

Seaweed farming in collaboration with offshore wind and solar

Zinzi Reimert - North Sea Farmers

THEME: Key results and impacts of UNITED pilots – The Netherlands



Seaweed farming in collaboration with offshore wind and solar – Key lessons from the Dutch pilot

Key results and impacts of the UNITED pilots

Zinzi Reimert – Manager North Sea Farmers



Funded by the European Union (H2020 Grant Agreement no 862915). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither the European Union nor the granting authority can be held responsible for them

14.Nov.23 4:30pm

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World's first floating solar and seaweed farms launched in North Sea (2020)

Oceans of Energy to build offshore solar array at Hollandse Kust Noord offshore wind park

BUSINESS DEVELOPMENTS & PROJECTS

April 25, 2023, by Amir Garanovic

Oceans of Energy has been awarded the contract for installing and operating offshore solar farm inside the Hollandse Kust Noord offshore wind park being developed by CrossWind, a joint-venture between Shell and Eneco.



Oceans of Energy's offshore floating solar system (Courtesy of Oceans of Energy)

Amazon Finances First-Ever Commercial-Scale Seaweed Farm Located Between Offshore Wind Turbines

BUSINESS DEVELOPMENT

February 16, 2023, by Adnan Durakovic

Multinational technology company Amazon is funding the world's first commercial-scale seaweed farm located between offshore wind turbines.



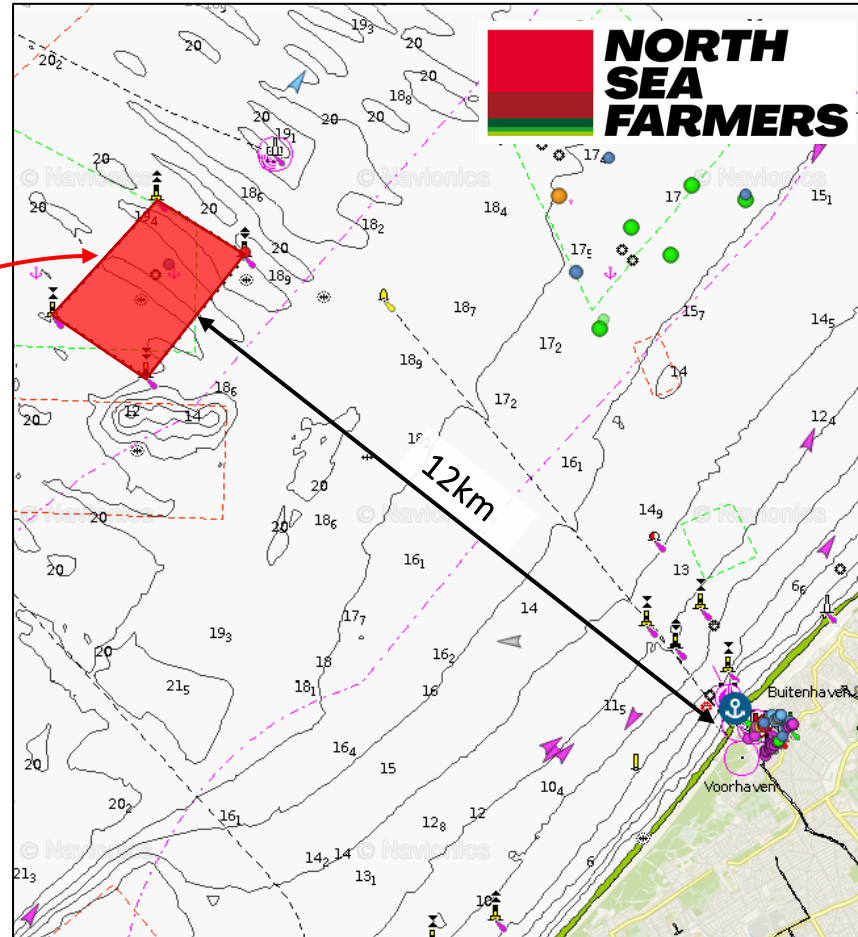
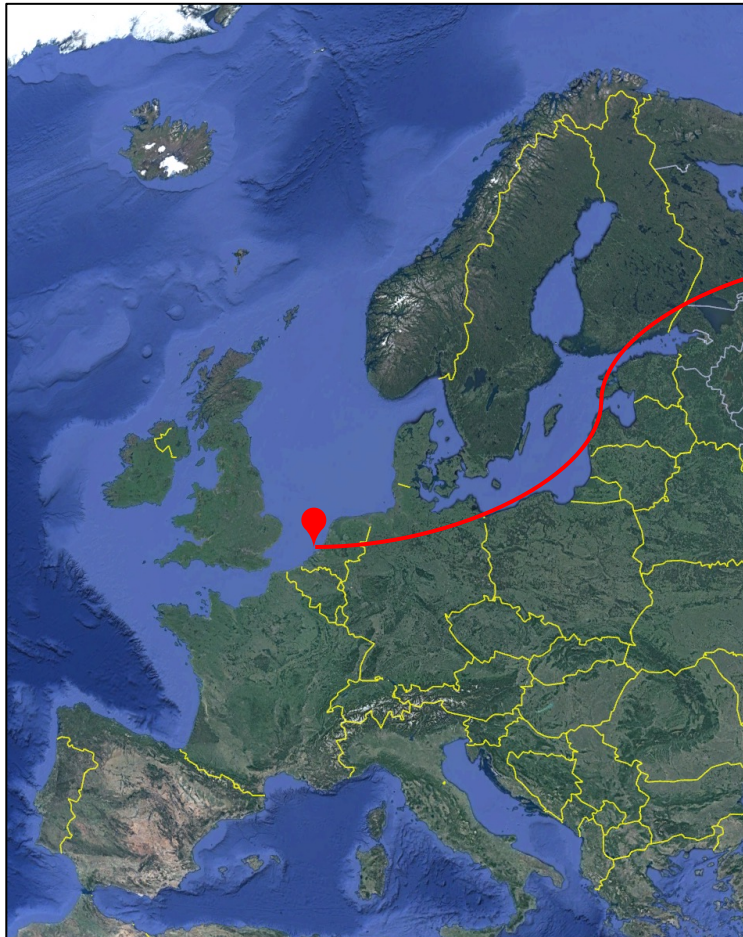
Amazon

