

Webinar

# New technologies for renewable power generation

Cyriel de Jong, KYOS

Walter Hueber, Kitepower

Maarten Berkhout, SeaCurrent

6 July 2023



# Speakers



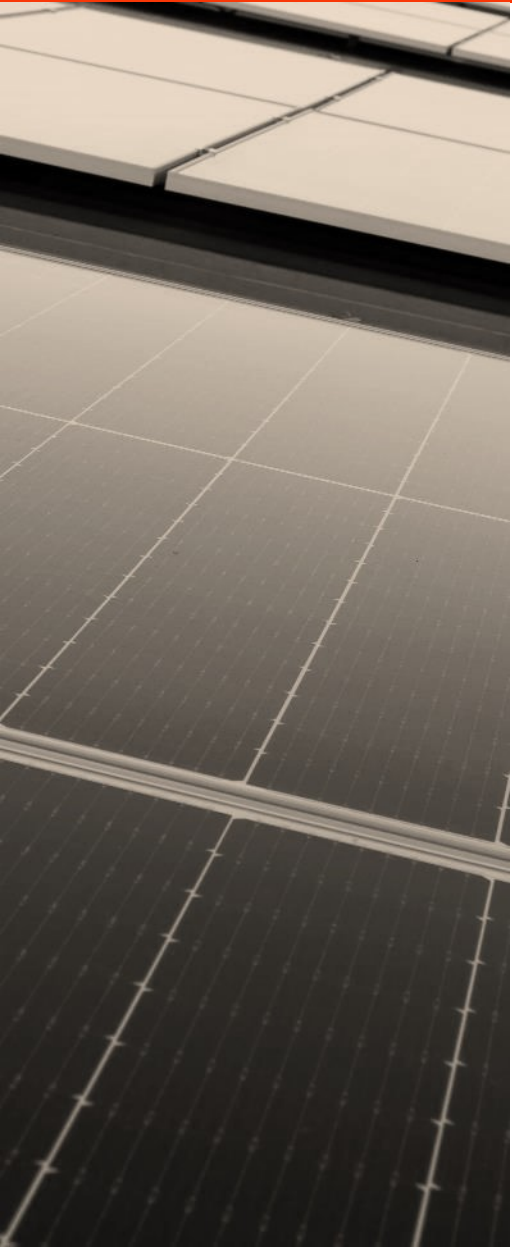
**Walter Huber**  
Chief Operating Officer  
Kitepower



**Maarten Berkhout**  
Chief Commercial Officer  
SeaCurrent



**Cyriel de Jong**  
Founder & CEO  
KYOS



# KYOS Energy Analytics

- International client base across Europe, plus Americas and Japan
- 35+ people, of which 25+ in Haarlem (NL)
- More than 100 corporate clients for its software services





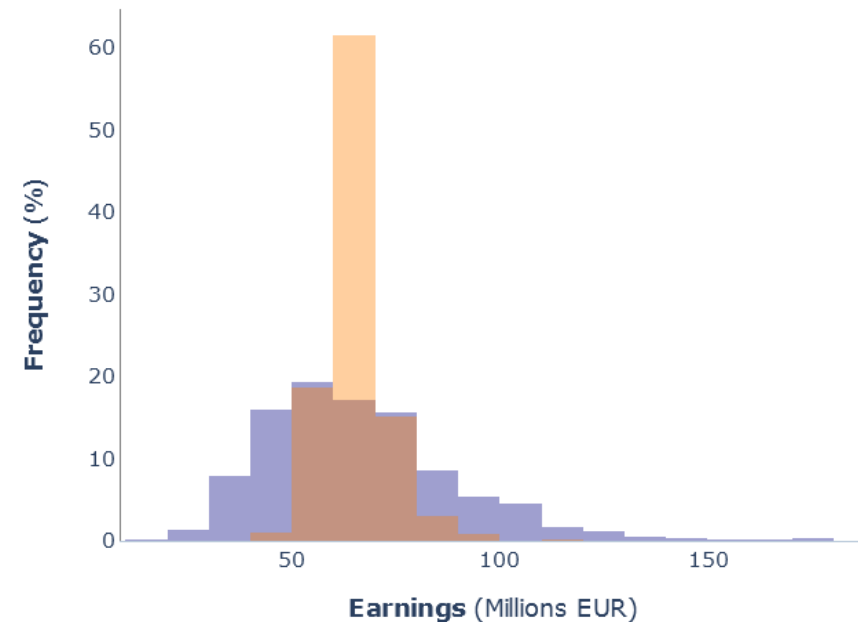
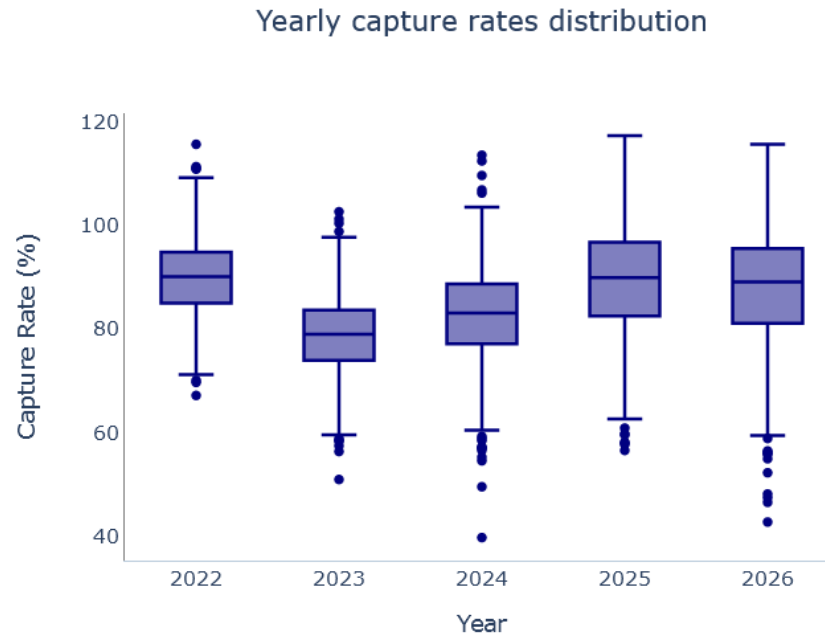
# KYOS approach to renewable energy assets



