RWE

Quarterly report
Q4 2023

OranjeWind
Offshore wind farm

RWE's OranjeWind offshore wind farm will be located 53 kilometers from the Dutch coast. To tackle the challenges of fluctuating power generation from wind and flexible energy demand, RWE has developed a blueprint for the integration of offshore wind farms in the Dutch energy system.

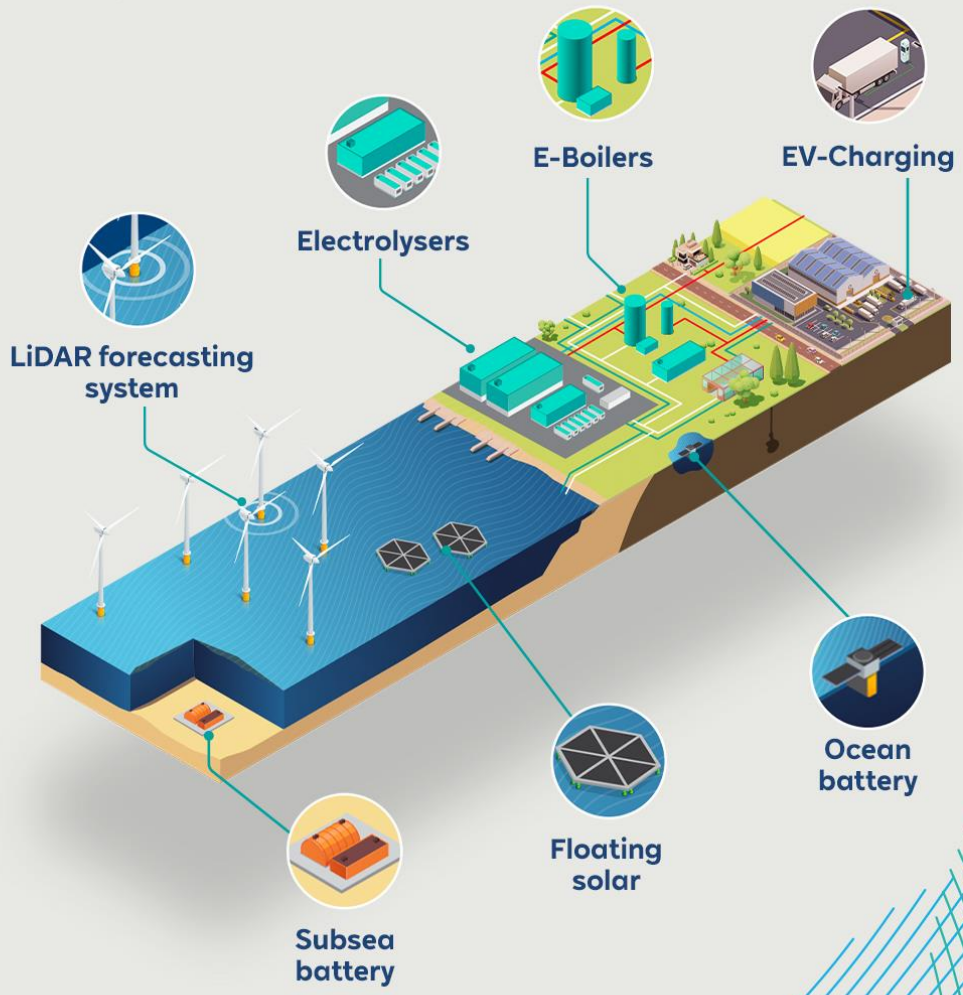
A combination of smart innovations and investments will be used to realize this perfect match between supply and demand.

