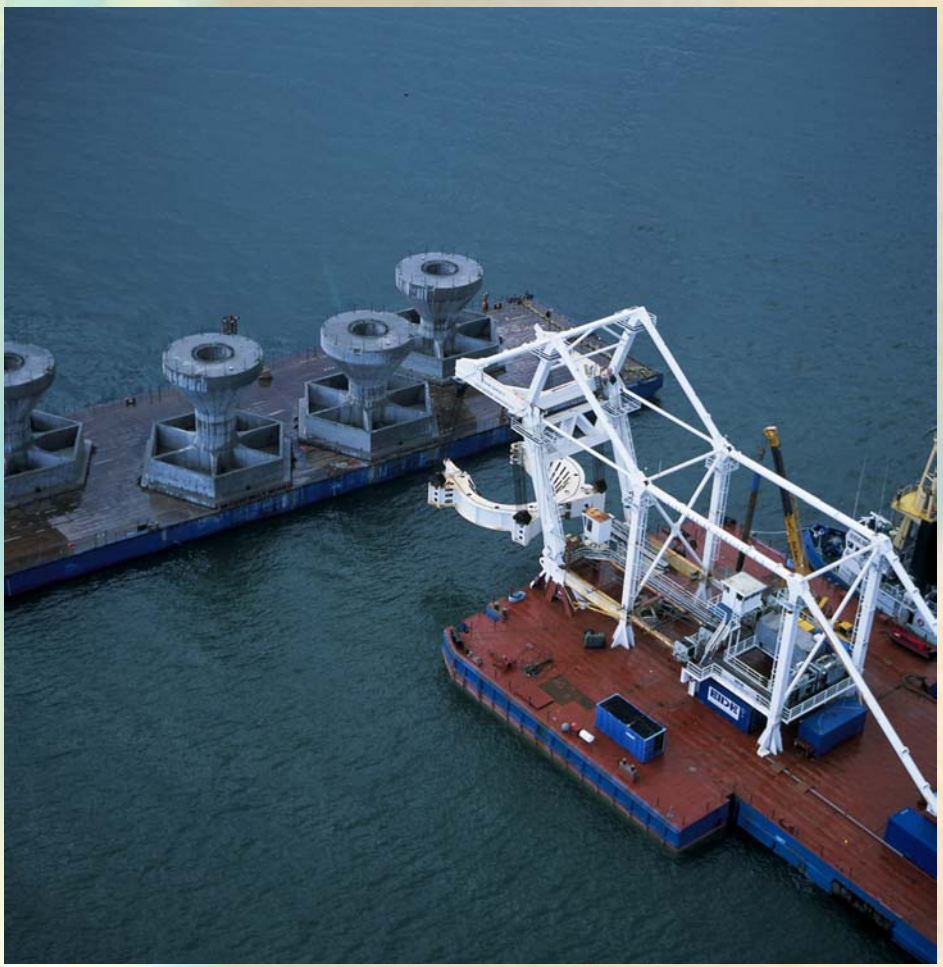
Transport barge

A2SEA 'Bunny-ears' transport

A2SEA 'Galley' transport

GBS grippers



Monopile grippers

Derrick barge and jack-up

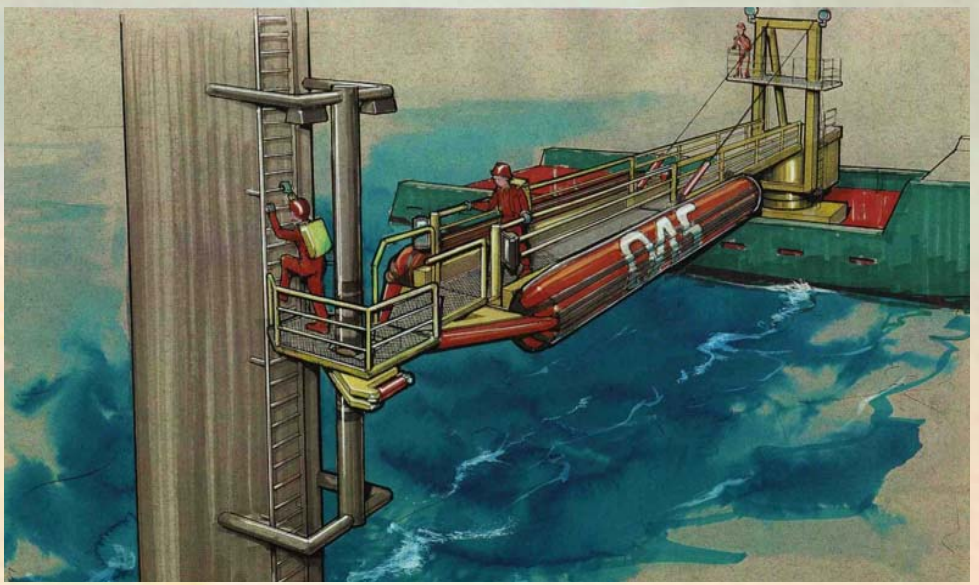
