Youwind

2026 Bangkok

From wind resource data to layout, yield and LCOE:

Scenario analysis with and without storage in the Philippines

EE@youwindrenewables.com

Youwind July 2026

Agenda

01 **Introduction to Edvald and Youwind**

02 The process of techno-economic assessment in layout design and LCOE optimisation

03 Introduction to BESS

04 Offshore wind case study with and without BESS

05 Onshore wind case study with BESS and solar as a hybrid system

Youwind – Edvald Edvaldsson. Founder and CTO

Youwind

BSc. Mechanical Engineering
MSc. Wind Energy Engineering

2006-2009 – Risk Management international banking
2011-2017: Orsted wind assessment and layout design
2018-2019 : Youwind advisor (Iberdrola, Scottish Power and Parkwind)
2020 – Today: Youwind CTO. Responsible for design and operations of the system.

Youwind - Designed for Clarity - Powered by Results

Youwind

Founded in 2018, Youwind platform is **designed for both offshore and onshore projects**, our digital solutions streamline wind farm development, optimise workflows through clear case comparison, and ensure validated bankable outcomes.
With seamless integrations and expert-backed guidance, Youwind delivers precision, efficiency, and reliability at every stage

Expert-backed

Developed by wind energy experts with over 15 years hands-on field experience—offering tailored guidance to ensure precision, practicality, and faster results.

Integrated

All-in-one platform combining engineering, GIS and mapping, financial modeling, and other integrations—streamlining workflows and improving accuracy from day one.

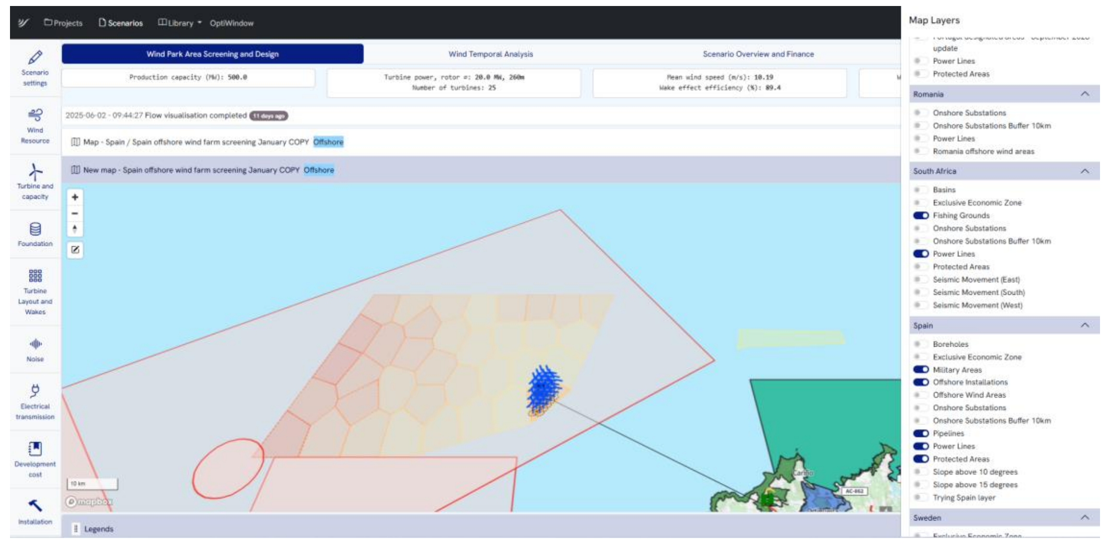
Seamless

Intuitive and structured steps that boost efficiency and collaboration—breaking silos, providing transparency to complex sensitivity analysis, and ensuring traceability across every project.

Bankable

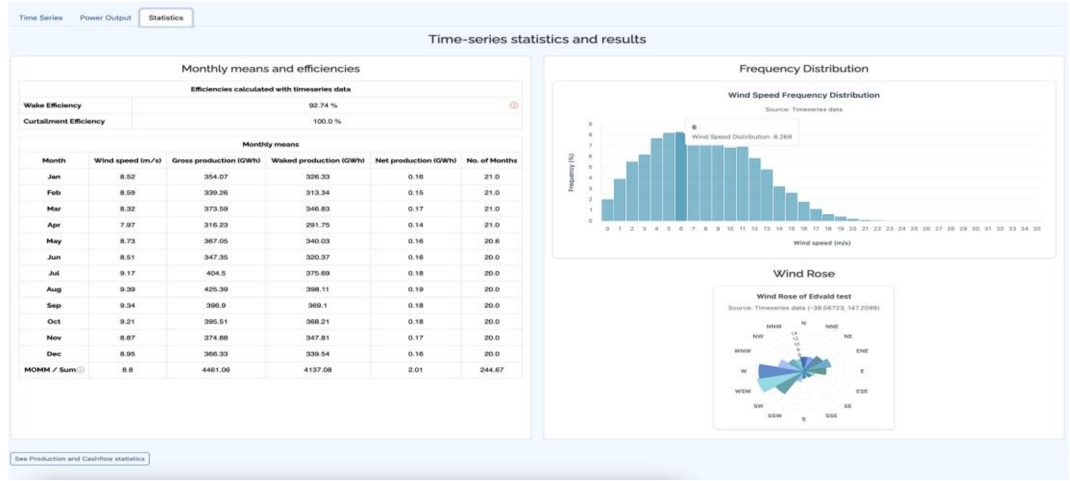
Validated and reliable yield and wake loss calculations that reduce risk, control costs, and accelerate decision-making to ensure clarity on long-term investments.

Youwind - Platform Technical Key Features



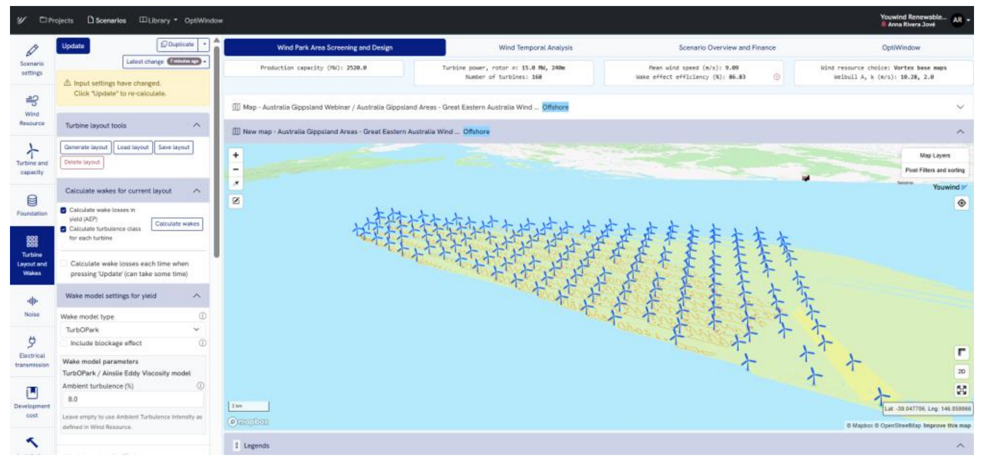
Area Screening

Screen global massive wind development zones for accurate LCoE heat maps and account for GIS constraints



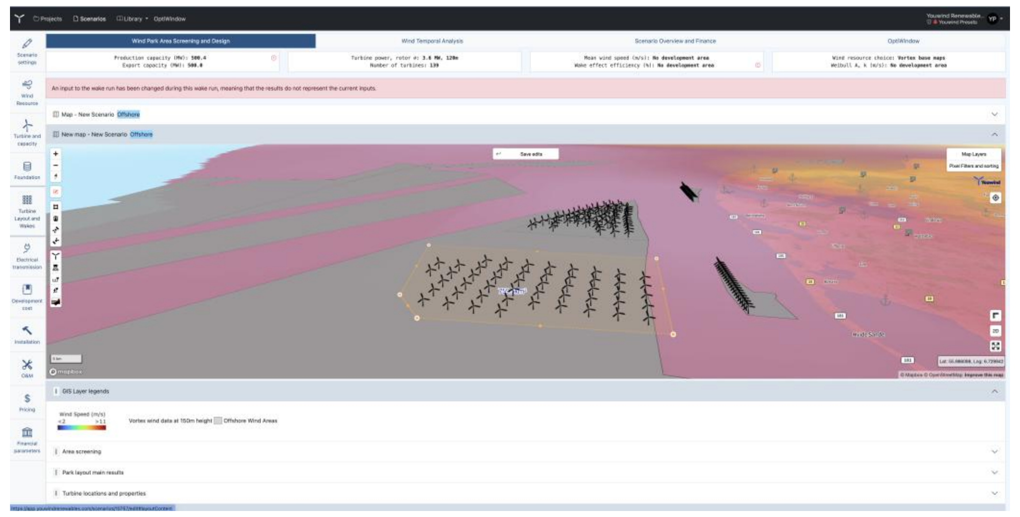
Wind Resource Assessments

Access to validated wind datasets from Vortex or upload your own, both at statistics or time series level



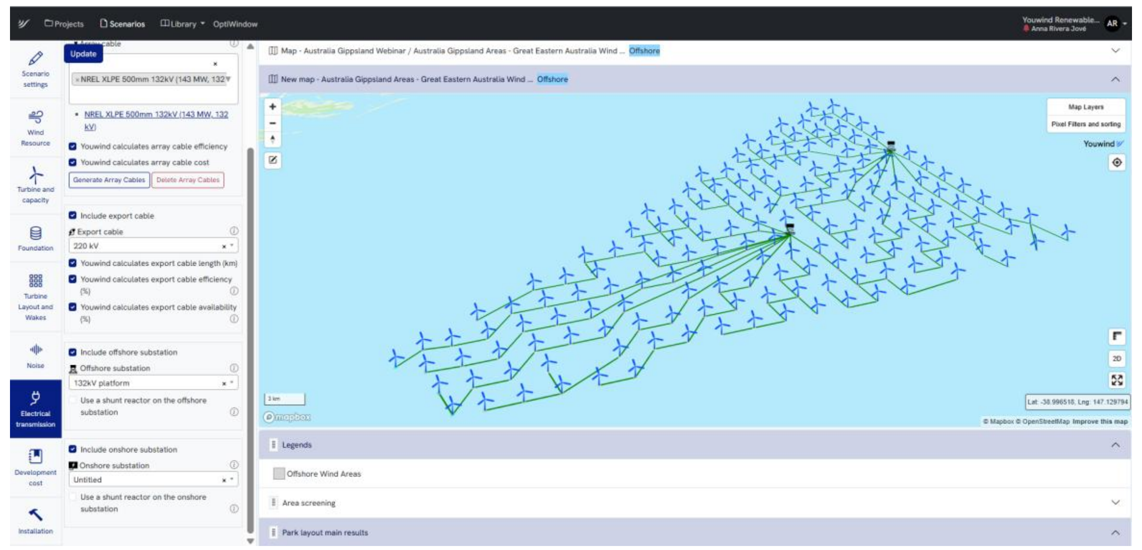
Validated and Advanced Wake Models

Run wake loss simulations with advanced models such as N.O. Jensen and TurbOPark, including blockage



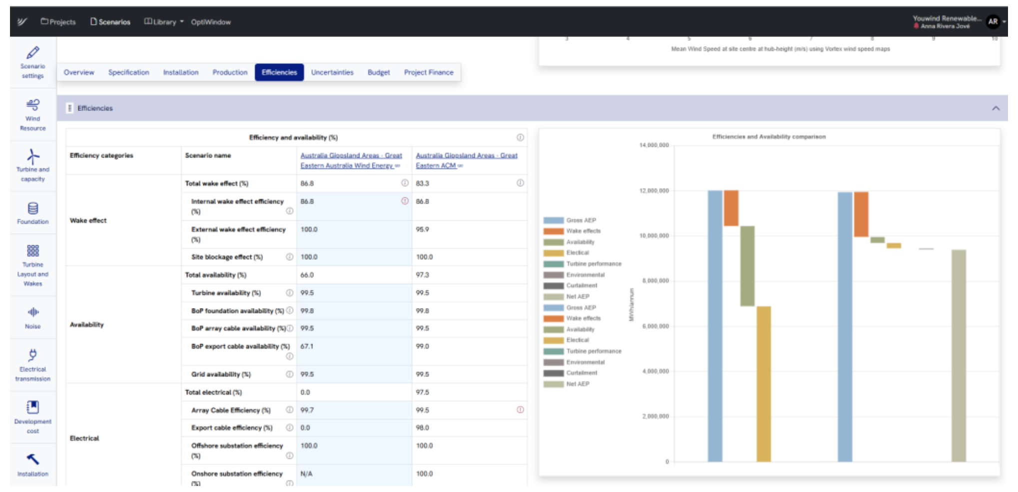
Layout Optimization with neighbouring effects

Visualize wake effects, estimate losses and generate layout scenarios automatically. Calculations performed with more than 5000 turbines in less than 1 hour.



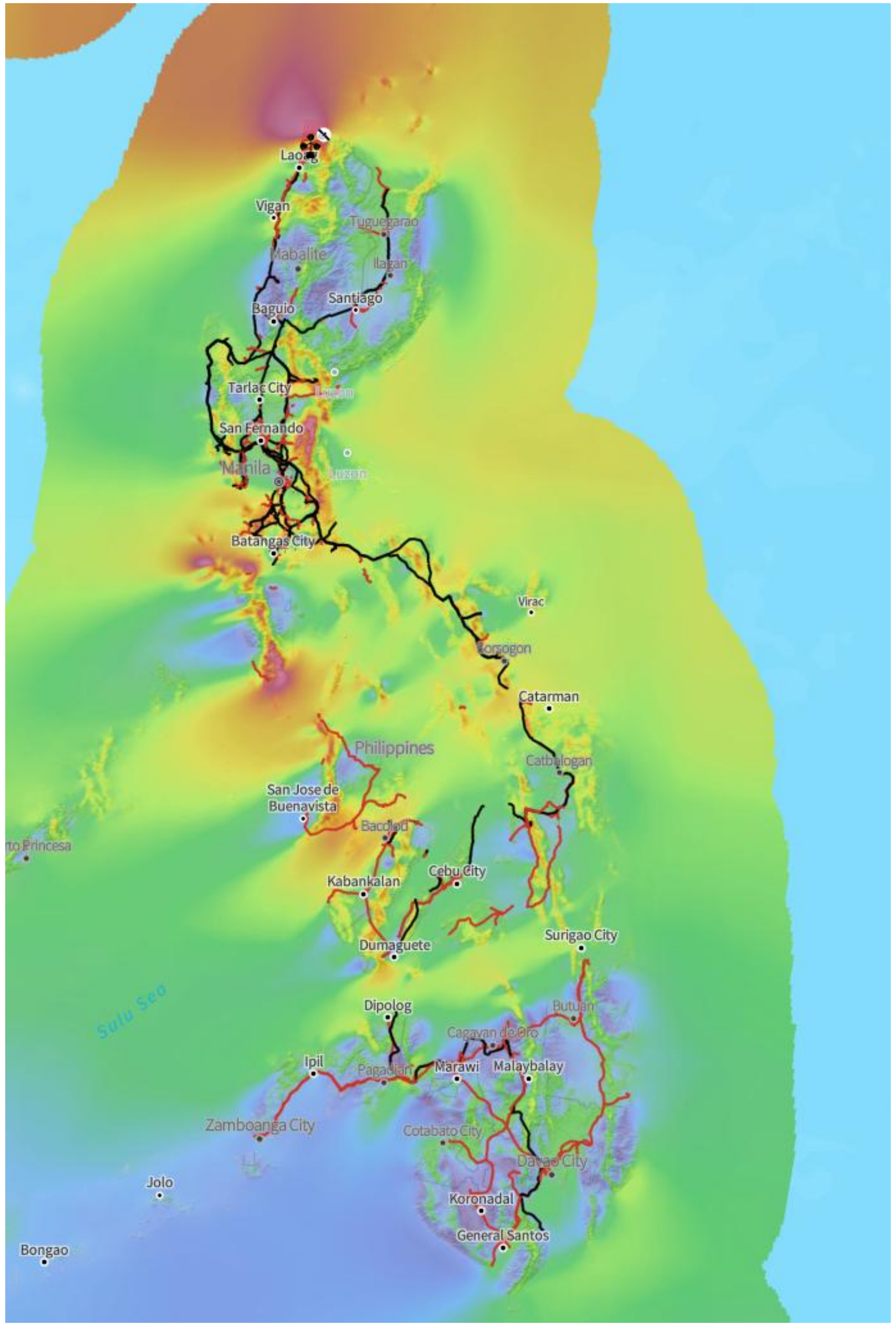
Electric System Design

Efficient generation, optimization, and comparison of cable layouts and routing, incorporating bathymetry and electrical losses.



Bankable Yield Assessments

Generate reliable P50/P90 yield assessments by combining all losses sources, such as wakes, electrical, curtailments, availability, etc.



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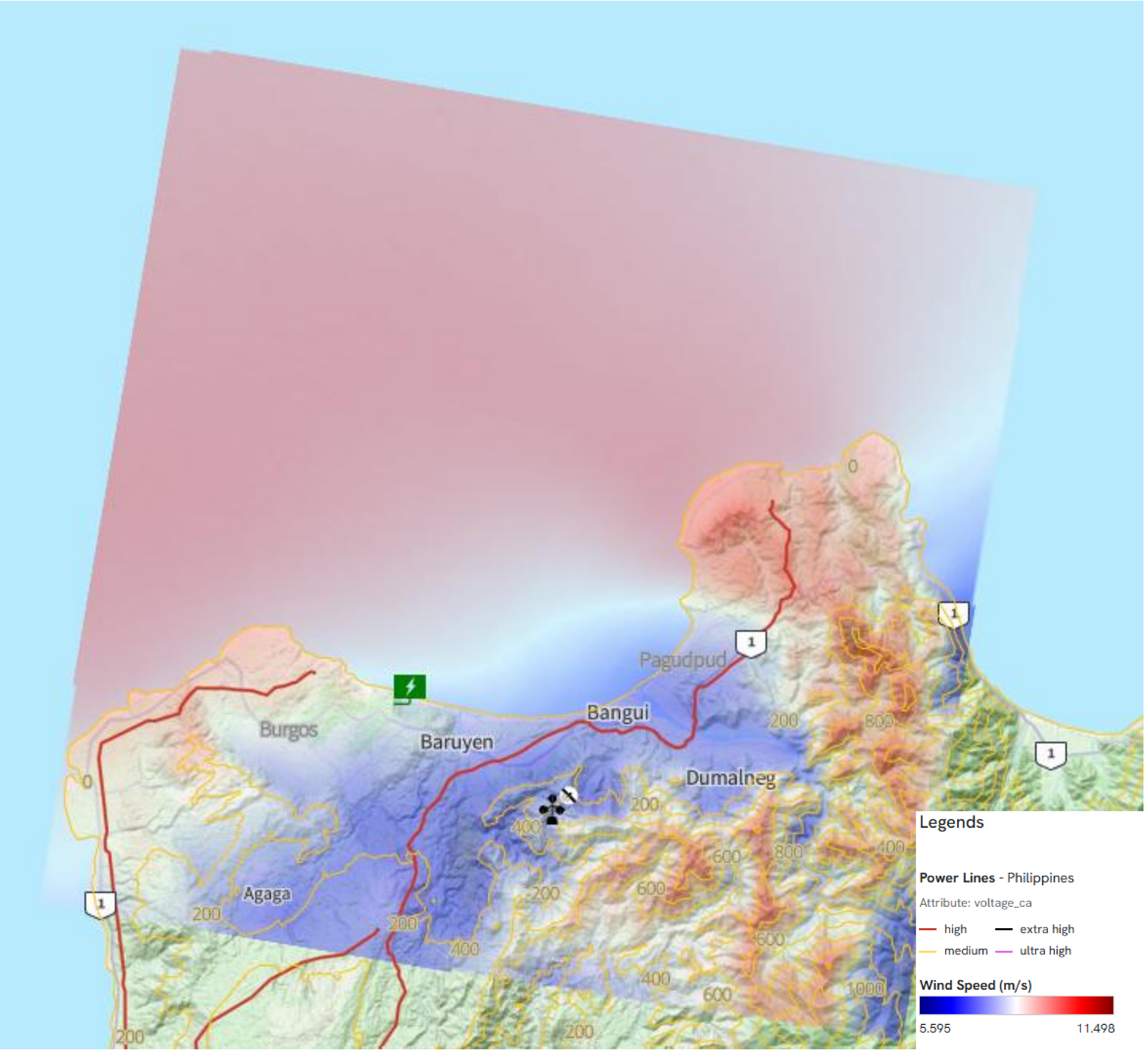
VORTEX

Youwind July 2026



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VORTEX

Youwind July 2026

01 Introduction – Wind resource and economics

A good wind site is not only windy — it must also be:

- Buildable
- Connectable
- Permittable
- Financeable
- Operable

Site conditions drive cost and risk

- Onshore: terrain, access roads, crane logistics, foundations, noise, visual impact, grid connection
- Fixed offshore: water depth, seabed, metocean, foundation type, export cable length, port and vessel access
- Floating offshore: water depth, seabed slope, anchors, moorings, dynamic cables, port strategy

Technology maturity differs by market segment

- Onshore: mature, but constrained by permitting, grid, local acceptance and transport
- Fixed offshore: commercial scale, but exposed to cable, vessel, foundation and installation risk
- Floating offshore: technically proven, but still scaling moorings, dynamic cables, floating substations and O&M

Energy yield is the commercial foundation

- Wind resource uncertainty directly affects revenue confidence, financing and bid strategy
- Wake losses, layout, availability, curtailment and measurement strategy all influence LCOE

The purpose of this crash workshop is to identify which of these levers matter most, and where the biggest improvements can realistically come from.

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Area screening for offshore wind parks

1. **Government-designated areas**
2. Wind resource
3. Bathymetry
4. Soil structure for foundation
5. Distance to shore (grid connection, harbour)

Area screening for offshore wind parks

1. **Government-designated areas**
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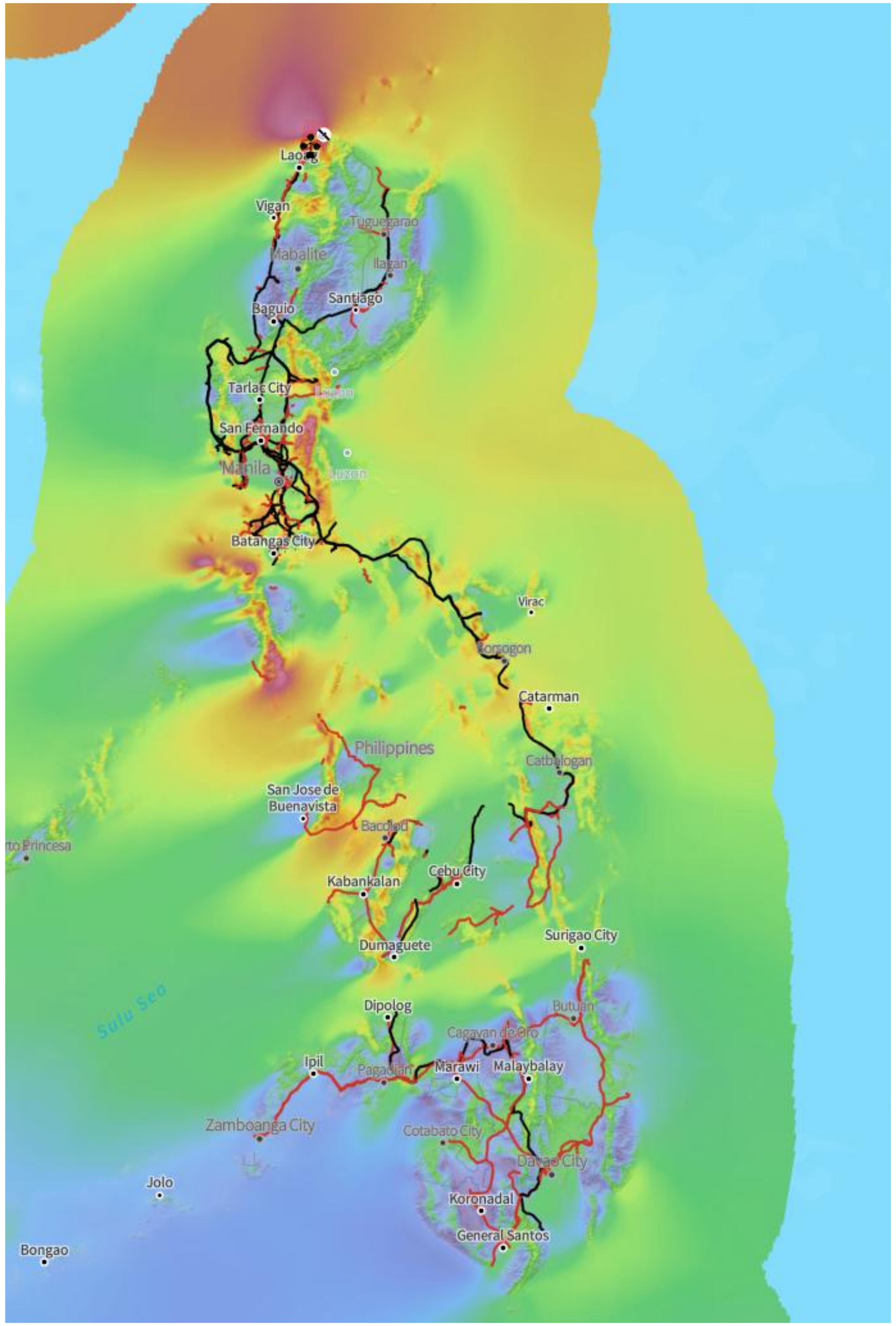
Wind power:

$$P = \frac{1}{2}\rho A {\color{red}v}^3 \text{ [W]}$$

A [m²] cross-sectional area
${\color{red}v}$ [m/s] wind speed



02 The process of techno-economic assessment on LCOE optimisation

Area screening for offshore wind parks

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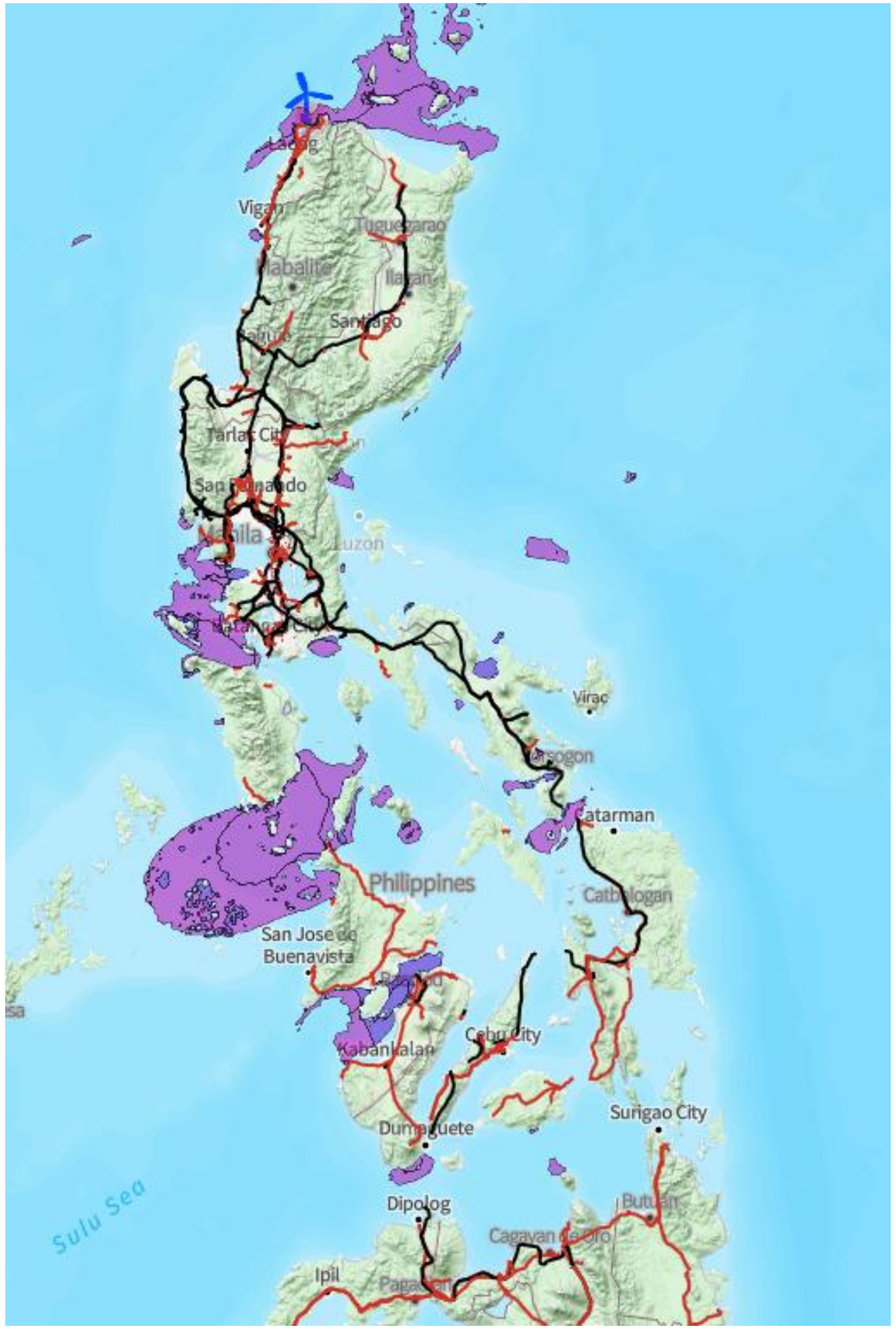

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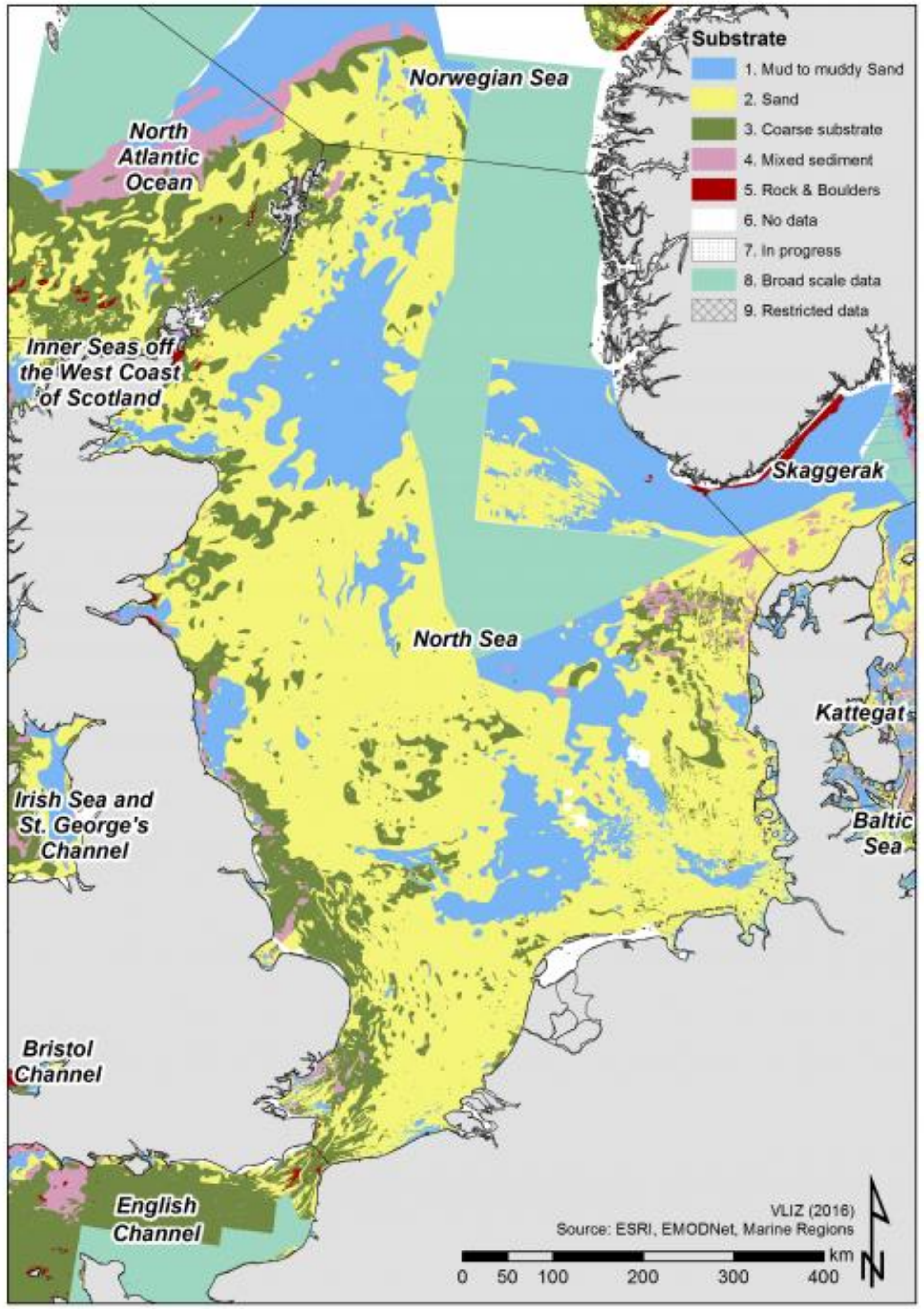