## KYOS Analytical Platform

software system to price and manage renewable assets and PPAs

- Create forward curves and long-term forecasts of energy prices
- Generate realistic scenarios / simulations of prices and volumes
- Apply realistic trading strategies
- Assess the value and manage the market risks





airborne wind energy

KITEPOWER



## Kitepower in a Nutshell



Based in:

**Delft**

Founded in:

**2016**

Team Members:

**18**

Projects Implemented:

**6**

Successful Flights:

**267**

Patents Granted:

**4**

Supported by:



Kitepower has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 881193. Awarded with the Seal of Excellence certificate.

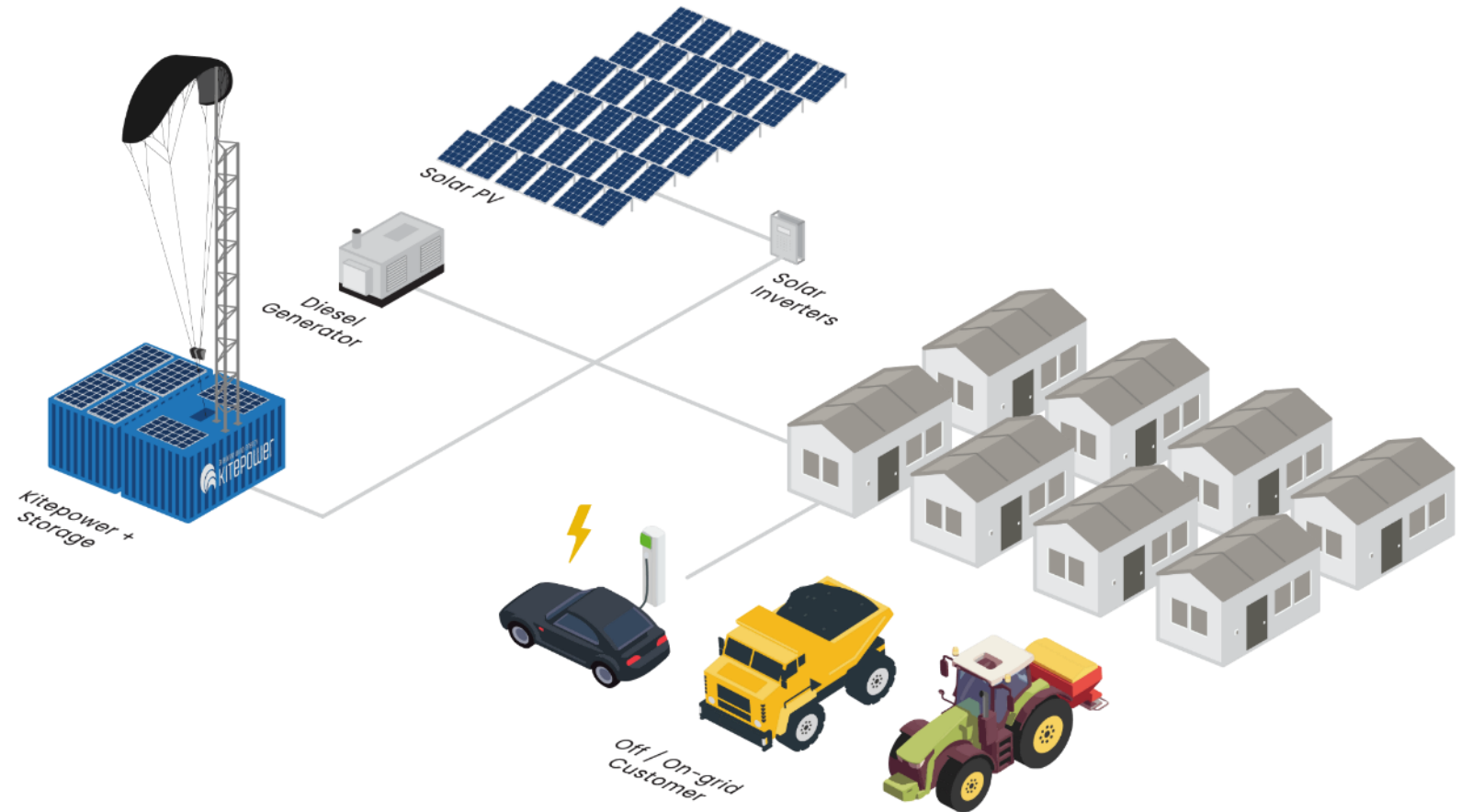


## .Kite Powered Energy Storage

# The only mobile renewable energy plant to power communities and businesses globally

When integrating Kitepower in combination with batteries, diesel generators can be switched off completely.