The North Sea Farm 1 will be located in a wind farm off the coast of the Netherlands, designed to test and improve methods of seaweed farming, while researching the potential of seaweed to sequester carbon.

2023

Dutch pilot

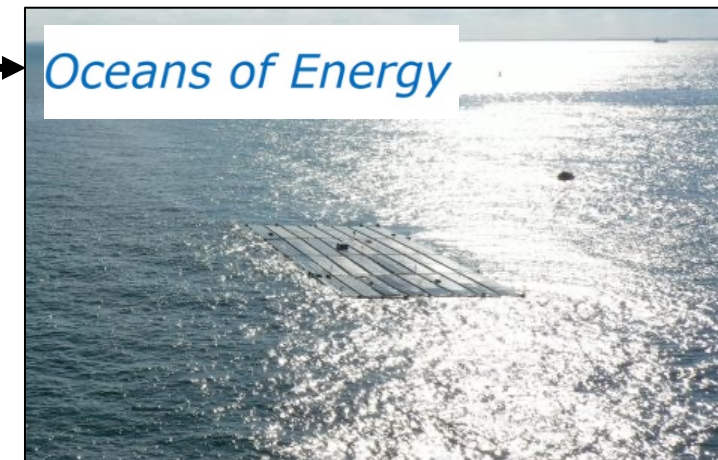
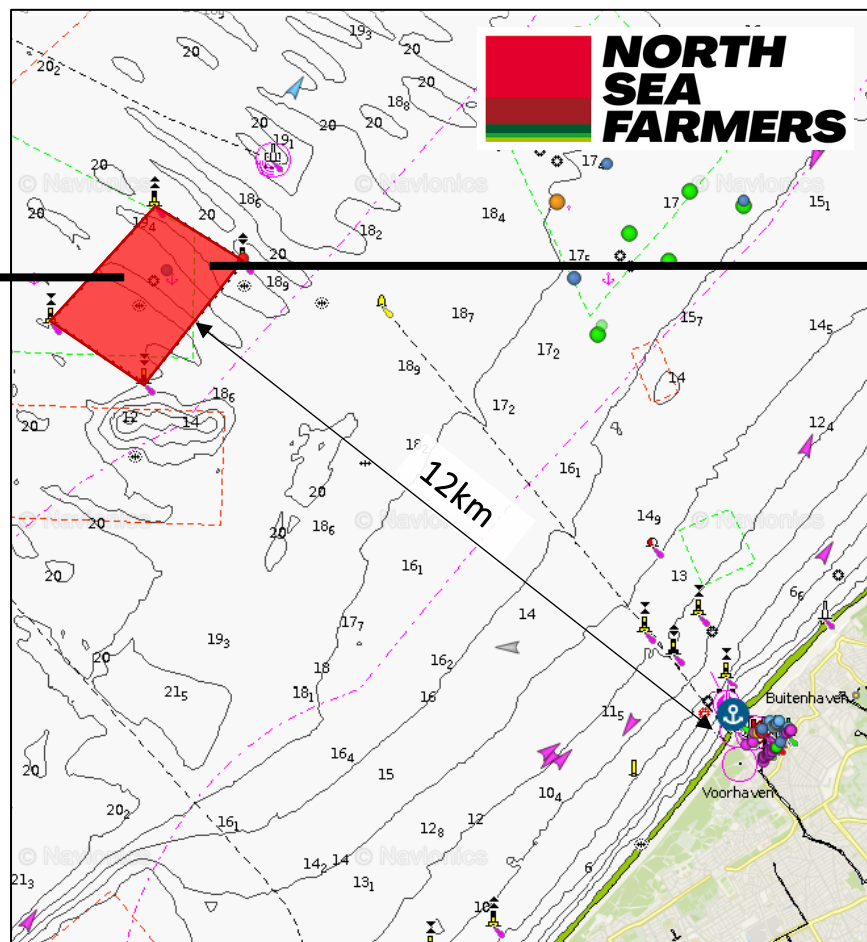
Dutch pilot location: North Sea Farmers Offshore Test Site



- Offshore conditions
- 12km off the coast
- 6km² innovation test area
- 18-20m water depth
- Permit for multi-use pilots
- Diving allowed
- Permit-to-work system
- 24/7 surveillance
- Weather forecast model
- Permit-to-work system

Dutch pilot

Seaweed cultivation & floating solar



Results of the Dutch pilot

Offshore solar

- Towards a 1 MW farm (1 football field)
- Insights in design, anchoring, installation, operations & monitoring



© Oceans of Energy

Results of the Dutch pilot

Offshore solar

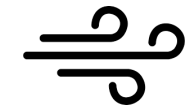

Survived storms:

- Ciara (2020)
- Dennis (2020)
- Bella (2020)
- Evert (2021)
- Corrie (2022)
- Dudley (2022)
- Eunice (2022)
- Franklin (2022)
- Poly (2023)
- Ciarán (2023)