Area screening for offshore wind parks

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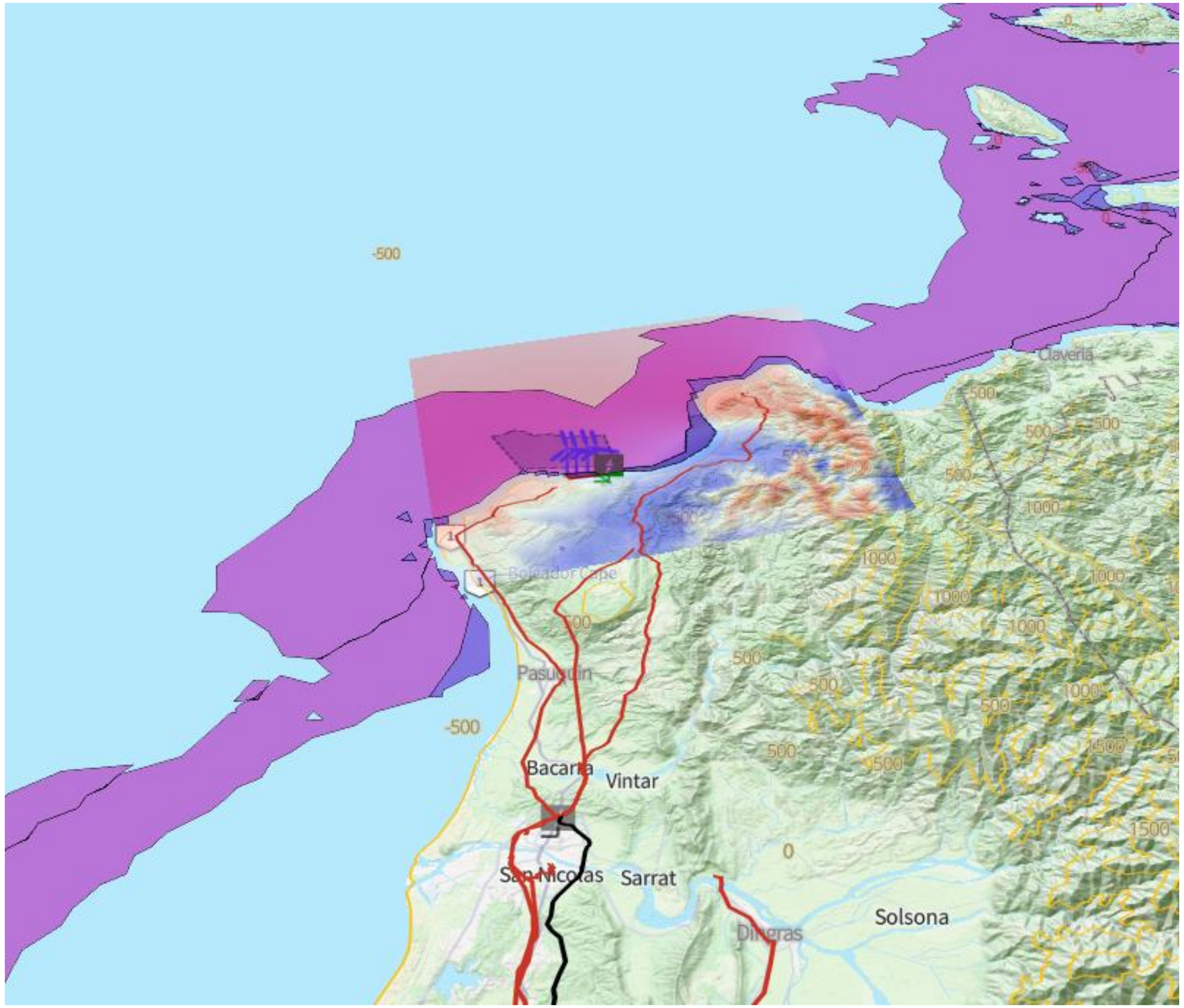
5. **Distance to shore (grid connection, harbour)**



Offshore logistics

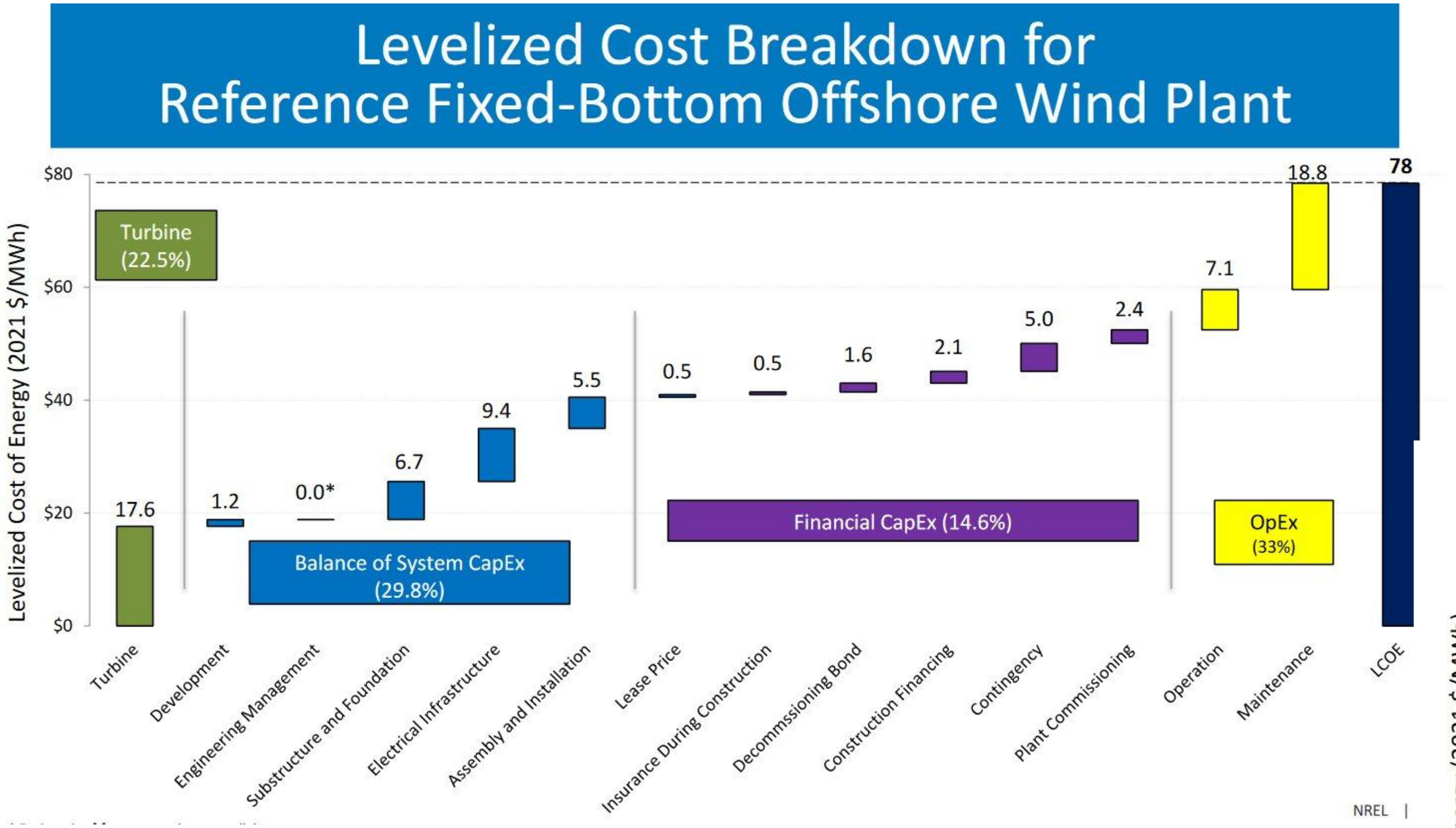
Jack-up vessel for wind park installation

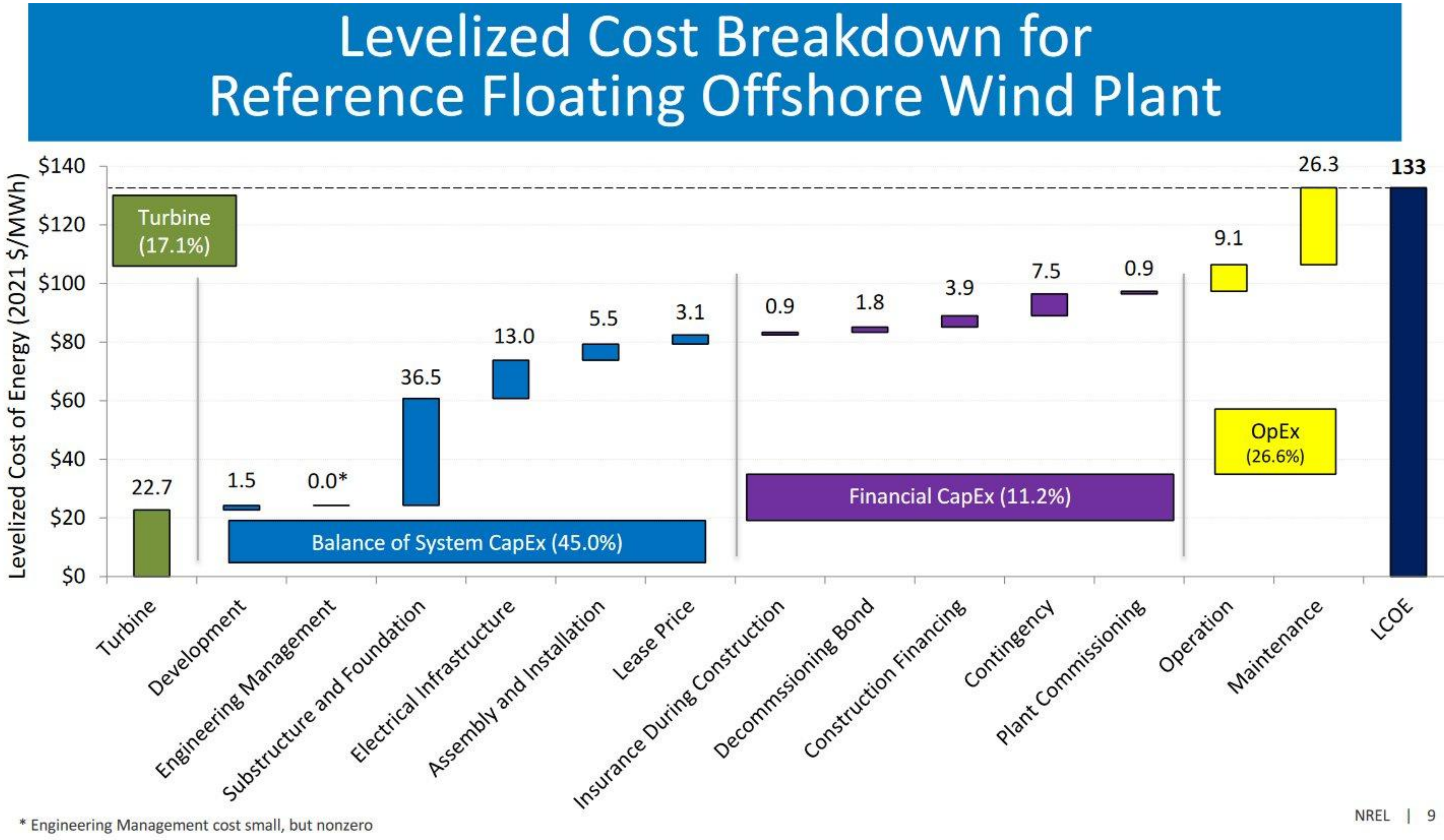
Wind energy port in Eemshaven, The Netherlands

Service Operation Vessel (SOV)

Helicopter service

02 The process of techno-economic assessment on LCOE optimisation





Source: NREL

02 The process of techno-economic assessment on LCOE optimisation

$$\text{LCOE} = \frac{\text{NPV of Total Costs Over Lifetime}}{\text{NPV of Electrical Energy Produced Over Lifetime}}$$

$$\text{LCOE} = \frac{\sum \frac{(I_t + M_t + F_t)}{(1 + r)^t}}{\sum \frac{E_t}{(1 + r)^t}}$$

- What happens if CAPEX increases 40%?
- What happens if WACC increases by 7%?

Case	CAPEX	OPEX	WACC	Capacity factor	LCOE	Change vs base
Base case	€3.5M/MW	€60M/year	7%	45%	€86.8/MWh	—
CAPEX +40%	€4.9M/MW	€60M/year	7%	45%	€115.4/MWh	+33.0%
WACC +7 percentage points	€3.5M/MW	€60M/year	14%	45%	€142.0/MWh	+63.7%
WACC +7% relative	€3.5M/MW	€60M/year	7.49%	45%	€90.3/MWh	+4.1%

02 The process of techno-economic assessment on LCOE optimisation

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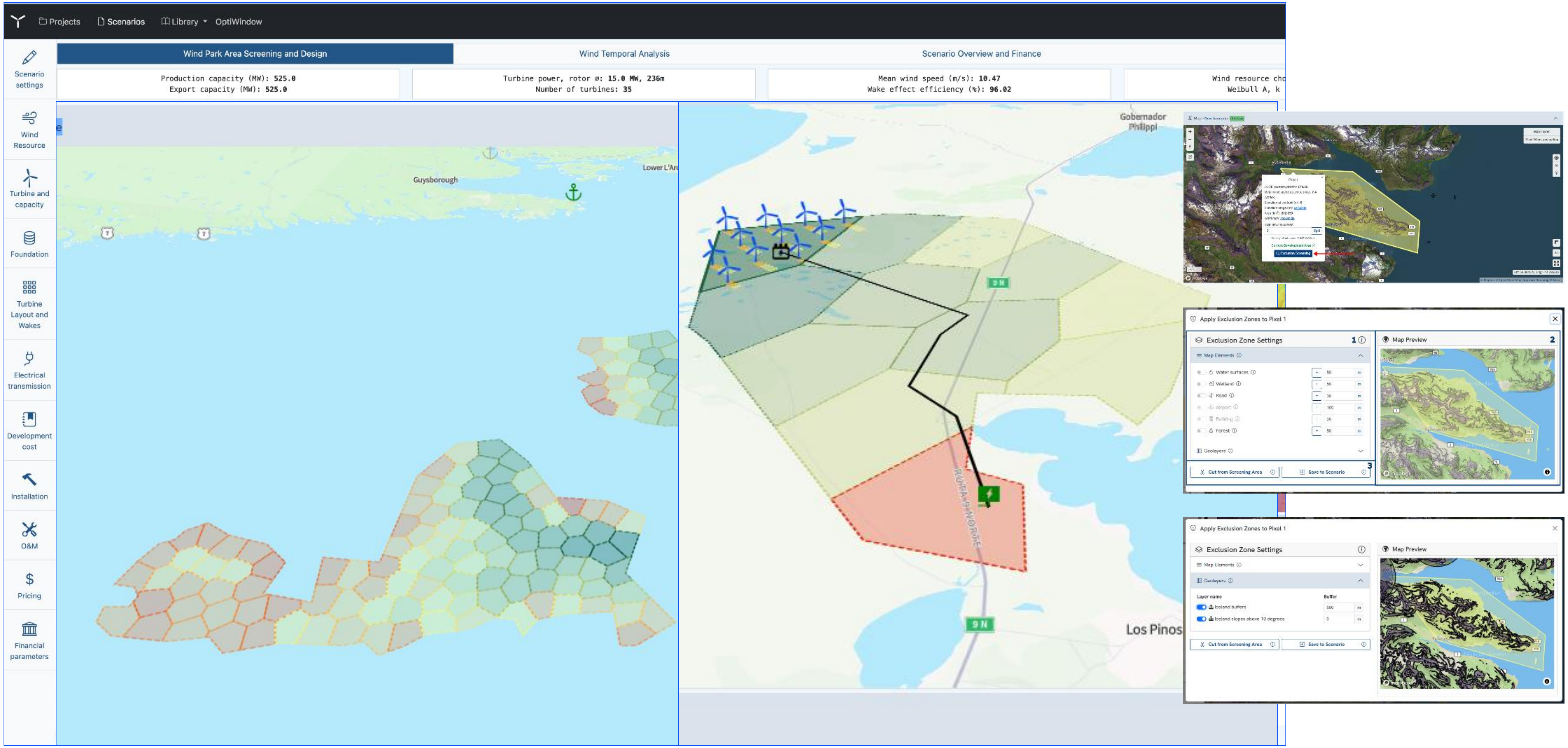

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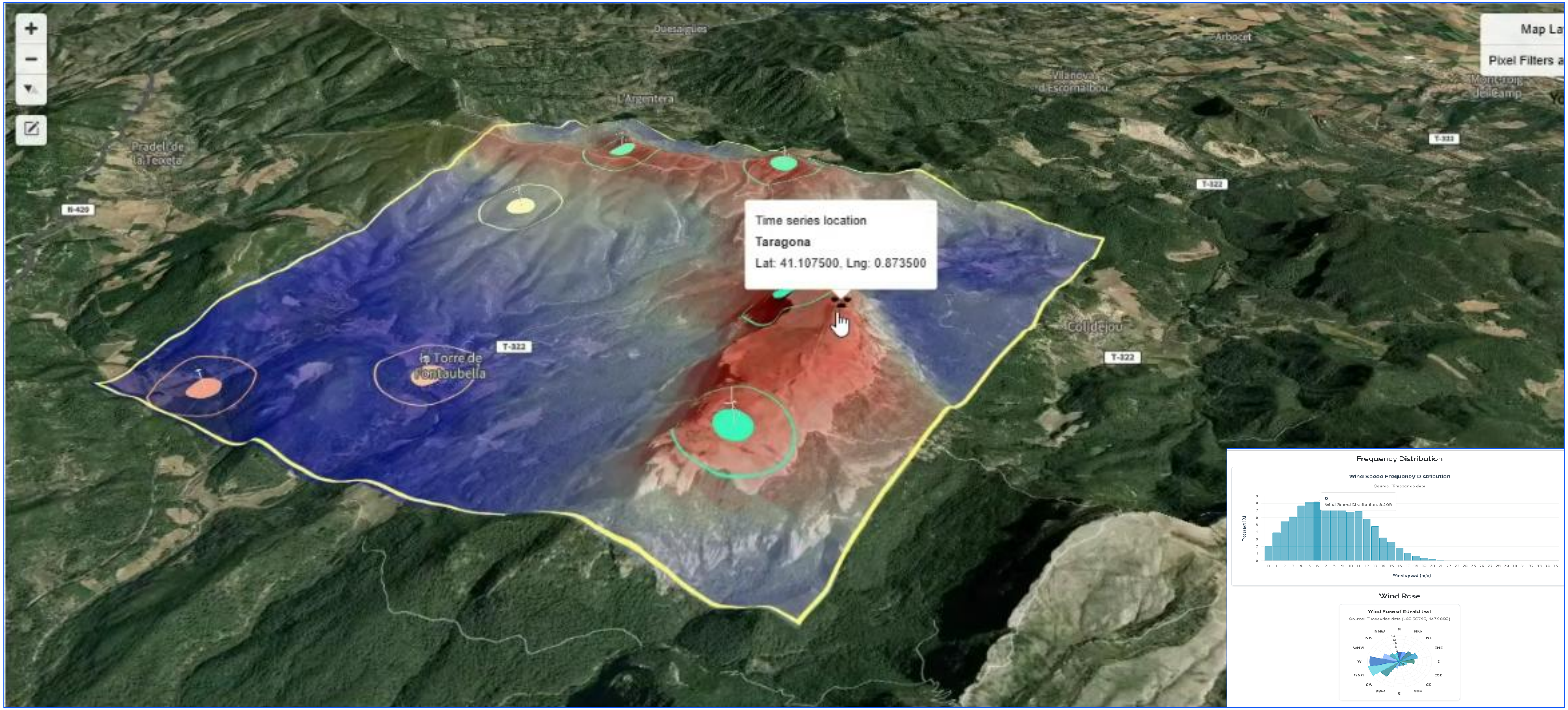

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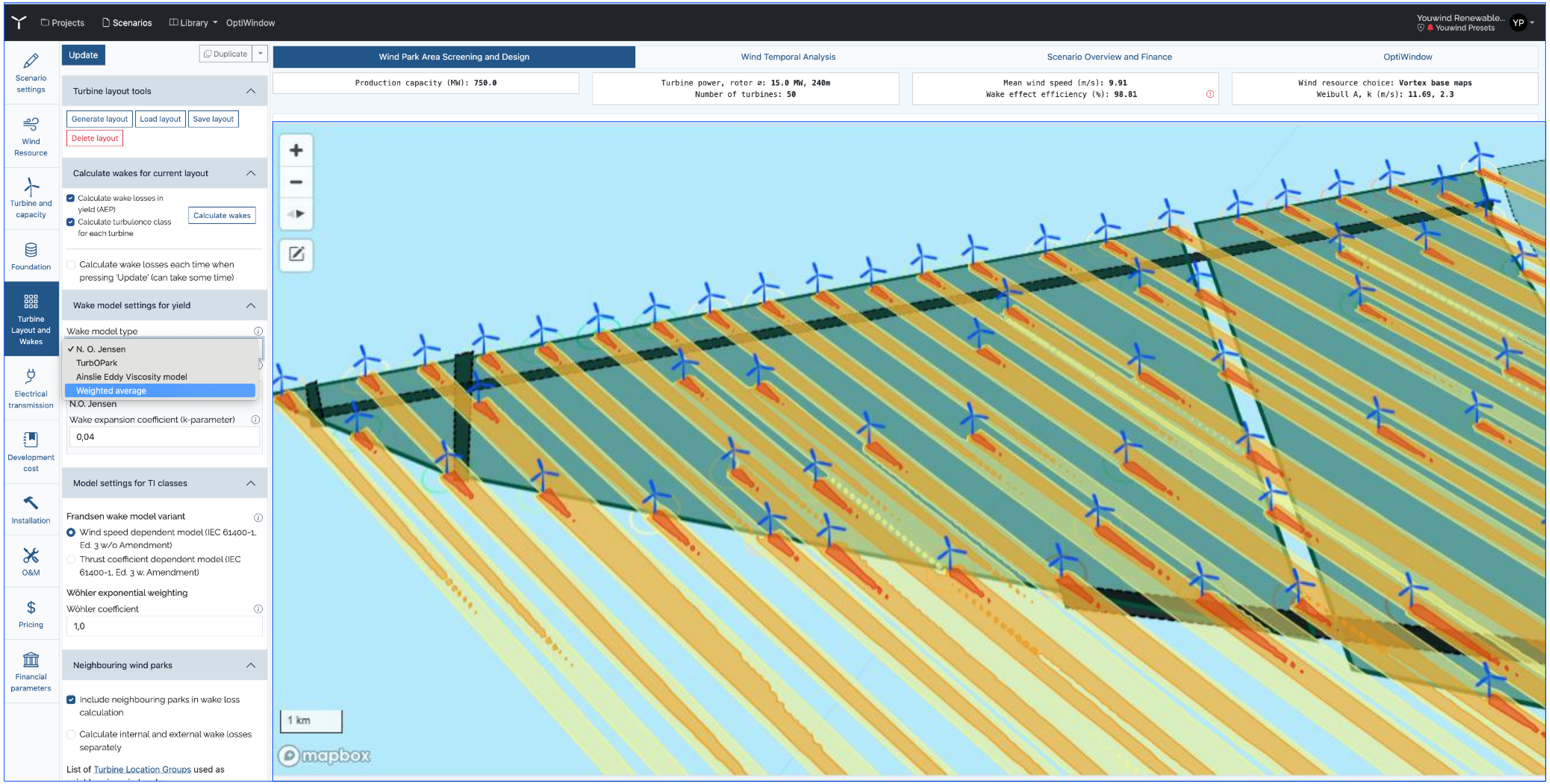

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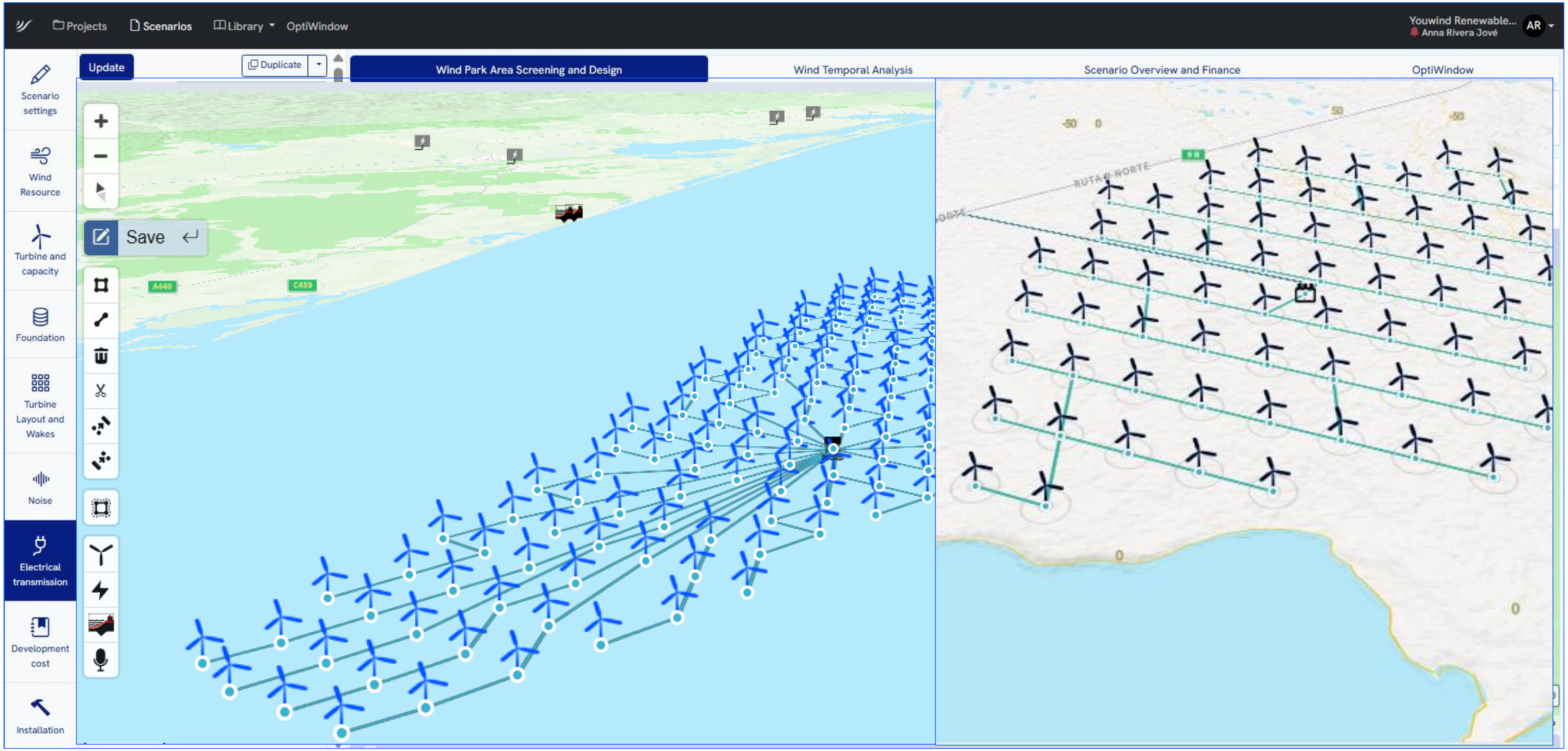

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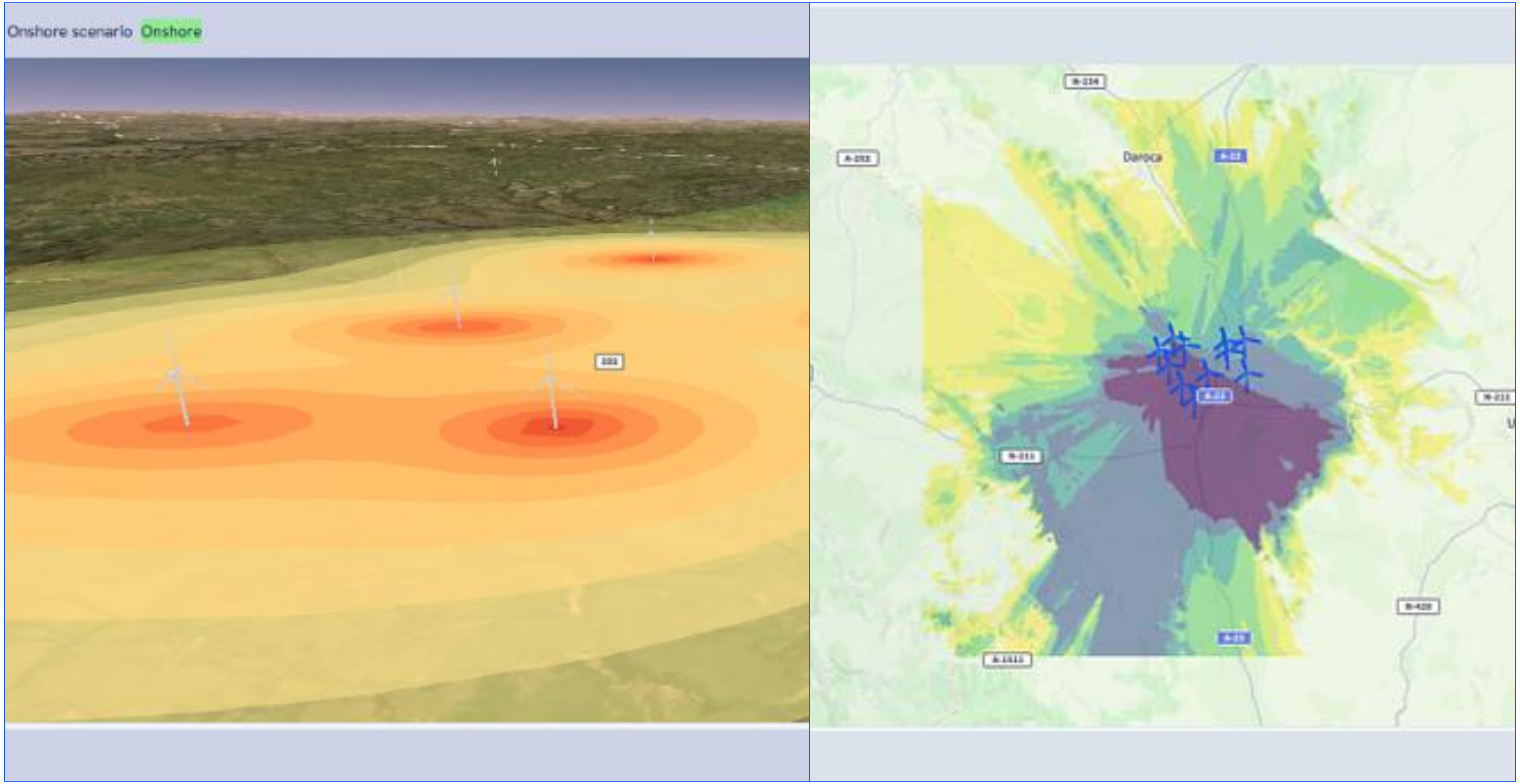
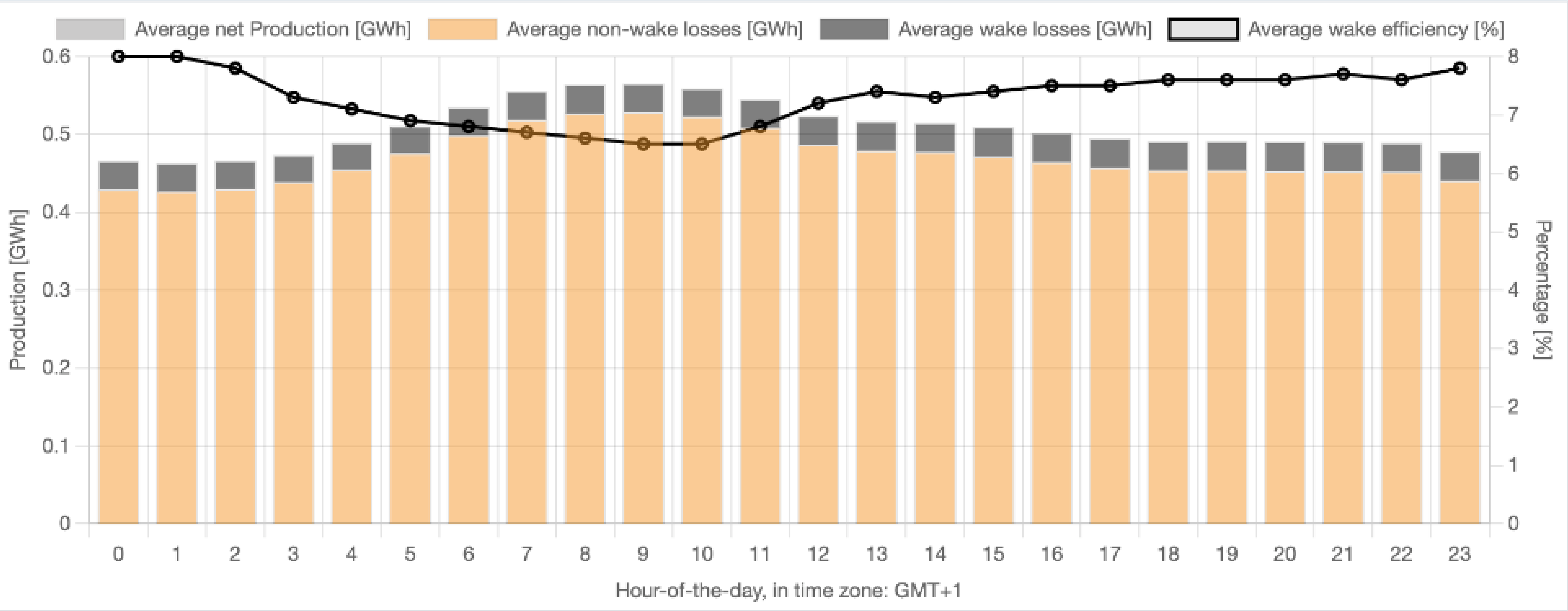