Hybridizing with Kitepower results in less diesel consumption for more clean energy, culminating in considerable financial savings even for areas that do not experience consistent high wind speeds.





# EV charging

July 4th, 2023





RATED POWER:

**100** kW

YEARLY POWER OUTPUT:

**450** MWh

In the Netherlands.

The Kitepower system:

**Produces** 130kW avg. 80% of time\*

- **High force:** 5 tons
- **High flight speed:** 100+ km/h
- **Low reel-out speed:** 3m/s

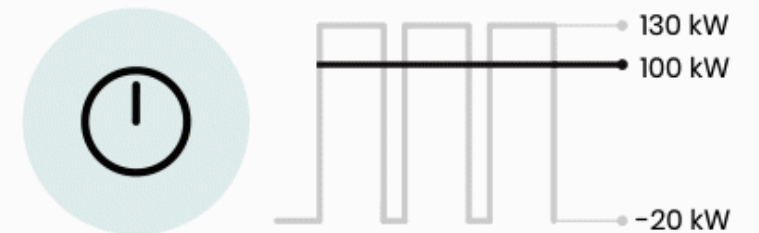
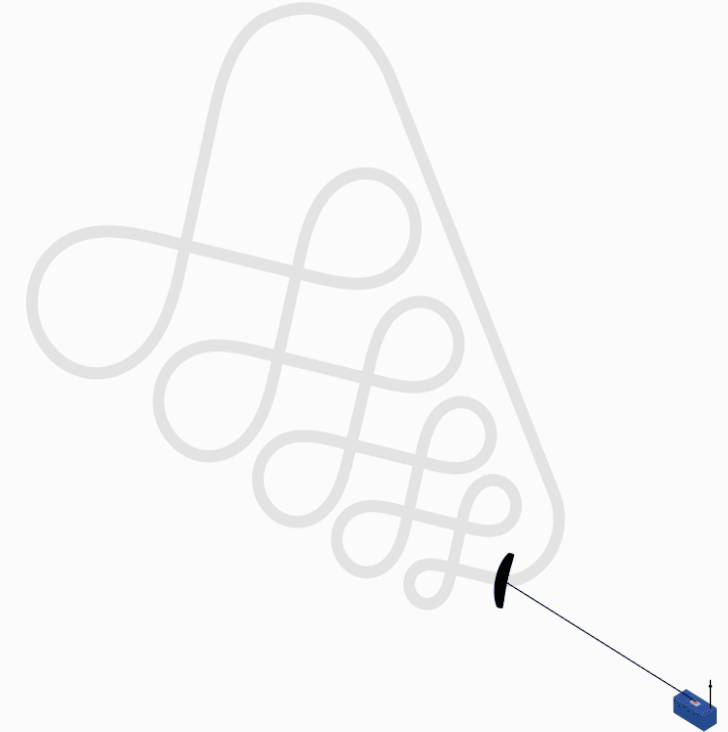
**Consumes** -20kW avg. 20% of the time\*

- **Low force:** 150 kg
- **Low flight speed:** 50 km/h
- **High reel-in speed:** 12 m/s