© Oceans of Energy 2022

2022-01-31 09:00 [Europe/Amsterdam] G4

 > 110 km/h
 > 10m



© Oceans of Energy 2023

Results of the Dutch pilot

Seaweed cultivation

- Two seasons of offshore seaweed cultivation with two cultivation systems

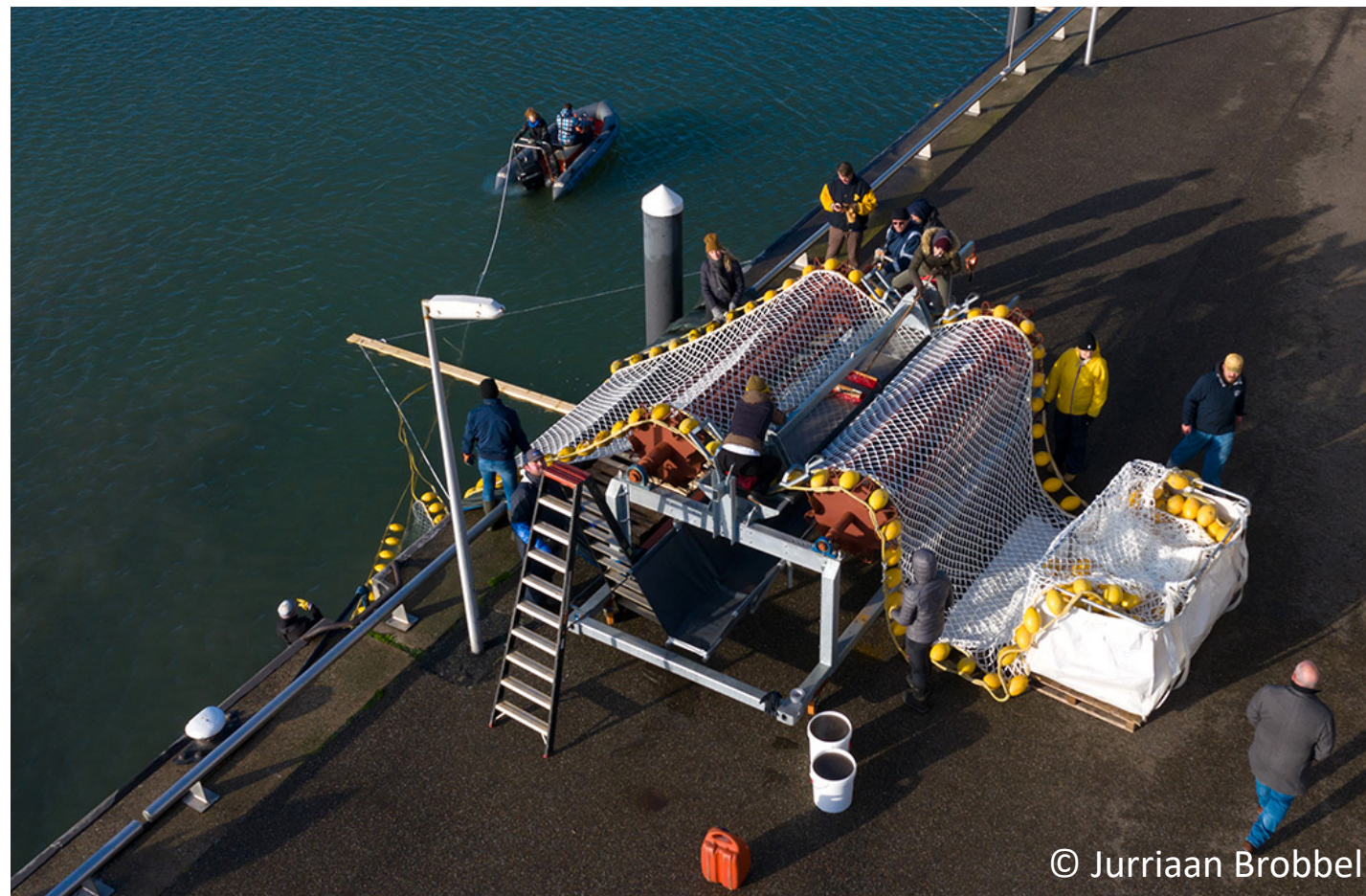


© The Seaweed Company

Results of the Dutch pilot

Seaweed cultivation

- Two seasons of offshore seaweed cultivation with two cultivation systems
- Next step in industrialization of the seeding process with a machine

