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BRAZIL AND DENMARK ON ENERGY TRANSITION

COOPERATION BRAZIL-DENMARK
OFFSHORE WIND & ENERGY PLANNING

- MoU signed in Dec, 2021 by MME and Ministry of Climate and Energy from Denmark
- Visits to Denmark of Brazilian MME, EPE, ANEEL and ONS
- Visits to Brazil by DEA and MCE
- Inception phase + 3 years – up to 9 years
- Offshore Wind: Regulatory and Technical Aspects
- Energy Planning: Renewables into the grid

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DANISH OFFSHORE WIND & PTX STORY

OFFSHORE WIND DEVELOPMENT IN DENMARK
30 YEARS OF EXPERIENCE

1991-2003: The First Phase of Development of Offshore Wind in Denmark

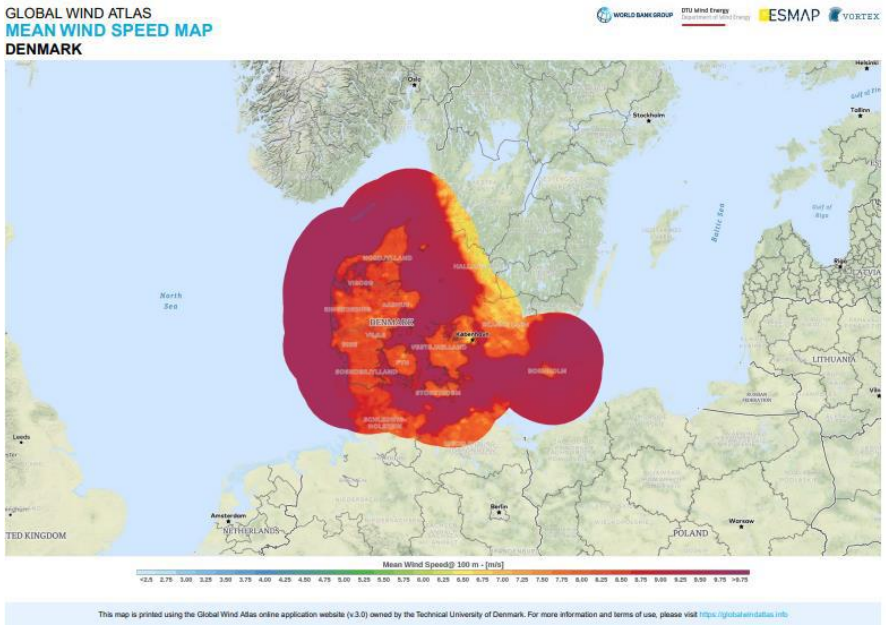
- The world's first offshore windfarm was built in 1991 (Vindeby) – 5MW
- Local wind cooperatives (Middelgrunden, Samsø)
- Demonstration projects (Horns Rev 1, Nysted)

2004: First Offshore Wind Tender released by the Danish Energy Agency:

- Horns Rev 2

2009: Two demonstration projects announced in connection with COP15 held in Copenhagen

- Sprogøand Avedøre Holme established by using the open-door procedure



2016: Historically low bid for the offshore wind farm Kriegers Flak (tender price of €49.9EUR/MWh = 37,2 øre DKK/MWh for 600 MW)