Project status: in development

RWE

OranjeWind

The perfect match
Unlocking full system integration



Latest news

RWE significantly increases investments in the energy transition: €55 billion worldwide for green technologies in the years 2024 to 2030

With its “Growing Green” investment and growth programme, which was launched two years ago, RWE is contributing significantly to the success of the energy transition and the decarbonisation of the energy system. The company has already invested €20 billion net since 2021. Thanks to its financial strength and broad expertise, RWE is in a position to deliver even more ambitious investment and growth targets. RWE presented its updated strategy and investment plans up to 2030 at its Capital Markets Day on November 28th, 2023.

Growing Green

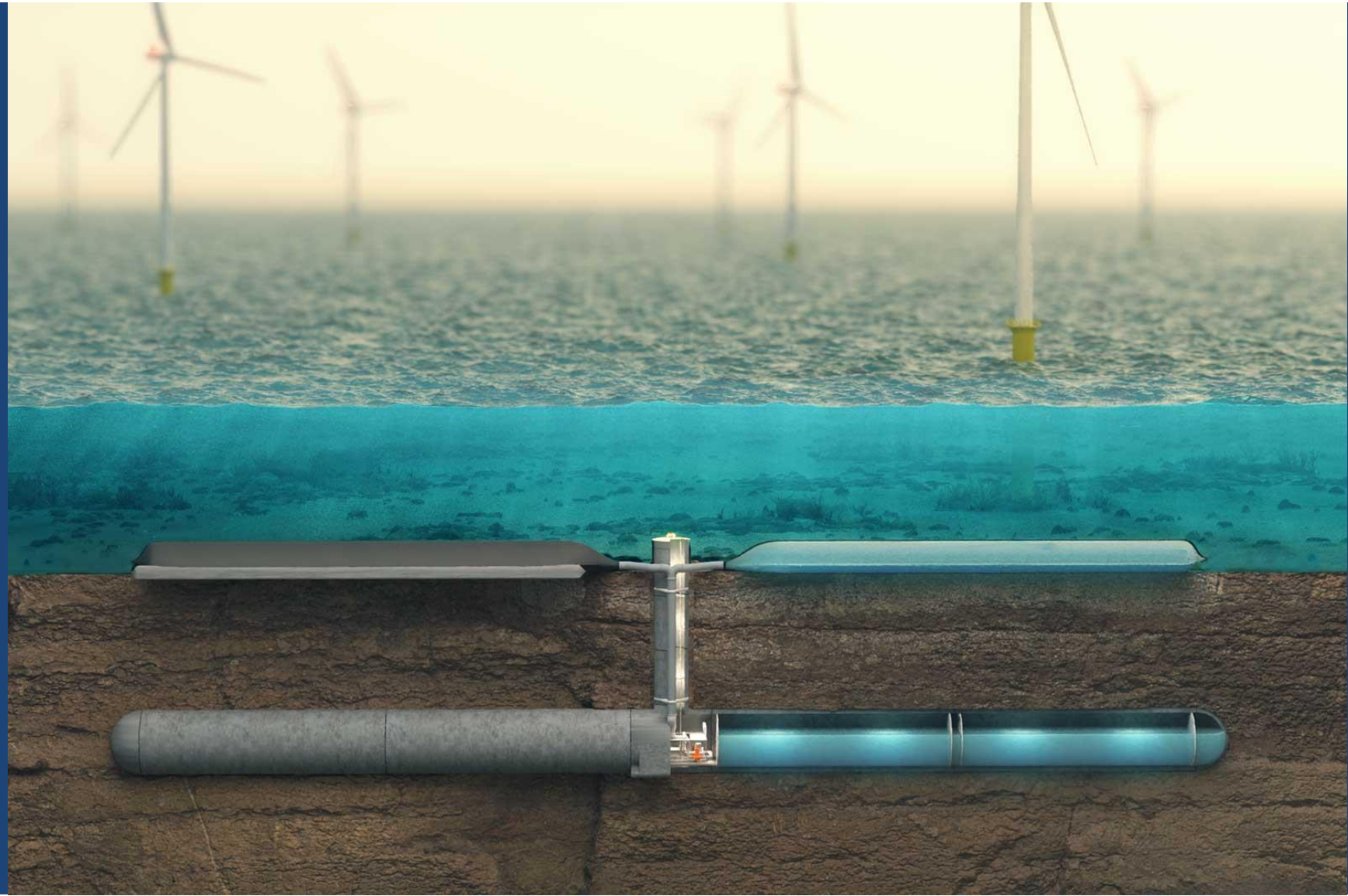
Innovations at OranjeWind (1)

