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KIVI Engineering Society
Afdeling Offshore Techniek

KIVI OT Online Lunch Lecture

Installation of Wind Turbines in the Emerging US Market (GustoMSC)

Presentation will begin at 12:30

21 January 2021

What is KIVI OT?

- KIVI: Royal Dutch Institute of Engineers (est. 1847)
- OT: department Offshore Technology (since 1969)
- Network of 1200 voluntary offshore enthusiasts
  - Including: young & senior professionals, researchers, retirees, students,
- Traditionally, very close ties with industry

- Goal:

- *connect people from all backgrounds with an interest in offshore engineering*

KIVI Engineering Society
Afdeling Offshore Techniek

What do we do?

- More than 10 activities organized per year
- Yard Excursions and on-board visits offshore vessels
- Graduation award for best thesis in offshore-related subject at Technical University and University of applied Science
- Lectures provided by companies, research institutes, and educational bodies
- Large symposia, e.g. “Future of the North Sea” nov-2019

KIVI Engineering Society
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Become a member of KIVI OT!

- Access to a wide network of offshore enthusiasts
- Free access to presentations, network events and excursions organized by KIVI OT.
- Receive monthly KIVI's magazine "De Ingenieur " (e- or hardcopy)
- Students are granted a free membership in 2021!

KIVI Engineering Society
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THIALF
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CT-UB
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CT-LB


HEEREMA

Signing up for KIVI OT

- Sign up via form – free membership for all students
- Welcome gift: book “50 years KIVI Offshore Technology”

KIVI Engineering Society
Afdeling Offshore Techniek

Who is KIVI OT?

Noëlle
Business Process Manager at Fugro

Sjoerd
Business Unit Manager @ DEME Offshore

Martijn
Department Manager Marine Engineering at BAM

Luuk
Assistant Project Manager Deep Sea Mining at Allseas

Andreina
Operational Excellence Lead at Bluewater Energy Services

Nina
Chairwoman study association UNFC of Rotterdam University of applied science

Hugo
Director operations & finance at Villari

Bertus
Retired Managing Director SBM Schiedam

Renate
Offshore Structures Engineer at Shell Projects & Technology

Hayo
Assistant Professor - Ice-structure interaction at TU Delft

Pieter
Chairman Offshore study association DOT

KIVI Engineering Society
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Installation of Wind Turbines in the Emerging US Offshore Wind Market

KIVI Offshore Technology

Karel.Wagner@GustoMSC.com

January 21st 2021

GustoMSC | NOV

Introductions

Karel Wagner
Sales Manager GustoMSC B.V.

- MSc Marine Technology – Delft University of Technology (2009)
- 11 years with GustoMSC as Engineer / Naval Architect / Sales
- Focus on Wind Turbine Installation Jack-ups
- 2017-2019 in Houston, TX for GustoMSC Inc.

GustoMSC

NOV

1862

1959

1975

1978

1987

2011

2016

2018

Pioneers don't tell stories, they write history

1905

1972

1977

1981

2003

2015

2019

Proven designs

> 30 units in offshore wind

- 40 years designing DP jack-up vessels
- Market leader in WTIVs and jacking systems
- NG series of self-propelled jack-ups