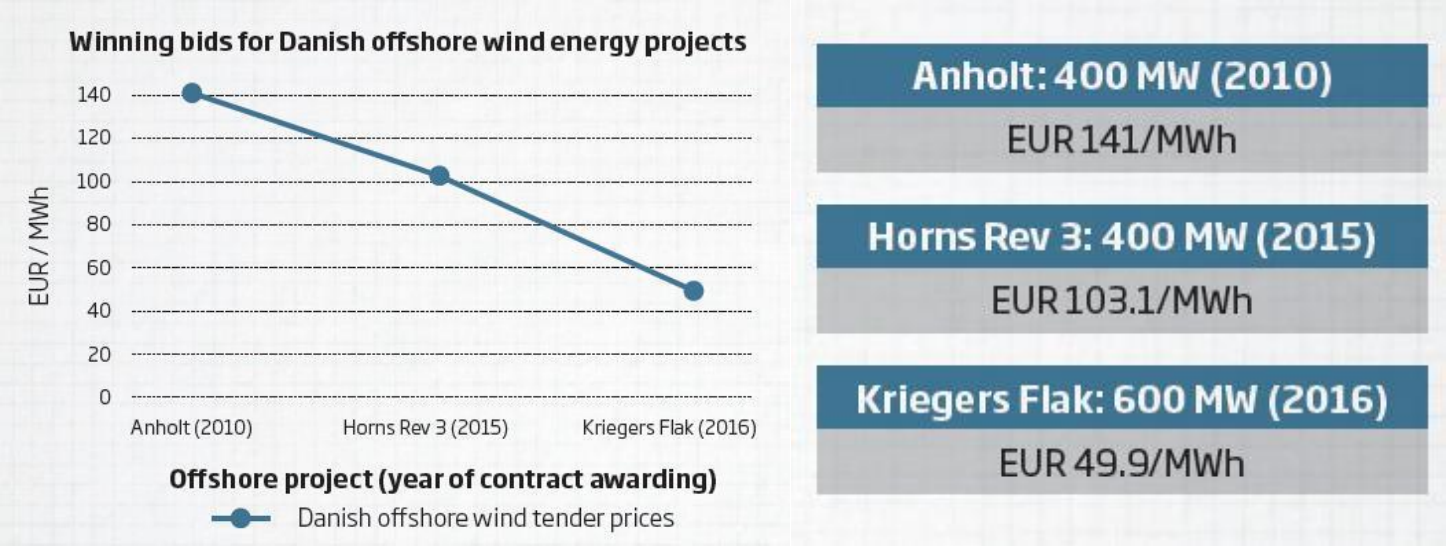
- Cross-border interconnection between Denmark-Germany

2020: Political decision on establishment of two Energy Islands with an option of future expansion up to 10 GW offshore wind for the North Sea Energy Island

2021: The Thor Offshore wind tender resulted in 5 developers willing, for the first time ever, to pay the Danish state money for building an offshore wind farm. Also for the first time, the winner bidder will pay for the landing cables and grid connection

DANISH APPROACH

DE-RISK PROJECT DEVELOPMENT



- Considerable government target and pipeline
- Frontloaded and government driven spatial planning and permitting
- Government-backed offtake arrangements
- Compensation for curtailment
- Revenue stabilization mechanism (pt. contract-for-difference)
- No local content requirements

LCoE reduction is main target of project development efforts

- **STRONG POLITICAL MANDATE:** Political mandate based on broad agreement across Parliament create robust decision making in the proceeding phases
- **THOROUGH PLANNING:** Maritime Spatial Planning and site selection in a one stop shop significantly limits the contenting risk and is a thus powerful de-risking tool
- **TRANSPARENT PROCUREMENT :** Dialogue with the industry and negotiation with prequalified bidders adapts the tender conditions to the technical and financial realities
- **GUARANTEED GRID:** Certainty for a timely grid connection ensures the business case for the project. This increases the competition to the benefit of the socio-economic price

THOR

2021 OFFSHORE WIND TENDER

Key features agreed with politicians:

Focus on cost-effectiveness –all aiming at getting the lowest bid price

- *International competition, attracting best players in the world*
- *No local content requirements*
- *De-risking the project for bidders as much as possible*
- *2 rounds of market dialogue*
- *Lowest bid price as award criteria*

***- Focus on build-on time**, Danish climate plans are key political pledges*

- Prequalification to sort out companies prone to project-failing

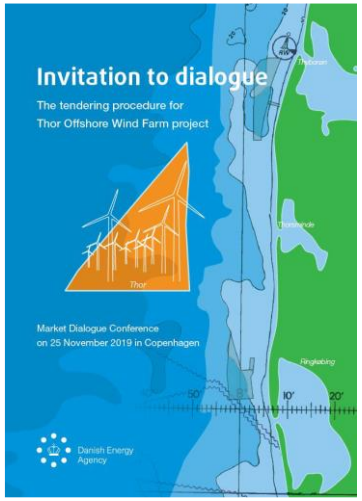
Negotiation of tender conditions, possibility of further reducing bid price