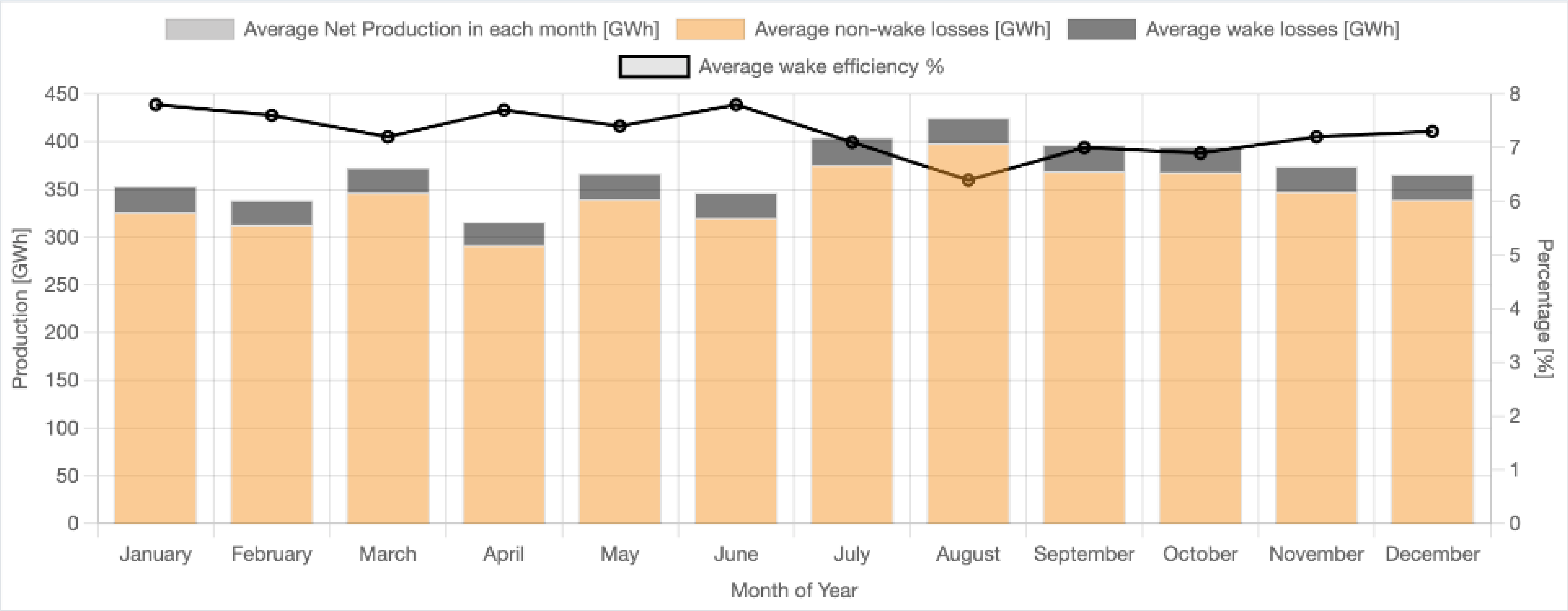
02 The process of techno-economic assessment on LCOE optimisation

Youwind

Admins Company
admin@example.com

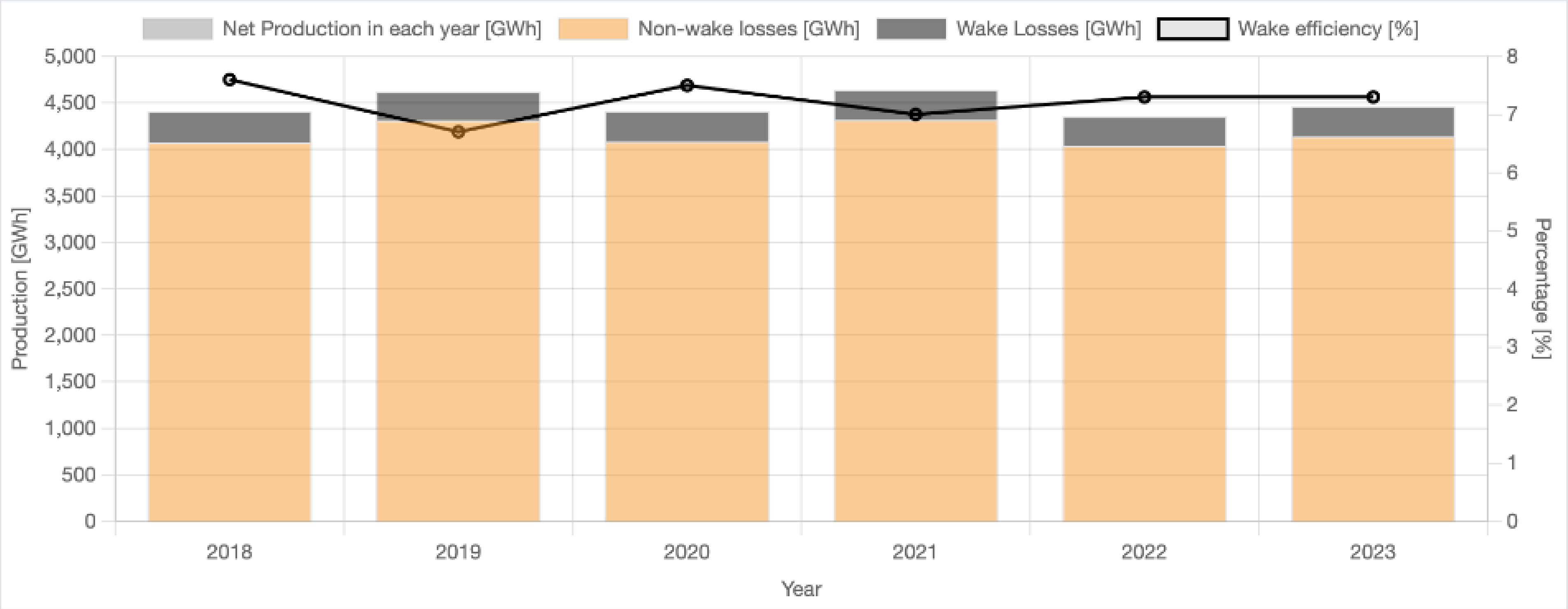
Daily and seasonal variation of production





Annual energy production

Net AEP statistics		
	Based on time-series	**Based on Weibull distribution**
P50 gross AEP - no losses	4,461.06 GWh	4,134.06 GWh
P50 waked AEP - wake losses only	4,137.08 GWh	3,833.84 GWh
P75 waked AEP - 20 years - wake losses only	3,932.28 GWh	3,644.05 GWh
P90 waked AEP - 20 years - wake losses only	3,748.72 GWh	3,473.94 GWh
P50 net AEP - all losses	2.01 GWh	2.02 GWh
P75 net AEP - 20 years - all losses	1.91 GWh	1.92 GWh
P90 net AEP - 20 years - all losses	1.82 GWh	1.83 GWh
P90 P50 ratio - 20 years	0.91	0.91



Cashflow

02 The process of techno-economic assessment on LCOE optimisation

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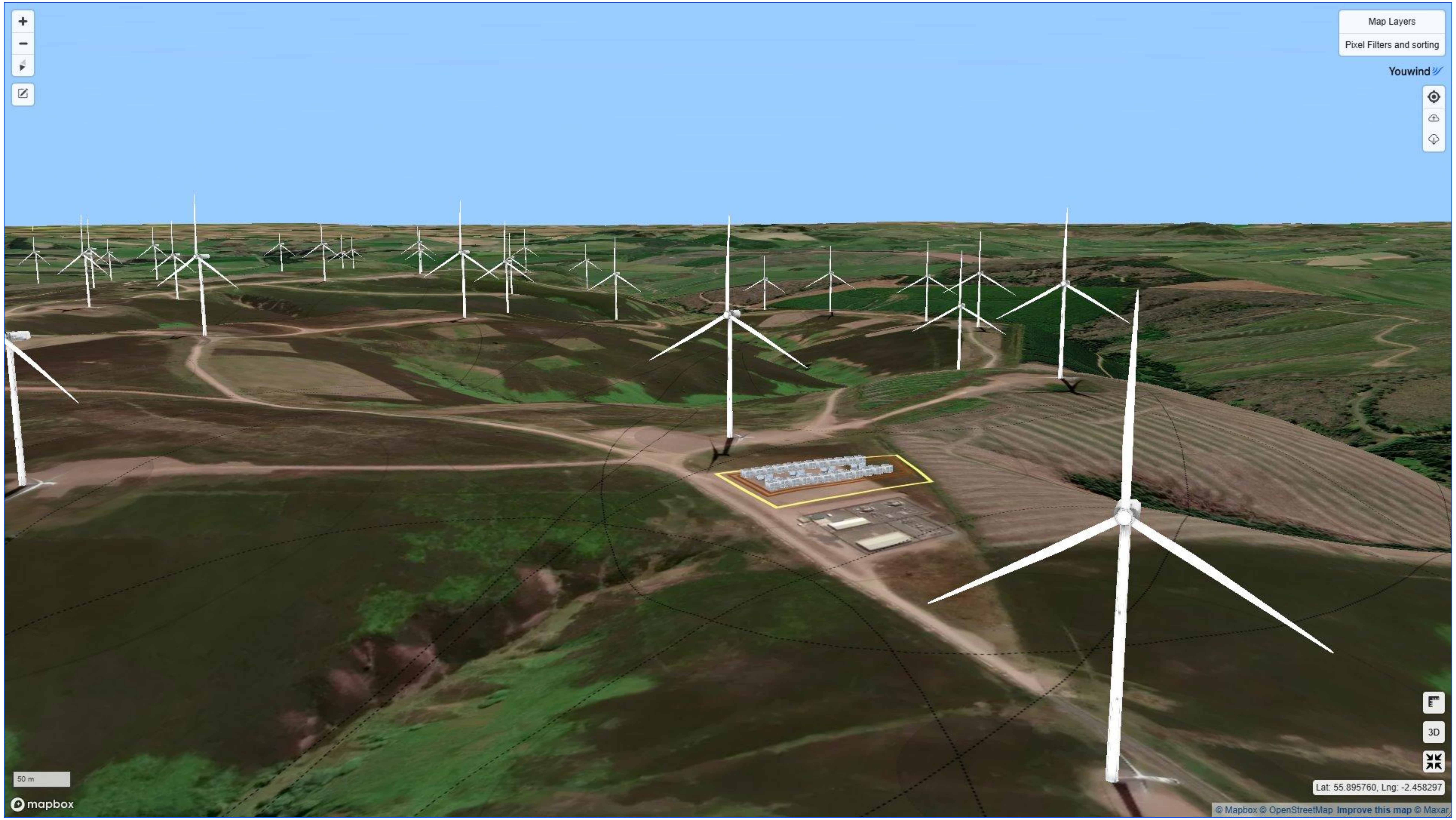

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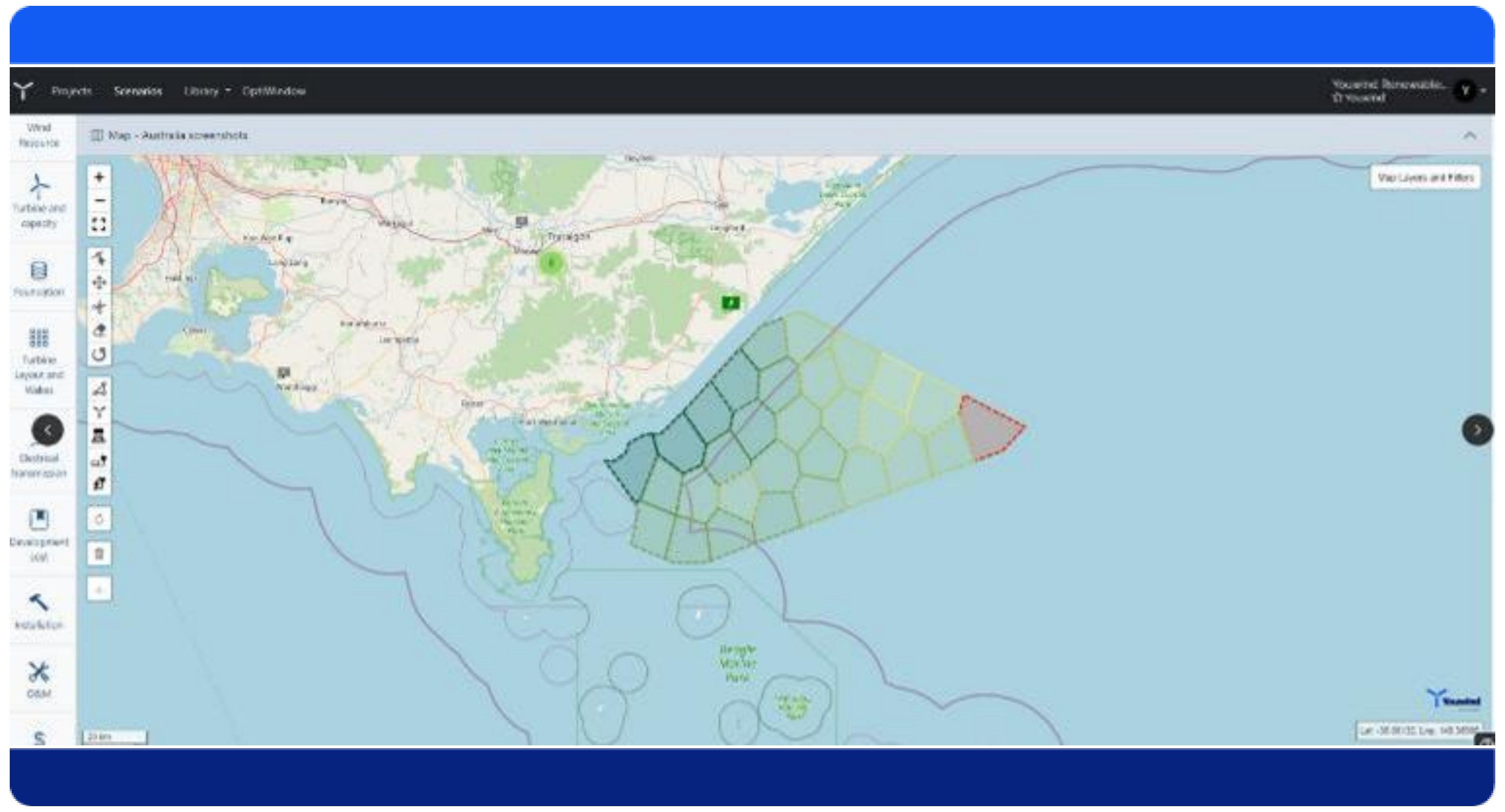
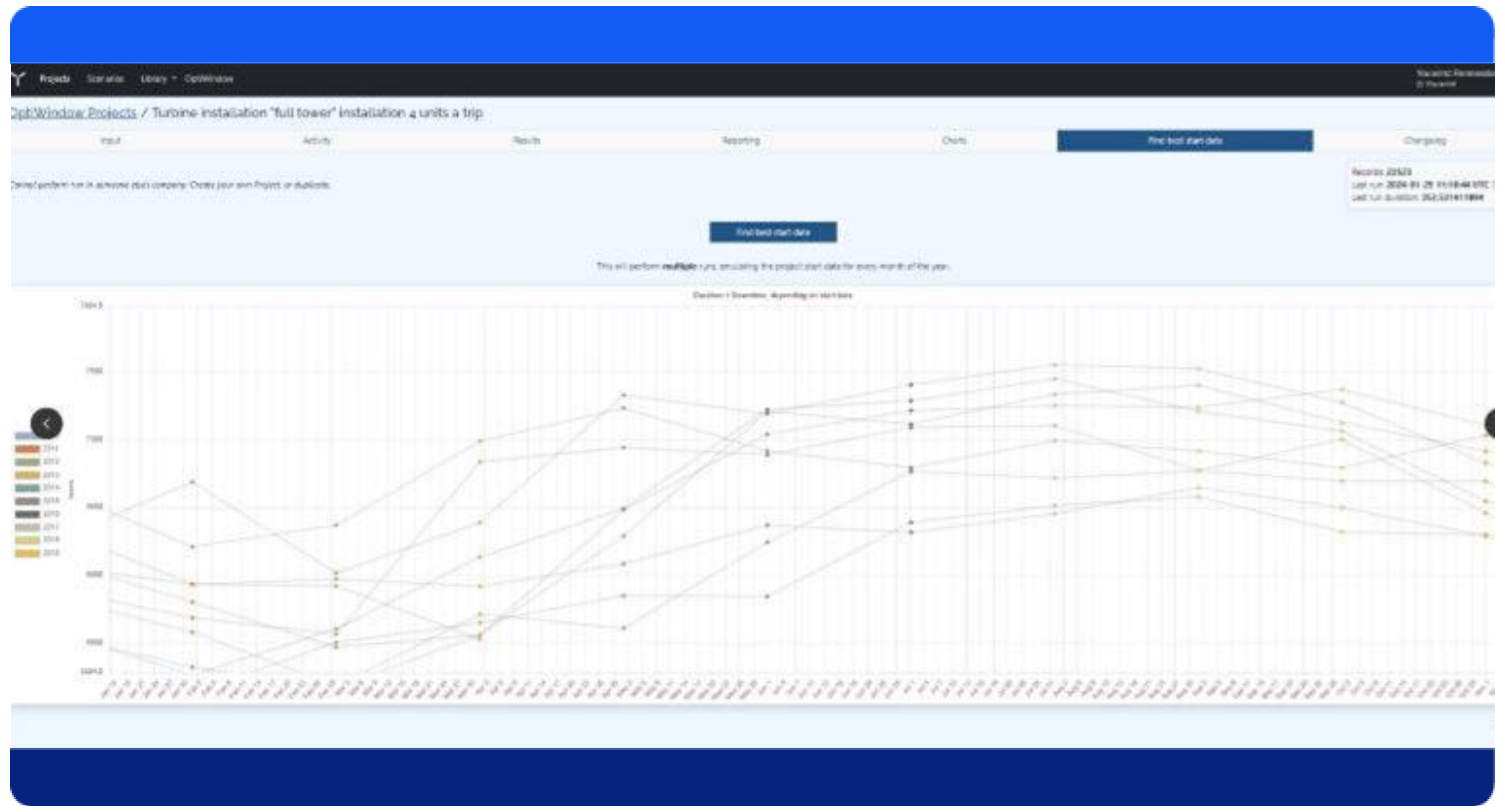