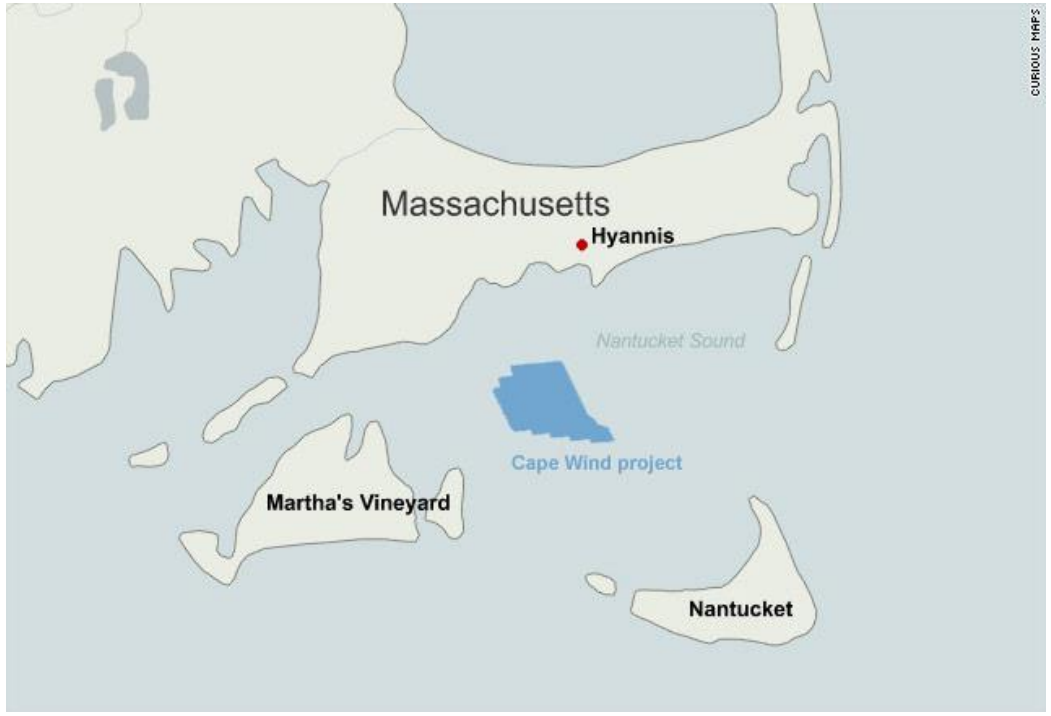
Agenda

US Offshore Wind – Turbine Installation in an emerging market

- US Offshore Wind Market – Past & Present
- Jones Act
- Local challenges
- Current & Future Installation Solutions

US offshore wind past

Cape Wind project - a troubled history



Block Island wind farm

Deepwater Wind (now Ørsted)

- 5 x Haliade 150-6 MW turbines
- PPA of 0.244 $/kWh
- Operational begin 2017
- In state waters offshore Block Island, RI

Photo courtesy Deepwater Wind

CVOW project

Dominion Energy / Ørsted

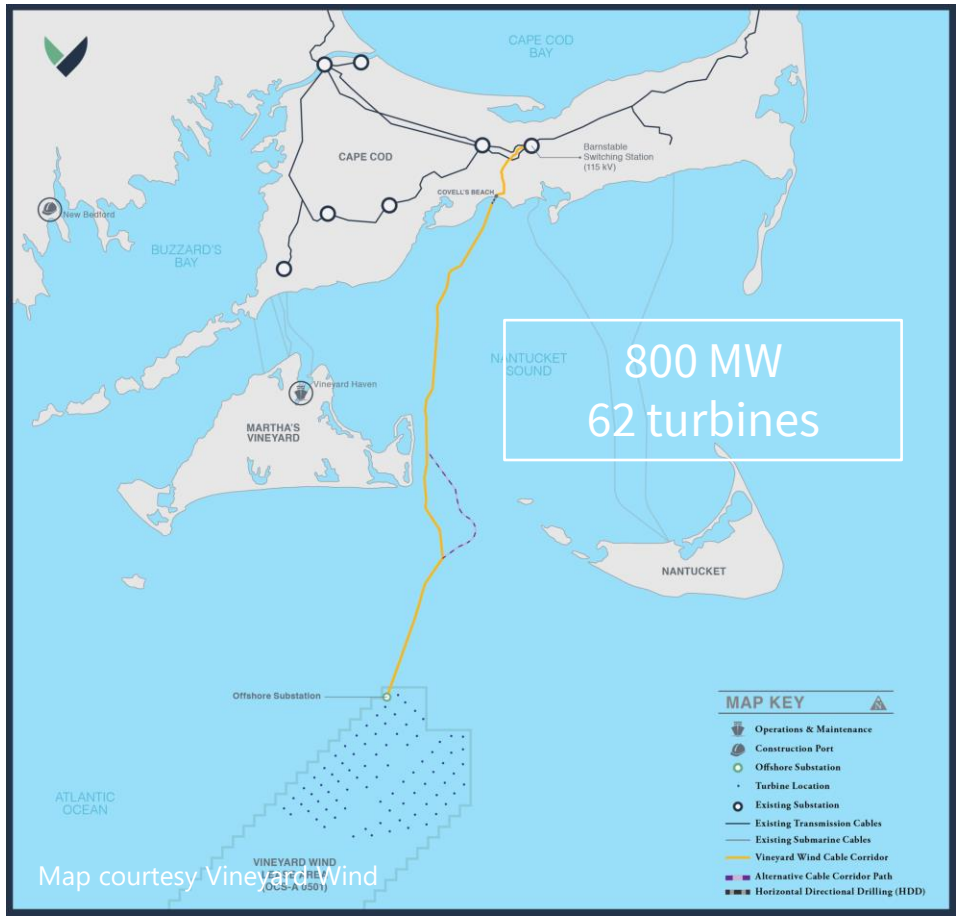
- 2x SWT-6.0-154 turbines
- Reported project cost; 300 M$
- Operational mid 2020
- In federal waters, 27 miles off the coast of Virginia