Jumping jack

‘Bunny-ear’ lifting

Mayflower and A2SEA

Svanen

Boat acces



Air access

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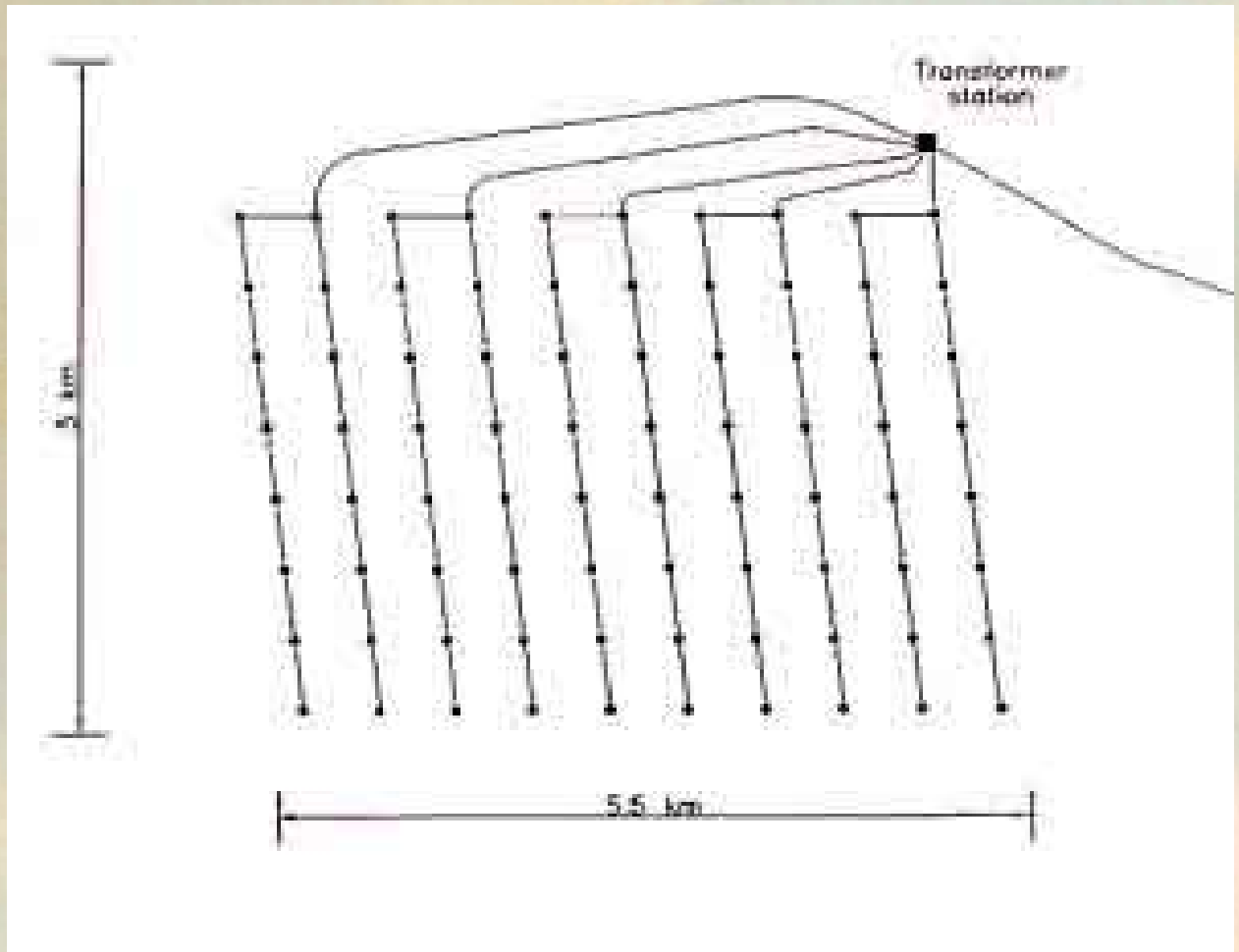
Power collection grid layout