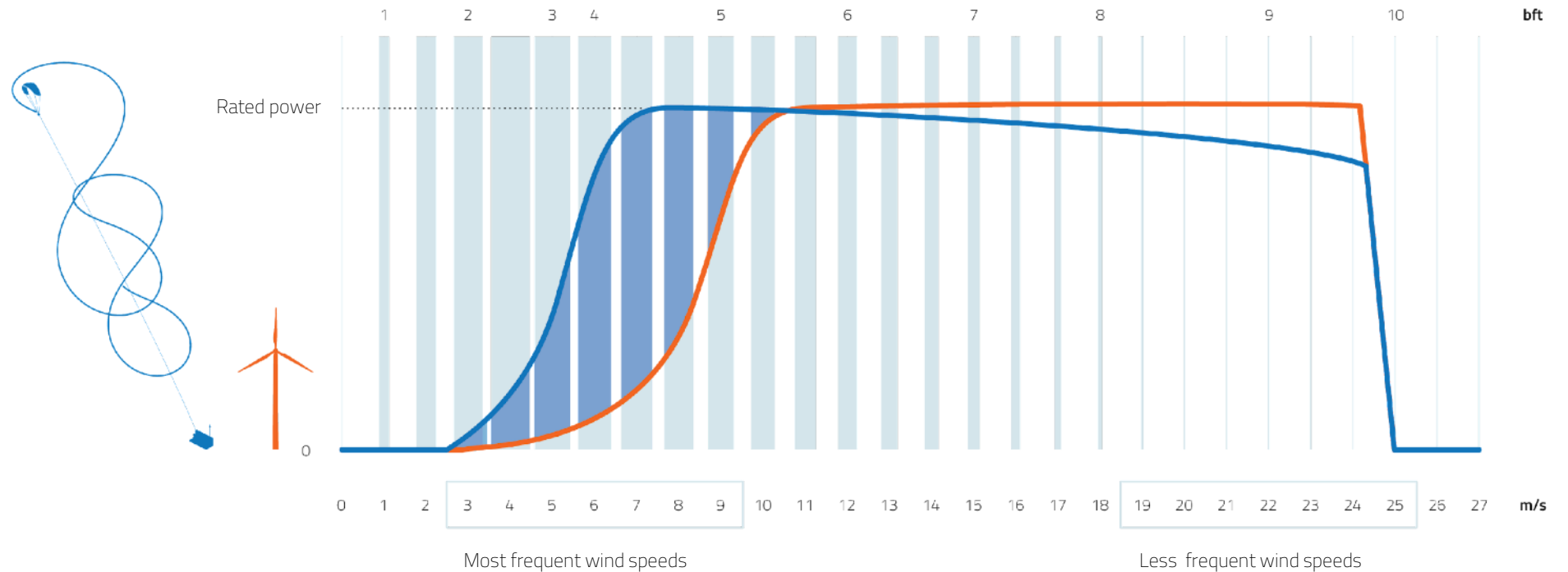
\*Takes around 100s to complete a cycle

## System Operation

The continuous pumping cycle



# Producing power at very low but frequent wind speeds








# Kitepower outperforms other technologies\*

Available renewable energy sources have limitations.

\*Comparing systems with the same energy output

## The Advantages of Kitepower

|   | Mass<br>t | Sealed Surface<br>m <sup>2</sup> | Energy throughout 24 hrs<br>  |   | Social Acceptance | Installation Time |
|---|-----------|----------------------------------|---|---|-------------------|-------------------|
|  | 220       | 50                               | ✓   | ✓ | ✗                 | weeks             |
|  | 70        | 2000                             | ✓   | ✗ | ✓                 | days              |
|  | 15        | 50                               | ✓   | ✓ | ✓                 | hours             |



### Low Mass

Kitepower systems takes less mass than traditional wind turbines and solar PV.



### Little Sealed Land

Kitepower leaves no traces and does not harm existing ecosystems.



### High Energy Production

High altitude winds allow for greater energy production compared to traditional wind turbines.



### Day and Night

Unlike solar PV, Kitepower produces electricity during day, night, on cloudy and rainy days.



### Less Impact

Kitepower flies almost invisible at high altitudes and does not require towers nor resource intensive foundations.



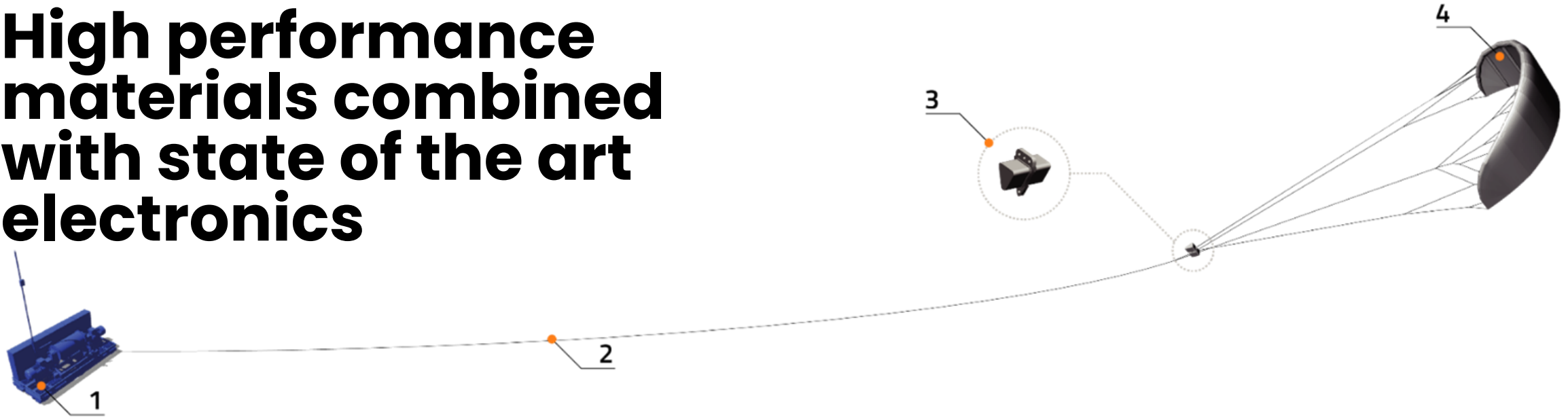
### Easy to Transport

Kitepower 20 ft. containers can be transported on a truck within Eurasia or shipped to other continents.



# High performance materials combined with state of the art electronics

## System Components



### 1. Ground Station

Converts the mechanical energy of the kite into electrical power and reels the kite in by using the generator as a motor.

|                  |                  |
|------------------|------------------|
| Width:           | 2,44 m           |
| Height:          | 2,60 m           |
| Length:          | 6,06 m           |
| Weight:          | 11 t             |
| IP Rating:       | IP64             |
| Lifetime:        | 25 years         |
| AC Power Output: | 400 V AC 3 phase |
| DC Power Output: | 550-700 V        |

### 2. Tether

A Dyneema® line is used for a lightweight and strong connection between the kite and the GS.

|                   |                         |
|-------------------|-------------------------|
| Type:             | UHMWPE Dyneema®         |
| Length:           | 358 m                   |
| Breaking strength | 19 tons                 |
| Diameter          | 14 mm                   |
| Density           | 0.97 kg/dm <sup>3</sup> |

### 3. Kite Control Unit

Controls the roll, pitch, and yaw of the kite and takes care of the communications between the sensor unit placed on the kite and the GS.

|                    |           |
|--------------------|-----------|
| Wireless Range:    | 2 km      |
| IP Rating:         | IP65      |
| Motor supplier     | Maxon     |
| Bus Voltage        | 44 V      |
| Int. communication | CANOpen   |
| DC Power Output:   | 550-700 V |