Photo courtesy Dominion Energy

Vineyard Wind I project

CIP / Avangrid

- Frontrunner as first large scale US project
- 15 miles south of Martha's Vineyard, Massachusetts
- Original Operation Date; 2022
- Federal permitting far along but delayed
- Permitting pending change of US administration?



Map courtesy Vineyard Wind

How likely is US Offshore Wind to take off in the near future?

Some indications

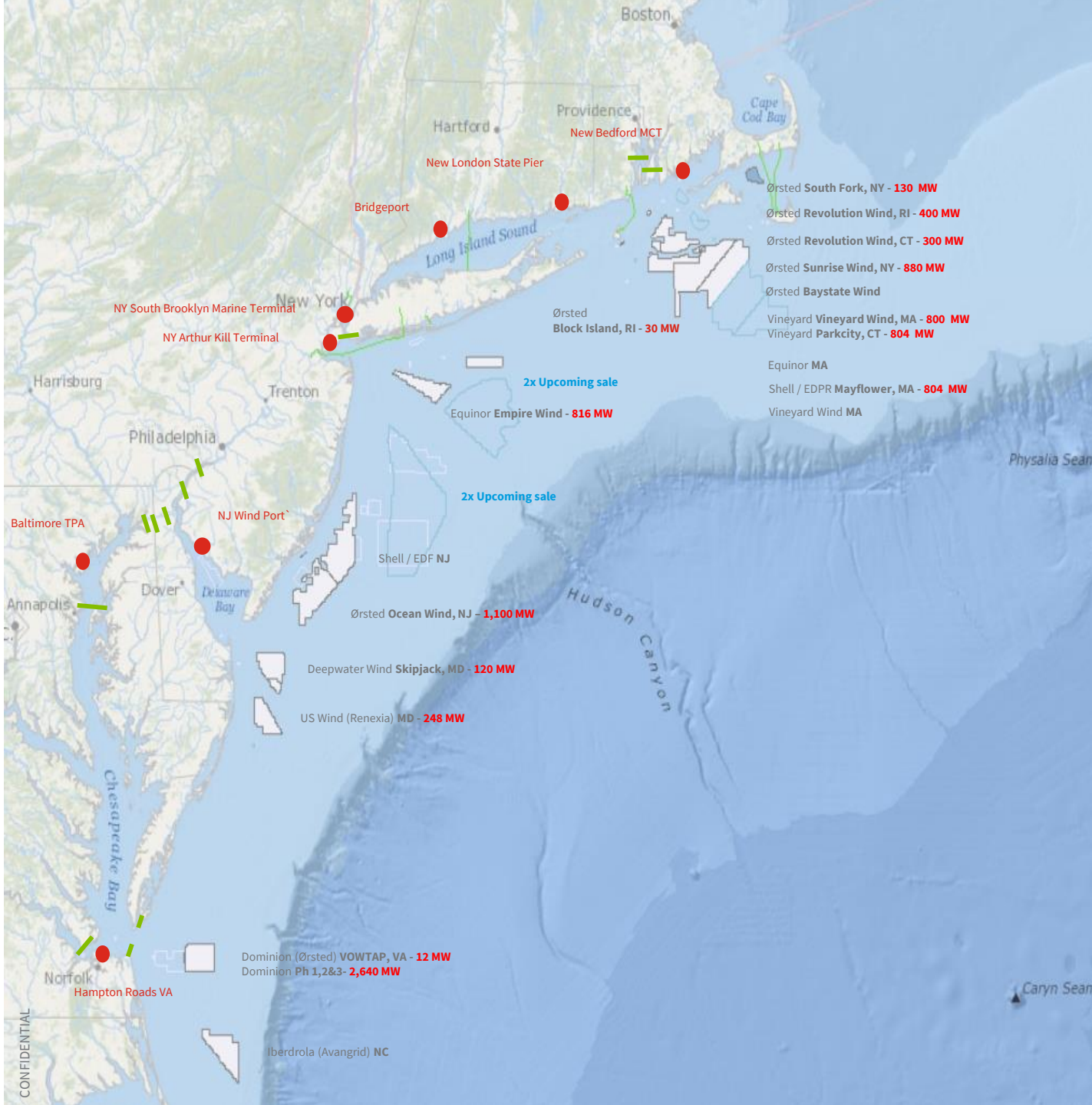
- Change to **‘pro-renewable’** Biden Administration
- States on the East coast have strong renewable and **offshore wind energy commitments**
- States on the East coast are competing as **frontrunners** in US offshore wind
- **Major global developers**, manufacturers, contractors are entering and investing
- **Infrastructure investments** are being initiated (ports and manufacturing locations)
- Much attention is being paid to **stakeholder outreach**