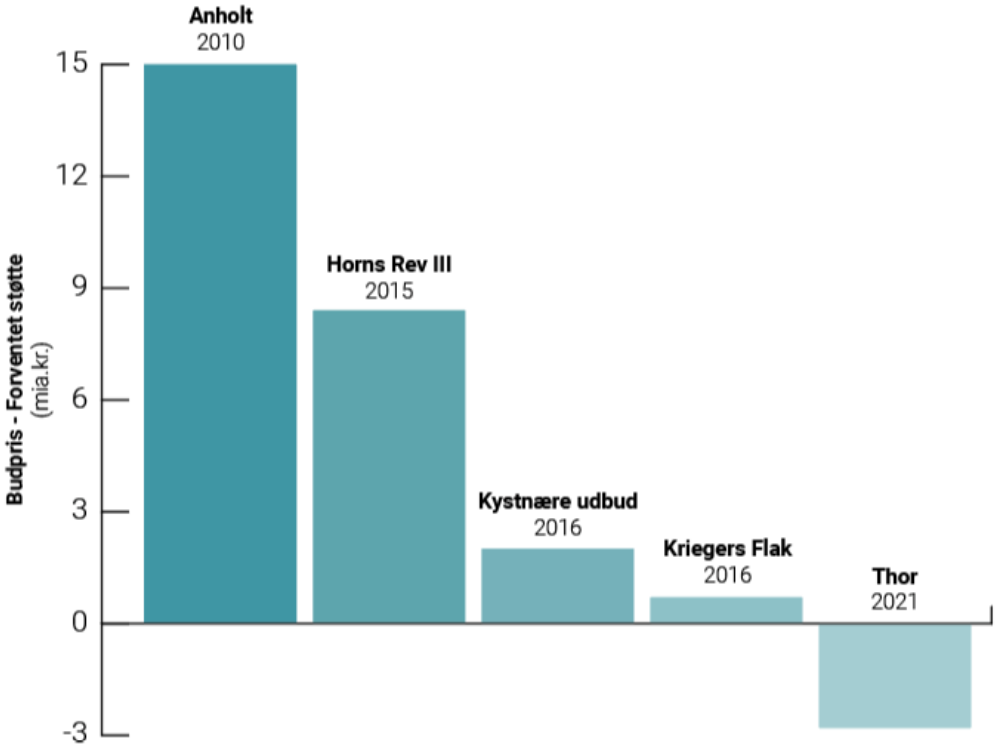
- ***One-stop-shop** for tender process (and after bid winner found also for permitting)*
- **Incentive for completion**: If the wind farm is not build on time, the Concessionaire will be liable to a fine for delay

Final bids 8th November 2021:

- Six bidders submitted a bid
- Five bidders provided a bid at lowest bid-price (0,01 øre/kWh)
- Drawing of lots between the five bidders to identify the winner
- Bid winner will pay 2,8 bn. DKK to the Danish state within

RWE wins tender, with 3 year CfD contract





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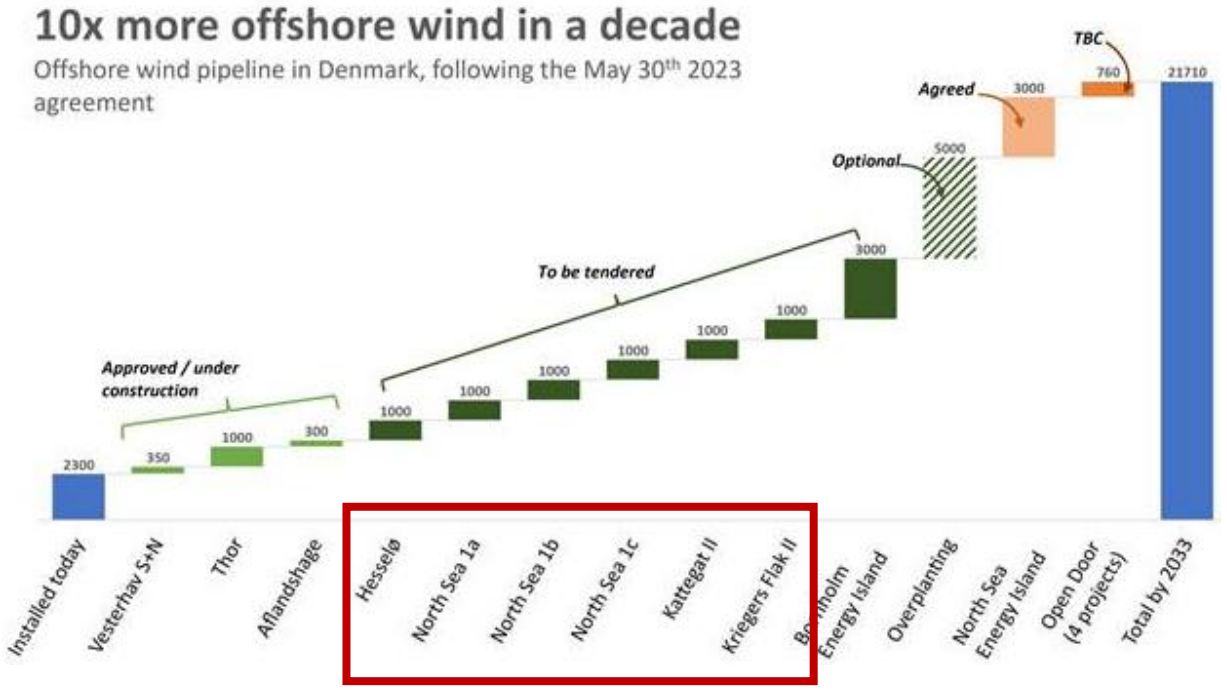
WHERE DANISH WIND BLOWS TO...