J-tubes

Power cable

Cable laying and washing

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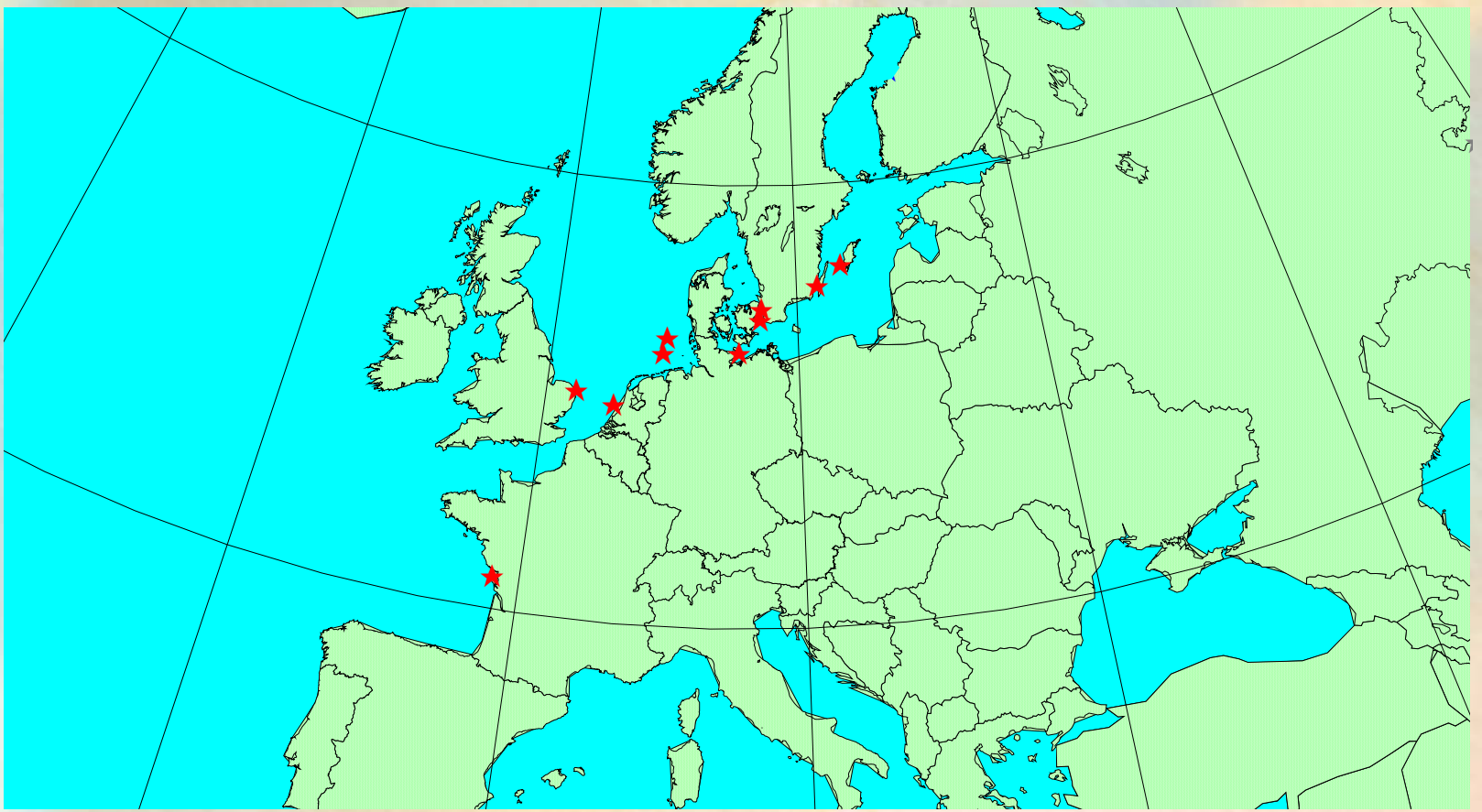