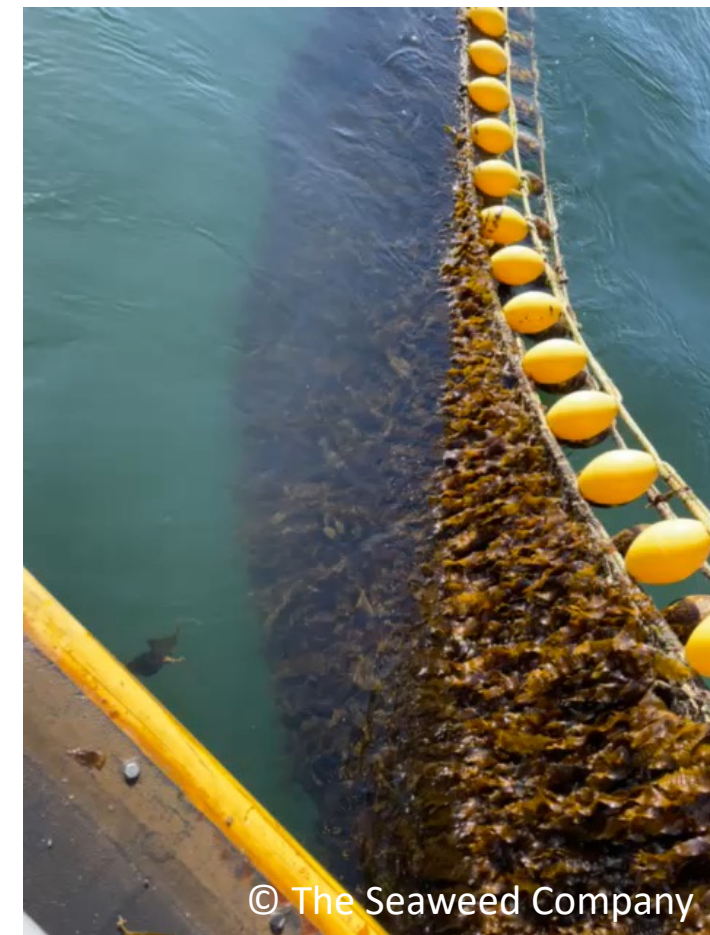
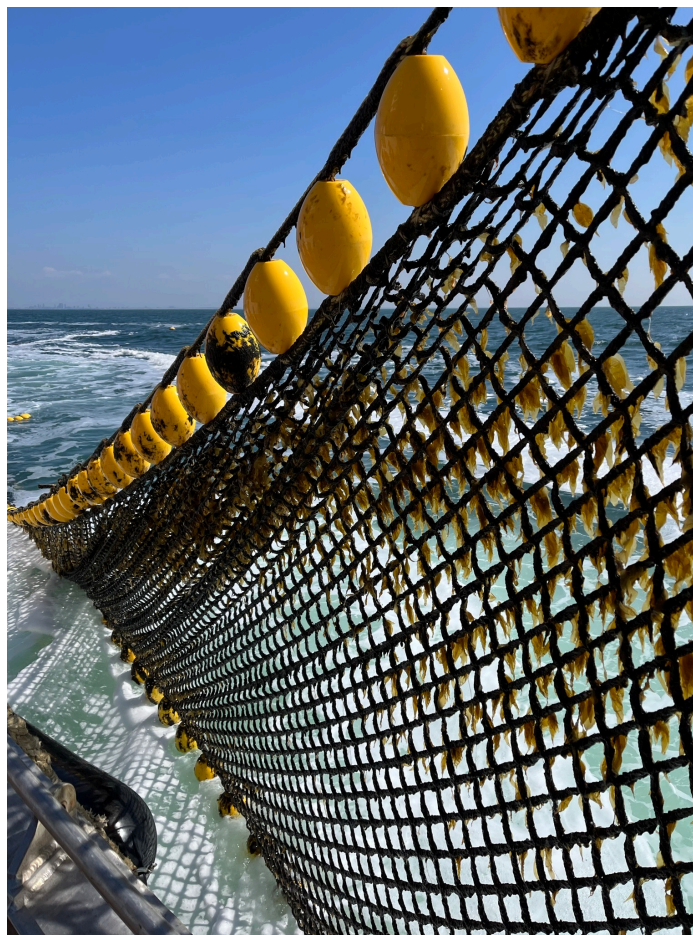