TARGETS AND AMBITIONS

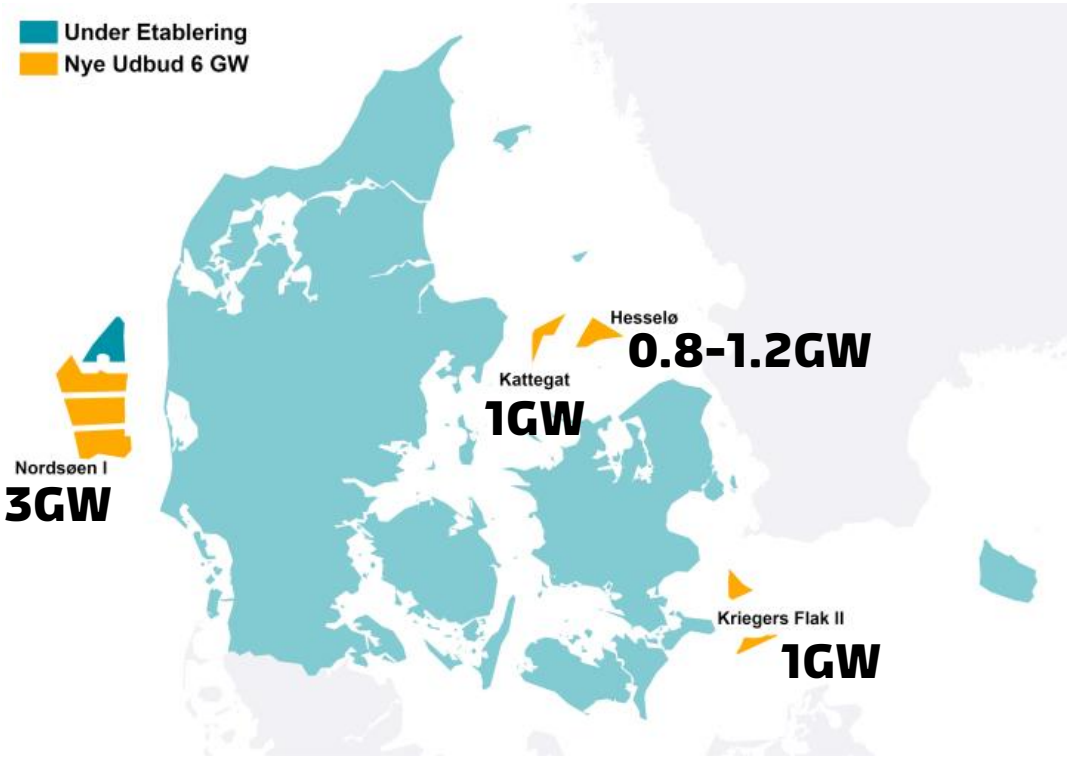
- Reach **22GW BY 2033**
- BornHolm & North Sea: first energy islands (non-artificial)
- Possibility of 5GW of extra capacity in tendered OFW farms
- North-sea 3GW of Energy Island
- Incoming open door projects: 760GW