US offshore wind

Commitments (Dec 2020)

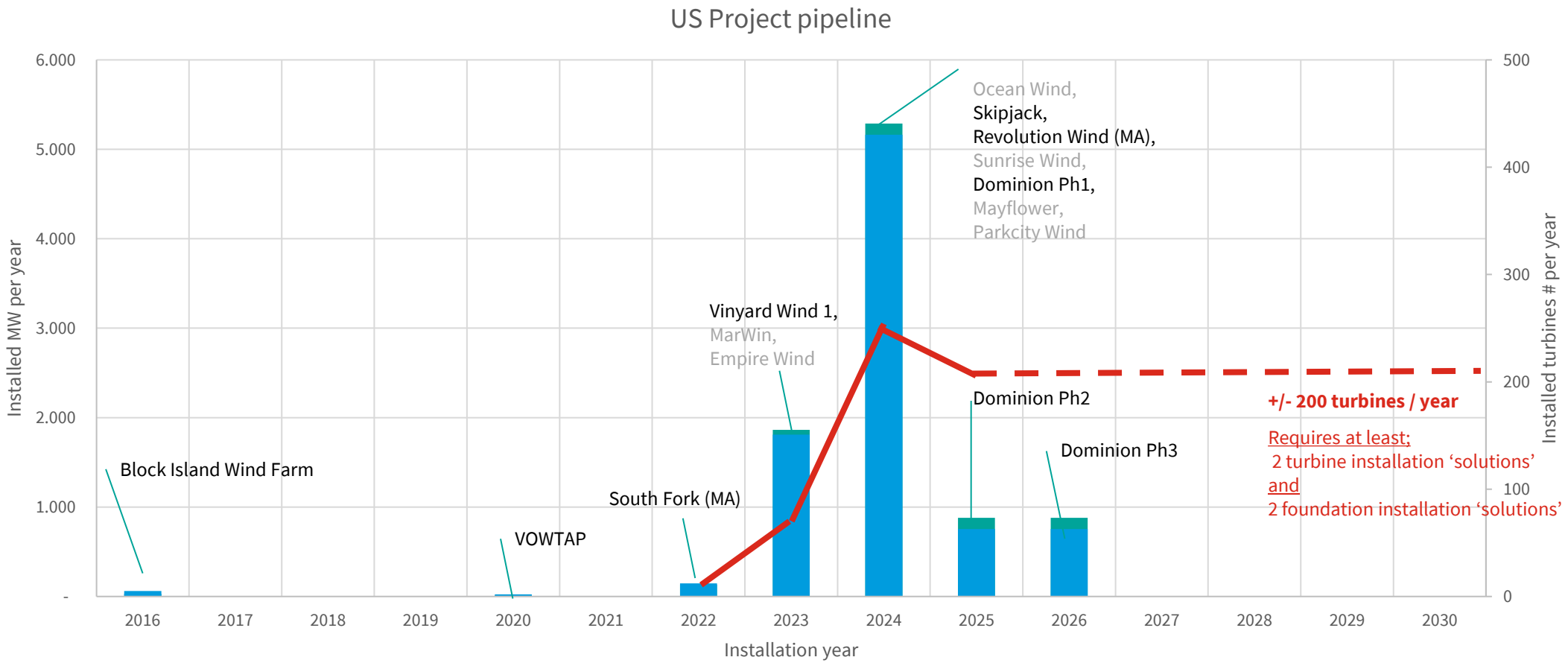
US NE-coast

- Bottom founded offshore wind
- State commitments
  +/- 29,000 MW by 2035
- Multiple awarded projects:
  +/- 9,000 MW
  +/- 750 turbines
- First large projects operational by 2024



US Project timeline