Screen

01

Optimize

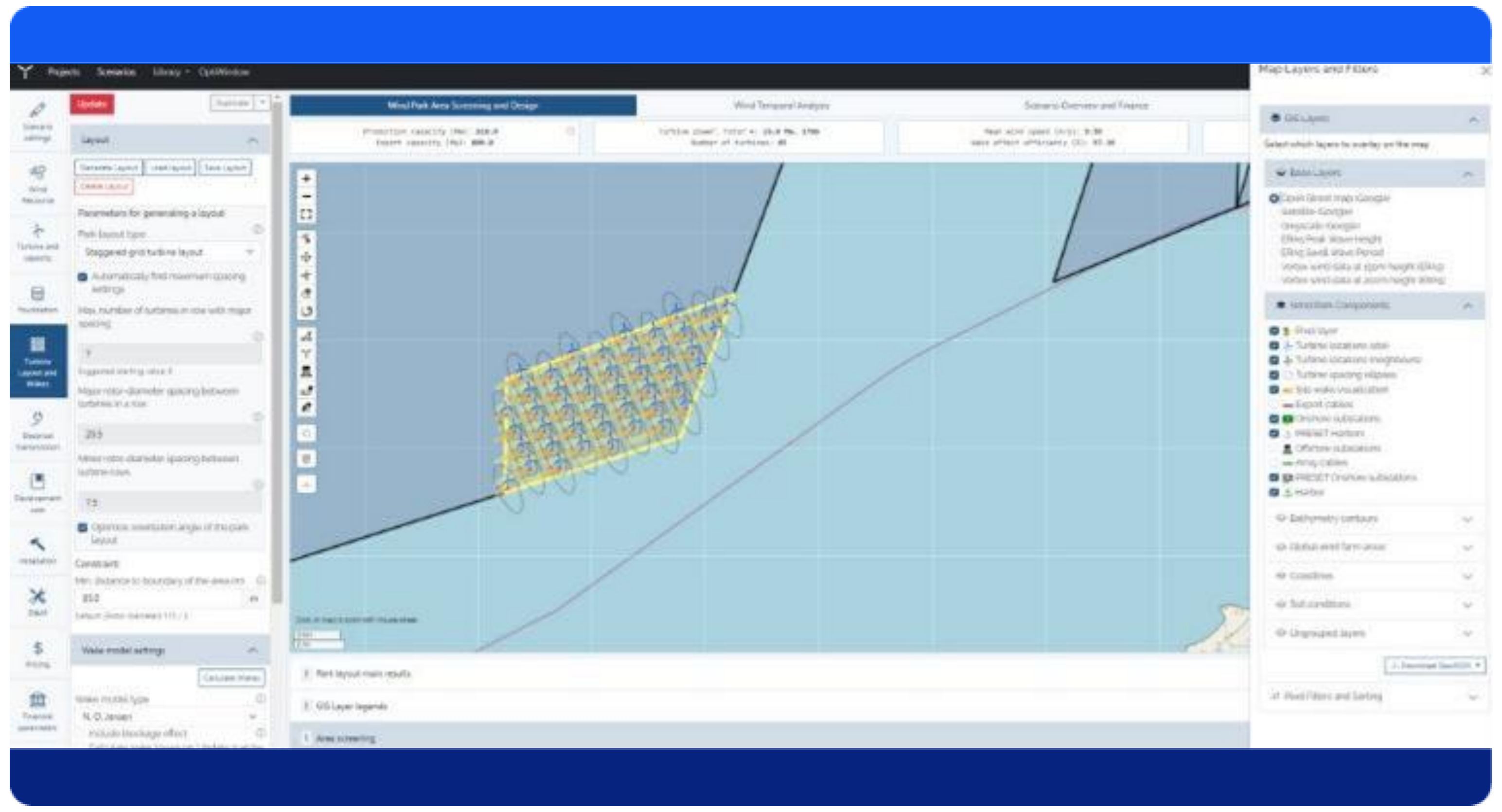
03

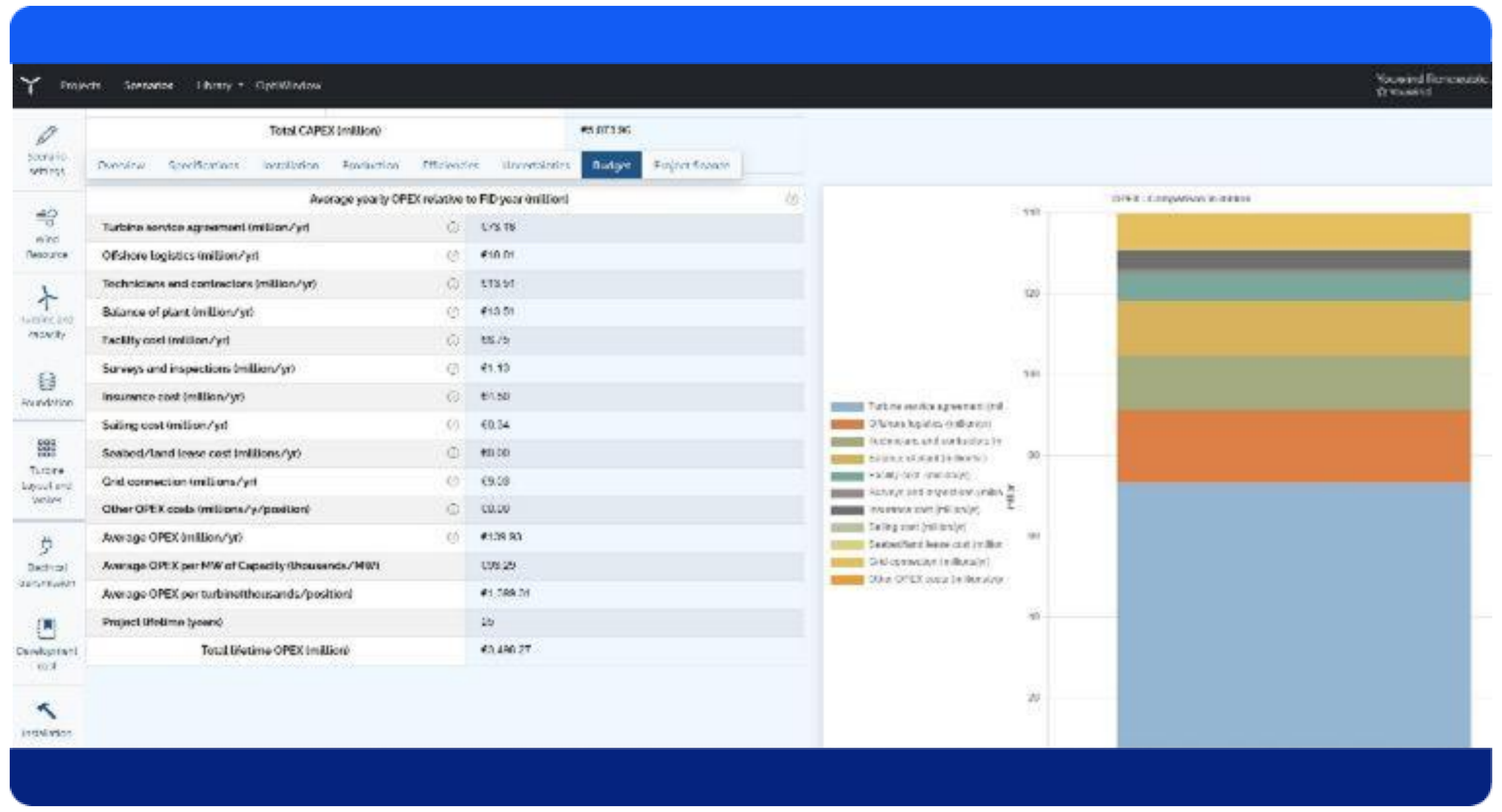
02

Design

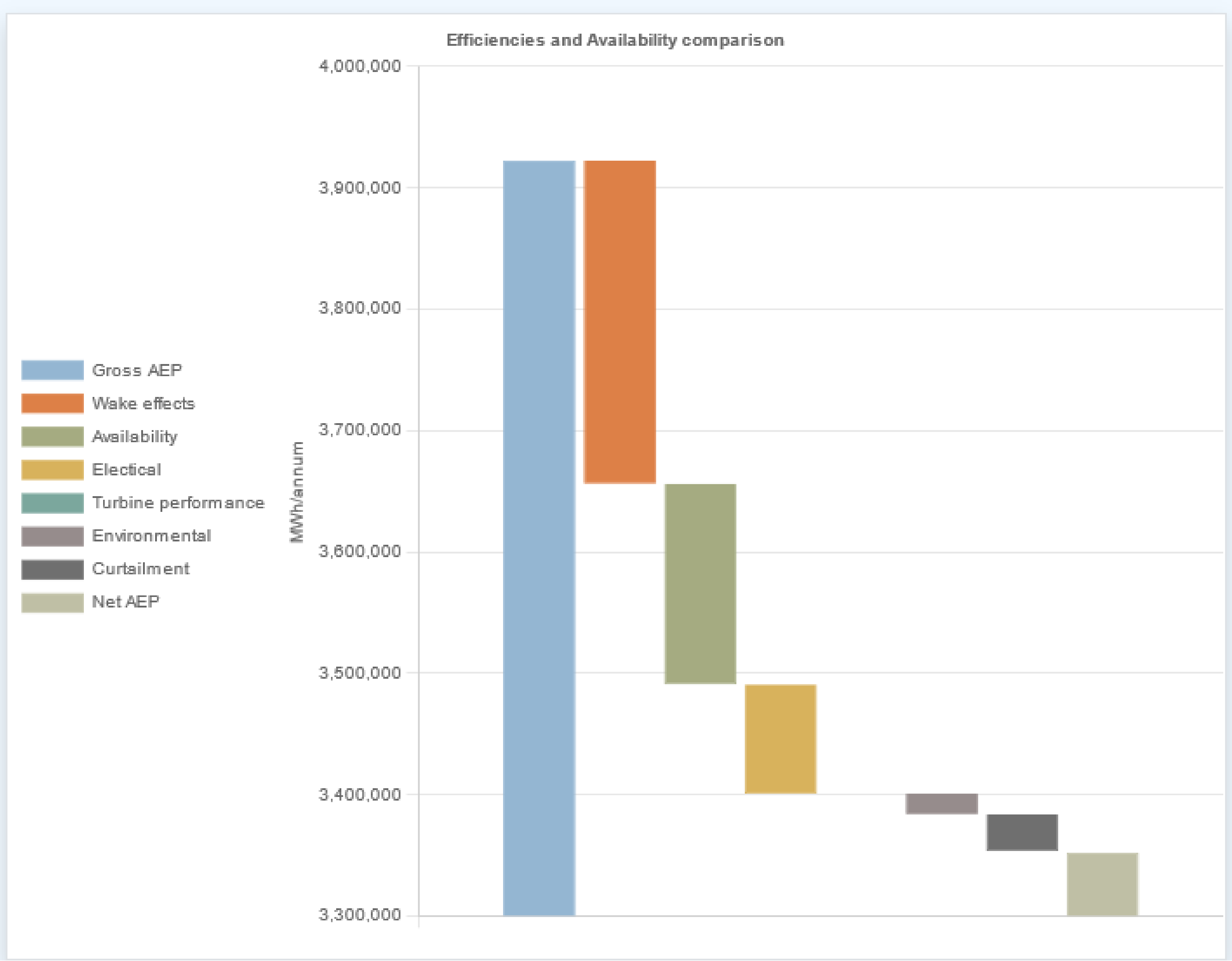
04

Decide





Efficiency of offshore wind parks

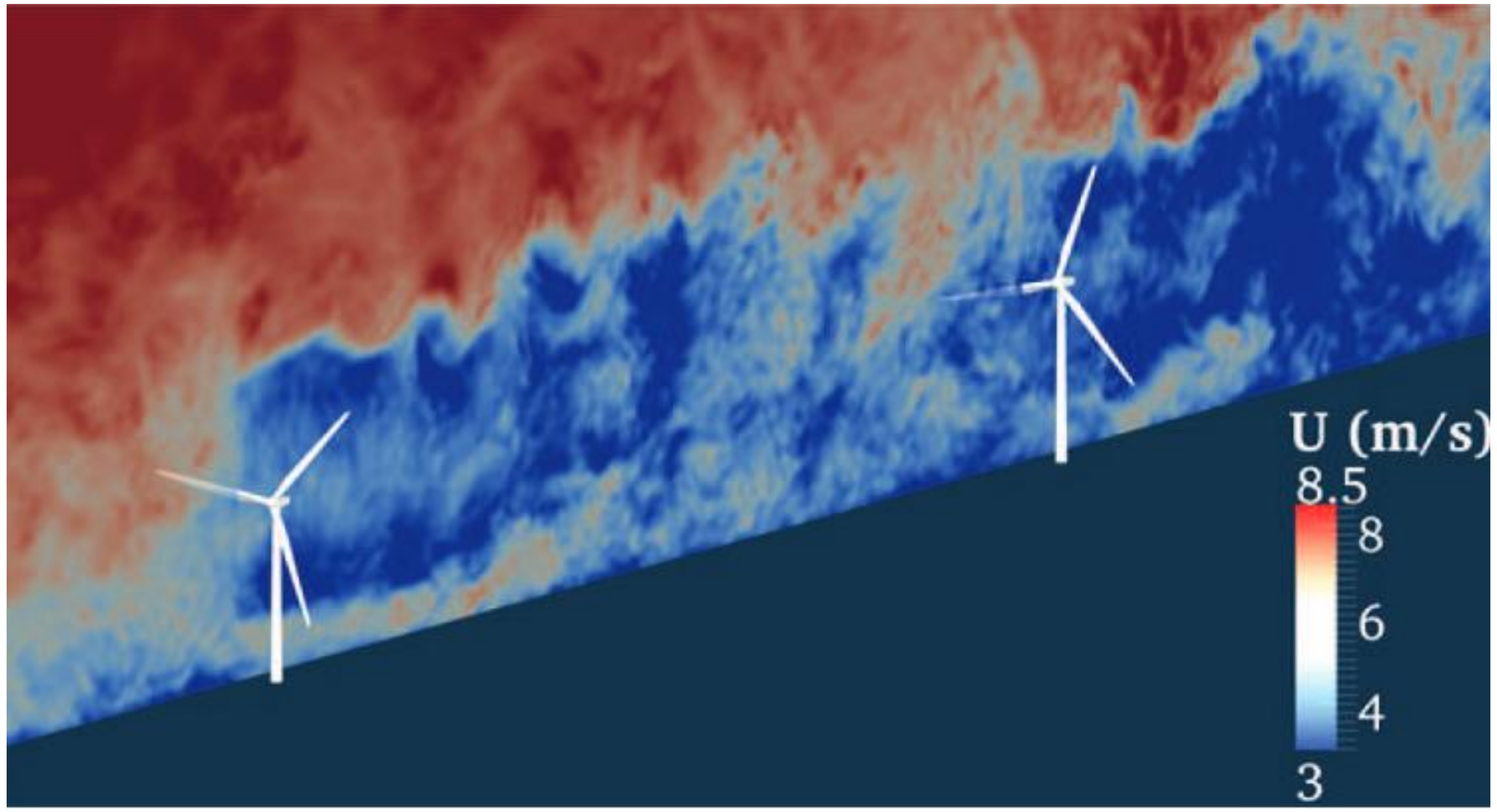


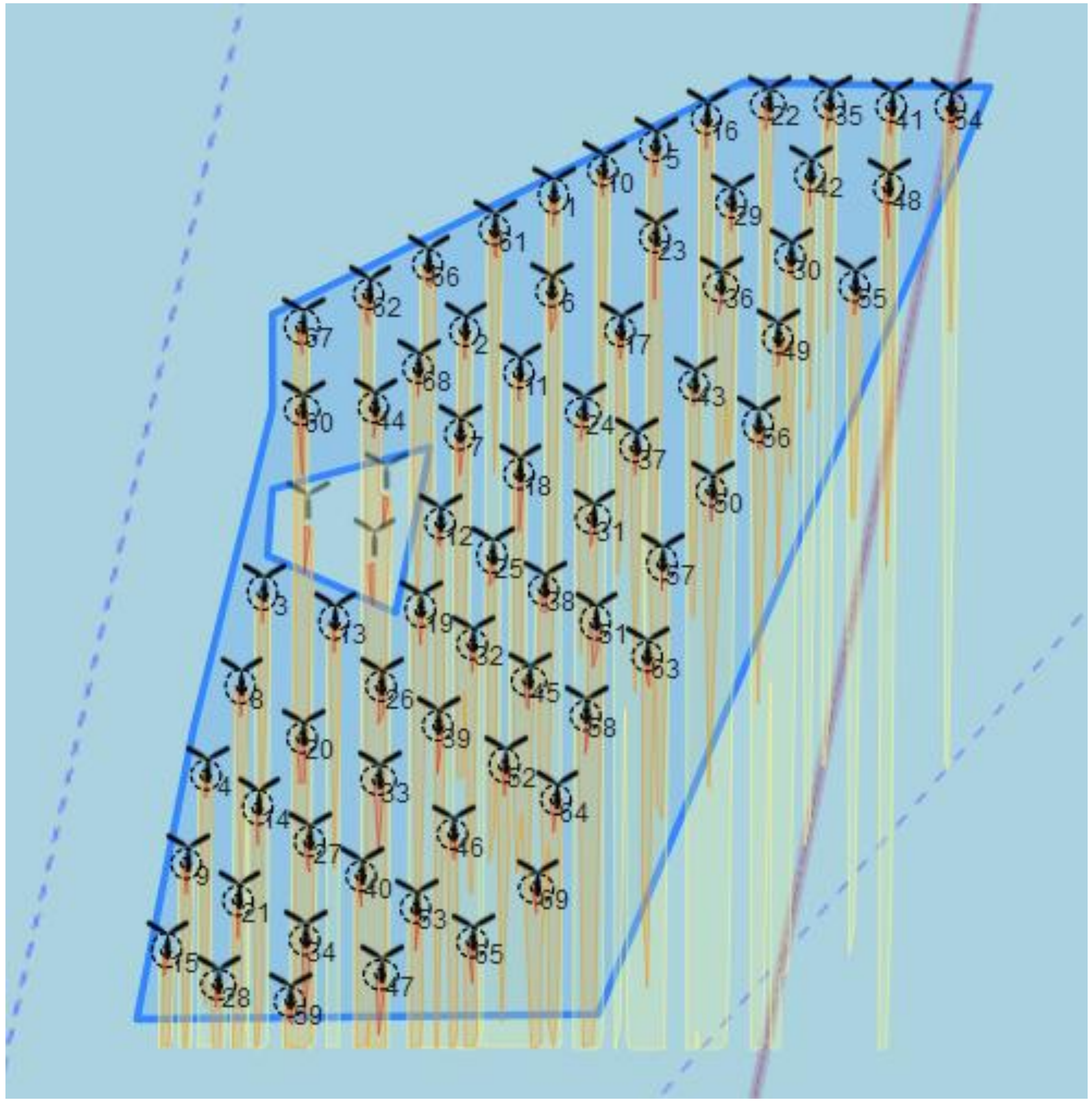
Efficiency and availability (%)		
Wake effect	Total wake effect (%)	93.2
	Internal wake loss efficiency (%)	93.3
	External wake loss efficiency (%)	99.9
	Site blockage effect (%)	100.0
Availability	Total availability (%)	95.5
	Turbine availability (%)	98.0
	Balance of plant efficiency (%)	99.8
	Array Cable Availability (%)	99.1
	Export Cable Availability (%)	99.0
	Grid availability (%)	99.5
Electrical	Total electrical (%)	97.4
	Array Cable Efficiency (%)	98.8
	Export Cable Efficiency (%)	99.2
	Offshore substation efficiency (%)	99.4
	Onshore substation efficiency (%)	100.0
Turbine performance	Total turbine performance (%)	100.0
	Site specific efficiency factor (%)	100.0
Environmental	Total environmental (%)	100.0
	Blade degradation efficiency (%)	100.0
Curtailments and operational strategies	Total curtailment (%)	98.9
	Curtailment efficiency (%)	98.9
Overall efficiency (%)		85.7

Efficiency of offshore wind parks

Largest loss are typically **wake effects** in the wind park.

→ Engineering wake models are used in the early stage of design to optimize layout and predict production.



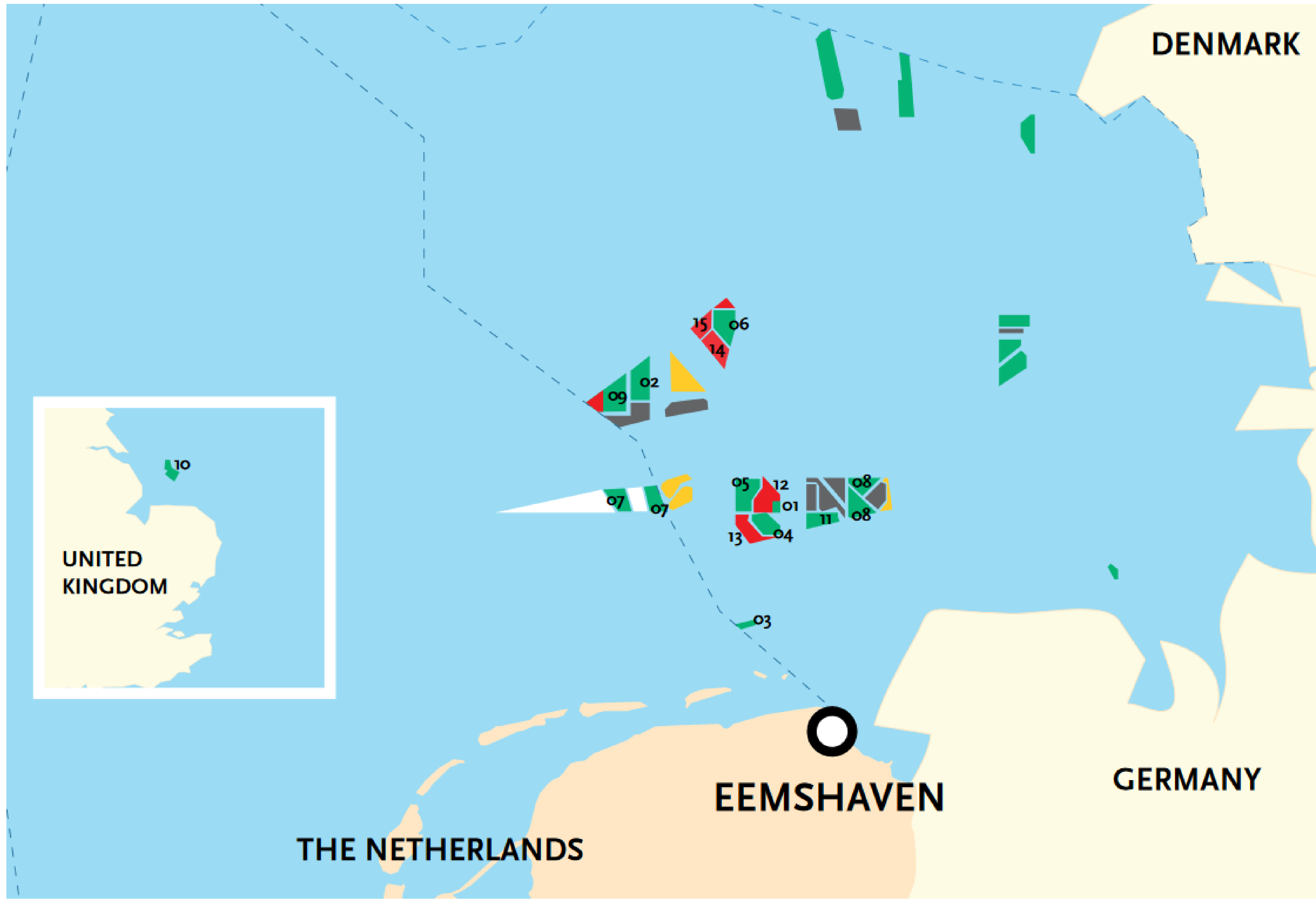


Wake visualization with TurbOPark engineering wake model

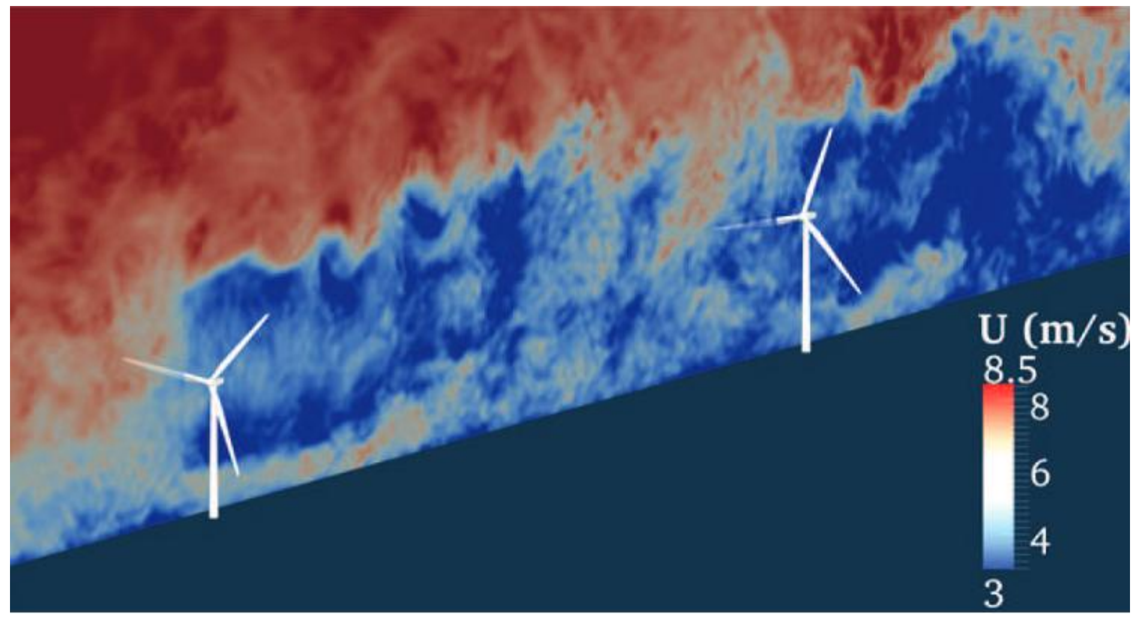
The wake effect photographed

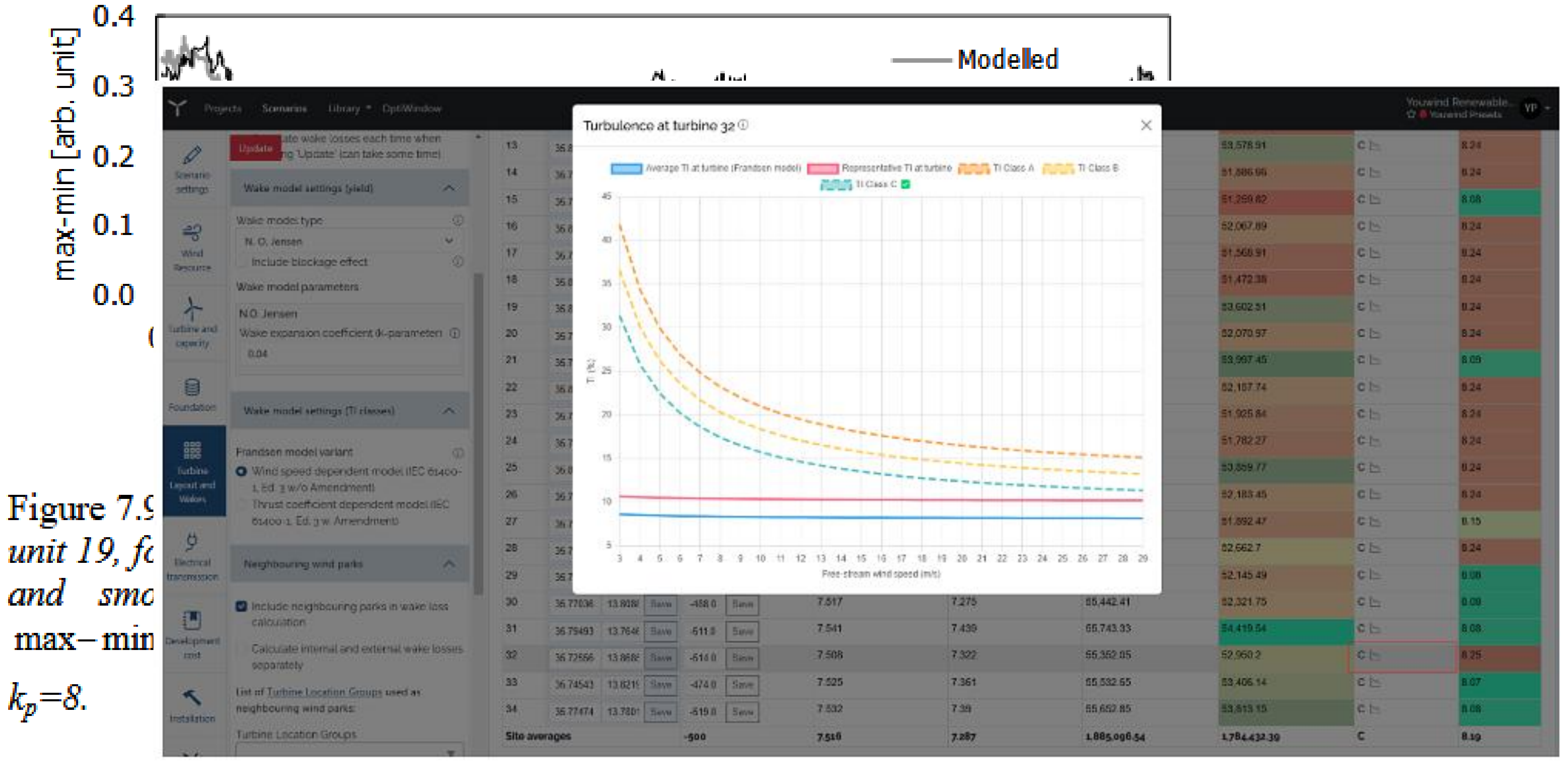
Internal and external wake losses

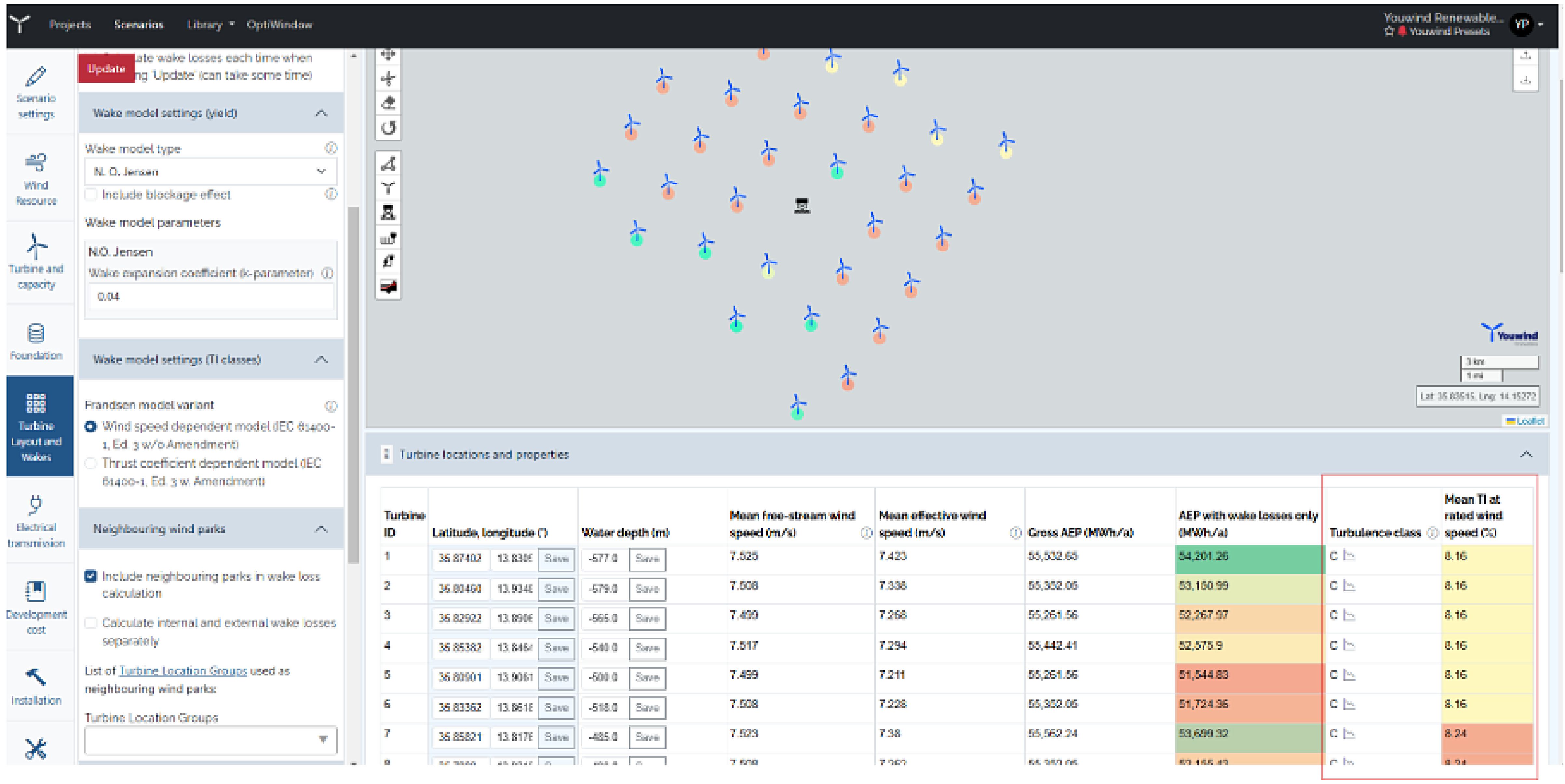
- In addition to internal wakes in a wind farm, wakes from neighbouring wind parks can introduce an additional loss.



Wakes also influence loads on the wind turbine components

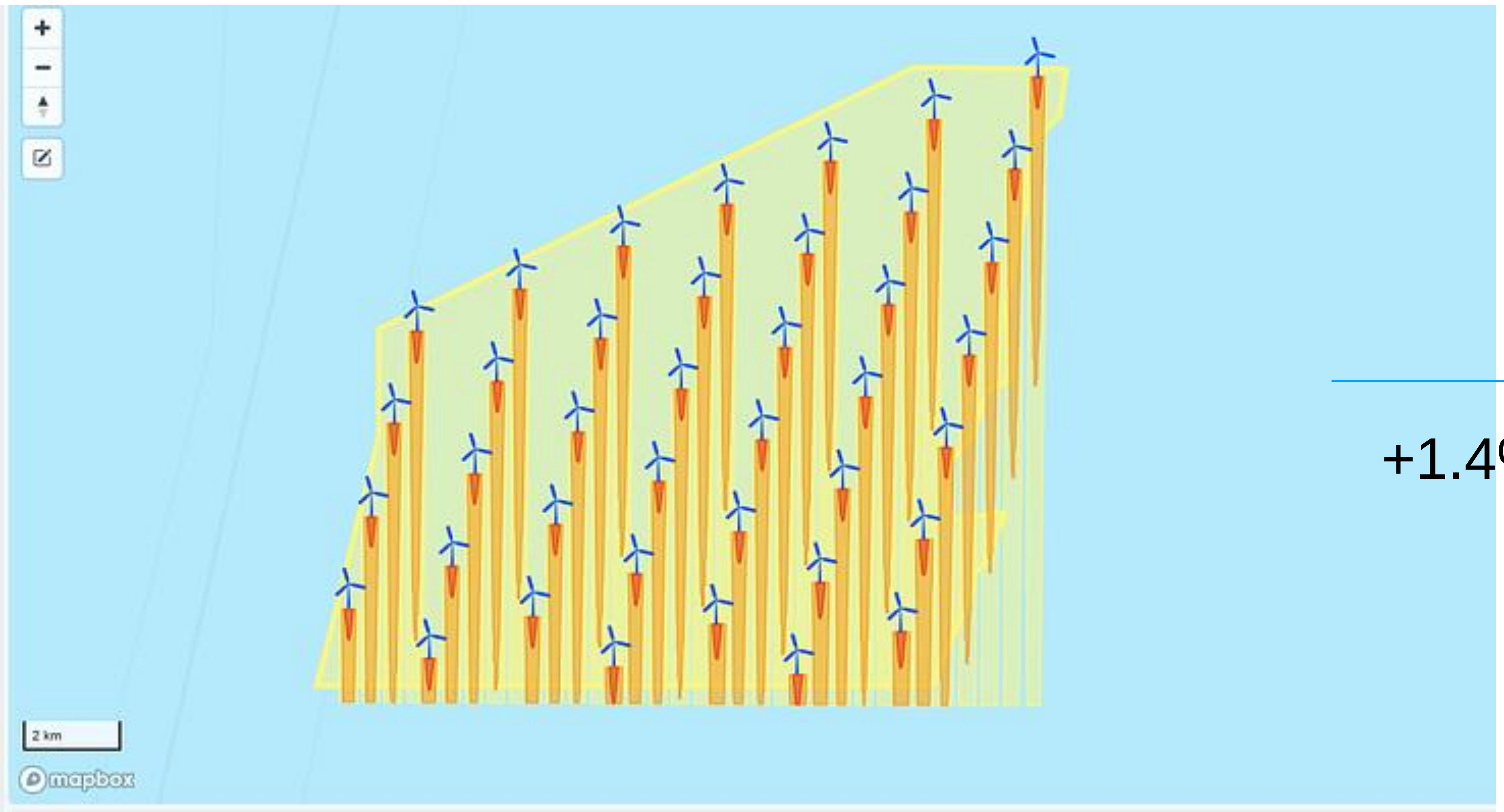




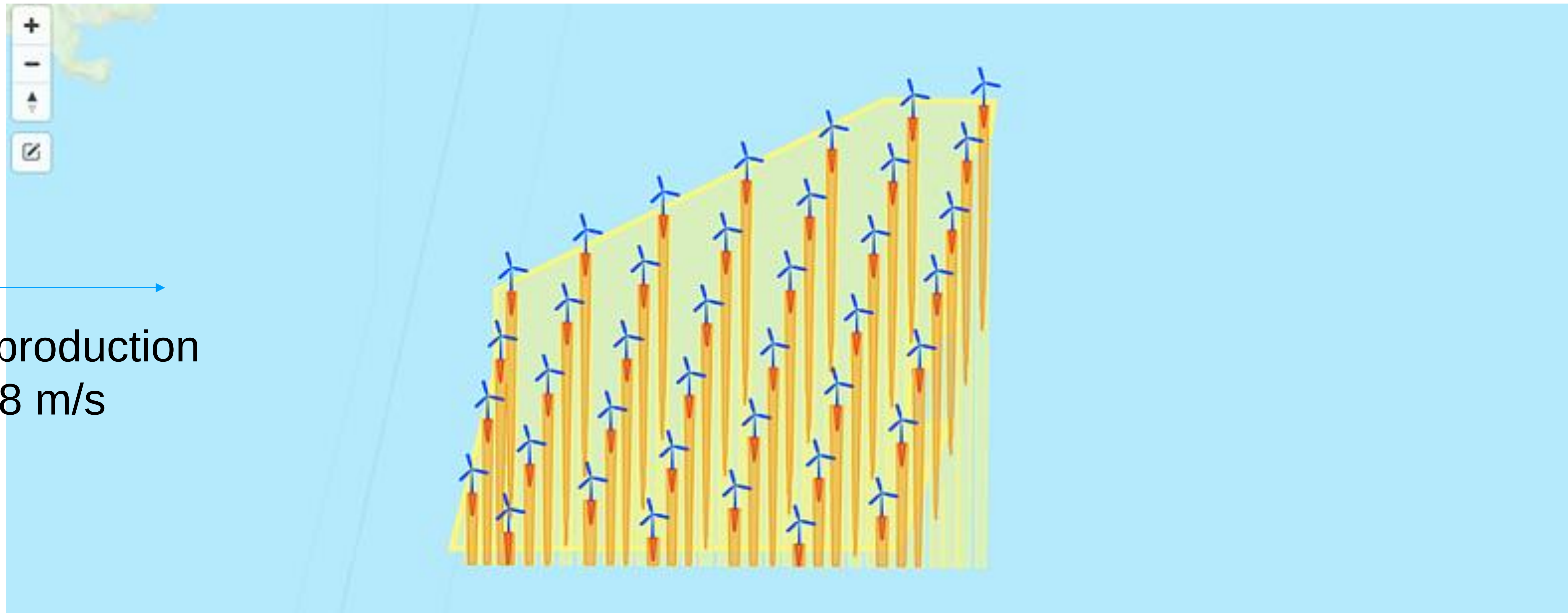


→ **Wake-added turbulence** models and turbine TI classes (A,B,C, S) have been developed to assess the suitability for a wind turbine in a wind farm layout.

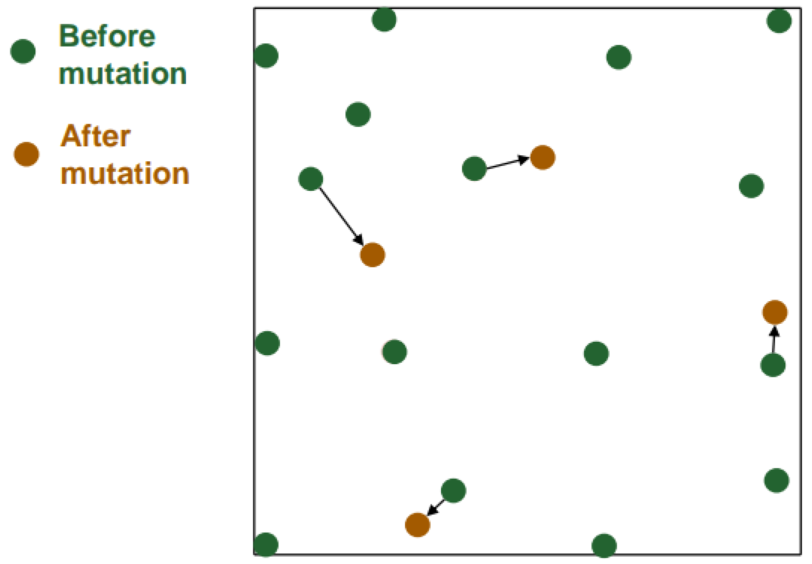
Further optimization with “free placement”

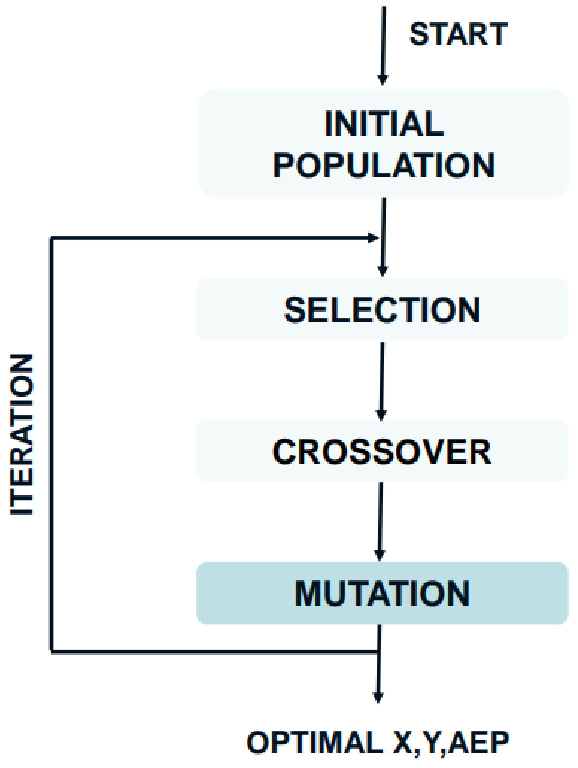


+1.4% production
at 8 m/s



Layout Optimization Genetic Algorithm (LO-GA)





Funded by the European Union

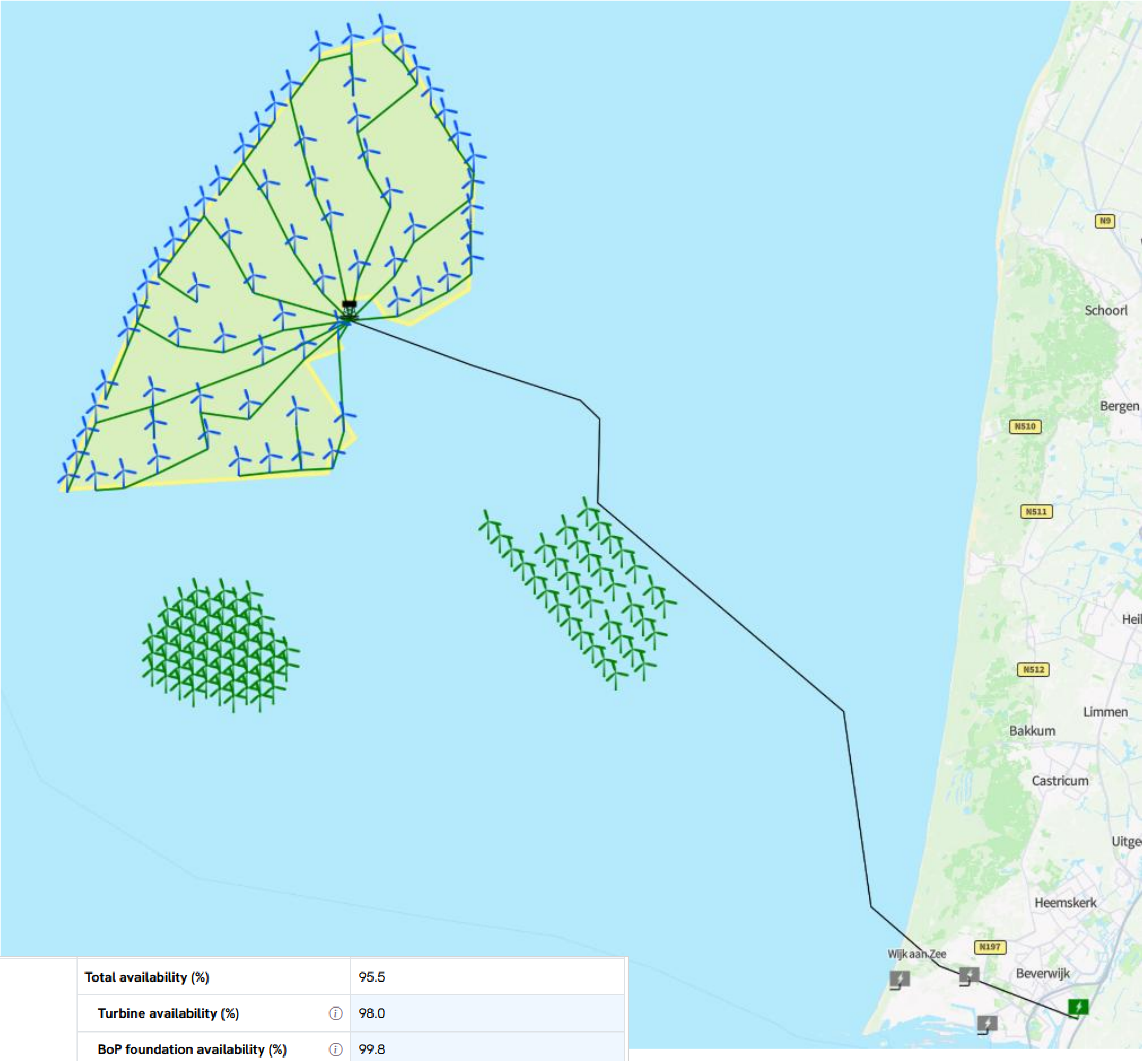
02 The process of techno-economic assessment on LCOE optimisation

Electrical Modelling & Optimization

Cable selection based on maximum power throughput

Electrical losses in array and export cables based on each turbines' power distribution