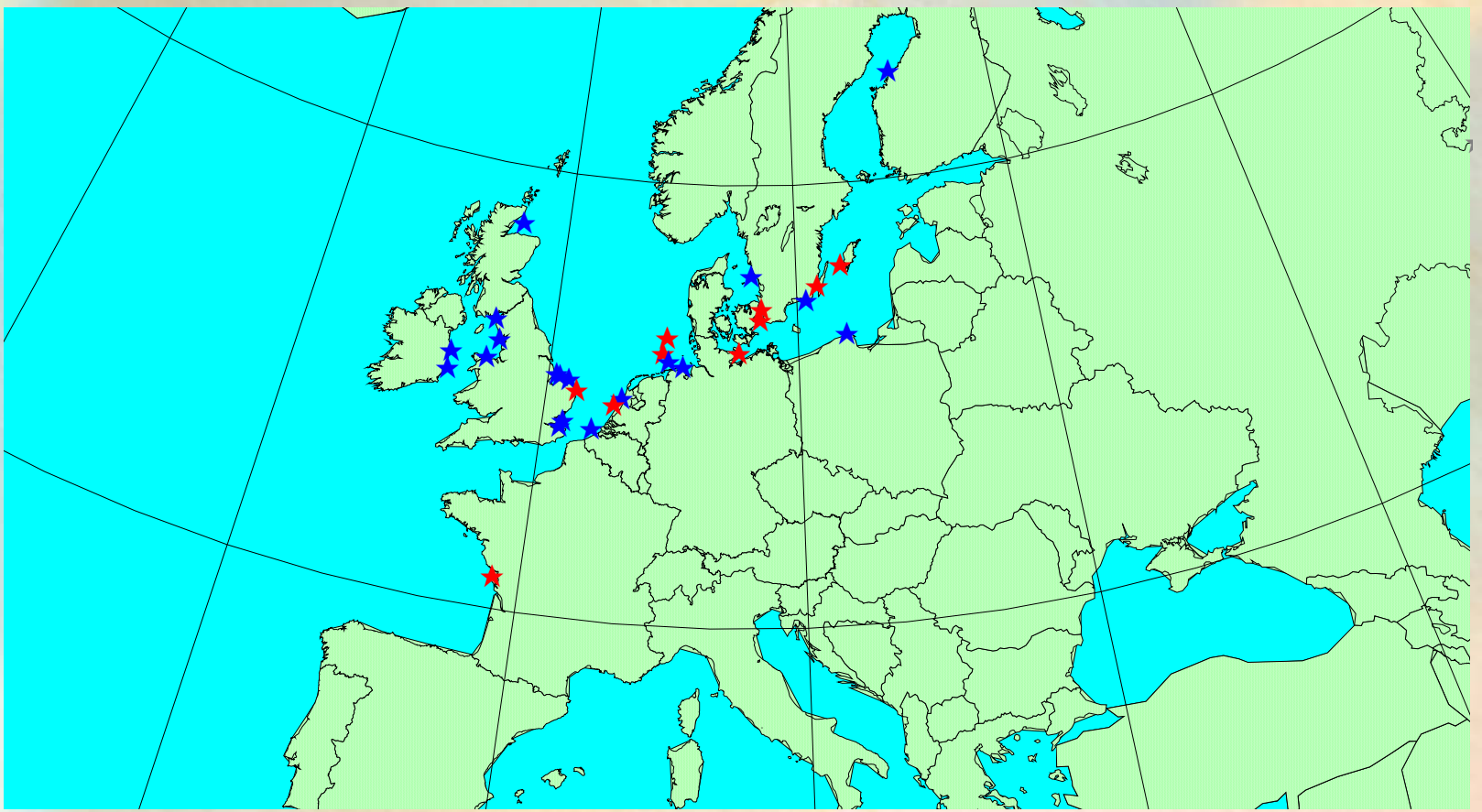
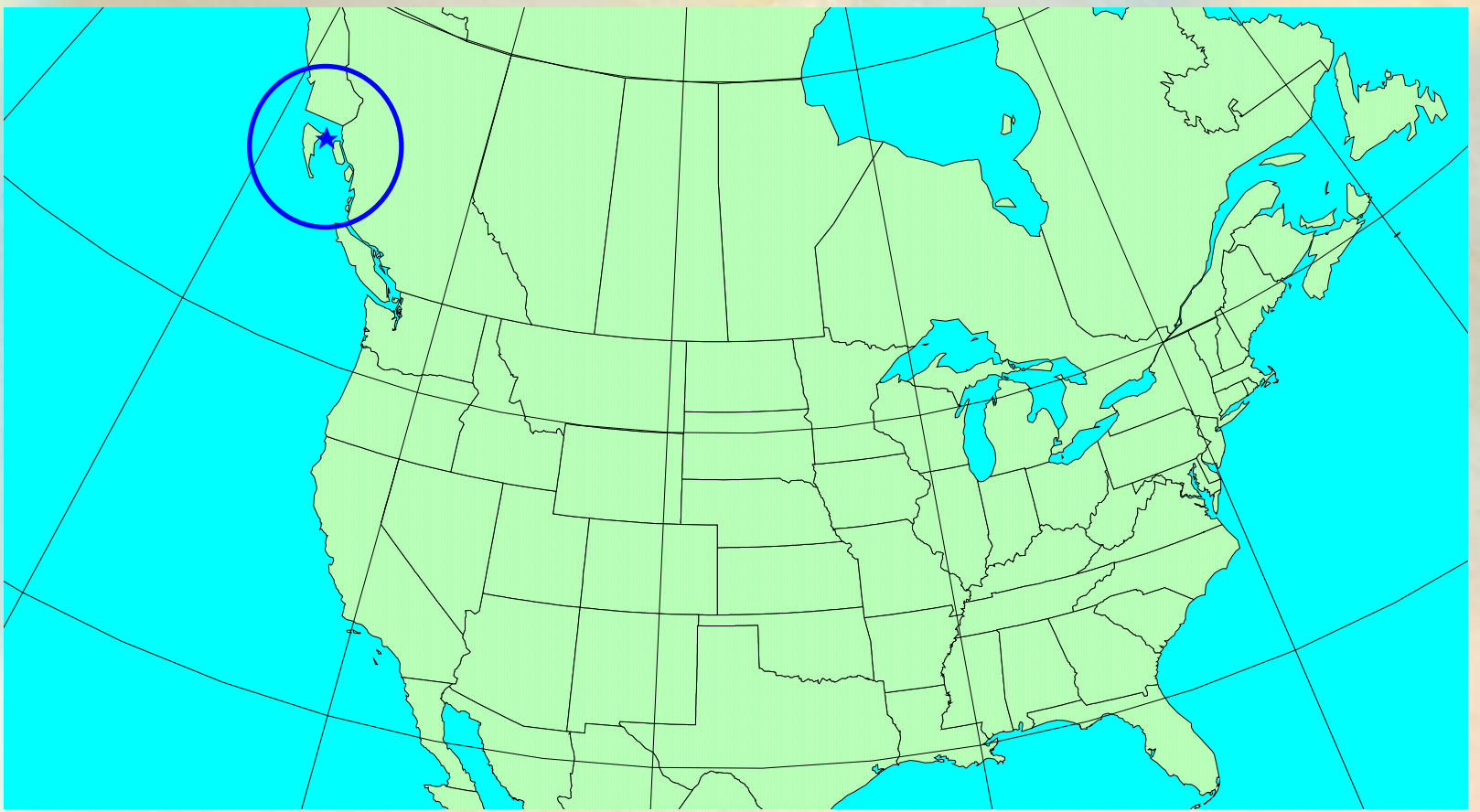
Planned projects: 2004