Subsea pumped hydro storage power plant (Ocean Grazer)

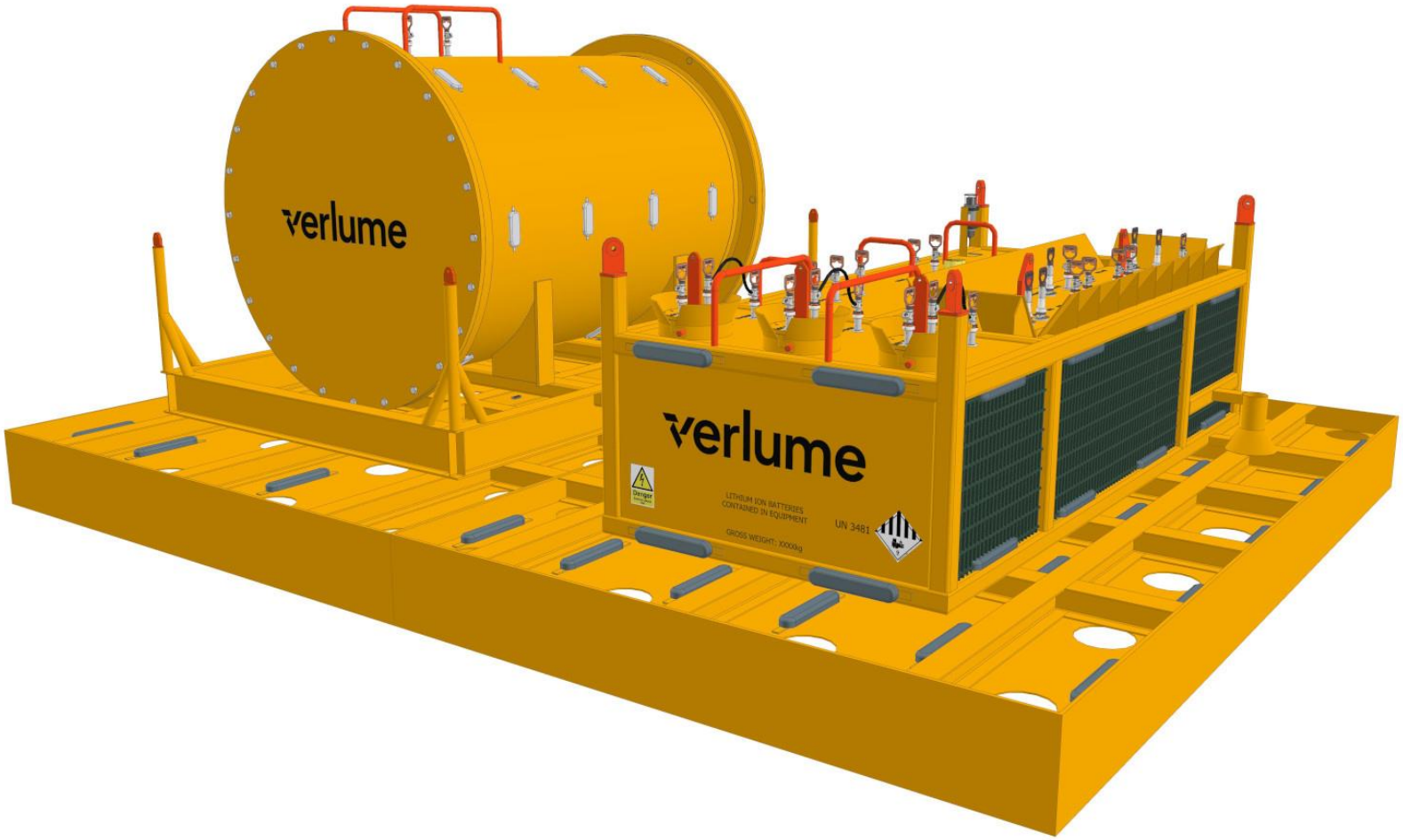
Ocean Grazer's Ocean Battery is a scalable, modular solution for energy storage that is produced by renewable sources such as wind turbines and floating solar farms at sea.
To store energy, the system pumps water from the rigid reservoirs into the flexible bladders on the seabed to store it under high pressure. When there is demand for power, water flows back from the flexible bladders to the low-pressure rigid reservoirs, driving multiple hydro turbines to generate electricity. As part of project OranjeWind, Ocean Grazer will be further developed in an inland underwater testing location.