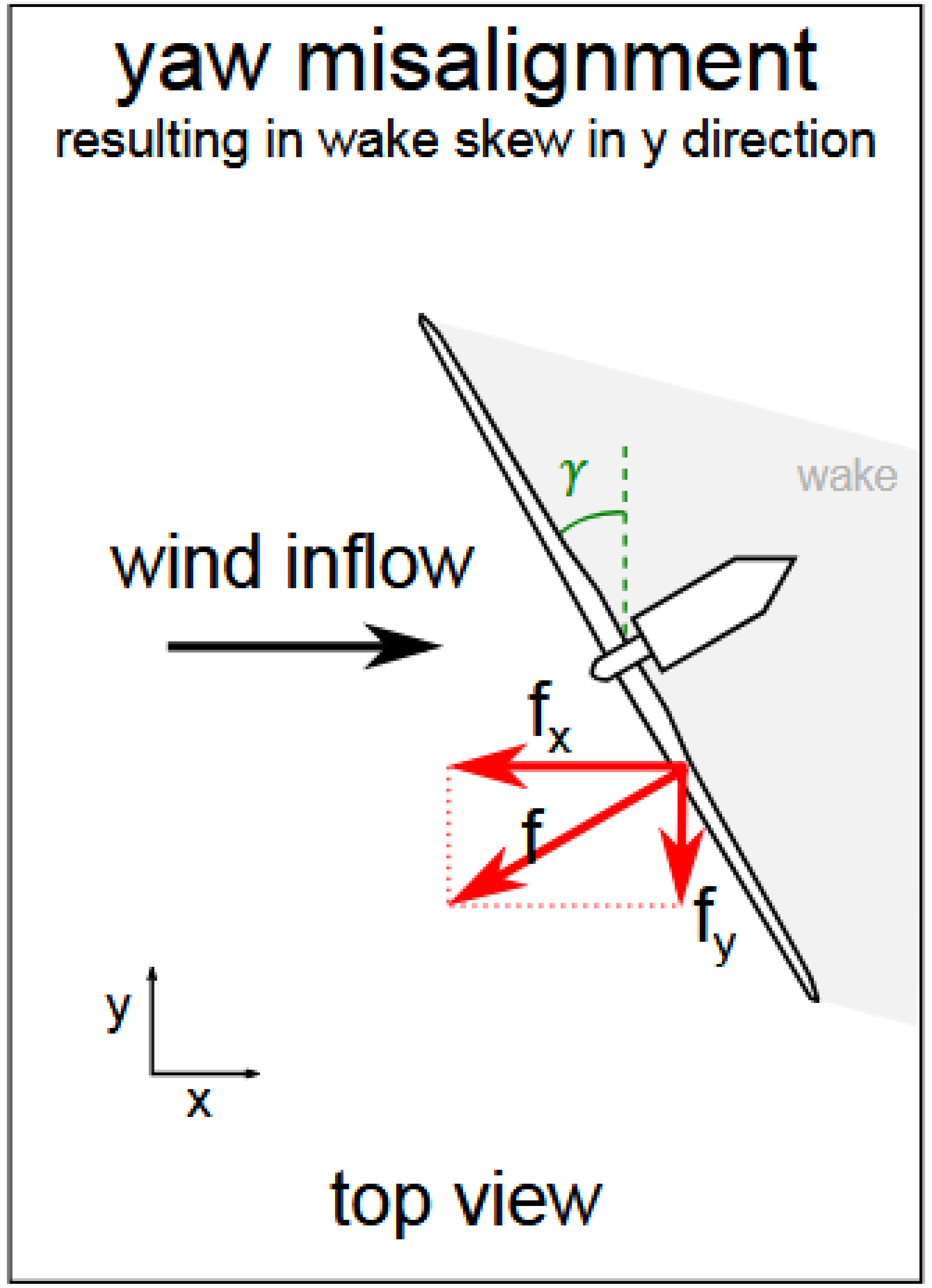
Transmission availability based on failure rate per km, repair time and statistical combinations

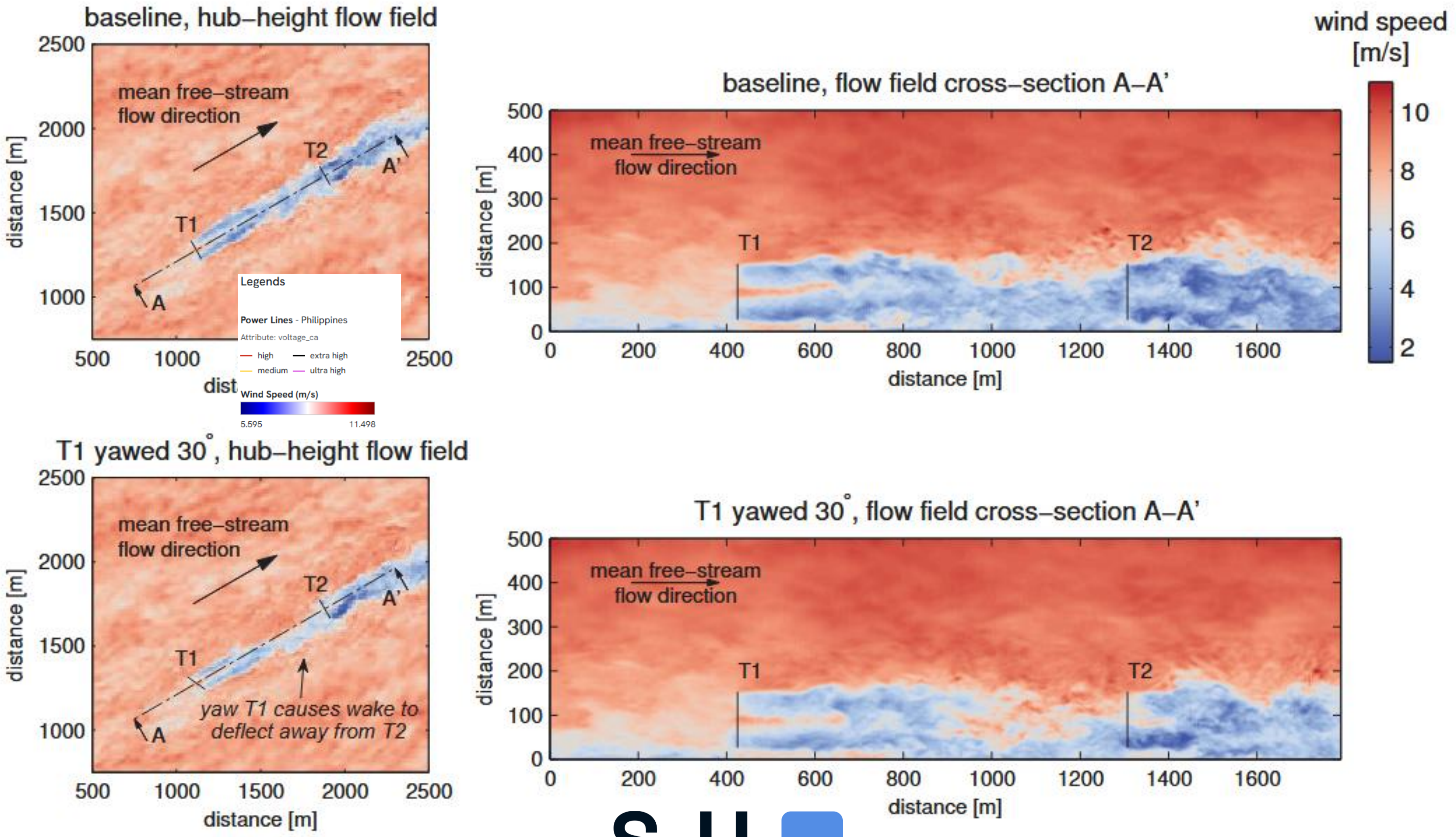


Availability	Total availability (%)	95.5
	Turbine availability (%)	98.0
	BoP foundation availability (%)	99.8
	BoP array cable availability (%)	99.1
	BoP export cable availability (%)	99.0
	Grid availability (%)	99.5
Electrical	Total electrical (%)	98.2
	Array Cable Efficiency (%)	99.6
	Export cable efficiency (%)	99.2
	Offshore substation efficiency (%)	99.4
	Onshore substation efficiency (%)	100.0

out of scope

Wake steering control





Funded by the European Union

02 The process of techno-economic assessment on LCOE optimisation

Model	Wake deficit profile	Wake expansion / recovery	Large-array treatment	Turbulence modelling	Wake superposition	Key inputs	Typical application
PARK 2	Top-hat (uniform deficit)	Linear wake expansion using wake decay constant (k)	None	Ambient TI only through k	RSS or linear superposition	CT, rotor diameter, wind speed, k	Early-stage layout design
PARK 2 + Large Array Correction	Top-hat	Same as PARK, but modified wake recovery in deep arrays	Empirical correction increases wake recovery downstream	Indirectly accounts for wake-generated turbulence	RSS or linear	CT, D, k, LAC parameters	Large onshore/offshore screening studies
Eddy Viscosity (Ainslie)	Continuous velocity field (Gaussian-like)	Solves simplified turbulent diffusion equation using eddy viscosity	None	Explicit eddy viscosity linked to ambient TI	Velocity field superposition	CT, TI, rotor diameter, downstream distance	More accurate engineering wake calculations
Eddy Viscosity + Large Array Correction	Continuous velocity field	Eddy viscosity model with additional deep-array wake recovery correction	Empirical correction for cumulative wake effects	Explicit turbulence diffusion plus LAC	Velocity superposition	CT, TI, eddy viscosity coefficients, LAC parameters	Offshore commercial-scale wind farms
TurbOPark	Gaussian	Turbulence-driven wake expansion with analytical formulation	Intrinsically developed for very large wind farms and clusters	Ambient TI plus wake-added turbulence govern recovery	Gaussian velocity deficit superposition	CT, TI, rotor diameter, spacing	Offshore arrays, neighbouring wind farms, energy yield assessments
Blondel–Ishihara	Gaussian	Analytical wake width and deficit based on momentum conservation and turbulence scaling	Naturally predicts faster recovery with increasing TI; no separate LAC required	Explicit dependence on ambient TI and CT	Gaussian superposition	CT, TI, rotor diameter, downstream distance	Modern optimisation, sensitivity analysis, offshore studies

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05 Onshore wind case study with BESS and solar as a hybrid system

BESS app situation:

- Most apps are coming from solar, no digital solution covering BESS and wind.
- Layout generators offer minimal to no flexibility in layout design.
- App offers no flexibility in editing layouts.

Market gap

- Youwind can combine its wind timeseries capabilities with a BESS dimensioning optimiser for the co-located business case.
- Layout tool that allows a quick preliminary design as input for its layout generation or updates later on.
- Interactable Mapbox-interface that supports the dragging and rotating of site elements and roads to offer editing.
- Realistic 3D visuals for stakeholder management

In the BESS library items, the user can customize the BESS size:

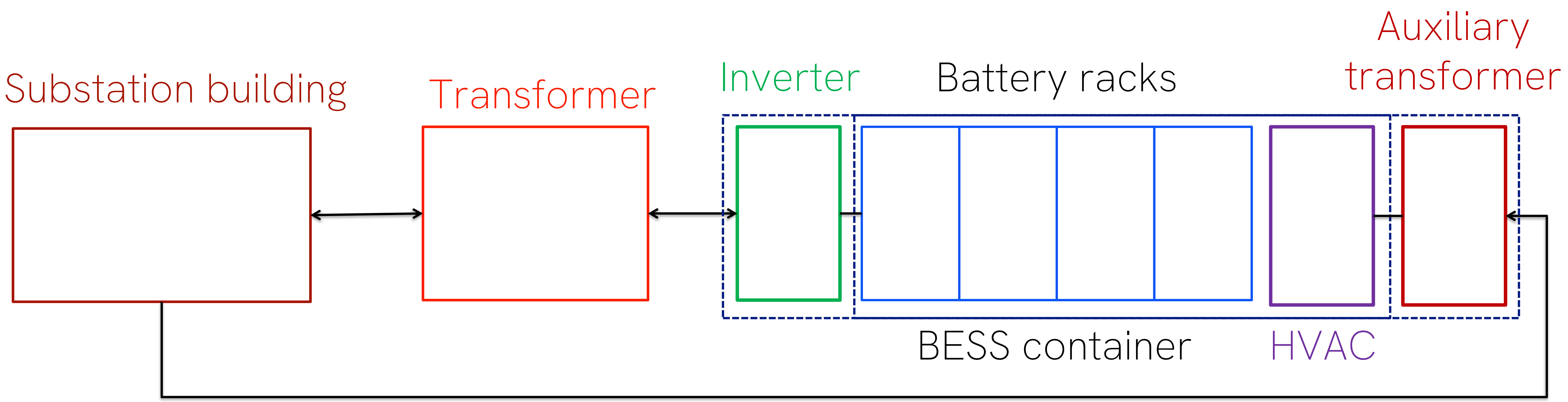
Container

Half-sized container

Other relevant library items:

Power conversion systems: Transformer/Inverter/MV Power skid

Roads



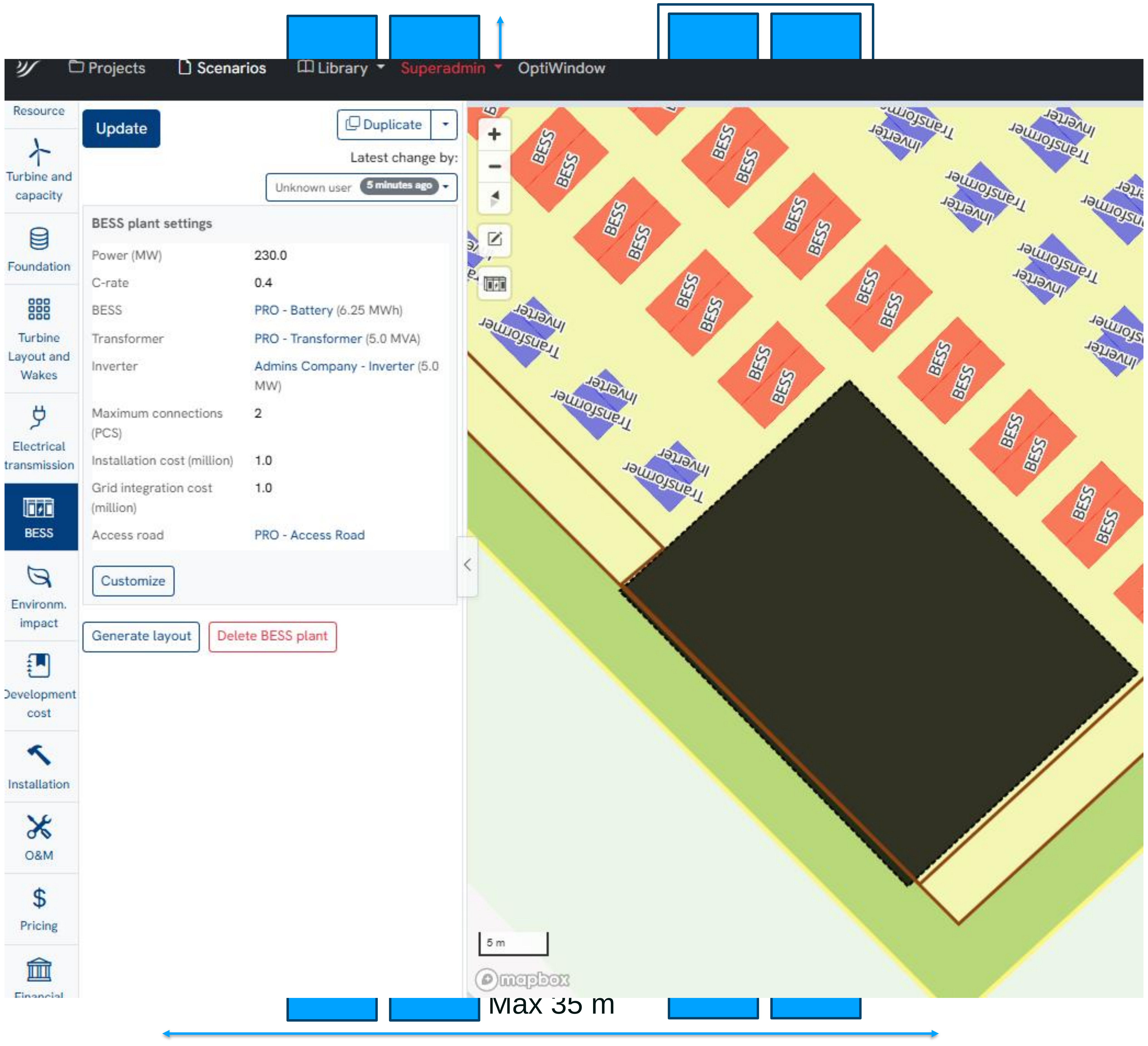
Schematic drawing

03 Introduction to BESS

Phase 1 – Layout generator

The layout generation considers user’s constraints to create site-specific layouts:

- Regulation constraints for inter-element distancing
- Exclusion zones (e.g., protected areas, slopes)
- Required roads/accesses
- Preferred placement of substation buildings
- Flexible shapes of substation buildings

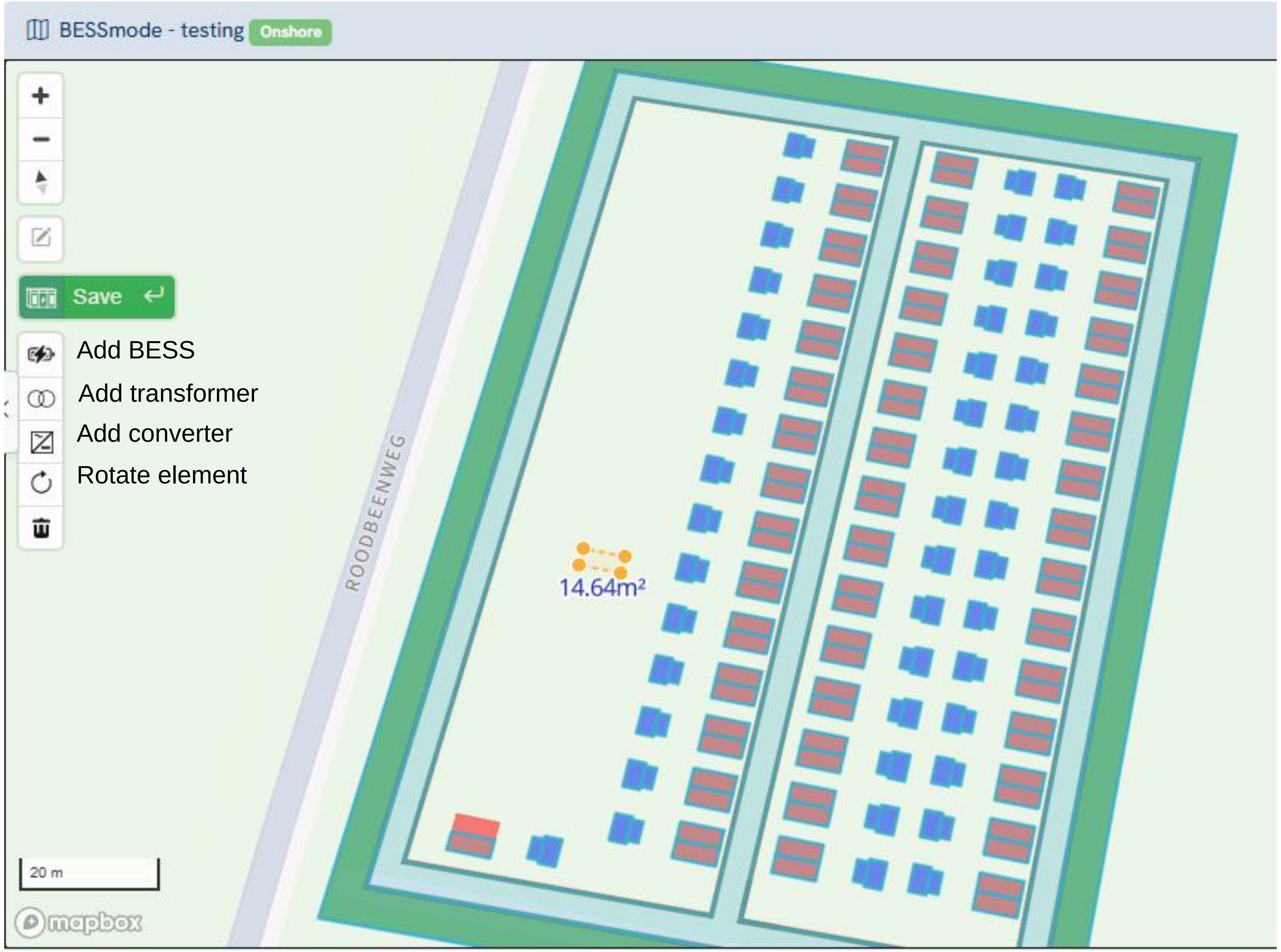


BESS lay-out - 4-hour PGS37-1 compliant

03 Introduction to BESS

BESS technical draw mode to easily work on a small site with support for adding and moving single elements.

- Drawn items (BESS, PCS) are dependent on BESS plant settings.
- Rotation of elements supported.
- It includes a changes handler with the options:
  - Revert changes
  - Save changes
  - Cancel changes



03 Introduction to BESS

Plant operations

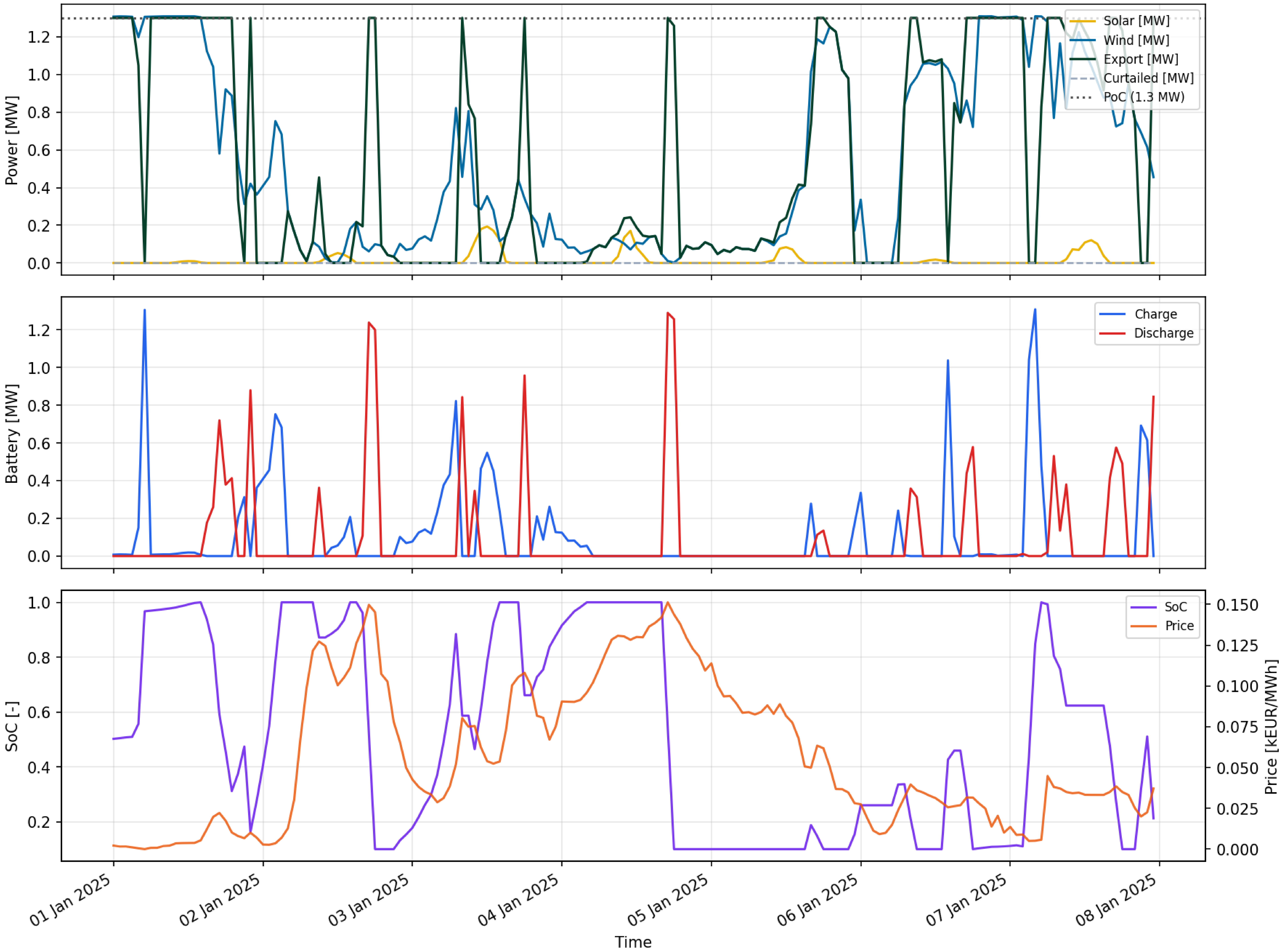
Operations of week 1 – a windy example

Revenue increase

+82 kEUR

Reduced curtailment

0.2 MWh



Agenda

01 **Introduction to Edvald and Youwind**

02 **The process of techno-economic assessment in layout design and LCOE optimisation**

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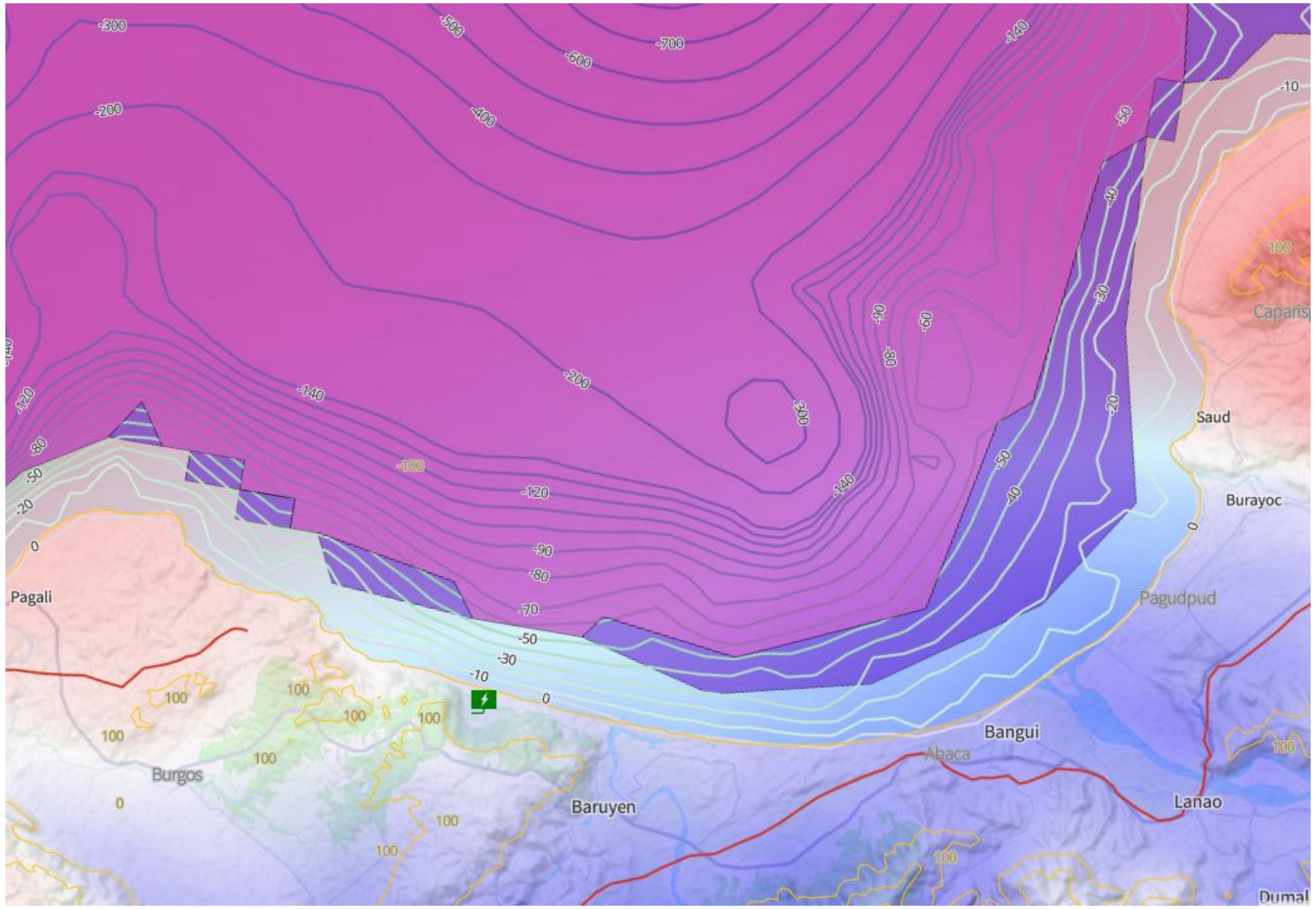
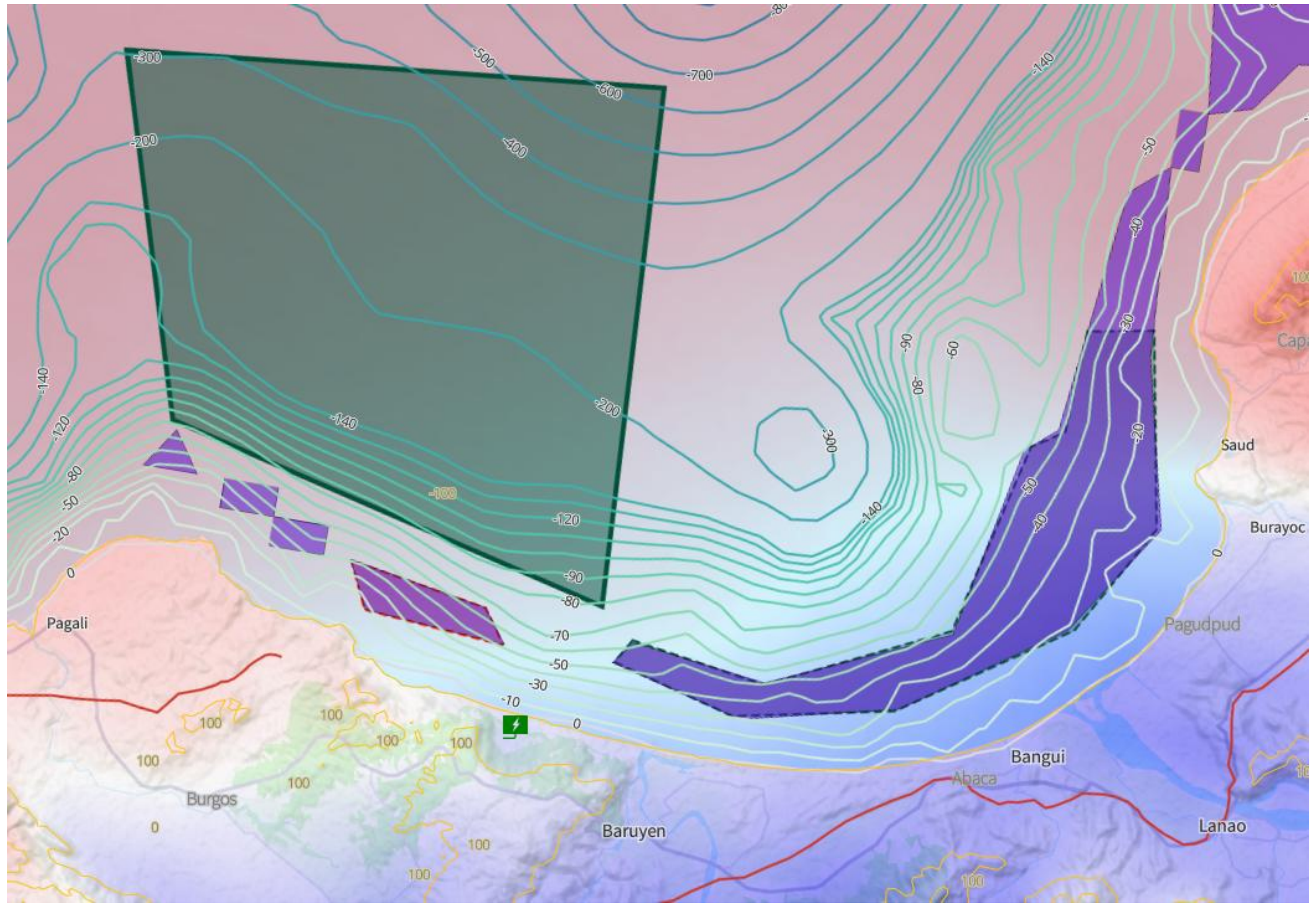
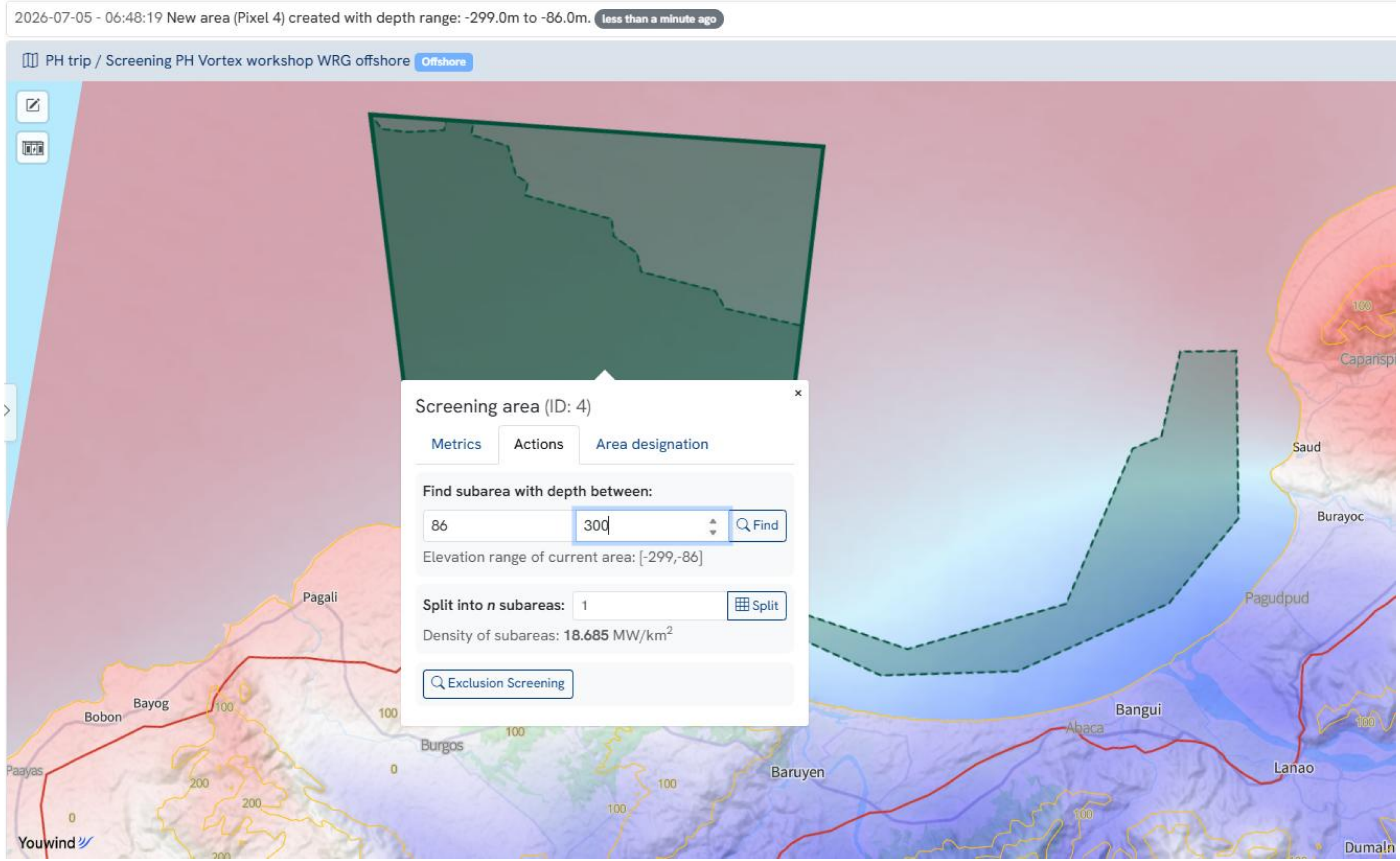
05 Onshore wind case study with BESS and solar as a hybrid system