© Jurriaan Brobbel

Results of the Dutch pilot

Seaweed cultivation

- Two seasons of offshore seaweed cultivation with two cultivation systems
- Next step in industrialization of the seeding process with a machine
- Challenging offshore operations & storms



© The Seaweed Company

Results of the Dutch pilot

Seaweed cultivation

- Two seasons of offshore seaweed cultivation with two cultivation systems
- Next step in industrialization of the seeding process with a machine
- Challenging offshore operations & storms
- Net step in industrialization of the harvest with a machine



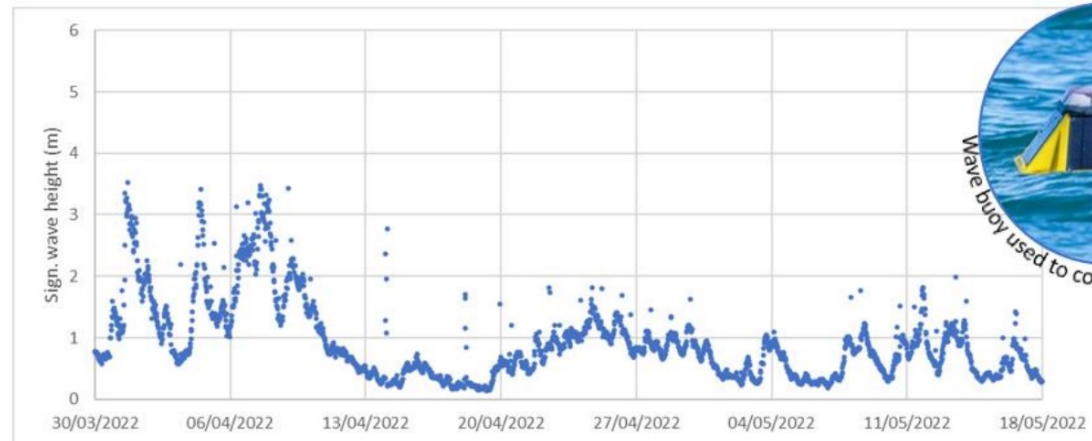
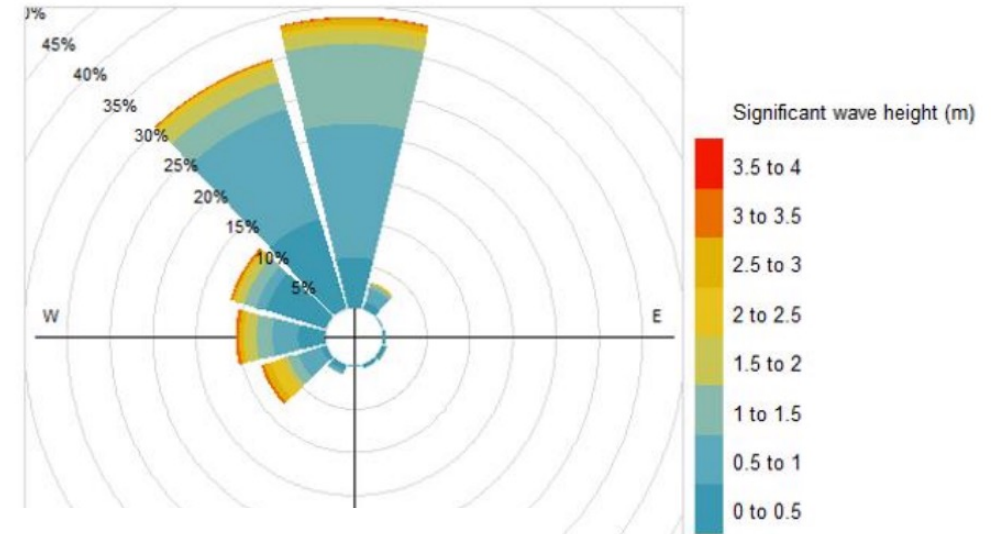
By CIV Den Oever & Boeg BV