Expected number of installations



The Jones Act

US Cabotage law protecting US shipyards and US shipowners since 1920

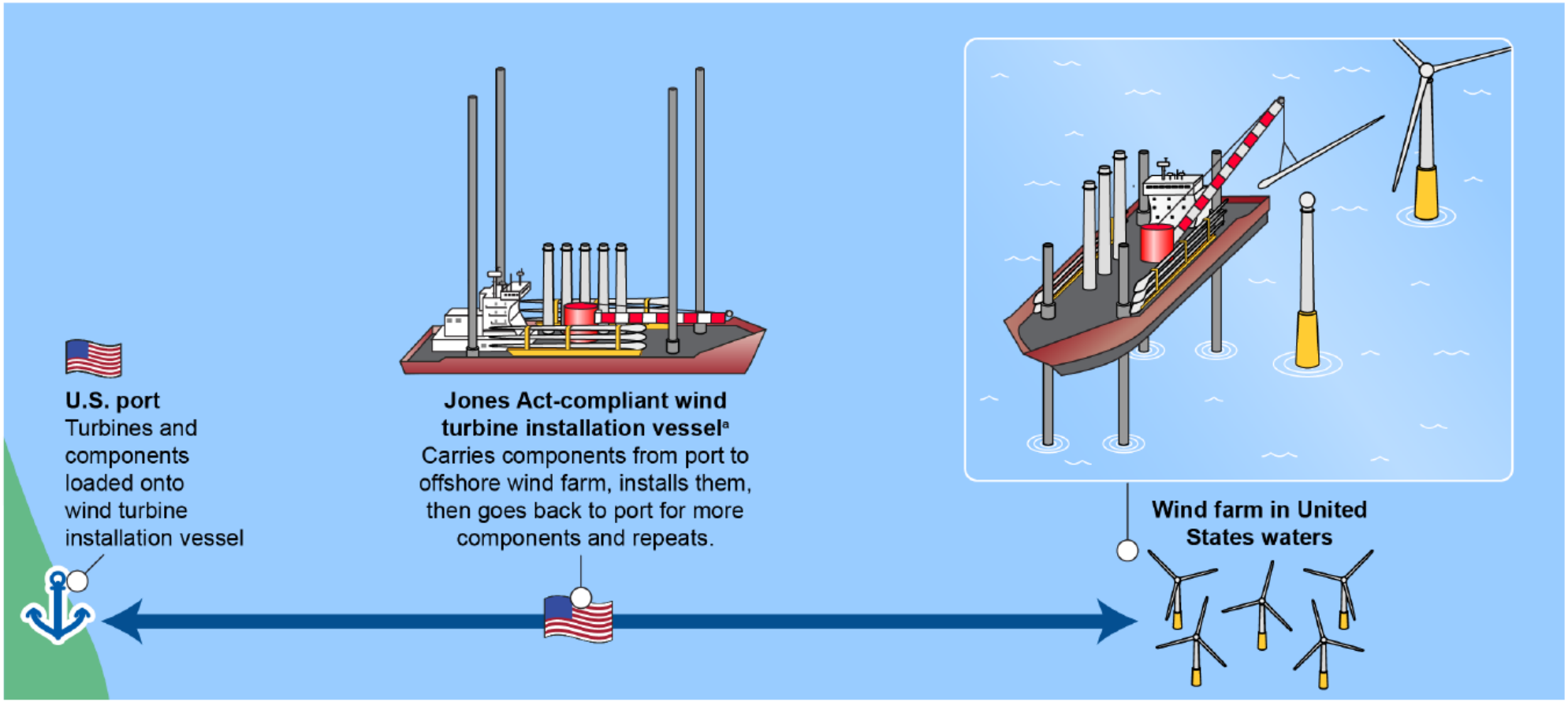
The Jones Act is the lifeblood for a U.S. maritime trade that supports 650,000 jobs and almost $100 billion in annual economic impact.