Status update

- The cooperation agreement was signed, and the kick-off meeting was held in November.
- Ocean Grazer started preparing the permit application.
- Ocean Grazer started with the concept design.



Innovations at OranjeWind (2)



Intelligent Subsea Energy Storage (Verlume)

Verlume is bringing multi-purpose storage solutions offshore through a subsea lithium-ion battery with integrated intelligent energy management, which has a modular and highly scalable design that will lead to a more balanced power output by shaving the peak power production offshore. Beyond preventing grid curtailment, the storage solution can provide multiple offshore services, such as frequency response, black start capability for wind turbines and charging of hybrid or fully electric service vessels and providing residency for Autonomous Underwater Vehicles (AUVs). This will enable further reductions of the CO2 footprint of offshore wind farms and associated logistics.

Status update

- The basic design phase has started and is ongoing including designing the mechanical part.
- RWE has selected the final location and has designed the foundation to install the cabinets.

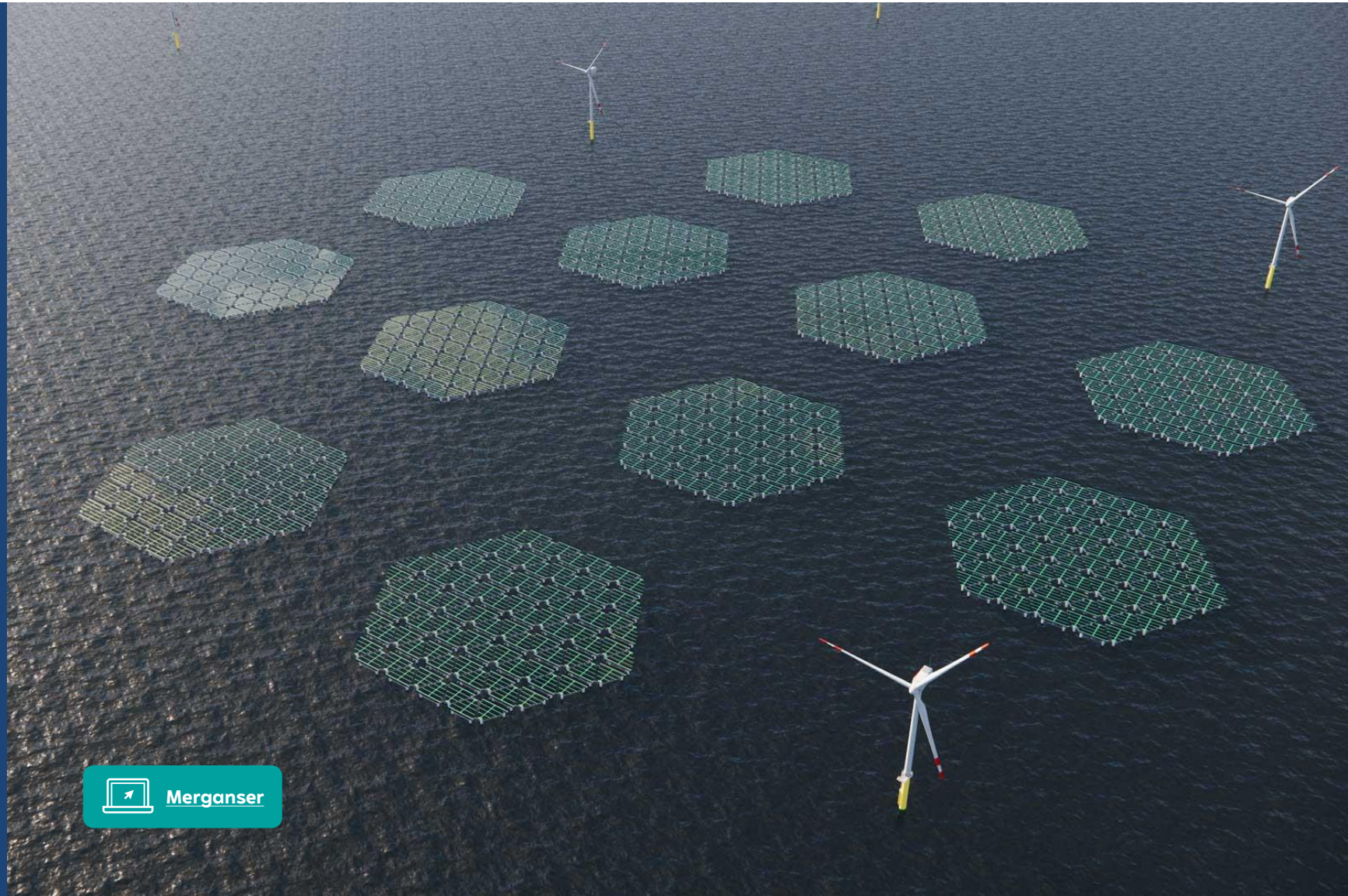
Innovations at OranjeWind (3)

Floating solar (SolarDuck)

The offshore floating solar technology, as developed by SolarDuck, provides an answer to increasing land scarcity for the generation of renewable energy. The integration of offshore floating solar into an offshore wind farm is a more efficient use of ocean space for energy generation and allows for synergies with regards to the construction and maintenance