NEXT STEPS: LARGEST TENDER TO DATE

6 TO 10GW OF NEW OFW

- Aiming Power-to-X, projects are allow to overplant, that is, install capacity up to 10GW – 4 out of 5GW planned by 2033
- DEA is at the moment promoting dialogue rounds with intended bidders



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OFFSHORE WIND

DANISH EXPERTISE – PIPELINE AS KEY FOR INDUSTRIAL AND TECHNOLOGICAL DEVELOPMENT

Ørsted

- Largest Developer of OFW projects – 9GW installed + 13GW in development/construction
- State Owned company from Oil & Gas to 100% renewable portfolio

CIP

- Largest fund for Renewable and Sustainable projects – 100 Billion euros by 2030

SIEMENS Gamesa RENEWABLE ENERGY

- largest offshore wind turbine manufacturer
- 14MW testing in Østerild, Direct drive technology and Recycable Blades

Vestas

- largest onshore wind turbine manufacturer
- 15MW WTG in test in Østerild

Port of Esbjerg

- Largest European Hub for Offshore Wind assembly, installation and operation activities
- From Oil & Gas to Offshore Wind, creating jobs, income and development

Expertise throughout the value chain including

- Engineering and project development
- OFW foundations
- Blades
- Internal components (hydraulics, control, software, etc)

Development of Green Hydrogen technologies to meet Climate targets

IMPORTANCE OF PIPELINE OF PROJECTS

Industrial and technological development possible via solid project development framework, lead by Danish policies and climate targets

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POWER TO X
DANISH STORY

THE FIRST PTX TENDER IN DENMARK AWARDED 280MW

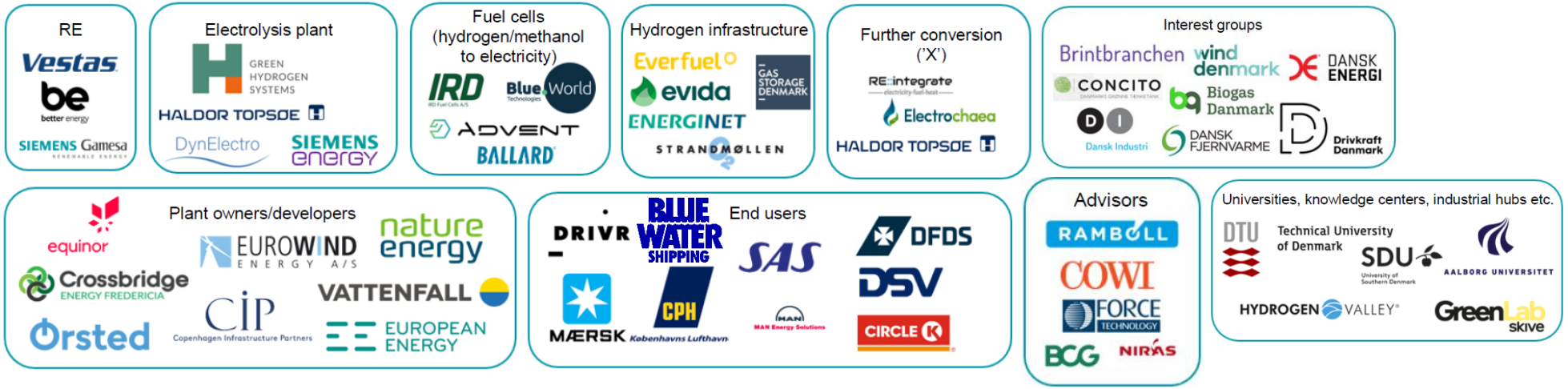
The Danish Energy Agency has concluded the first Power-to-X Tender and six projects will win the State Aid.

- The total budget of the PtX tender was 1,25 billion DKK (BRL890 million)
- Energy Agency has received bids for more than DKK 4 billion, corresponding to electrolysis capacity of more than 675 MW

Four different companies are behind the six winning projects and can now start building up the production of green hydrogen in Denmark.