The Jones Act requires '*merchandise*' transported between two US points to be transported by vessels that are US flagged, US built, manned and owned by US citizens.

The Jones Act was recently amended to include Offshore Wind developments

The Jones Act

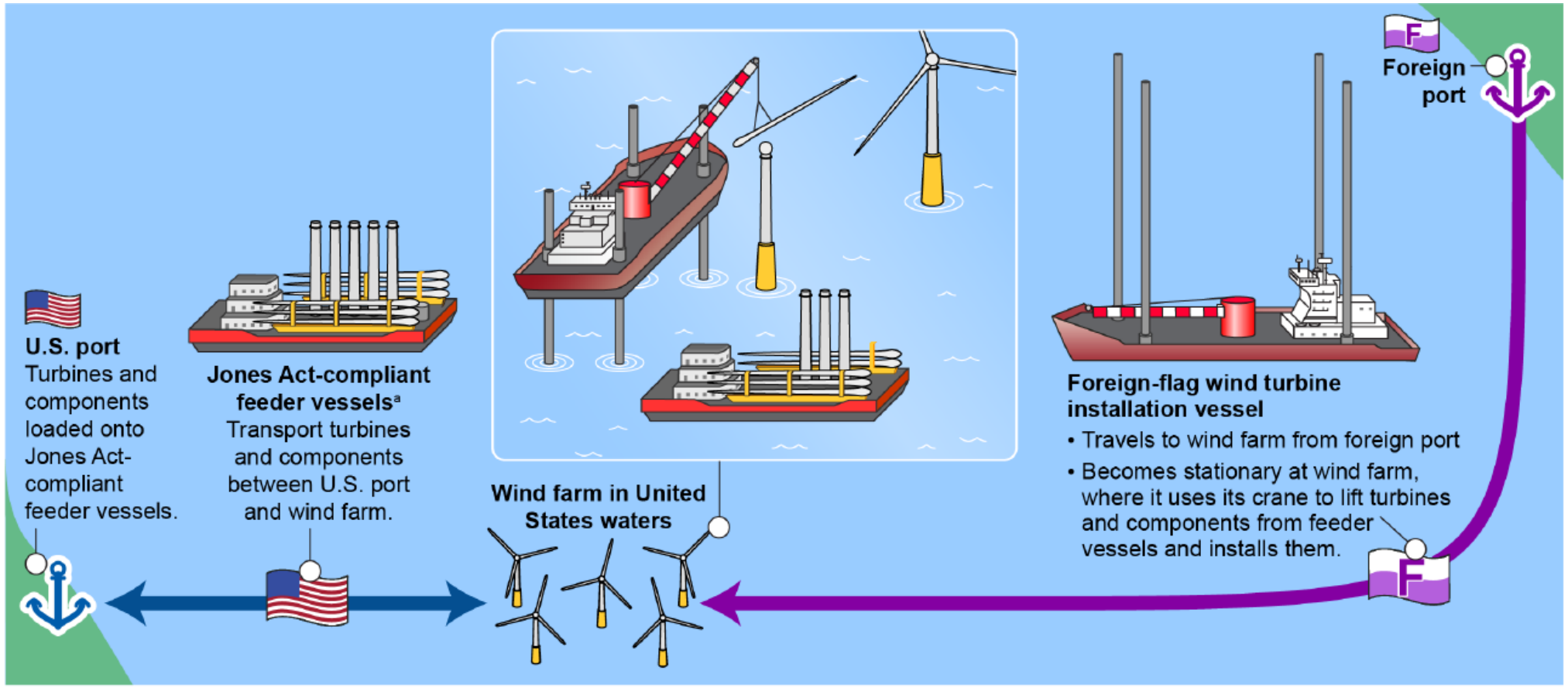
Option I: US flagged T&I vessel



Source: GAO. | GAO-21-153

The Jones Act

Option II: Feeder to foreign T&I vessel



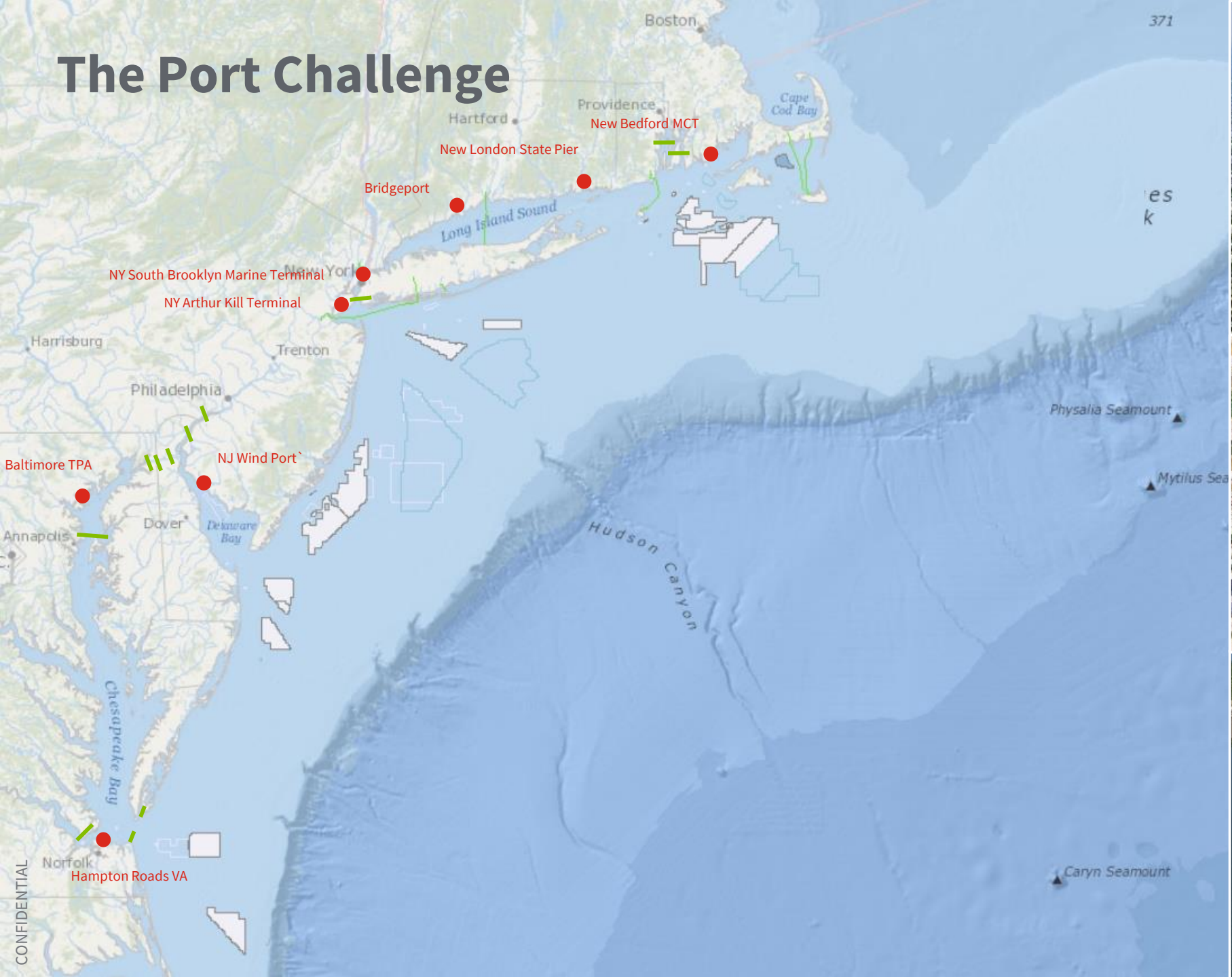
Source: GAO. | GAO-21-153

Challenges for US Offshore Wind Installation

The vessel investment challenge

1. **Jones act**
2. **No suitable crane vessels or jack-ups**
3. **No suitable installation operator or contractor**
4. **High Capex**
5. **Pipeline of work**
6. **Time required to build**
7. **Few suitable shipyards**

The Port Challenge



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Installing next gen turbines

Lifting heavier and higher

- Industry is making s step change with introduction of 12 and 14 MW turbines. End is not in sight
- Components are significantly heavier and hub heights higher
- Foundation weights > 2,000 t

→Is the table still stable?

Challenges for US Offshore Wind Installation

Technical challenges

1. *No suitable ports*
2. *Port infrastructure*
3. *Large turbines*
4. **Environmental conditions**
5. **Large water depth**

Potential solutions

New-build vs existing, self-transiting vs feeder

1. New-build Jones Act compliant Installation jack-up