of the multi-source renewable energy plant. The result is a more balanced production profile due to the complementary nature of wind and solar resources. RWE and SolarDuck are cooperating for the first pilot installation off the Dutch coast; Project Merganser. This will lay the foundation for the larger installation at OranjeWind.

Status update

- Visit to Merganser site in Amsterdam with stakeholders on December 7
- Commissioning of Merganser pilot expected to take place early 2024.
- Concept design phase and basic design phase ongoing.
- RWE and SolarDuck preparing EPCI contract to be signed mid-2024



Innovations at OranjeWind (4)

LiDAR power forecasting (ForWind – Oldenburg University)

The innovative power forecasting methodology based on LiDAR (Light Detection And Ranging) has the potential to support grid stability and significantly improve the integration of wind power in future energy systems, by accurately forecasting sudden changes in power production caused by wind ramp events - strong variations of wind speed over a short period of time. Wind ramp events may cause sudden and strong changes in power leading to a significant and unexpected drop or increase of energy supply to the grid. If not forecasted accurately, both in timing and amplitude, these can result in critical grid imbalances and on the longer term hamper the further implementation of wind energy. With OranjeWind, we aim to demonstrate and further develop this innovative technology.

Status update

- The cooperation agreement was signed.
- Two LiDARs were purchased and ready to install at Amrumbank West as soon as weather allows.