Planned projects: 2004 & 2005

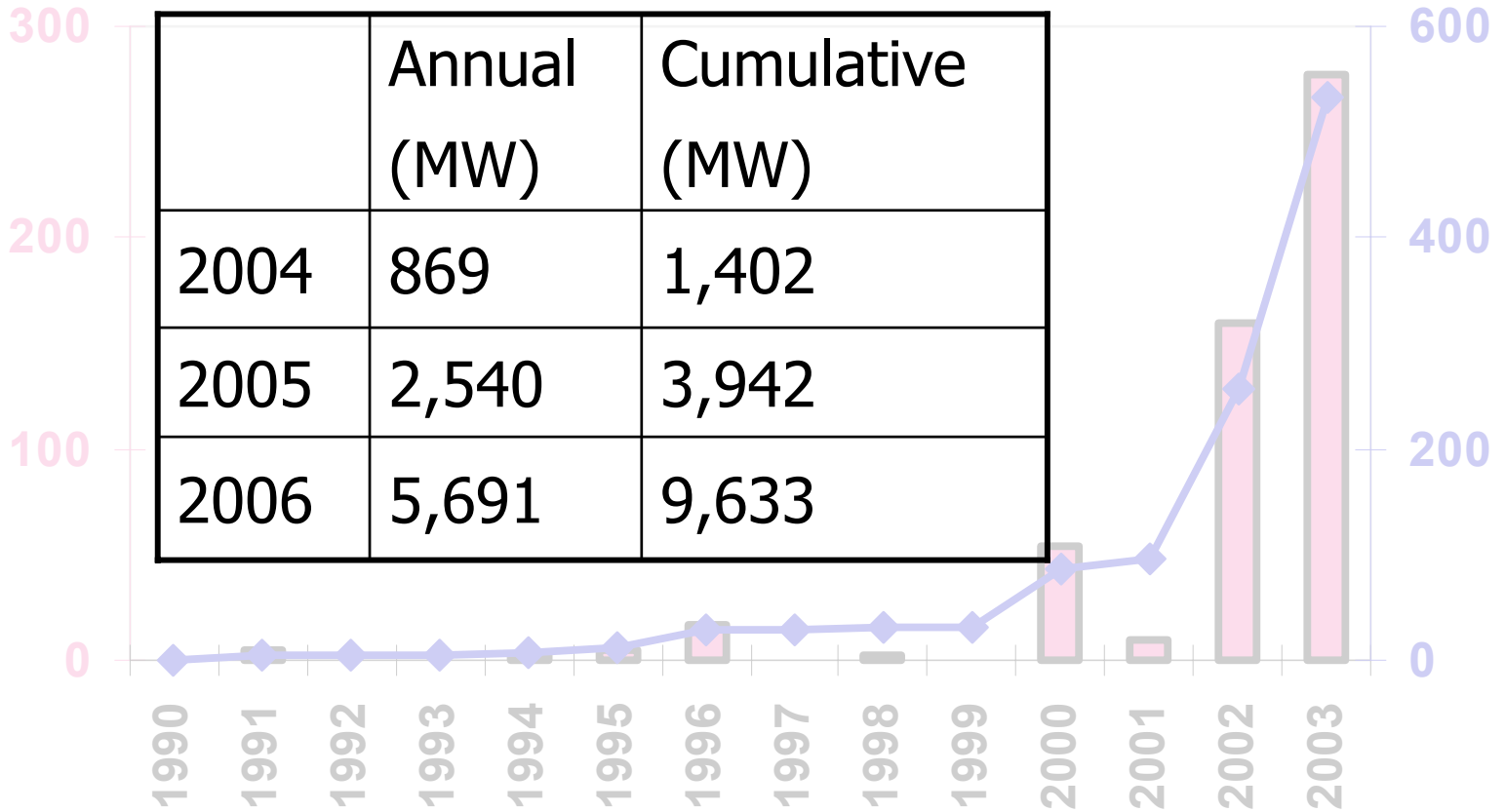


First outside Europe: Nai Kun 2005?



Planned installed capacity

	Annual (MW)	Cumulative (MW)
2004	869	1,402
2005	2,540	3,942
2006	5,691	9,633



Douglas-Westwood 'World offshore wind database'