### 4. Kite

Consists of a hybrid between an inflatable and a fixed fibre-glass skeleton, forming the best combination for a strong and lightweight wing.

|                   |                   |
|-------------------|-------------------|
| Size Flat:        | 60 m <sup>2</sup> |
| Size Projected:   | 47 m <sup>2</sup> |
| Force:            | 3,5 t             |
| Avg. Flight Speed | 100 km/h          |
| Maximum chord     | 3.9 m             |

# Initial deployments



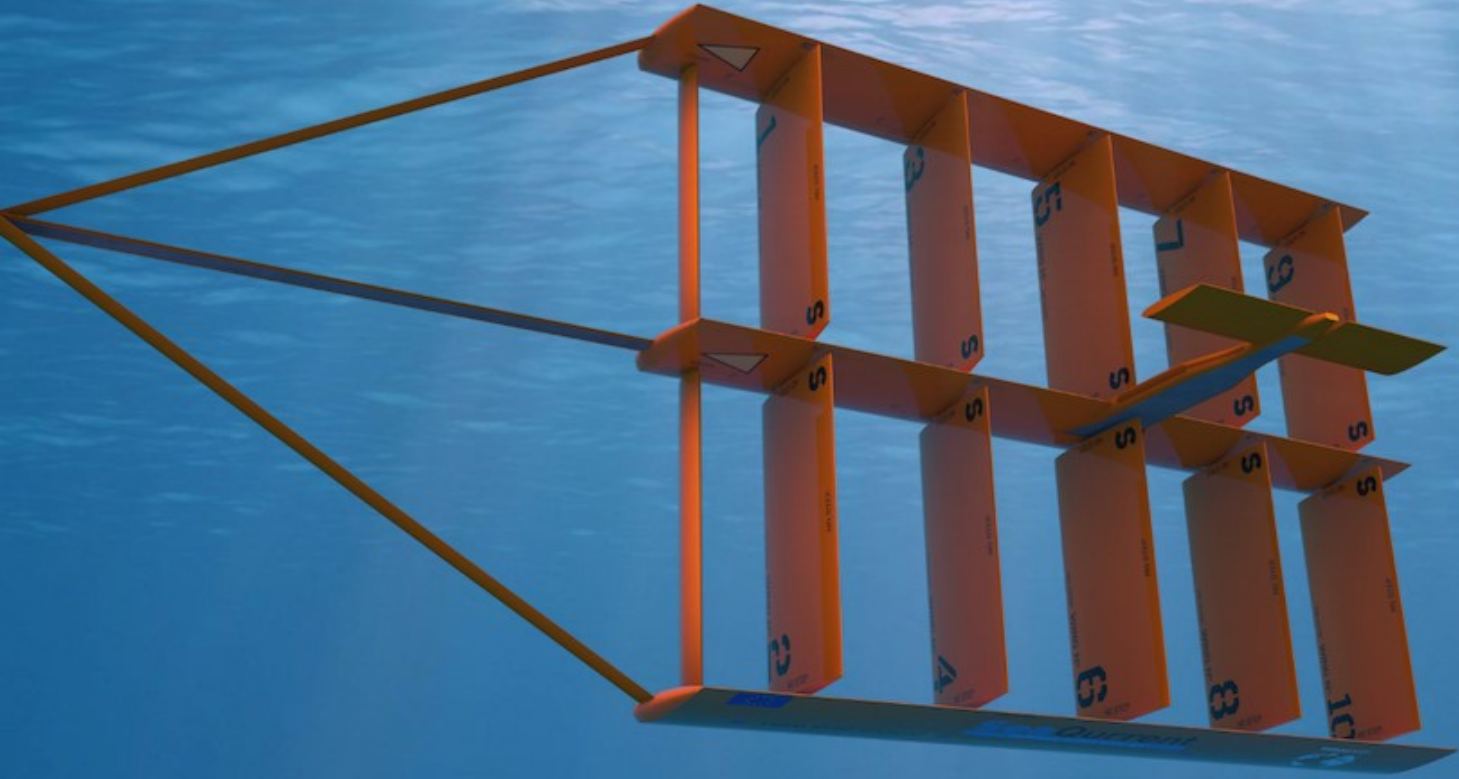
**Agriculture**



**Construction**



**Communities**



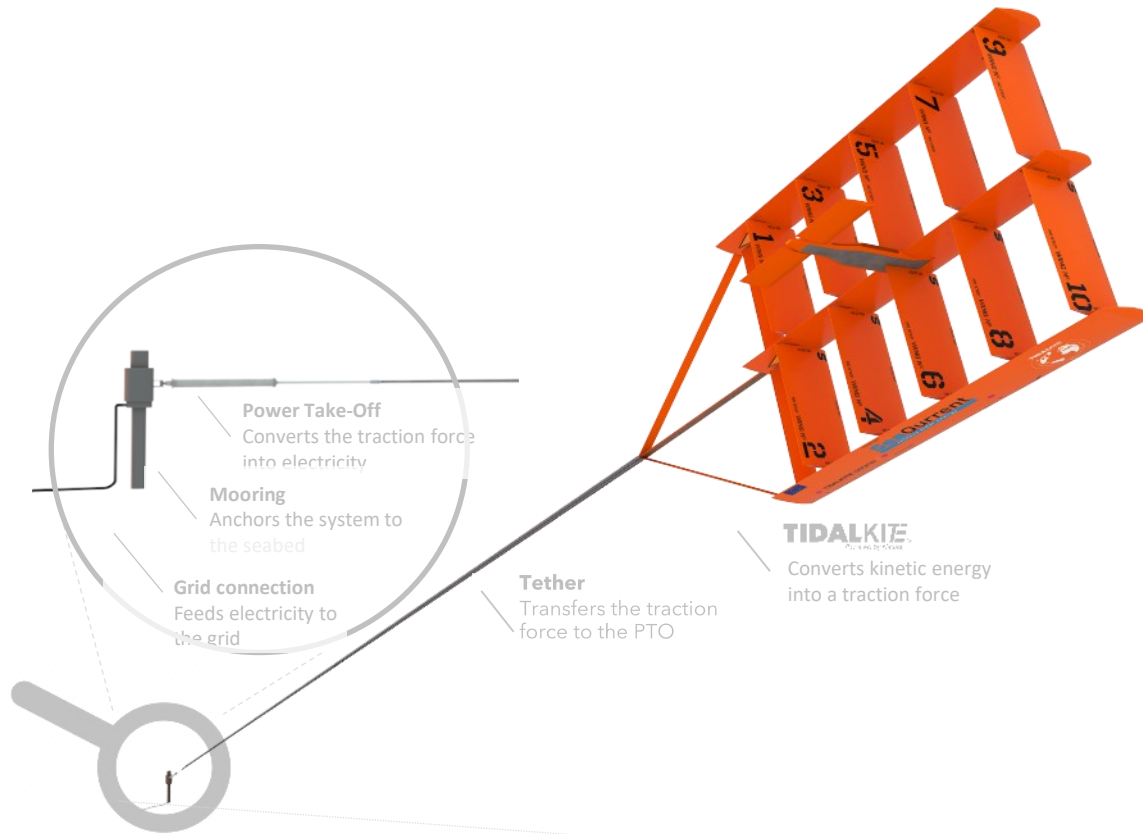
The most affordable baseload renewable energy solution