Results of the Dutch pilot

Monitoring

Data collection on & near the installations:

- Cameras
- Load cells
- Sensor equipment
- Wave buoys
- Inspection trips
- Environmental sampling



By Oceans of Energy 2022

Results of the Dutch pilot

Monitoring

Remote data collection with buoys:

- Large data buoy

- Large vessel for installation
- Challenging O&M
- High costs



Results of the Dutch pilot

Monitoring

Remote data collection with buoys:

- Small data buoy

- Small vessel for installation
- Easy O&M
- Lower costs



Results of the Dutch pilot

Monitoring



2023-11-07 09:00 [Europe/Amsterdam] (2) OTS Buoy

Impacts of the Dutch pilot

Seaweed cultivation

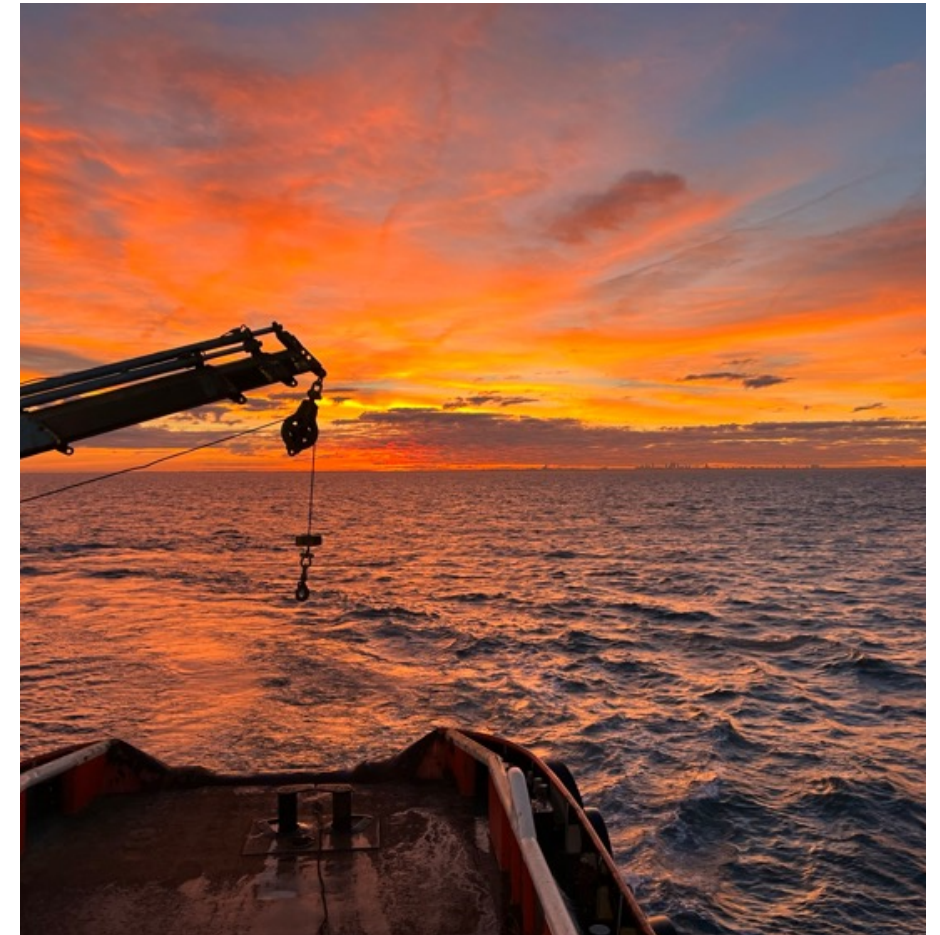
- Offshore seaweed cultivation system and corresponding seeding & harvesting machine to be commercialized

Solar farm

- Assessed and verified by DNV for operations in high wave, harsh offshore conditions such as in the Dutch North Sea

General

- Monitoring equipment developed and tested, amongst others: load links, cameras, GPS, wave buoy, ecological & data buoys.