Status of prospects August 2003

Developments	156
Rated output (MW)	65,434
No. of turbines	16,580
Offshore cable (km)	14,854
Investment (M€)	76,700

2nd Round UK

North West

Greater Wash

Thames Estuary

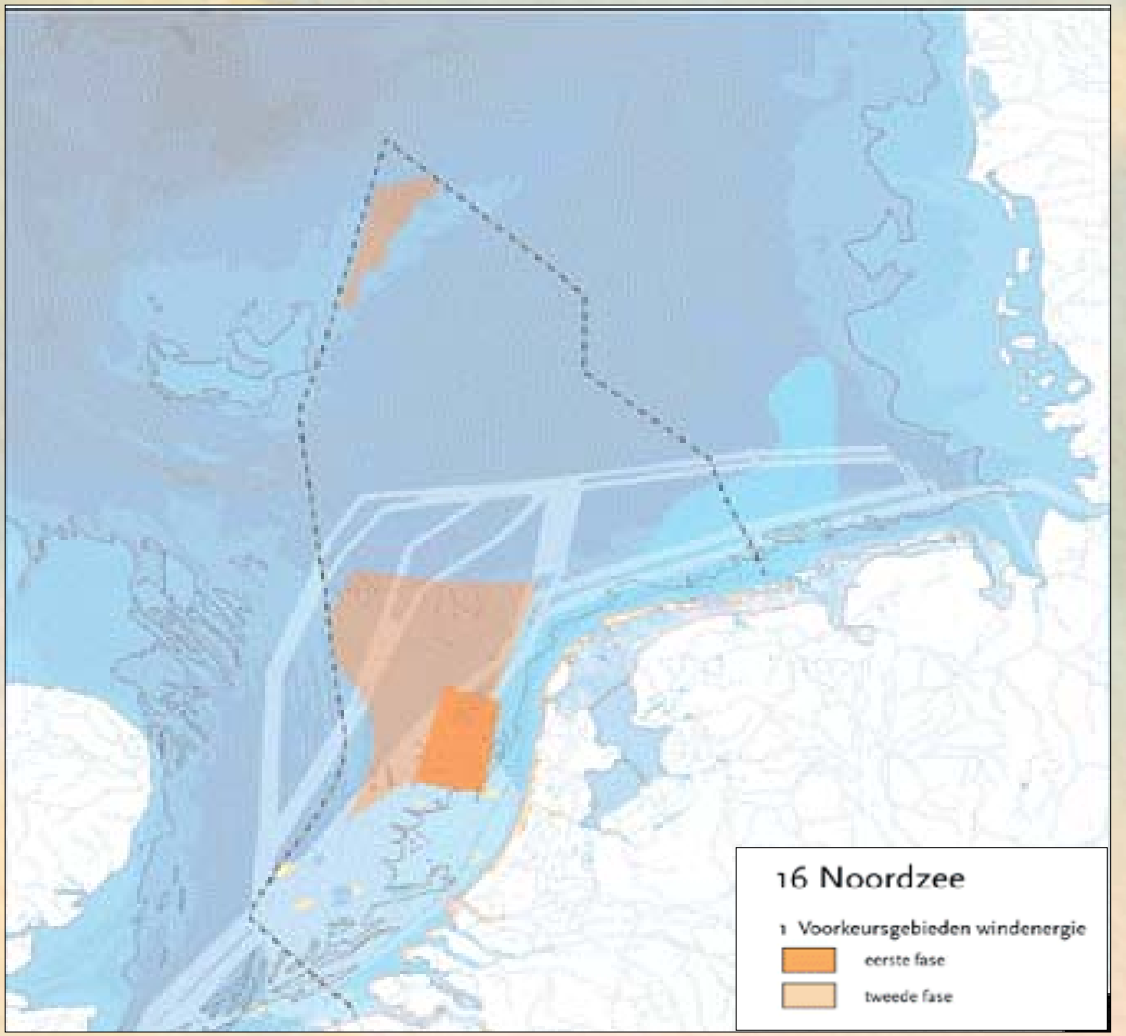
Submitted:

20 GW

Netherlands after Q7-WP and NSW

Designated areas in

‘5e Nota Ruimtelijke ordening’



6 GW in 2020

Investment: 6,400 M€

(HSL: 5,300 M€)

Netherlands after Q7-WP and NSW

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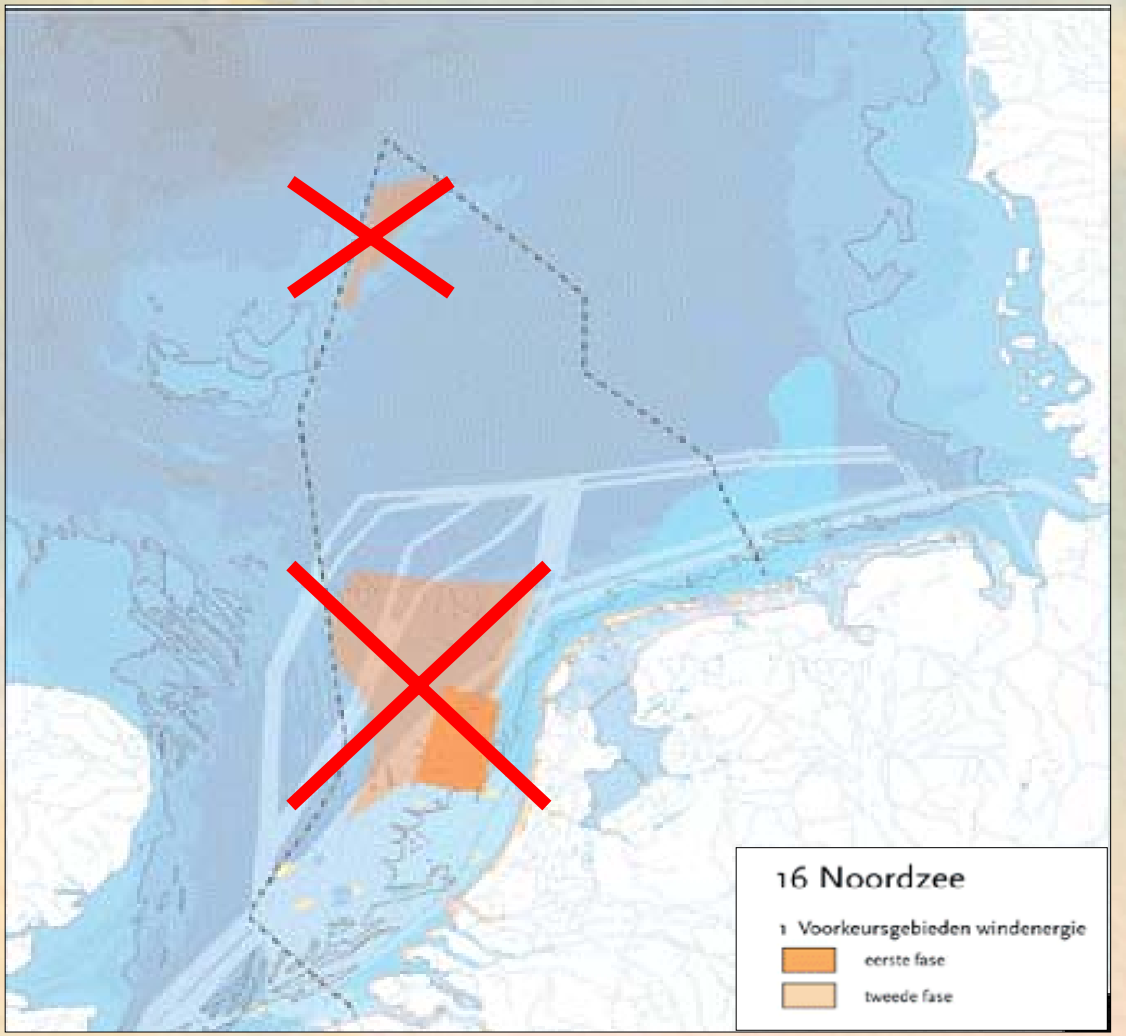