Screening – fixed bottom areas vs. floating

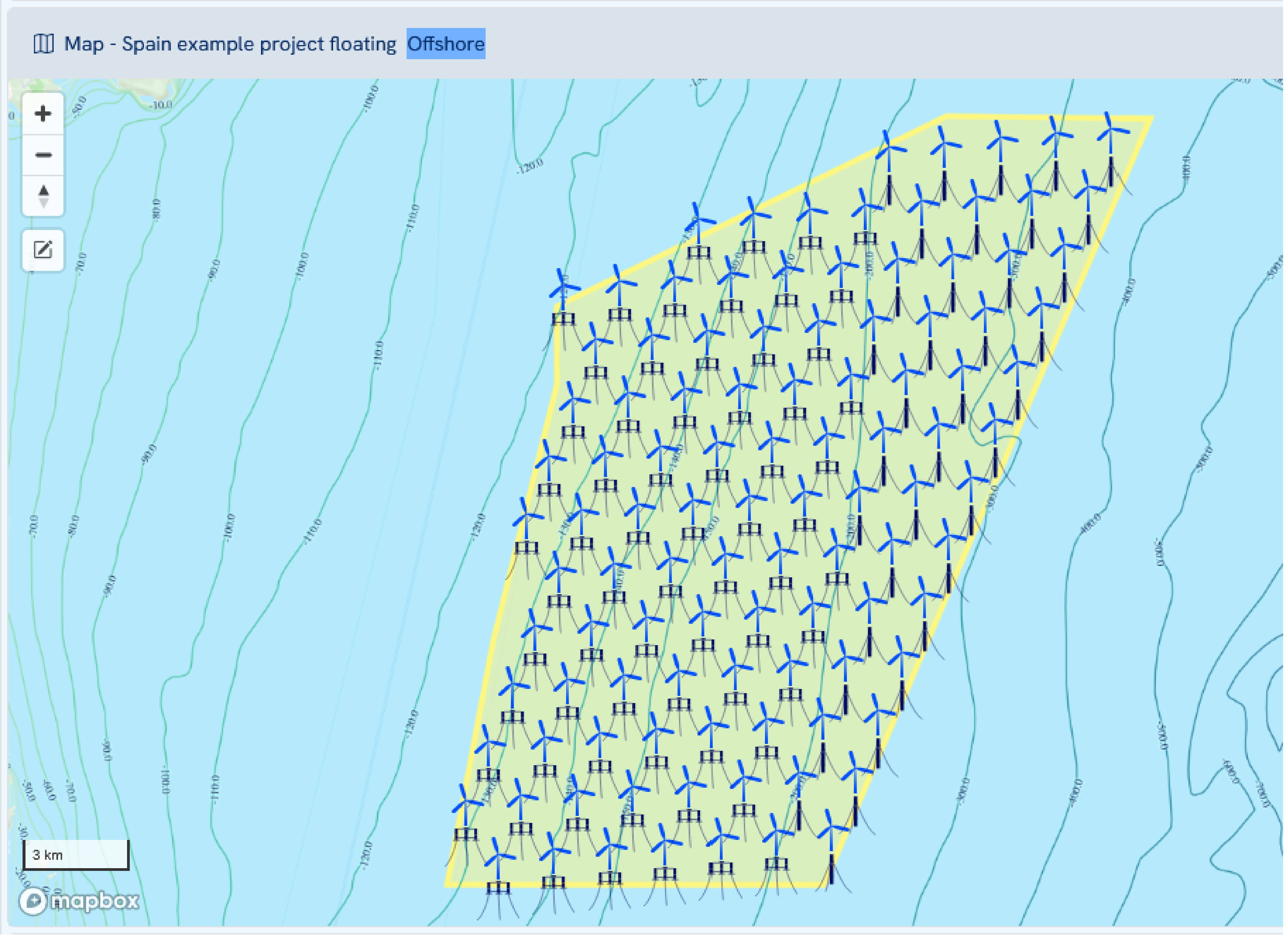




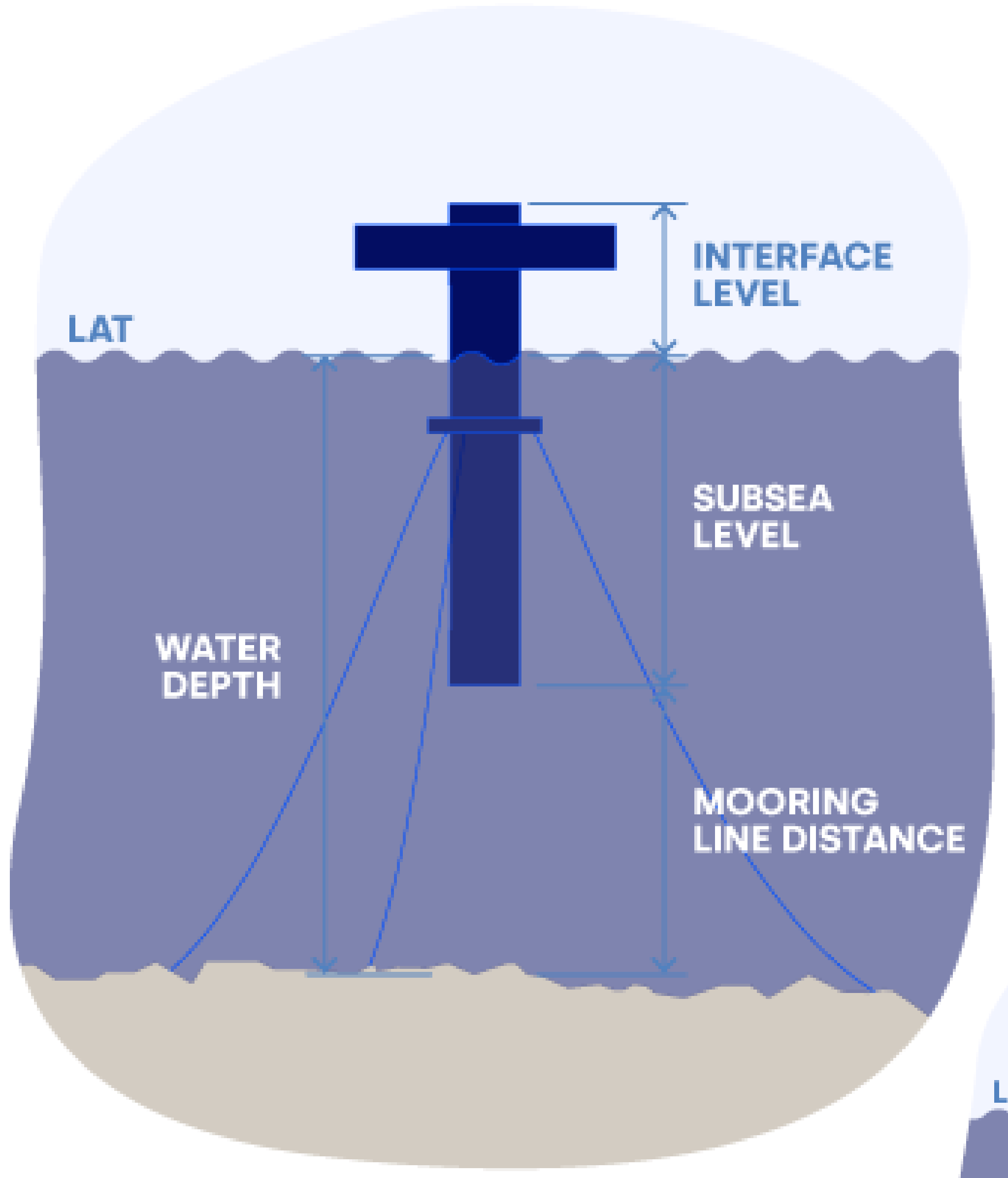
Screening – fixed bottom areas vs. floating

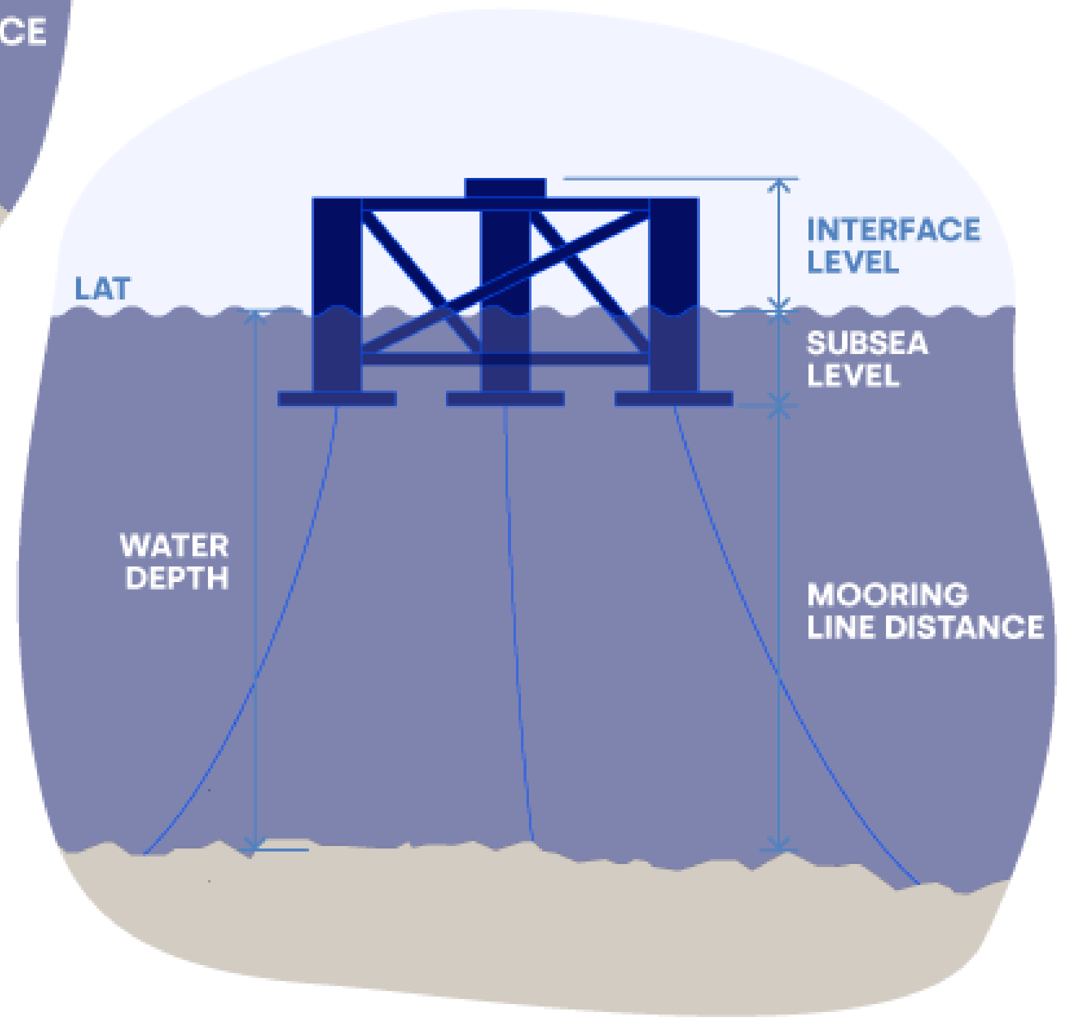


Example of wind park layout design in our software



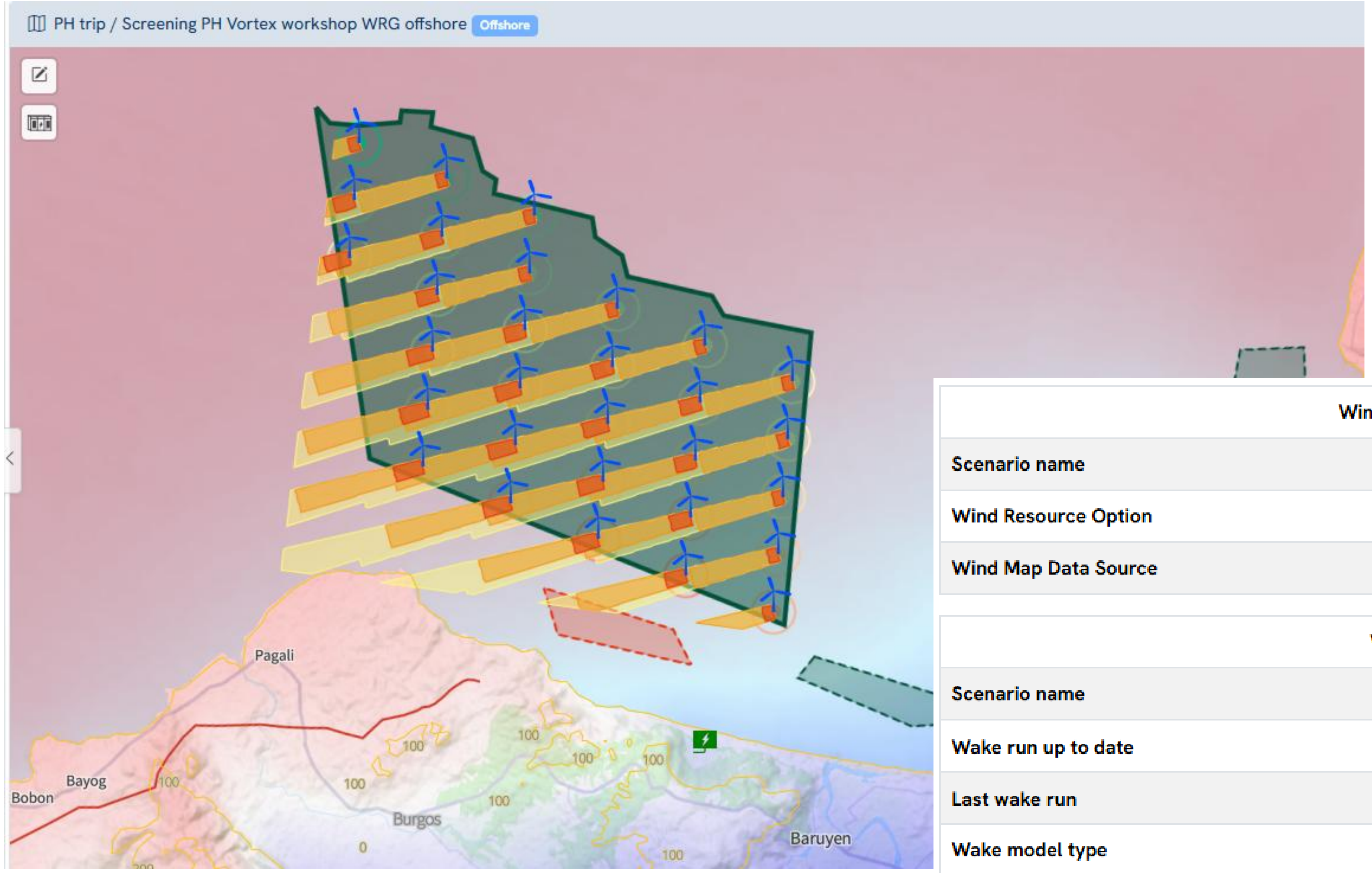
Spar buoy





Semi-submersible with catenary mooring

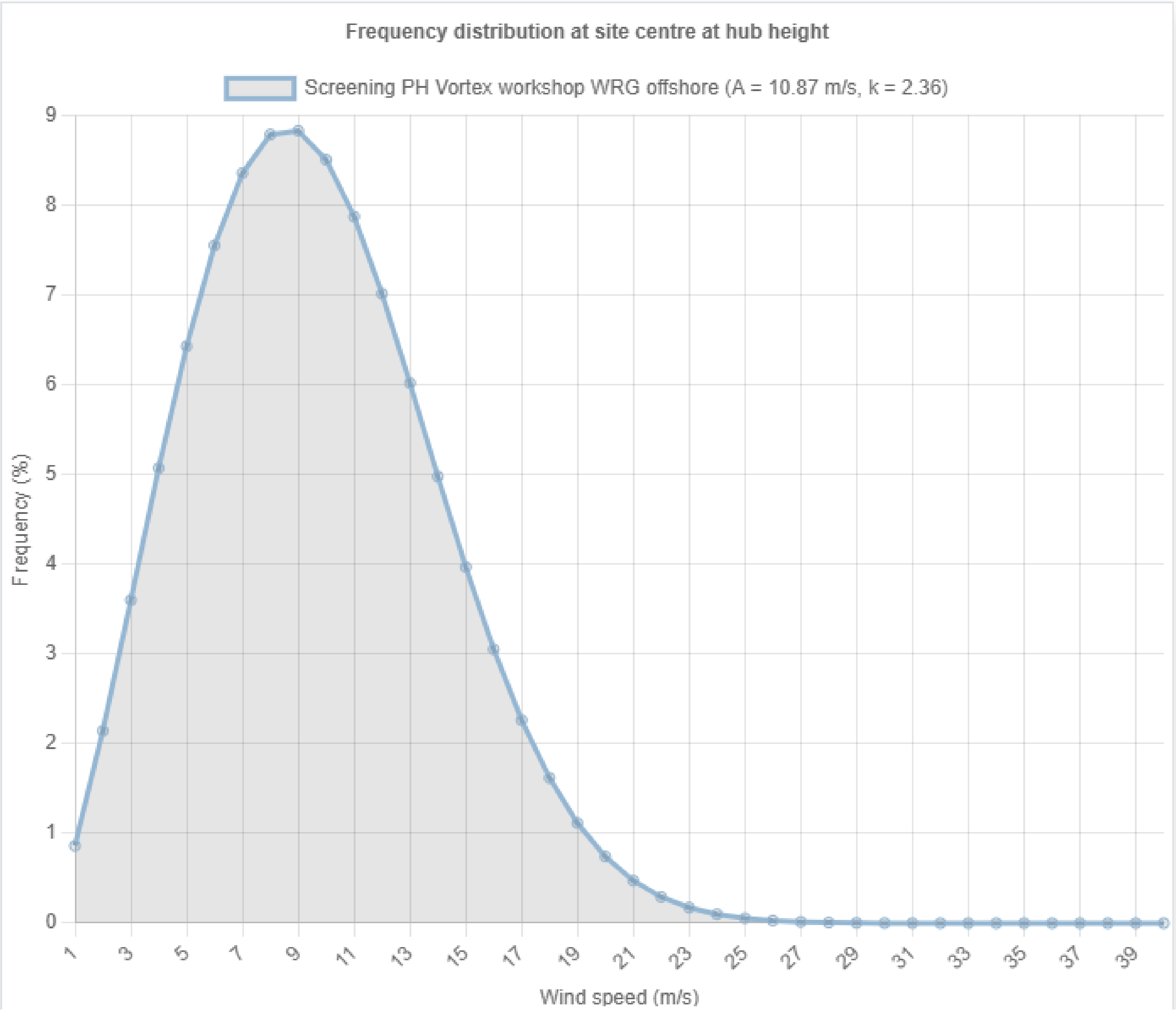
Screening – fixed bottom areas vs. floating



Wind resource settings	
Scenario name	Screening PH Vortex workshop WRG offshore
Wind Resource Option	Weibull Wind Map
Wind Map Data Source	Wind Resource Grid (WRG): PH test site 150m

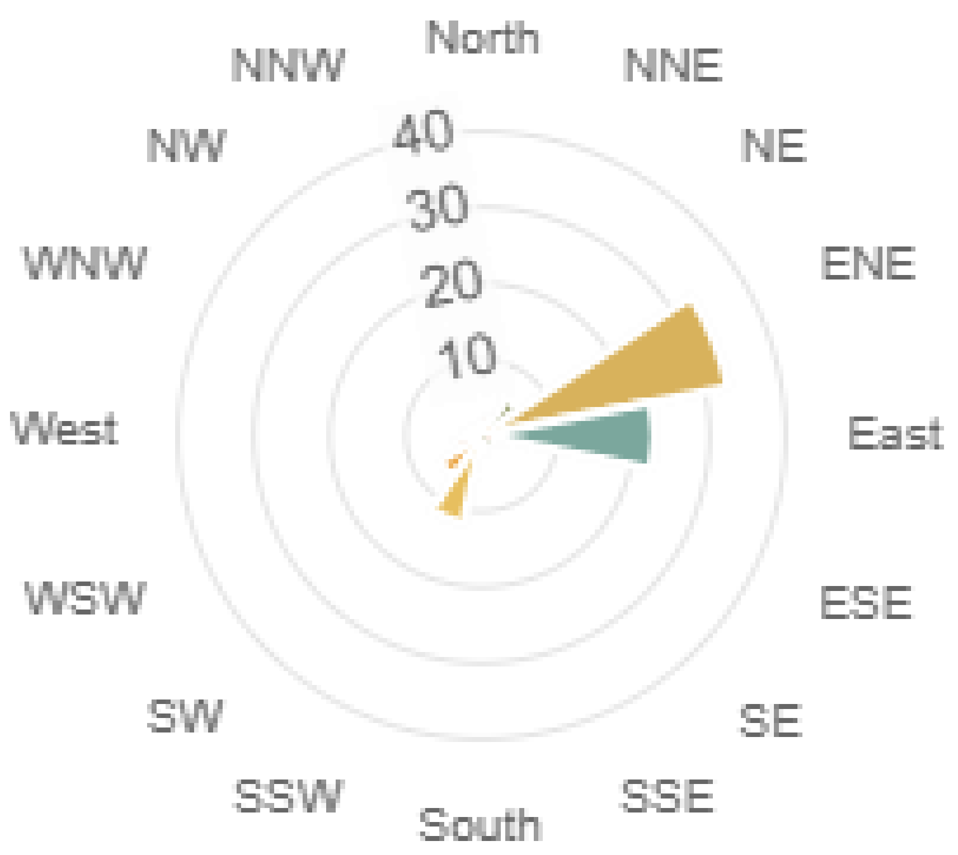
Wake modelling	
Scenario name	Screening PH Vortex workshop WRG offshore
Wake run up to date	✓
Last wake run	2026-07-05 06:53:14
Wake model type	Jensen
Wake loss (%)	6.121
Include neighbouring parks in wake loss calculation	✓
Include blockage effect	✗
Ambient turbulence (%)	N/A
Jensen k	0.04

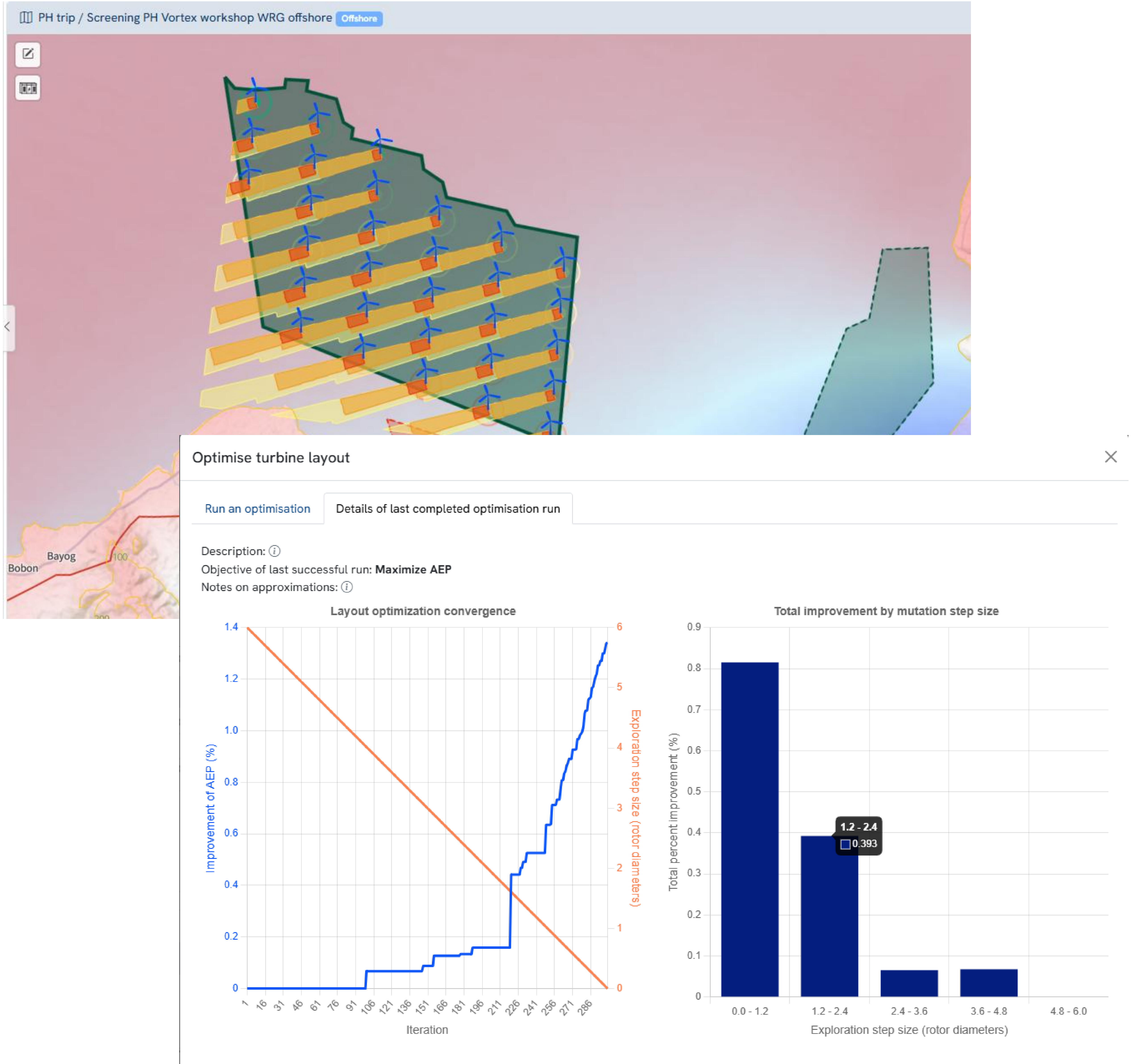
Production overview

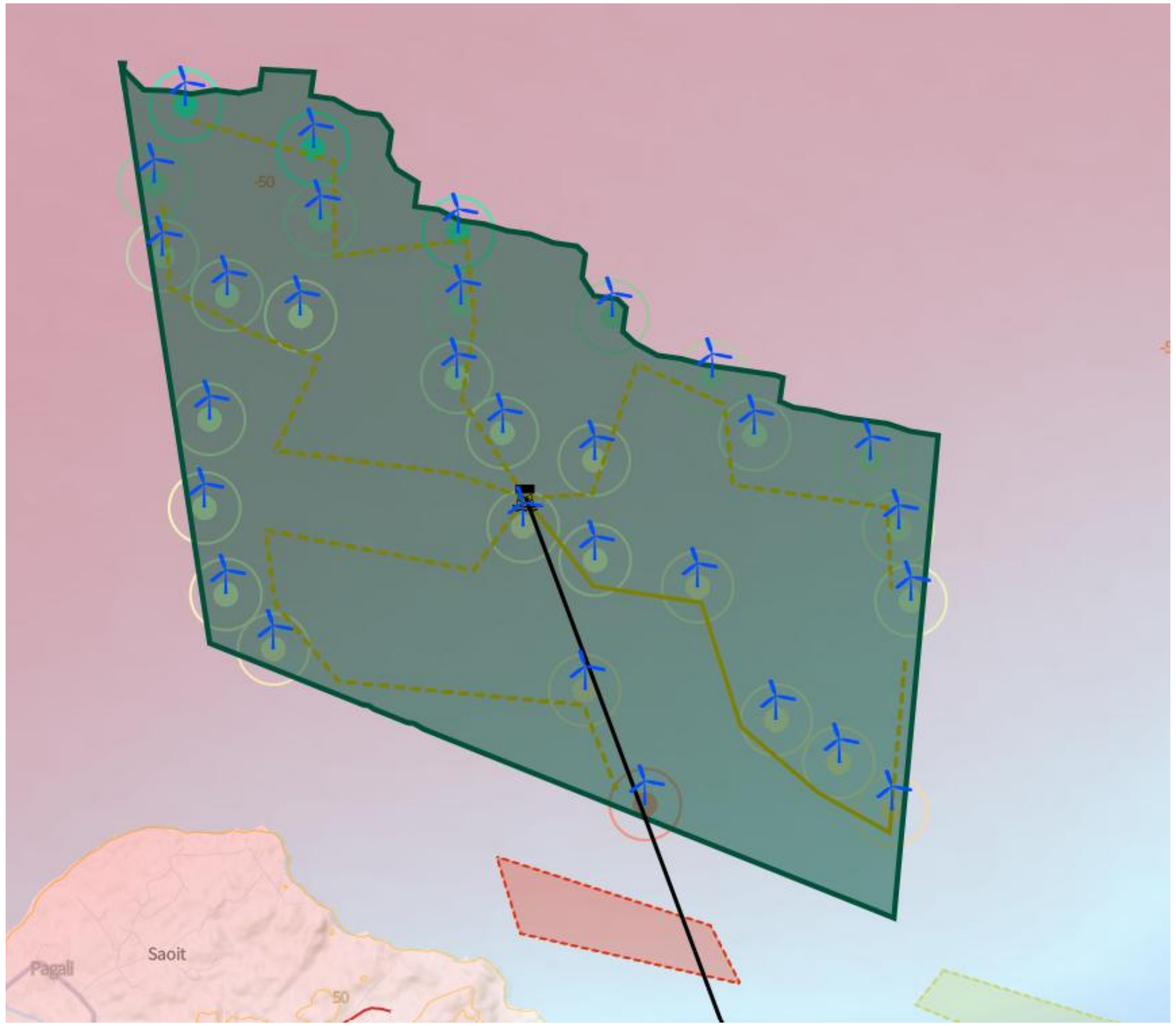


04 Offshore wind study

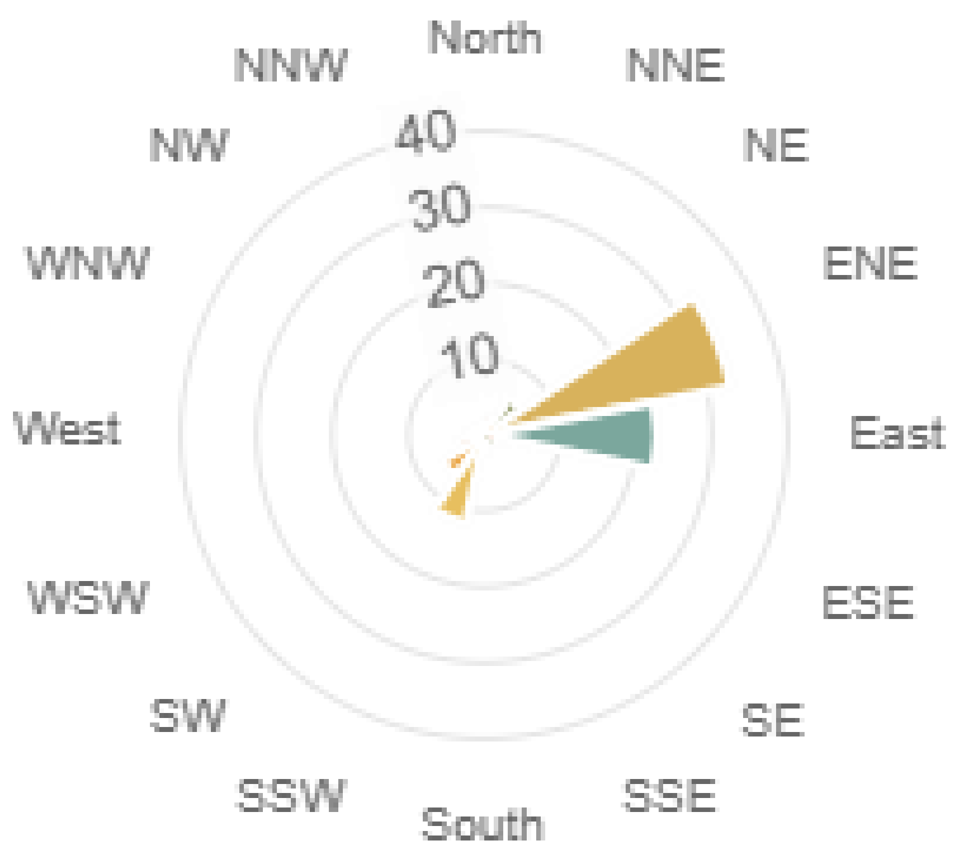
Screening – fixed bottom areas vs. floating