The team of the Dutch pilot

Brigitte Vlaswinkel



Oceans of Energy

Joost Wouters



 *The Seaweed Company*

Zinzi Reimert



 **NORTH SEA FARMERS**

DAY 2

11:35 @ Room Pascal: Commercialisation of multi-use

17:00 @ Room Kelvin: Solar & wind energy combined



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Dutch pilot

Safety: automatic permit-to-work system

Log NSF Offshore Test Site

Old OTS Database | New OTS Database (07-22) | Users Offshore Test Site | Vessel | Captain | Infraction Log OTS | Incident Log OTS | Password Overview

Views | Grid view | 1 hidden field | Filter | Group | Sorted by 1 field | Color | Share view

	Date of...	Name of Org...	Plot Selec...	Activity Type	Description of Offshore Activities	Harbor of ...	A Ti...	
5	12/7/2022	Oceans of Energy	Plot 2	Civil structural works >3hrs	farm extension	Scheveningen	12:00	1
6	29/6/2022	Oceans of Energy	Plot 2	Small works <3hrs	Small inspection	Scheveningen	09:00	2
7	27/6/2022	Oceans of Energy	Plot 2	Civil structural works >3hrs	3 Anchor installation	Scheveningen	10:00	2
8	27/6/2022	Oceans of Energy	Plot 2	Civil structural works >3hrs	anchor installation	Scheveningen	10:00	2
9	22/6/2022	North Sea Farmers	Plot 5	Harvest/seeding works >3hrs	Harvest seaweed Wier&Wind	Scheveningen	7:15	2
10	22/6/2022	North Sea Farmers	Plot 5	Harvest/seeding works >3hrs	Press during harvest seaweed Wier&Wind	Scheveningen	7:15	2
11	17/6/2022	Oceans of Energy	Plot 2	Long inspection >3hrs	Monitoring equipment installation and swap	Scheveningen	07:30	1
12	16/6/2022	North Sea Farmers	Plot 3	Harvest/seeding works >3hrs	Decommissioning of three seaweed nets for ...	Scheveningen	7:00	1
13	11/6/2022	The Seaweed Co...	Plot 3	Civil structural works >3hrs	Repair Cultivator 2	Scheveningen	9:00	1
14	4/6/2022	The Seaweed Co...	Plot 3	Small works <3hrs	Installation 2x GPS at Cultivator 2	Scheveningen	8:00	4
15	2/6/2022	Oceans of Energy	Plot 2	Small works <3hrs	General inspection and monitoring trip	Scheveningen	7:30	2
16	2/6/2022	The Seaweed Co...	Plot 5	Small works <3hrs	3rd Monitoring trip & sampling	Scheveningen	8:00	2
17	23/5/2022	Oceans of Energy	Plot 2	Long inspection >3hrs	Farm extension installation	Scheveningen	07:00	2
18	23/5/2022	Oceans of Energy	Plot 2	Long inspection >3hrs	Farm extension tow out	Scheveningen	07:00	2
19	18/5/2022	Oceans of Energy	Plot 2	Inspection & small maintenance < 3h...	Eco reseach	Scheveningen	12:00	18/5/2022
20		North Sea Farmers	Plot 5	Inspection + diving > 3hr	Diving trip for "De Wilde Noordzee"	Scheveningen	12:00	17/5/2022

NORTH SEA FARMERS

Offshore Test Site Work Permit Application

Please fill in this form to apply for a permit to visit the Offshore Test Site (OTS). One form must be submitted per vessel which will visit the site.

***Divers: If your operations will use divers, please email Zinzi at zinzi@northseafarmers.org with your diving plan. Once approved by Rijkswaterstaat, you can proceed with filling out this form.

***Privacy: Information filled out in this form regarding your offshore work will be shared with organizations involved in the process such as Royal Dirkzwager who monitors visits to the site, the coast guard, or Rijkswaterstaat. Other users of the Offshore Test Site do not have access to your information.

Please continue below to apply for the permit.

Date of Offshore Activities Departure *