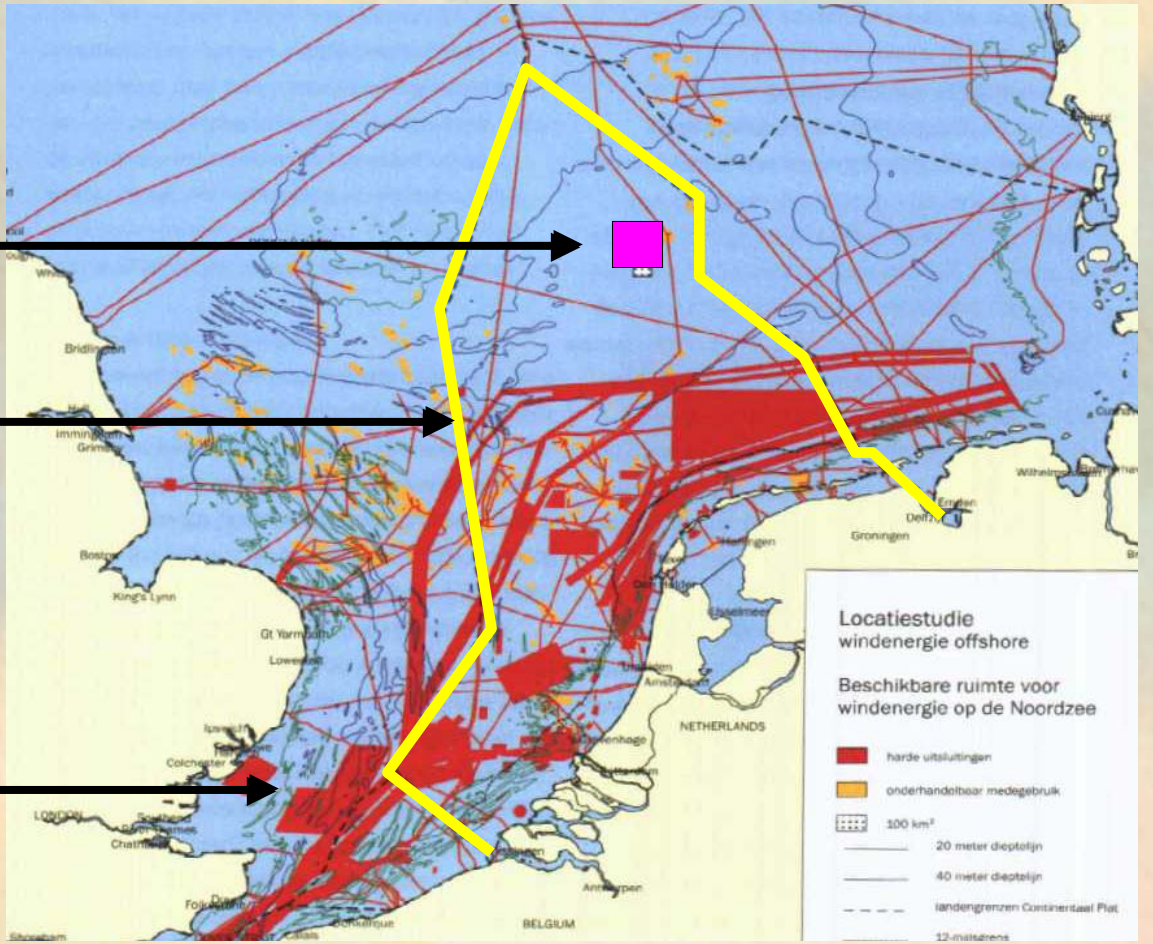
Netherlands – Location

1000 km² – 6 GW

Dutch exclusive economic zone (EEZ)

Hard exclusion

(e.g. shipping lanes)



Targets European Wind Energy Association, EWEA (EU-only)

Status of targets October 2003

	2010	2020
Total capacity (MW)	75,000	180,000
Offshore (MW)	10,000	70,000
Percentage of generation capacity	10.6	21
No. of households (M)	34	85
No. of Europeans (M)	86	195

Europe: addicted to swimming!