COMPANY	PROJECT	LOCATION	PRICE (BRL/GJ)	TOTAL SUBSIDY (MILLION BRL)	CAPACITY OF PLANT (MW)
European Energy	Padborg PtX ApS	Padborg	32,62	646,0	150
	Kassø PtX Expansion ApS	Rødekro	47,52	58,1	10
	Vindtestcenter Måde KpS	Esbjerg	28,37	31,2	9
Electrochaea	Biocat Roslev	Rybjerg	42,55	50,6	10
Plug Power Idomlund Denmark	Plug Power Idomlund Denmark	Holstebro	6,60	76,4	100
HyproDenmark	Everfuel	Fredericia	47,87	The rest of the budget	

Danish expertise extends throughout entire value chain, with global leading companies and present in Brazil



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OPPORTUNITIES IN BRAZIL

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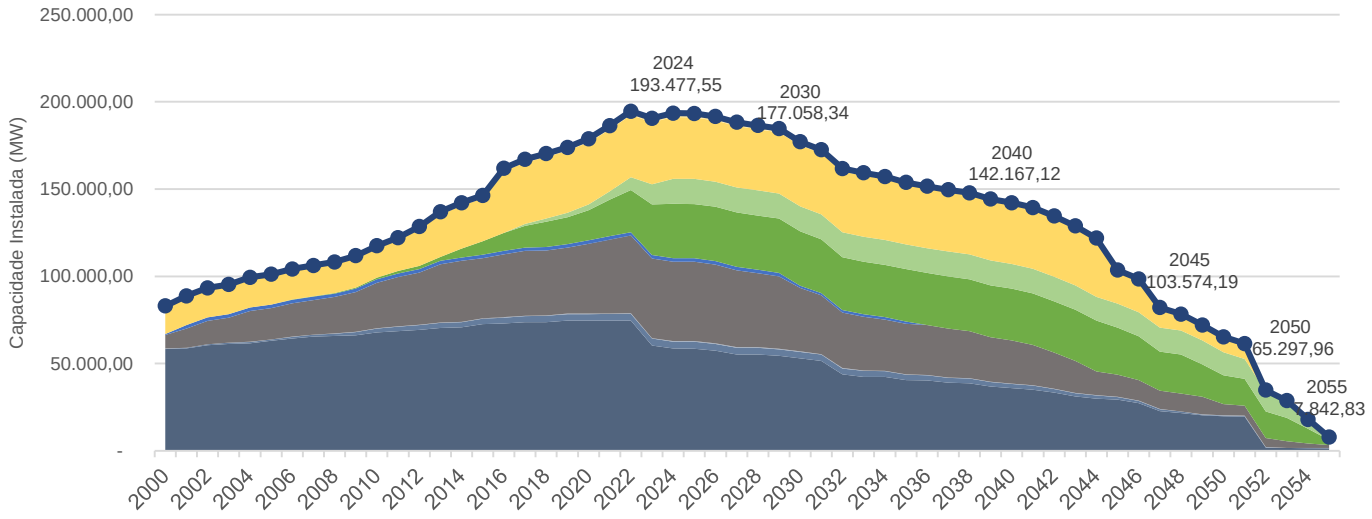
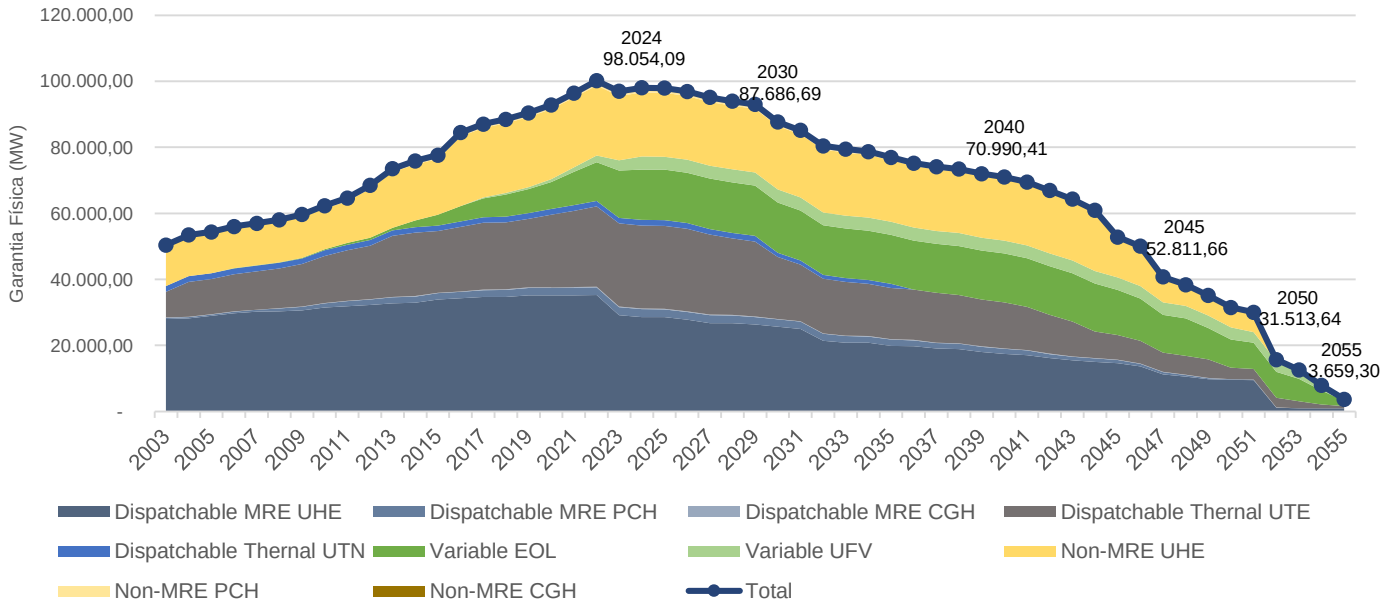
OPPORTUNITIES IN BRAZIL