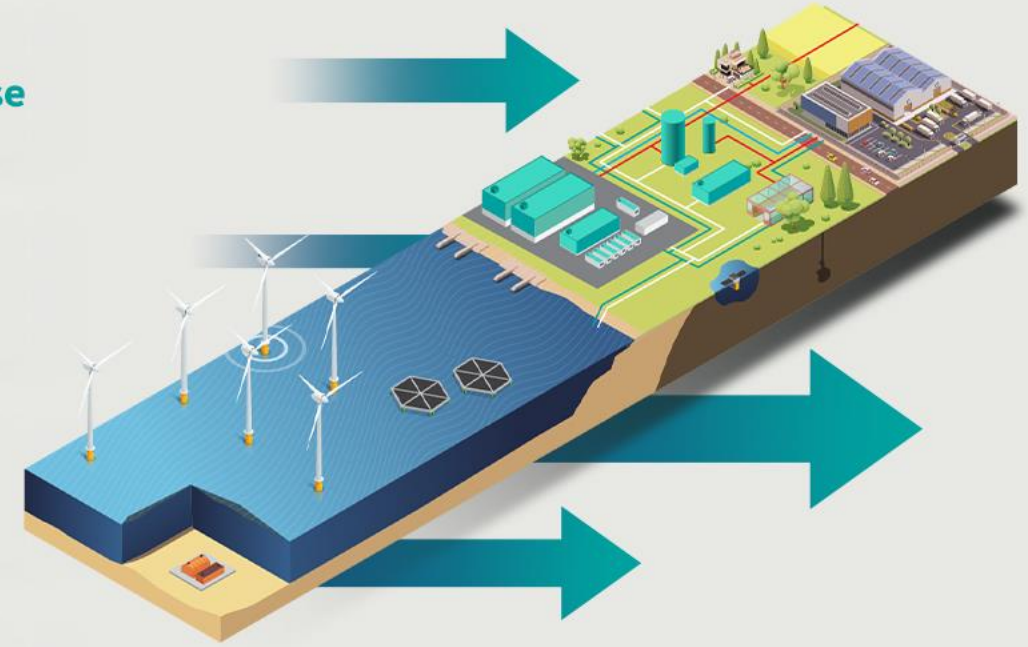
RWE

OranjeWind Knowledge

Research, communication and dissemination

Generating Knowledge

- Collecting **In-house expertise**
- Learning from **OranjeWind**
- Facilitating **research**
- Stimulating **innovations**



Sharing Knowledge

- **Initiating and joining** learning communities
- **Hosting on-site** demonstrations and events
- **Developing** workshops, webinars and teaching material
- **Contributing to** education of the future workforce
- **Publishing in** scientific journals and conferences

OranjeWind Knowledge (1)

MBO Knowledge sharing event

One of the pillars in our OranjeWind knowledge programme is contributing to the education of the (future) workforce. To that end, RWE organized a knowledge sharing event for several MBO institutes on October 12th, 2023.

The event took place at MBO Noorderpoort in Delfzijl and at one of RWE's sites in Eemshaven. The discussion focused on how to include new and existing technologies that are essential to the energy transition, into the curriculum of these institutes.

The importance of working together to ensure the energy transition was highlighted during the event, as well as the enthusiasm of the MBO institutes to work on the energy transition.

Sustainable Industry Challenge

The Sustainable Industry Challenge, organized by Chemport Europe, was offering a chance for global innovators to test and implement solutions in the Netherlands, and RWE was looking for system integration innovations.

Two companies were chosen as finalists, Power to Hydrogen and Phelas. They presented their innovations at the Magnum plant in Eemshaven on November 15th. While both innovations were very promising, the upside potential with Power to Hydrogen proved to be the deciding factor, and they were chosen as the winner.

RWE will explore further cooperation with both companies.

Sustainable Industry Challenge

OranjeWind Knowledge (2)

RWE signs iXclusive partnership with iTanks for inspiration and innovation

RWE has signed a partnership agreement with iTanks for their innovation platform. iTanks will provide inspiration in various fields such as assetmanagement, energy storage and generation. They will scout innovations ant technologies that are relevant for RWE and the OranjeWind project.