**TIDALKITE™**  
Powered by Nature



# Patented solution

## 3D Harnessing innovation



- High energy yield
- Widest deployment potential
- Low cost
- Minimal impact

### Energy Converted

3D Harnessing  
Multiple wings in tandem

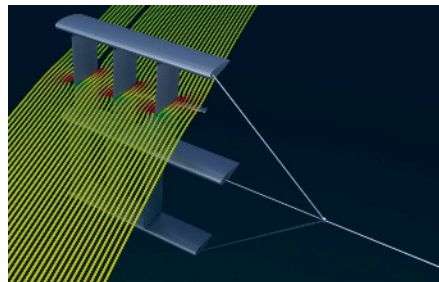


Conventional 2D Harnessing

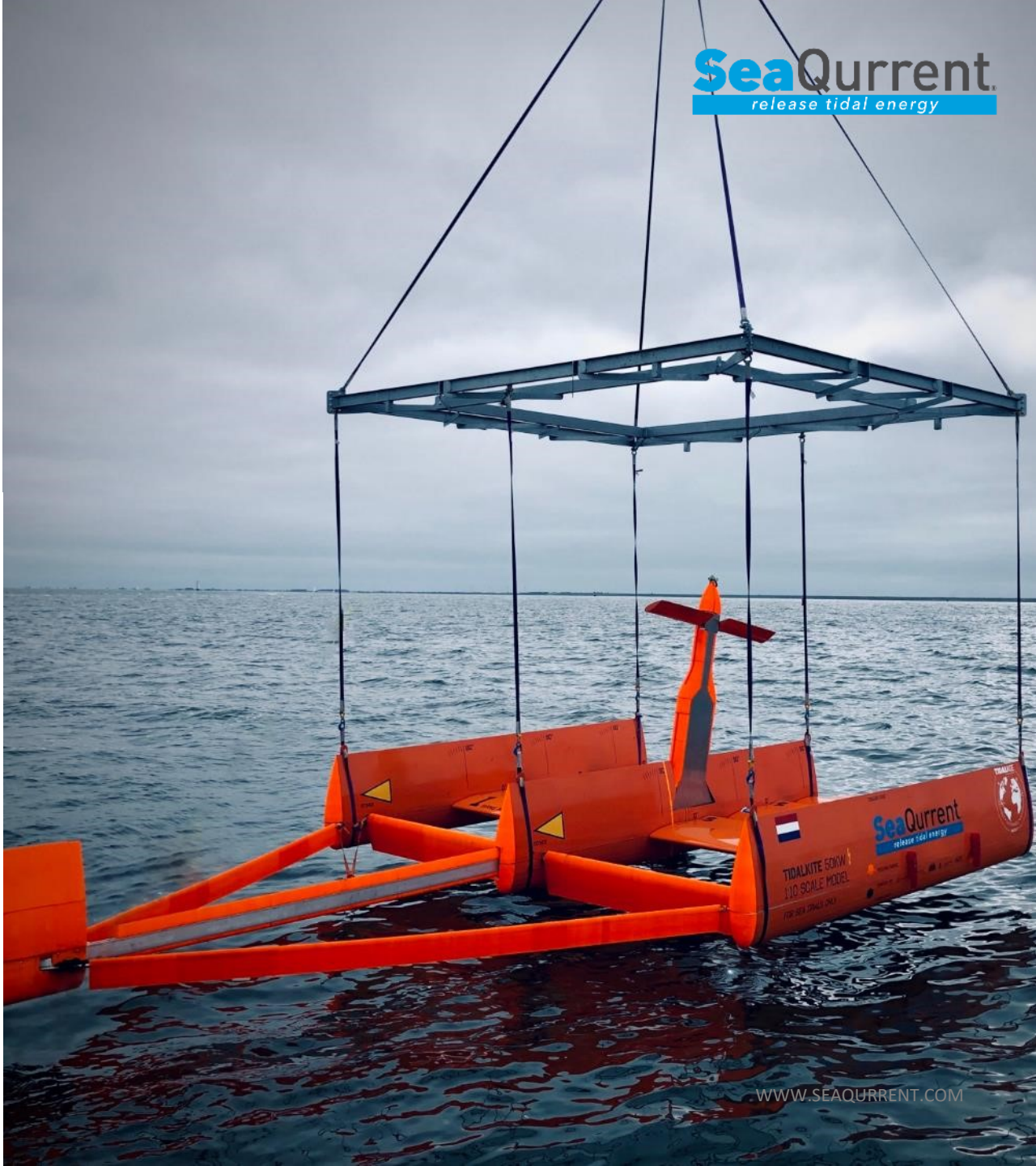


**TidalKite is uniquely suited for**  
shallow-water-low-velocity areas

# Technology advancement



**SeaCurrent**  
release tidal energy





# The team – 20 FTE



**BSc Youri Wentzel**  
 Founder – CEO, CTO  
 20+ years in the energy sector at Shell, NAM, CB&I, Imtech. Successful Management buy-Out and exit and 2 patent applications