SOME BRAZILIAN ENERGY NUMBERS





- Dados ANEEL – SIGA – Jul/2024: Capacidade instalada e Garantia Física por fonte, incluindo MRE
- ONS gerencia despacho das UHE e UTE, para atender demanda já descontada das variáveis EOL e UFV
- Planejamento (PDE's) busca condições de lastro ao mais baixo custo
- Nos próximos 15 anos, 28GW de garantia física encerrarão outorgas
- PDE2032: aumento de 43% na demanda em rel. 2022
- Em 2021, Brasil ranqueou 72º em consumo energético per capita, com consumo na ordem de 20% do Top10
- Fatores de capacidade medidos em 2021

Hydro	ONW	SPV
43%	45%	19%

- Atlas Eólico CE aponta 62% de FC para OFW. RN aponta 64%

KEY MESSAGE

ONW E OFW PODEM ATENDER DEMANDA DA RENOVAÇÃO DA MATRIZ BRASILEIRA, TRAZENDO MAIS SEGURANÇA DE FORNECIMENTO, PERMITINDO/TRAZENDO CRESCIMENTO

Consumo de Energia Per Capita (2021)

Pos.	Country	MWh/Capita
1	Iceland	51.070
2	Norway	24.177
3	Qatar	18.124
4	Kuwait	17.308
5	Finland	15.644
6	United Arab Emirates	15.161
7	Canada	14.737
8	Sweden	13.015
9	USA	12.613
10	Luxembourg	12.135
11	Taiwan	11.826
12	Brunei Darussalam	11.656
13	South Korea	11.402
14	Saudi Arabia	10.341
15	Singapore	10.220
...		
34	Denmark	6.160
35	China	5.848
...		
69	Argentina	2.911
70	Romania	2.901
71	Thailand	2.713
72	Brazil	2.663
73	Mexico	2.630