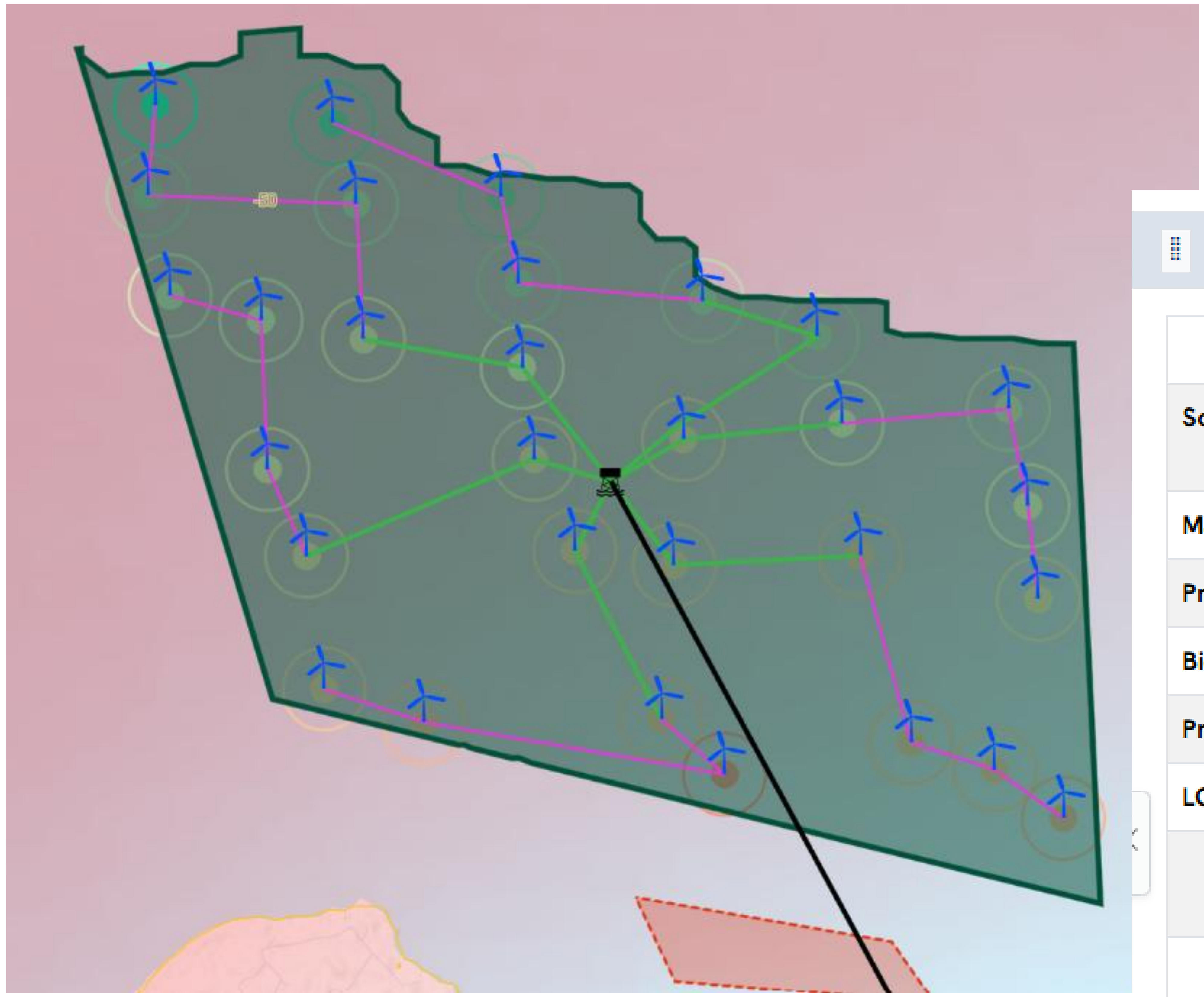






Screening – fixed bottom areas vs. floating LCOE optimisation

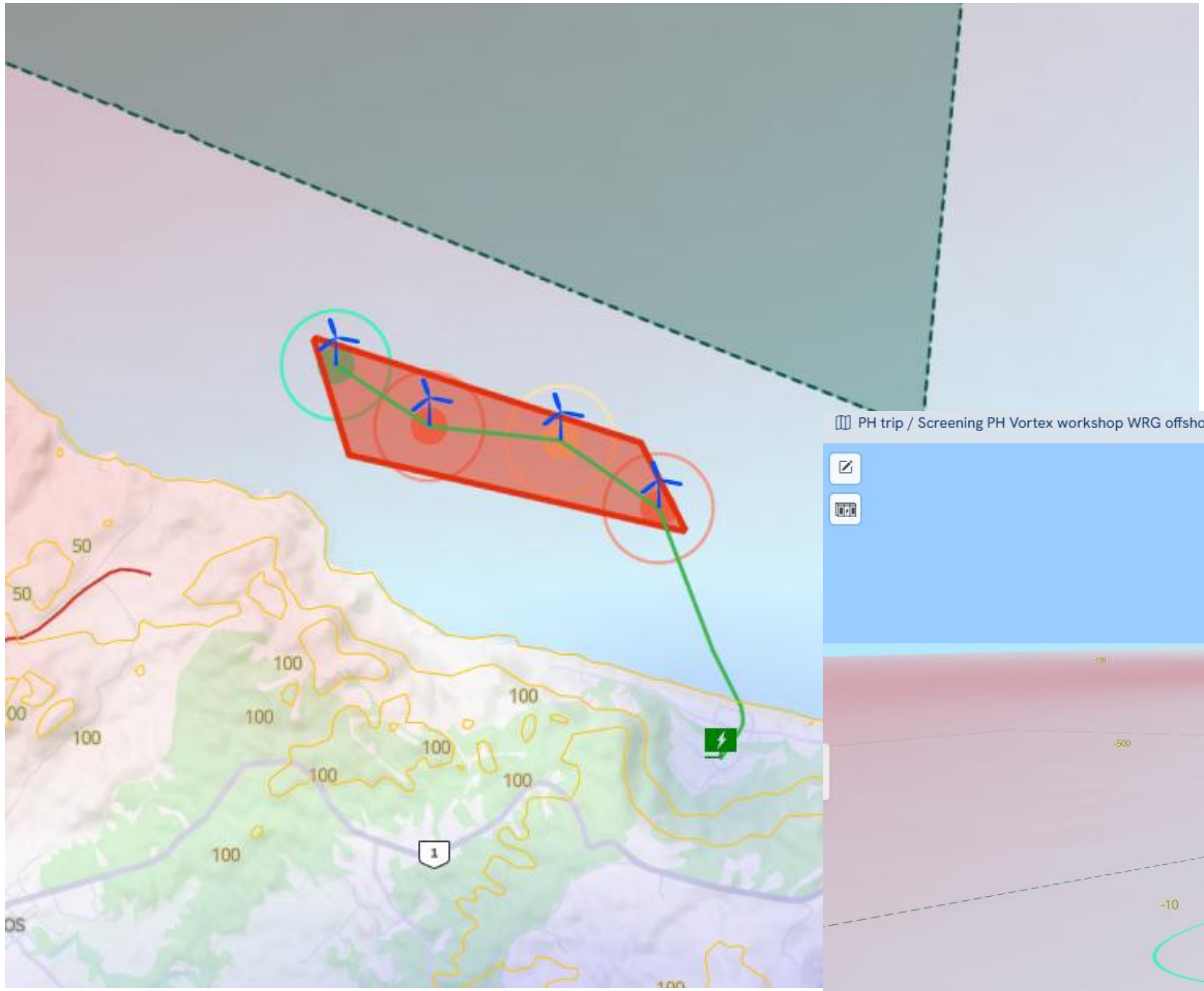
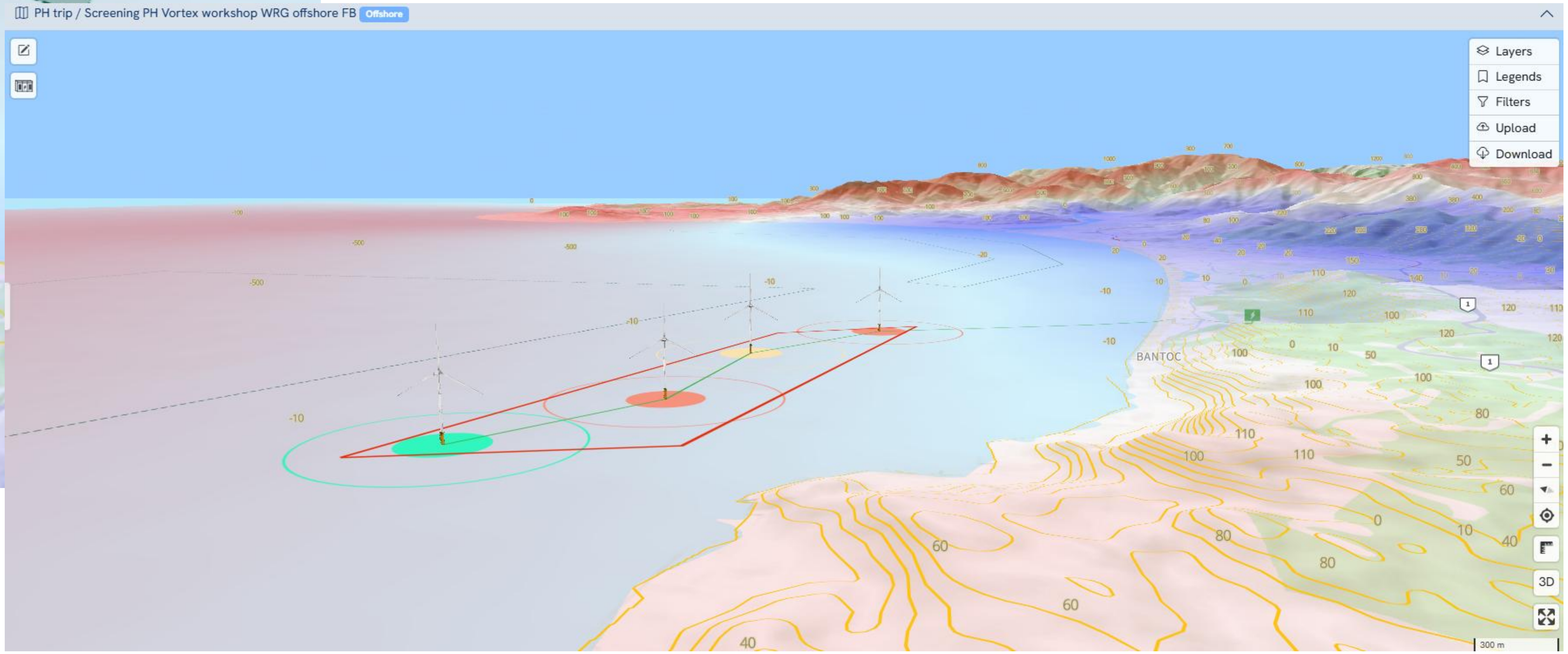




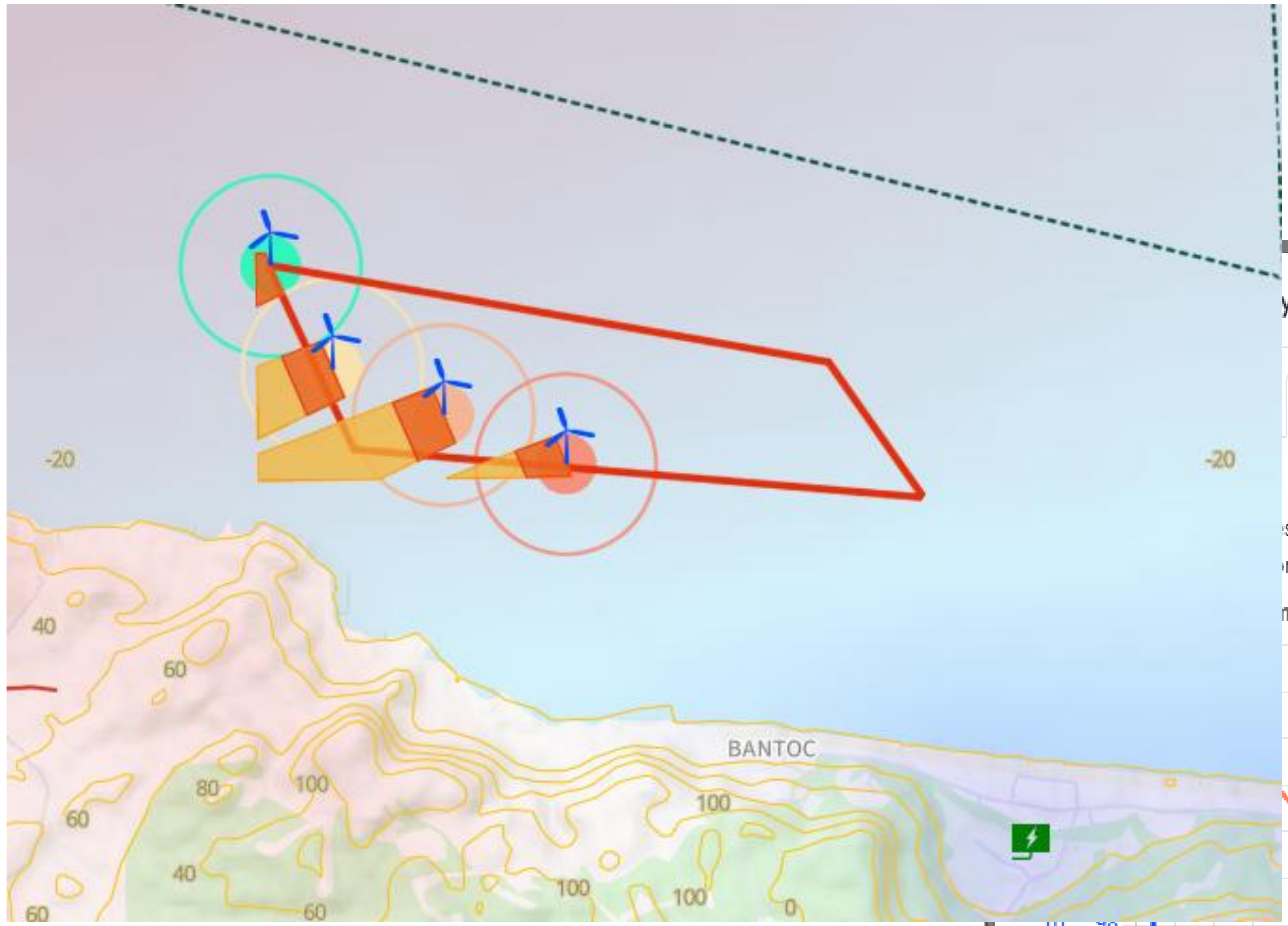
Project Finance

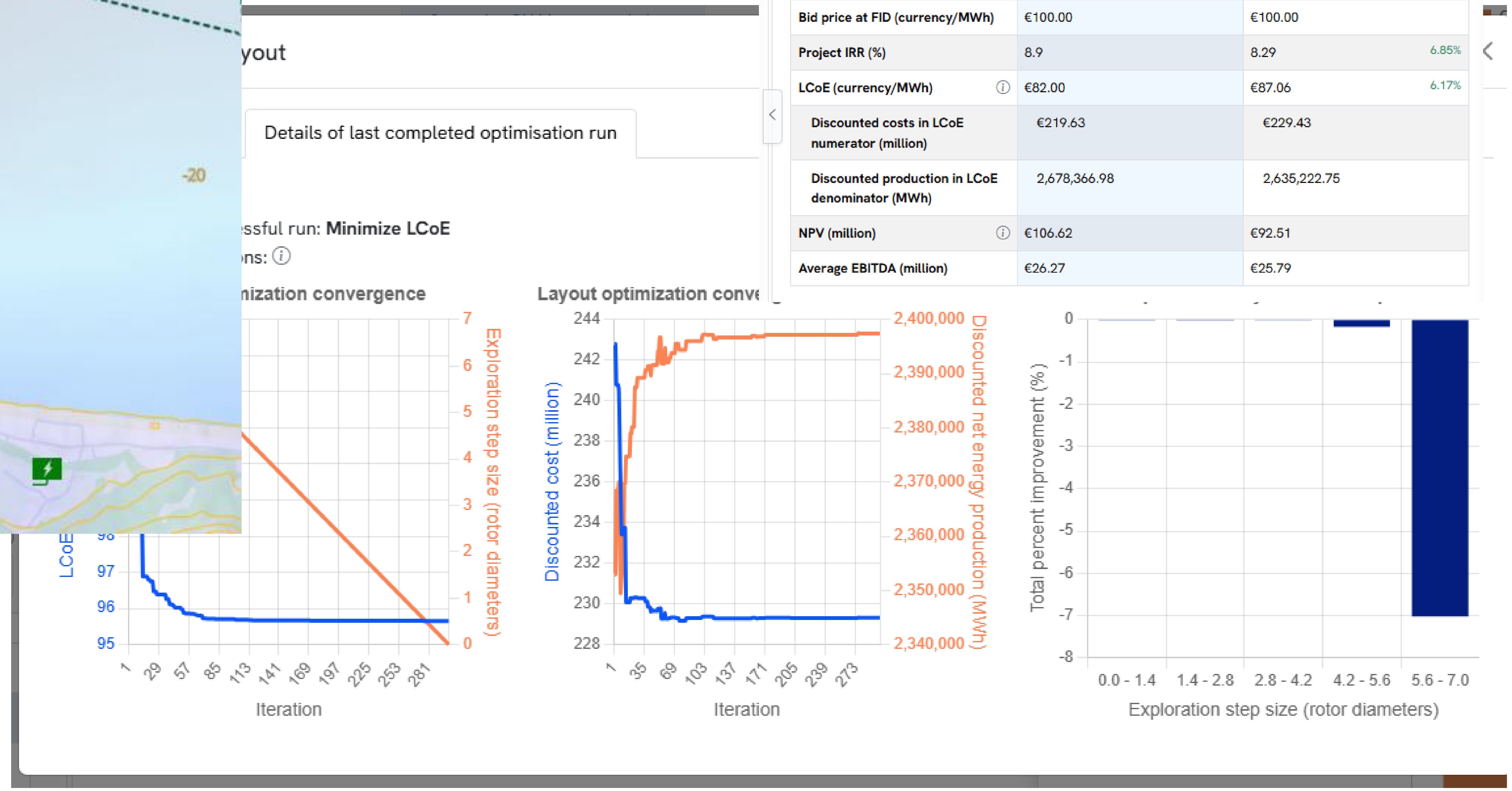
Financial indicators		
Scenario name	Screening PH Vortex workshop WRG offshore LCOE optimised	Screening PH Vortex workshop WRG offshore
Main Characteristics	-	-
Project lifetime (years)	25	25
Bid price at FID (currency/MWh)	€100.00	€100.00
Project IRR (%)	8.23	7.89 4.13%
LCoE (currency/MWh)	€115.90	€121.20 4.57%
Discounted costs in LCoE numerator (million)	€1,603.63	€1,686.36
Discounted production in LCoE denominator (MWh)	13,836,479.09	13,914,184.18
NPV (million)	€37.80	€-17.88
Average EBITDA (million)	€209.46	€199.79

Screening – fixed bottom areas vs. floating

Screening – fixed bottom areas vs. floating LCOE optimized



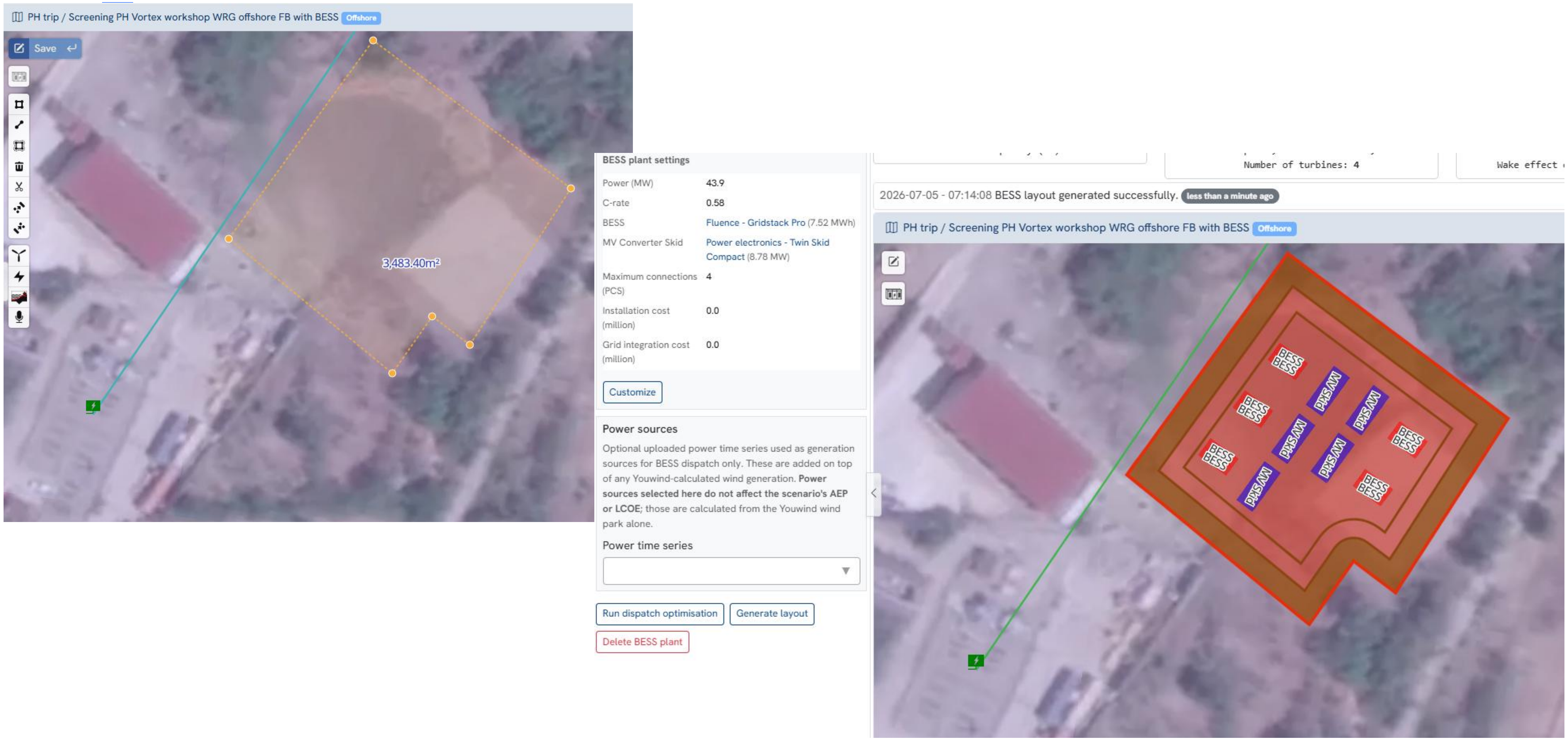


Project Finance

Financial indicators

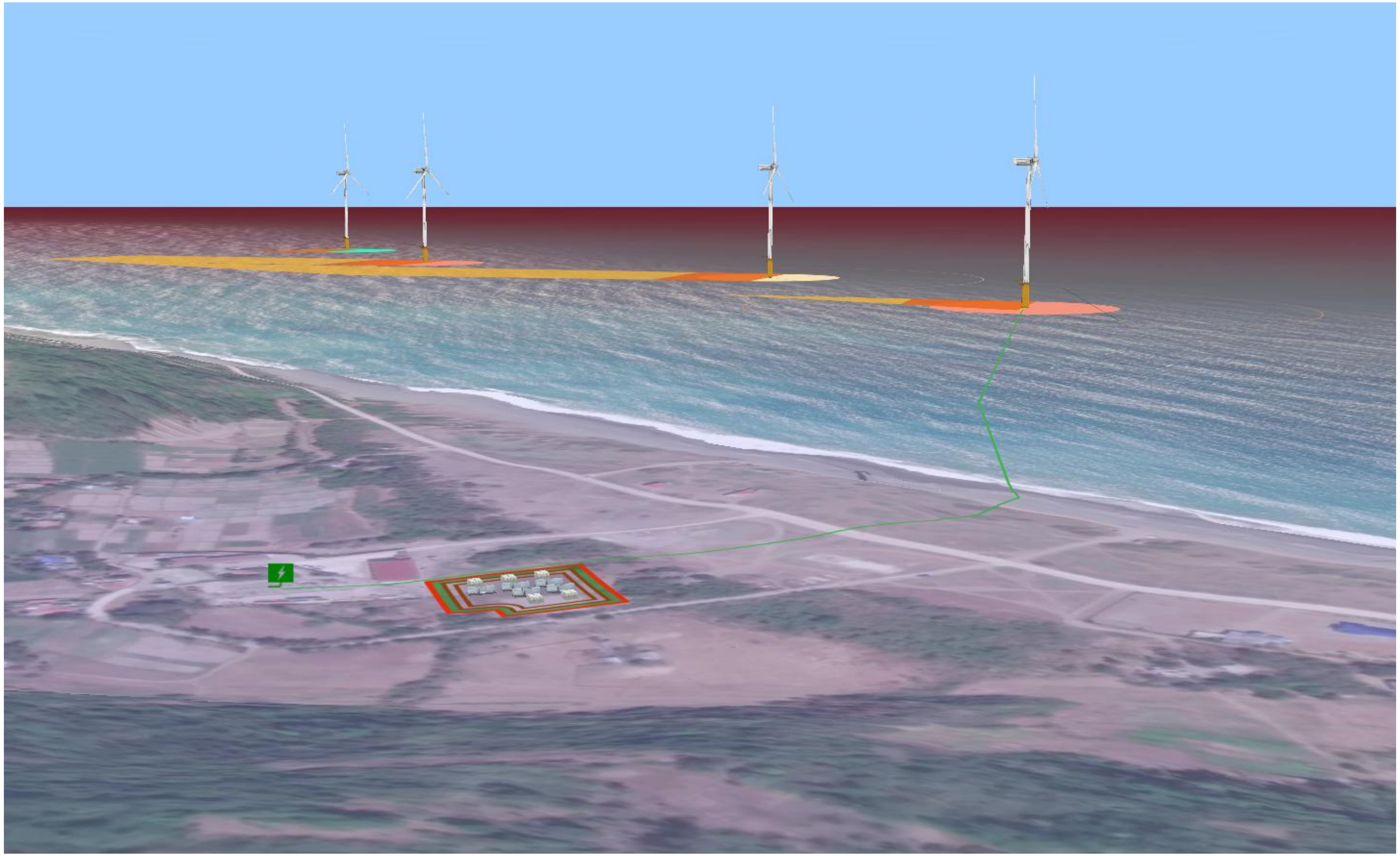
Scenario name	Screening PH Vortex workshop WRG offshore FB LCOE Optimized	Screening PH Vortex workshop WRG offshore FB
Main Characteristics	-	-
Project lifetime (years)	25	25
Bid price at FID (currency/MWh)	€100.00	€100.00
Project IRR (%)	8.9	8.29 6.85%
LCoE (currency/MWh)	€82.00	€87.06 6.17%
Discounted costs in LCoE numerator (million)	€219.63	€229.43
Discounted production in LCoE denominator (MWh)	2,678,366.98	2,635,222.75
NPV (million)	€106.62	€92.51
Average EBITDA (million)	€26.27	€25.79

Screening – fixed bottom areas vs. floating

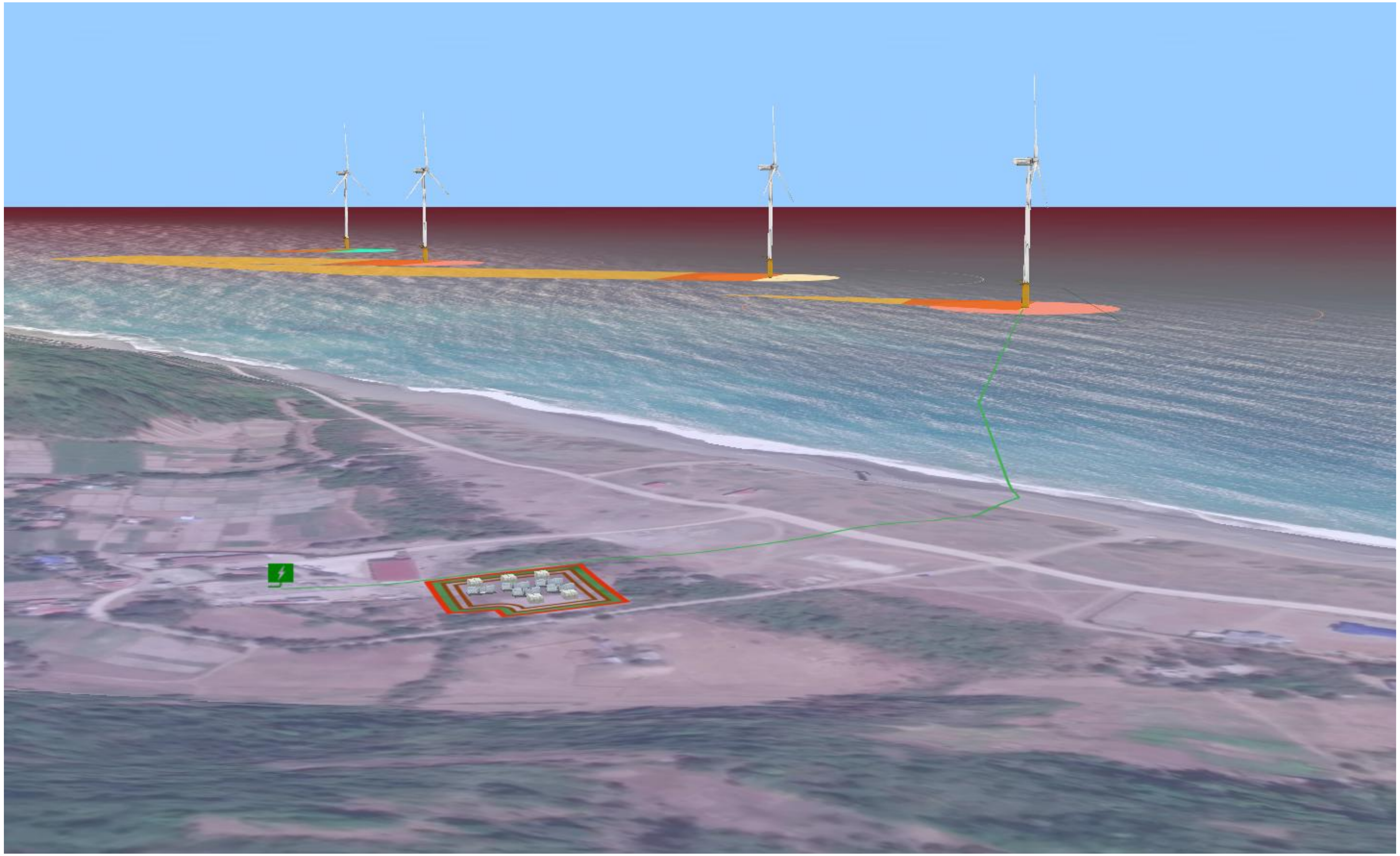


Screening – fixed bottom areas vs. floating

Screening – fixed bottom areas vs. floating



Screening – Coupled with solar



Screening – Coupled with solar – upload solar time series

Power sources

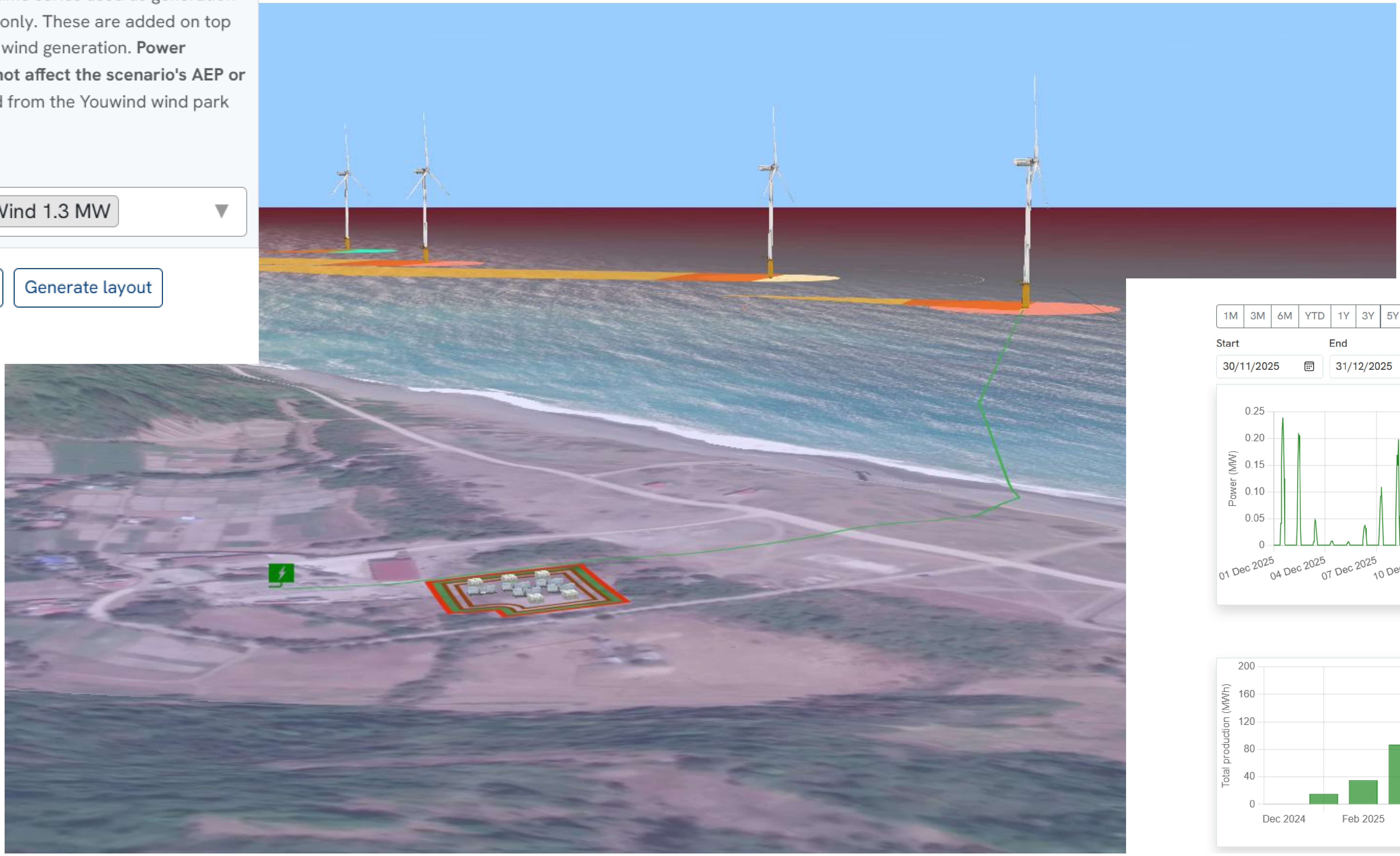
Optional uploaded power time series used as generation sources for BESS dispatch only. These are added on top of any Youwind-calculated wind generation. **Power sources selected here do not affect the scenario's AEP or LCOE**; those are calculated from the Youwind wind park alone.