**MSc Maarten Berkhout**  
 Co-founder - CCO  
 20+ years energy sector experience in project development, sales and R&D&I management at Vattenfall, Nuon, Triogen



**BBA Maurits Alberda**  
 Co-founder – COO, CMO  
 18 years experience in business development, marketing and operations at Energy Academy Europe, Energy VentureLab



An experienced and well-advised team that has proven they can get things done (photo: part of the team)

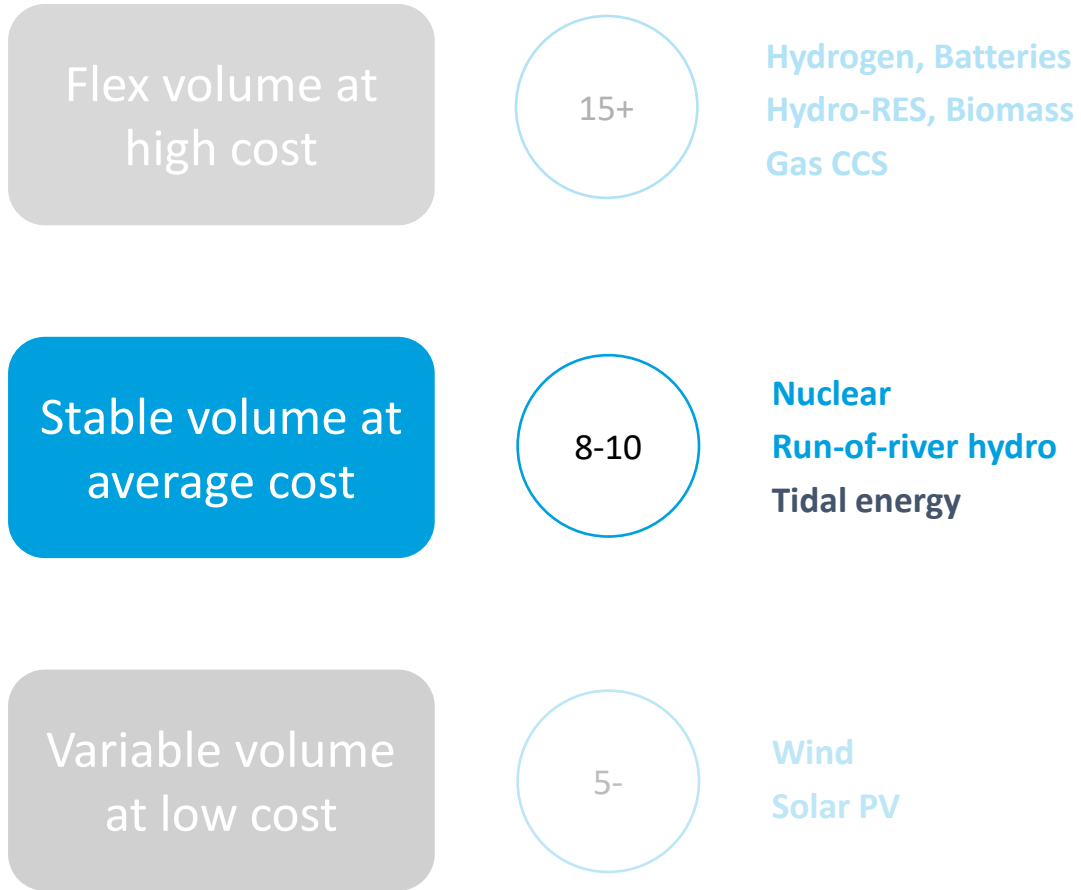
## Supported by





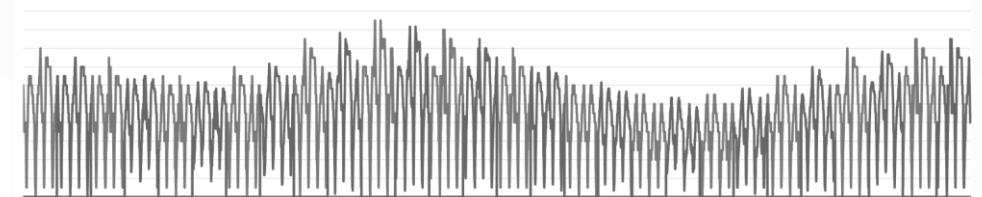
# Tidal energy is predictable and reliable