2. US Liftboats feeders
3. New-build feeder jack-up
4. Floating barge feeder
5. Motion compensated feeder barge or vessel
6. Other

1. Jones Act WTIV

Dominion Energy NG-16000X-SJ

- Announcement and keel laying on Dec 21st, 2020
- Built at Keppel AmFELS, TX completion end 2023
- NG-16000X design with GustoMSC jacking system
- Equipped with 2,200 t main crane
- Capable of transporting and installing next generation wind turbines
- Investment of monumental importance for US Offshore Wind
- 1 unit is not enough for the US market, more and possibly different solutions can be expected

2. US liftboats

e.g. Block Island Wind Farm

- Designed for US GoM O&G service work
- Hit & Run units; highly restricted; low workability
- Limited Liftboats that can meet water depth & airgap requirements
- Low payload capacity (+/- 500 t variable load). Not capable of carrying next generation turbine components.

Photo courtesy Deepwater Wind

3. Feeder jack-up

E.g. NG-3750C feeder or larger

- Dedicated new-build can improve on many of the restrictions of US Liftboats
- Sufficient payload for 1 or 2 next generation WTGs
- High workability to match capabilities of WTIV
- Smaller jack-ups are easier to build in the USA
- Many of the challenges as for new-build WTIV remain; high investment, build time, port access / infrastructure
- Relatively high cost of total spread

4. Barge feedering

- US market currently strongly relies on barges; assets available, no port access issues
- Possible without large investment, use of existing assets. Likely solution for first projects
- Low workability, two key challenges:
  - How to achieve safe hook-on and lift-off? → Motion compensation
  - Mooring or station keeping? Risk of overloading jack-up when mooring alongside
- Tug operations, port loading

Photo courtesy Bard

5. Steady Top Feeder Vessel

Increasing workability at sea with innovative and practical solutions

Wrap-up

How will the US Offshore Wind market and vessel situation evolve?

Main Challenges

1. Certainty and timeline of projects
2. Actual amount of projects and amount of assets or solutions required
3. Which projects and ports to target? E.g. New York, New England
4. The investment case; short or long term
5. The risk associated with growing turbines; what to design for?

Will we see early makeshift solution that are replaced by dedicated solutions over time?

Will we see one single or multiple solutions working next to each other?

What differences will we see between turbine and foundation installation?

Thank you kindly for your attention

Karel.Wagner@GustoMSC.com

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Thanks for joining today!

Our next activity (18-FEB-2021): Offshore Wind and Climate Change from "Target" (Cost) to "Budget" (CO_2) hosted by Siemens Gamesa

Keep an eye on our LinkedIn page and website for updates!
Linkedin.com/company/kivi-ot
kivi.nl/ot