IEA - Dados de 2021

DESAFIOS

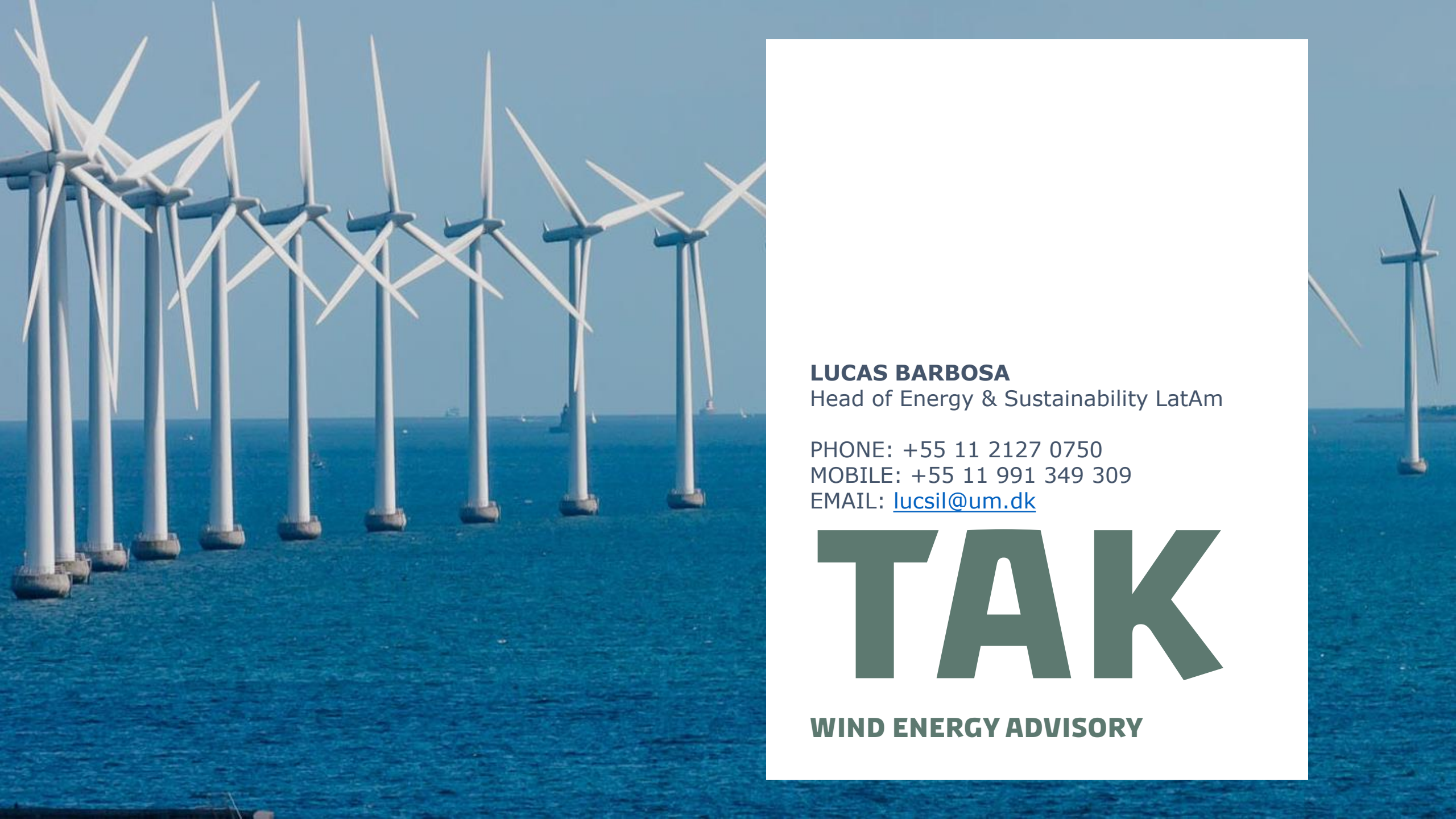
Curto prazo

- **Cadeia produtiva** (WTGs, Vessels, Capital, Eng., etc) alocada na EUR, EUA e Asia
- **Políticas públicas**: Ramp up do setor requer **PPAs** que cubram riscos **dos primeiros projetos**
- Investimentos (Industria, Infra) requerem **de-risking** e **pipeline** sólido **de projetos**

OPORTUNIDADES

Curto prazo

- Investimentos podem ser re-alocados de mercados em crise, caso **Regulação seja celere**
- **Free market e separação lastro e energia** traz demanda por novos projetos
- **Abundância de recursos** é oportunidade para reduzir custos no médio-curto prazo
- ONW e OFW podem acelerar **liderança do Brasil na** revolução de combustíveis sintéticos e **economia verde**
- EOL, principalmente **OFW** pode ser **chave para Hidrelétrica** se tornar **bateria** do SIN
- Cadeia produtiva estabelecida no Brasil, criando **Hub industrial – ONW e OFW**



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