## Complements production portfolio



## Target customer segments in 600GW ~600 B€ market

- Islands
- Project developers
- CPPA (ESCO)

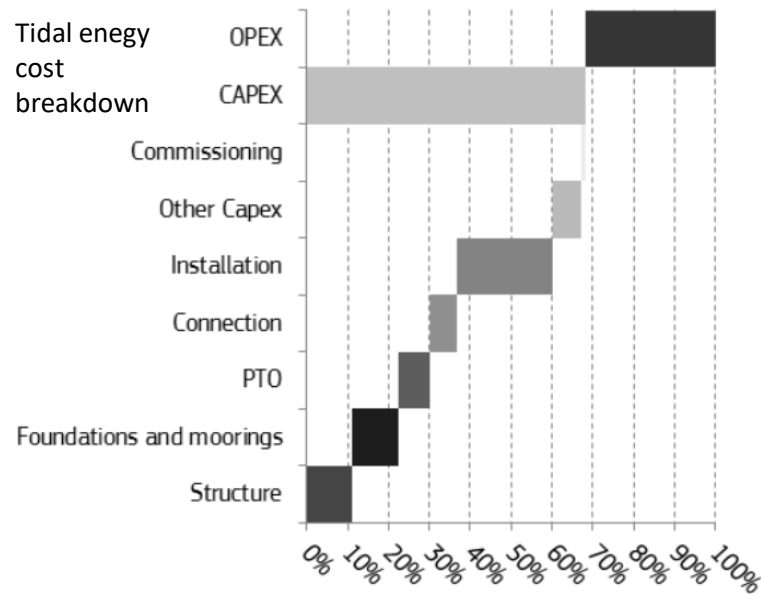


# Low-cost, high-energy yield

## TidalKite, a step change in tidal energy

### Low cost

- Low weight structure
- Towable system (small standard vessels)
- Near shore deployment



Source: <https://marineenergyjournal.org/imej/article/view/18/1>

### High energy yield

- 3D harnessing for higher area coverage
- Adaptable operating depth and direction
- Decoupled energy harvesting (kite) and electricity production (PTO), separately optimised

Flow depth velocity and direction (ebb and flood)

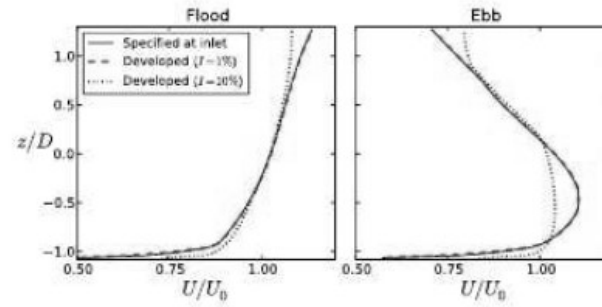
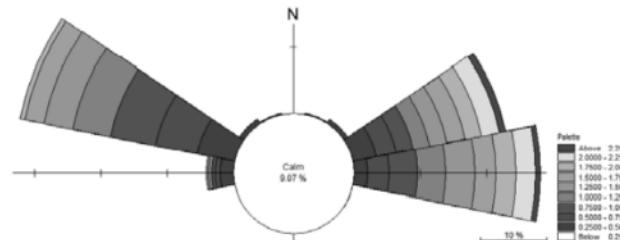
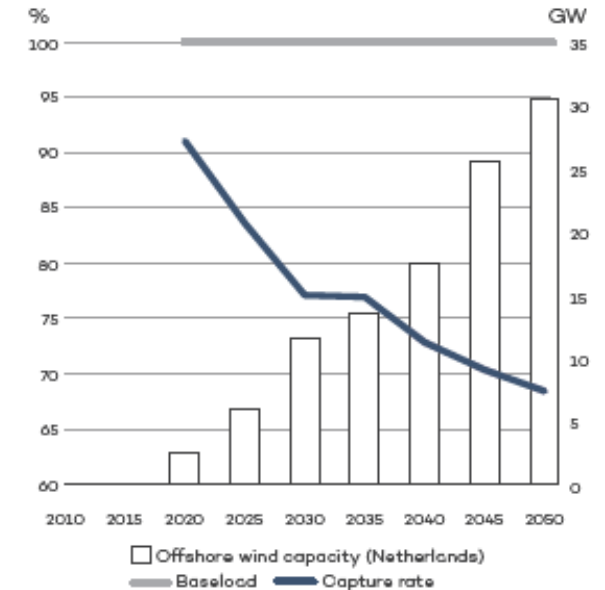


Fig. 4. Developed velocity profiles of Uniform, Flood and Ebb flow downstream of inlet.



### Higher revenues

- Baseload price (capture rate ~100%)
- System integration cost low
- Dependable capacity for ancillary services



<https://afry.com/en/newsroom/news/afry-evaluates-offshore-wind-business-case-dutch-ministry-economic-affairs-and>



# Discussion



# Contact Details



We look forward to supporting you with the right tools and advice in the rapidly changing energy sector!



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