The iTanks platform will also contribute to knowledge sharing in the OranjeWind Knowledge programme, for example by organizing events, workshops podcasts and webinars hosted by iTanks.

iTanks

iTanks
Innovation by Collectivity

Jouw Energie van Morgen-Truck

The faculty of Science and Engineering of University of Groningen, Gasunie and RWE challenge students to think about solutions for the future energy system by visiting secondary schools in the *Jouw Energie van Morgen*-truck. The truck can be booked by all secondary schools in the Netherlands, and it can be used for events. Teaching material related to the OranjeWind wind farm will be developed for the truck.

The purpose of the truck is to contribute to the future workforce by getting students excited about working in the energy transition.

Jouw Energie van Morgen

OranjeWind Knowledge (3)

RWE kicks off OranjeWind Knowledge research programme with TNO and Universities

On December 6th, RWE has kicked off the OranjeWind Knowledge research programme that is set up together with TNO, Delft University of Technology, Eindhoven University of Technology, University of Groningen and Utrecht University. The purpose of this research programme is to close knowledge gaps and provide valuable insights in key focus areas for system integration

As part of the programme, six PhD's will research topics related to system integration, the implemtentation of innovations, balancing technologies and spatial-temporal lay-out of energy infrastructure. The PhD positions will open next year.

GroenvermogenNL opened the GroenvermogenWaterstofHuisNL

RWE participates in two work packages of GroenvermogenNL, which aims to accelerate the development of a market for utility scale hydrogen usage.

On December 1st they opened the doors to the *GroeneWaterstofHuisNL*. They hosted an event to discuss R&D, pilots and demos and human capital. To the latter topic, Arjan van der Stelt gave a presentation about how RWE is developing the future workforce, for example through initiatives in the OranjeWind Knowledge programme.

GroenvermogenNL

Upcoming activities

Battery and Hydrogen inspiration days

In the first quarter of 2024, two inspiration days will be hosted for teachers of various MBO institutes. The first will focus on battery storage and will visit RWE Kraftwerk Westfalen in Hamm. The second will focus on hydrogen development. The RWE installation that will be visited during that session is still to be decided.

The goal of these events is to inform practitioners of vocational education about the state-of-the-art installations that power the energy transition. Information about these installations can be embedded into vocational education to facilitate a smooth transition from student to professional.

Education modules at Universities of Applied Sciences

RWE will support with the development of educational modules related to the energy transition. In doing so, students will be familiarised with the energy sector and its challenges. Furthermore, the best innovative ideas and solutions created by the students are valuable for accelerating the energy transition and will be shared openly.

For the Hanzehogeschool the minor Hydrogen in the Energy Transition is being developed with aim of introducing students to the field of hydrogen, a key energy carrier in the energy transition.

At Avans University of Applied Sciences, RWE provides input and guest lectures for the Master Material & Energy Transition. RWE also participates in a curricular project where students of Industrial Engineering & Management develop business cases for sustainable energy innovations.

RWE

About RWE

RWE is leading the way to a green energy world. With its investment and growth strategy Growing Green, RWE is contributing significantly to the success of the energy transition and the decarbonisation of the energy system. Around 20,000 employees work for the company in almost 30 countries worldwide. RWE is already one of the leading companies in the field of renewable energy. Between 2024 and 2030, RWE will invest 55 billion euros worldwide in offshore and onshore wind, solar energy, batteries, flexible generation, and hydrogen projects. By the end of the decade, the company's green portfolio will grow to more than 65 gigawatts of generation capacity, which will be perfectly complemented by global energy trading. RWE is decarbonising its business in line with the 1.5-degree reduction pathway and will phase out coal by 2030. RWE will be net-zero by 2040. Fully in line with the company’s purpose - Our energy for a sustainable life.