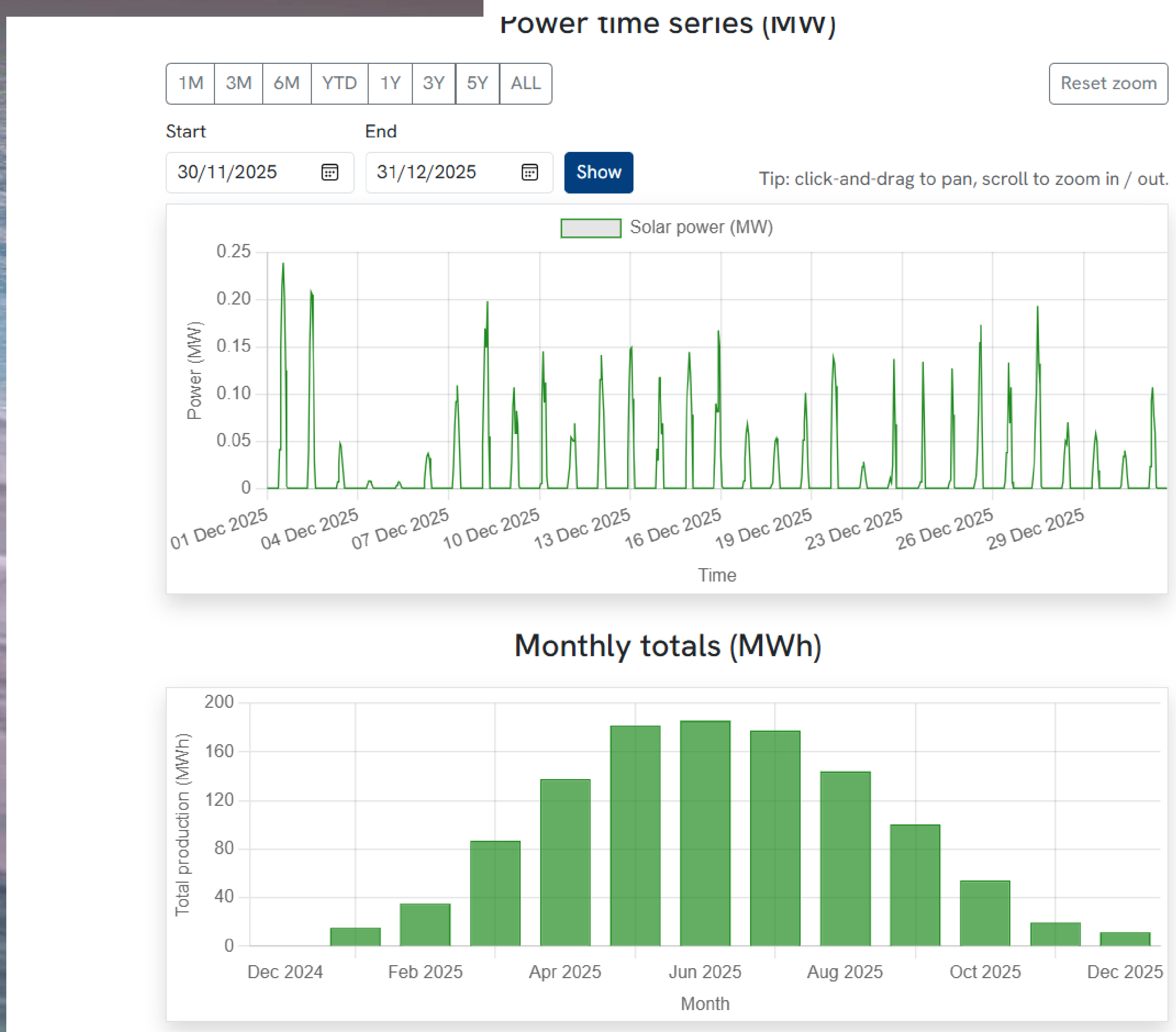
Power time series

× Solar 1080 kW × Wind 1.3 MW ▼

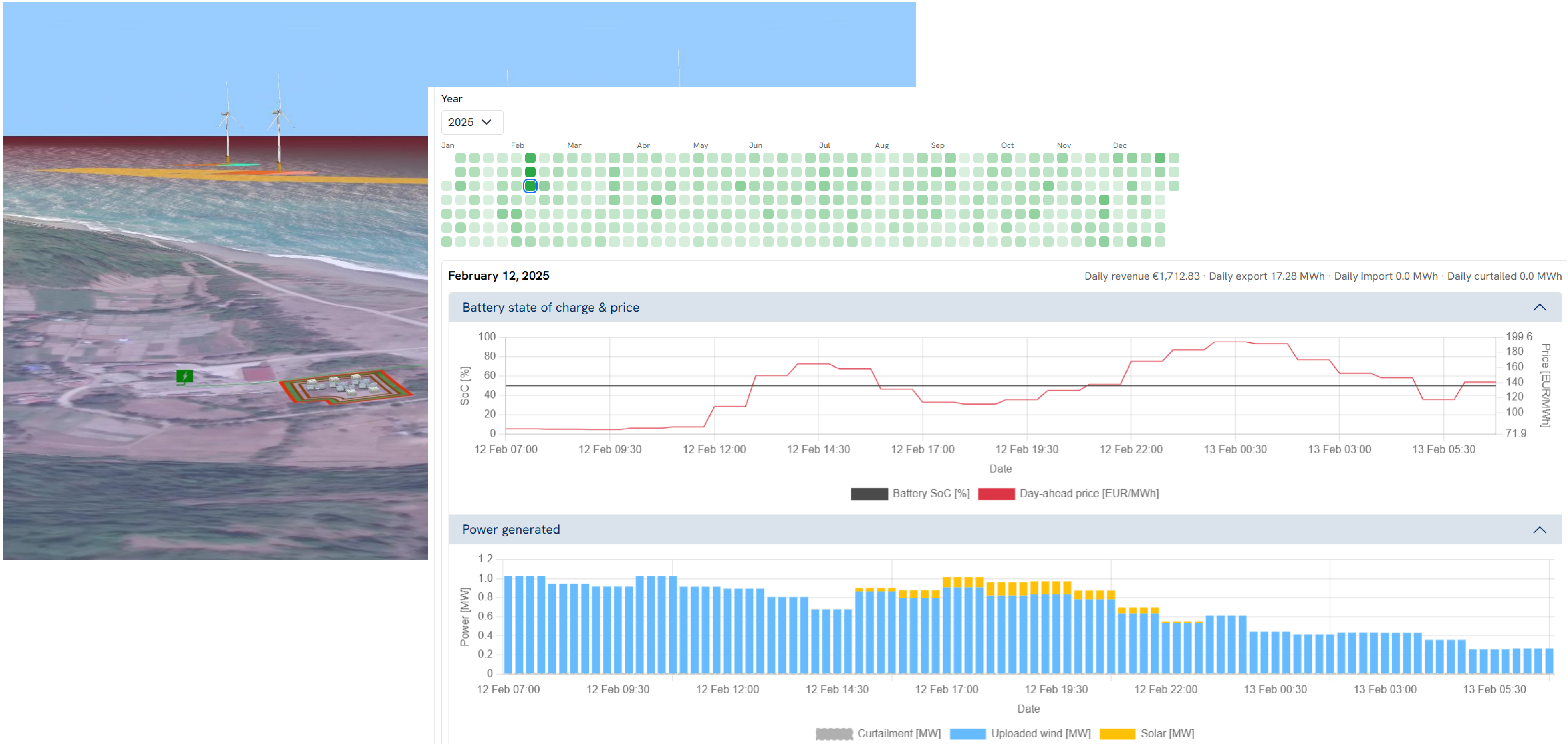
Run dispatch optimisation | Generate layout

Delete BESS plant





Screening – Coupled with solar – upload solar time series



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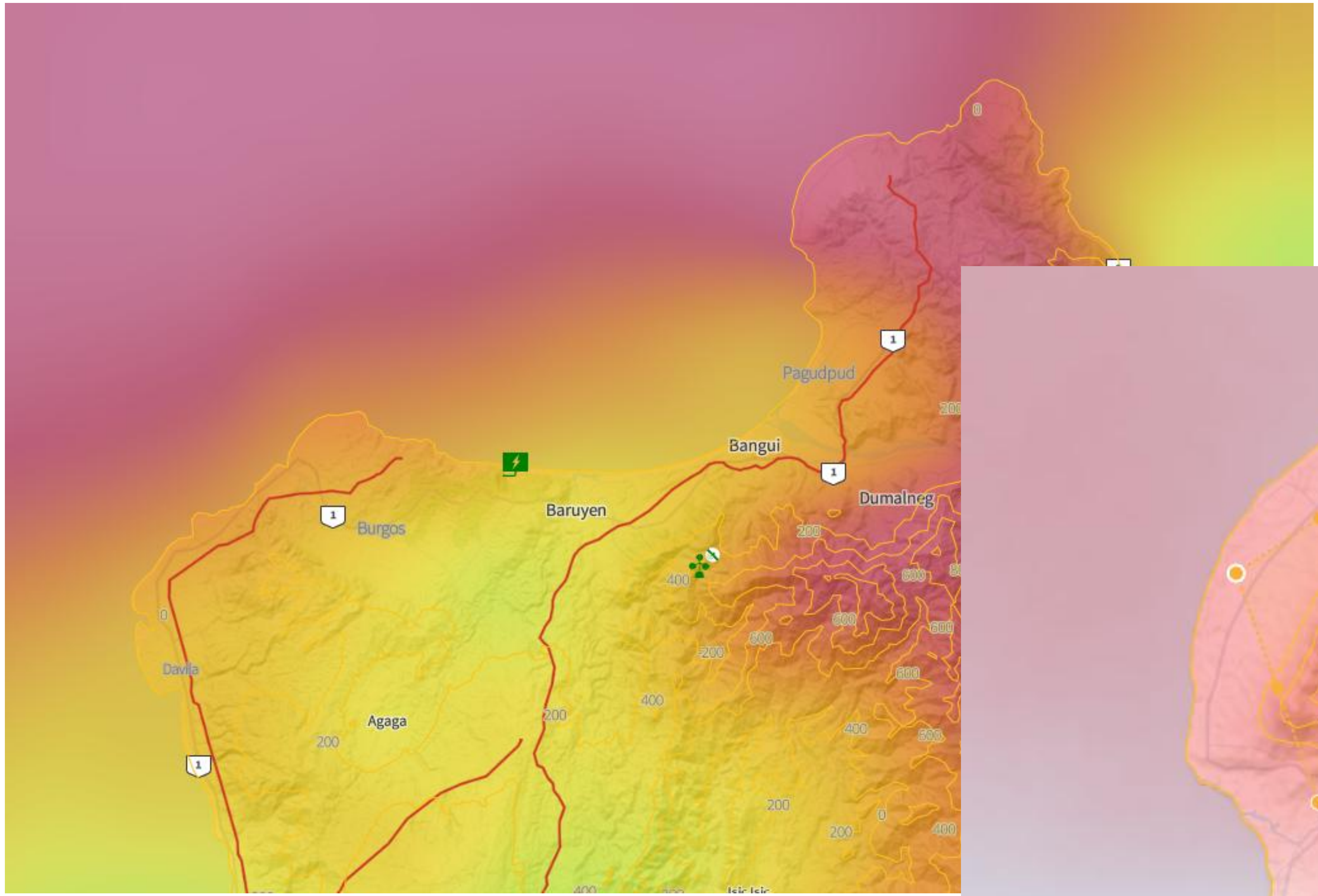
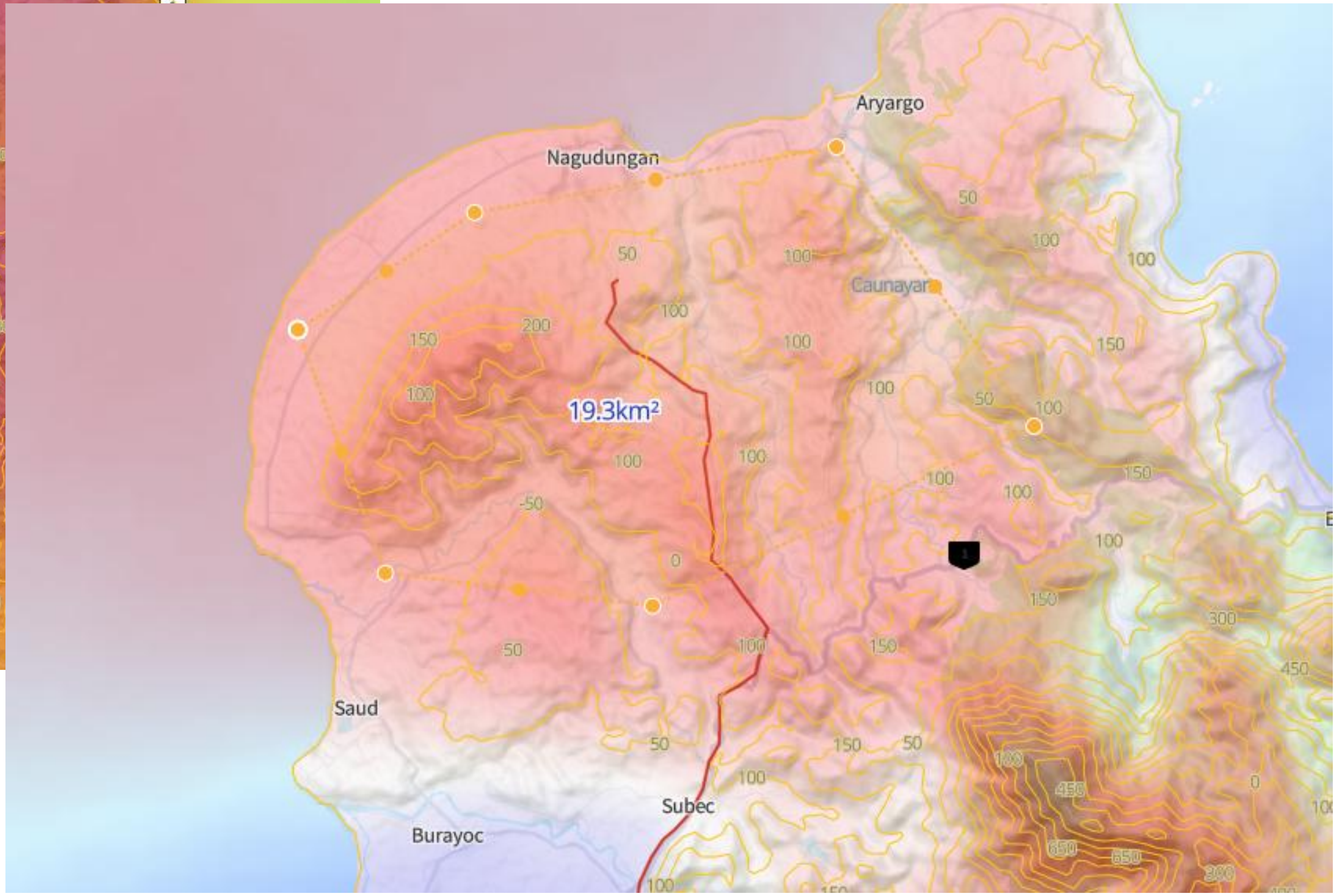
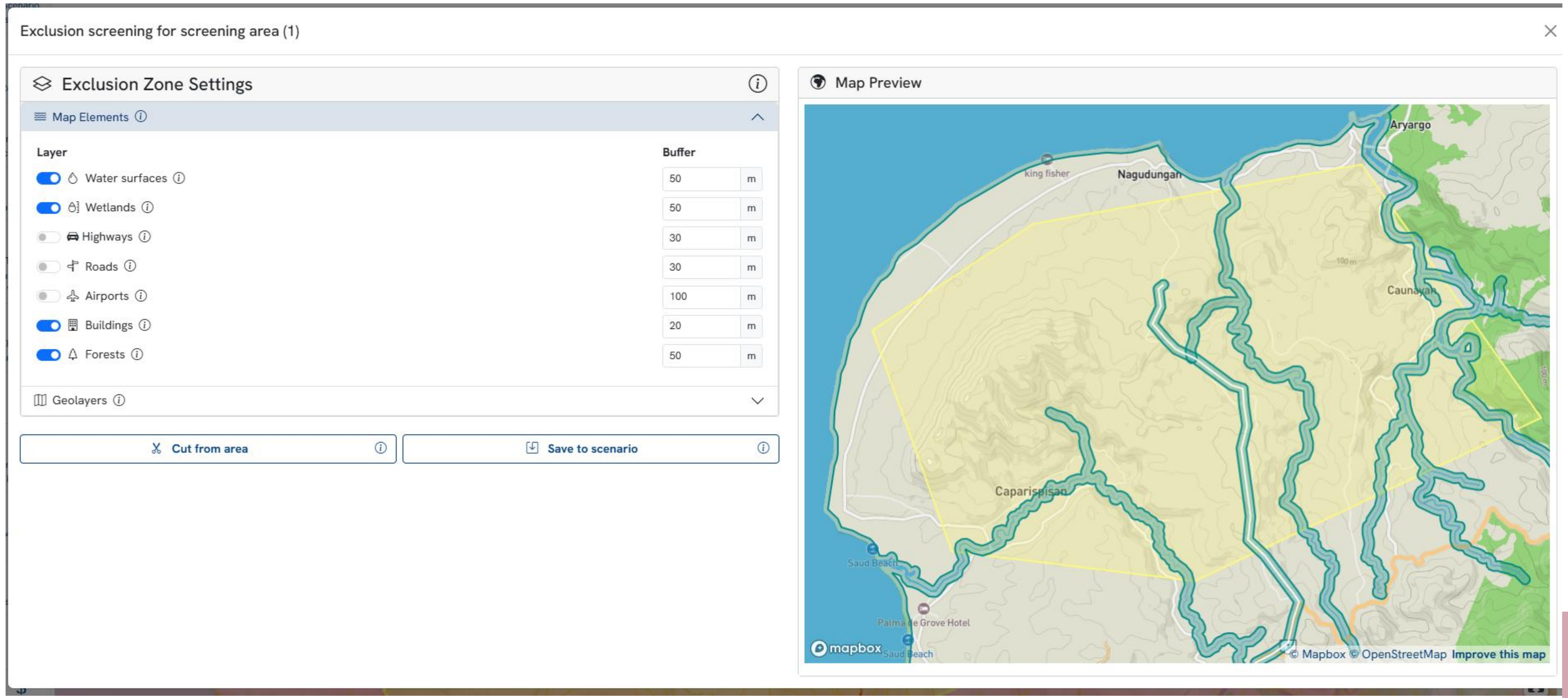
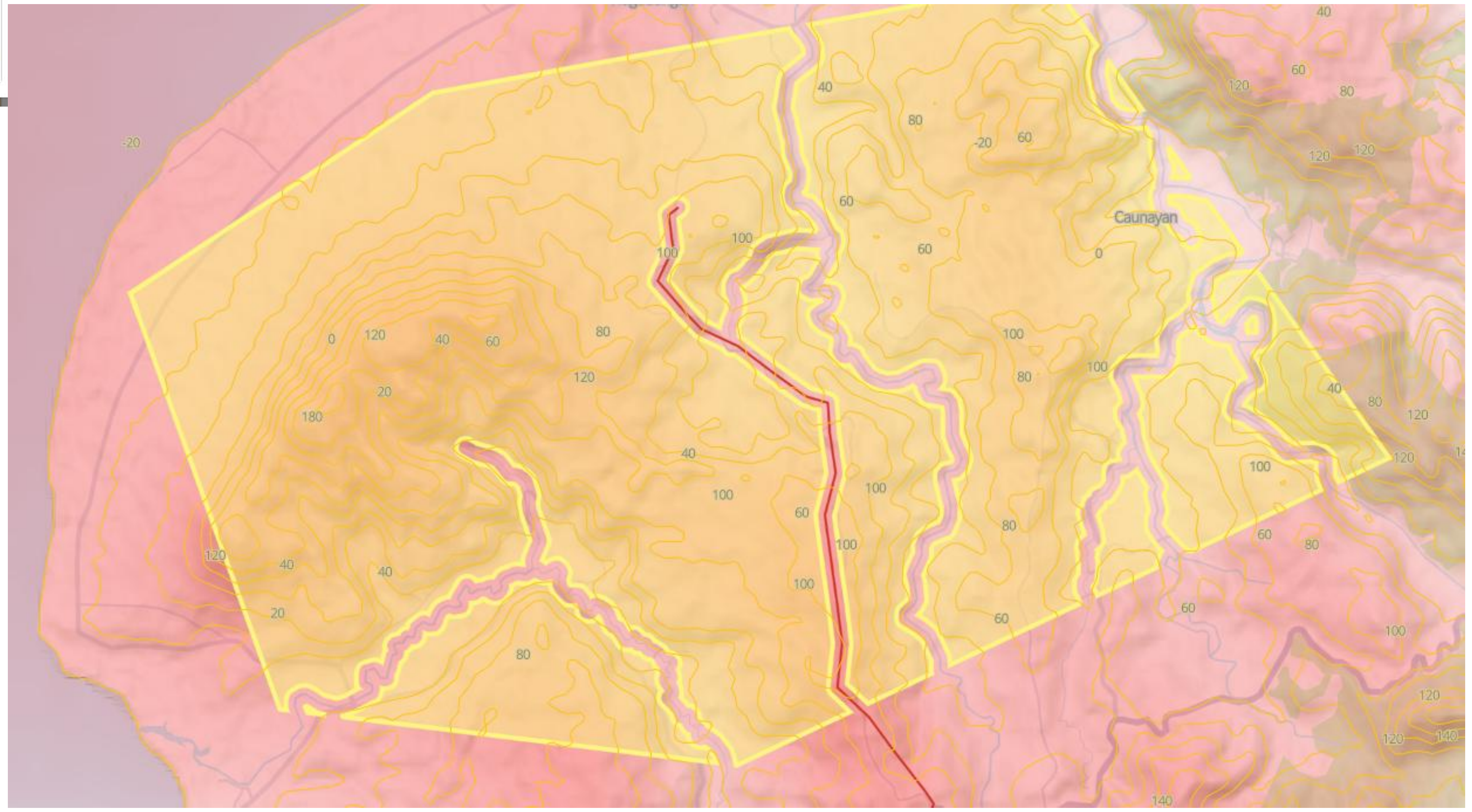
Screening


Pagudpud
Bangui
Baruyen
Burgos
Dumalneg
Davila
Agaga

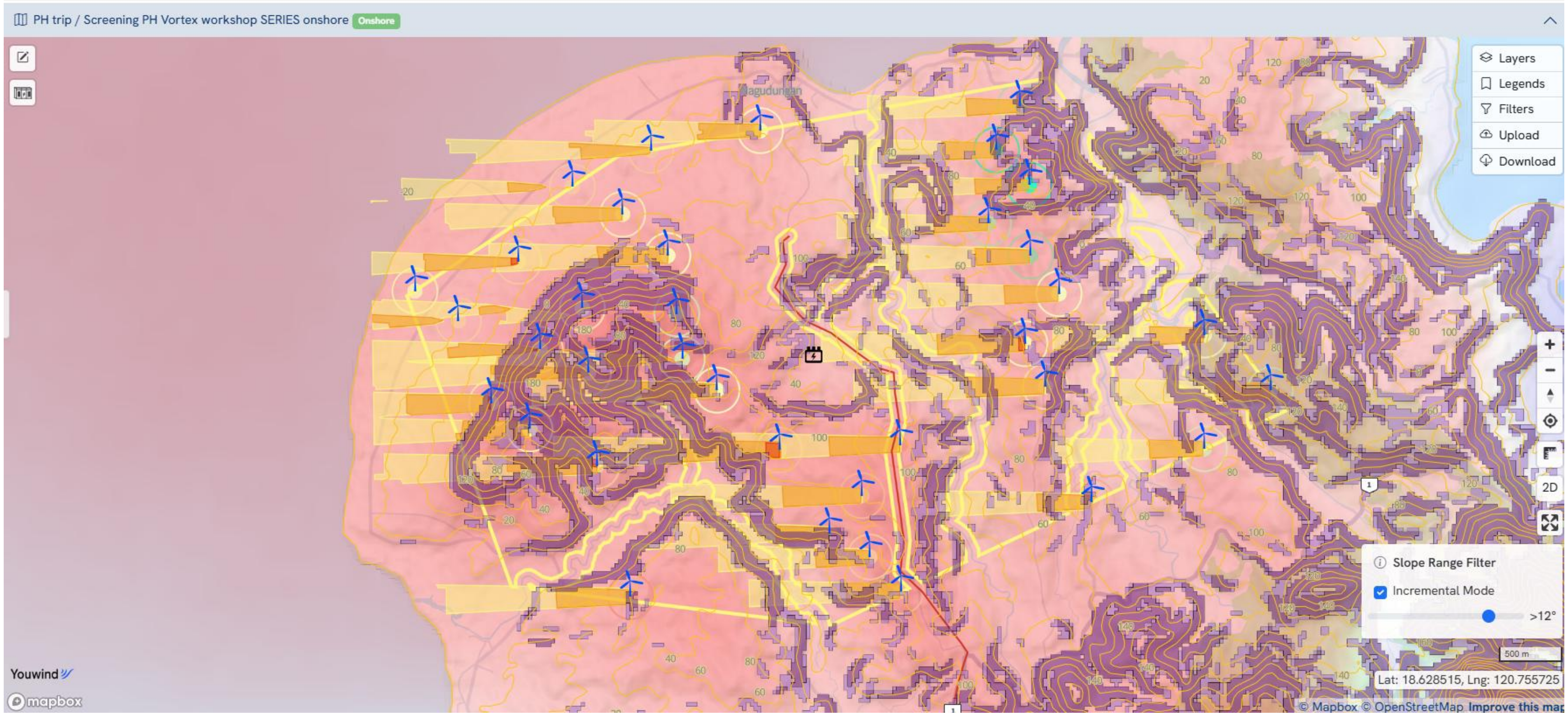

Aryargo
Nagudungan
Caunayan
19.3km²
Saud
Subec
Burayoc

Screening

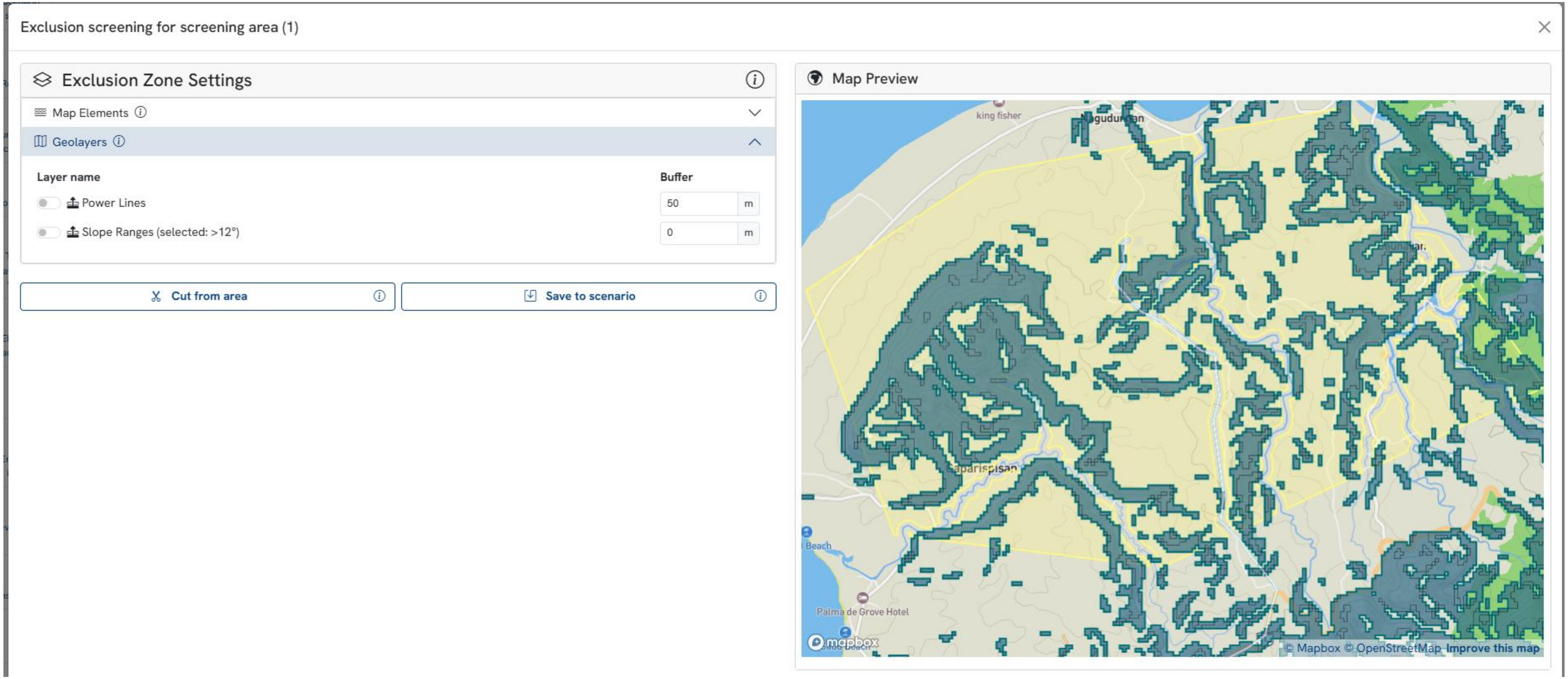

Exclusion screening for screening area (1)
Exclusion Zone Settings
Map Elements
Layer
Buffer
Water surfaces 50 m
Wetlands 50 m
Highways 30 m
Roads 30 m
Airports 100 m
Buildings 20 m
Forests 50 m
Geolayers
Cut from area
Save to scenario
Map Preview
Aryargo
king fisher
Nagudungan
Caunayan
Caparispisan
Saud Beach
Palmade Grove Hotel
mapbox
© Mapbox © OpenStreetMap Improve this map


Caunayan

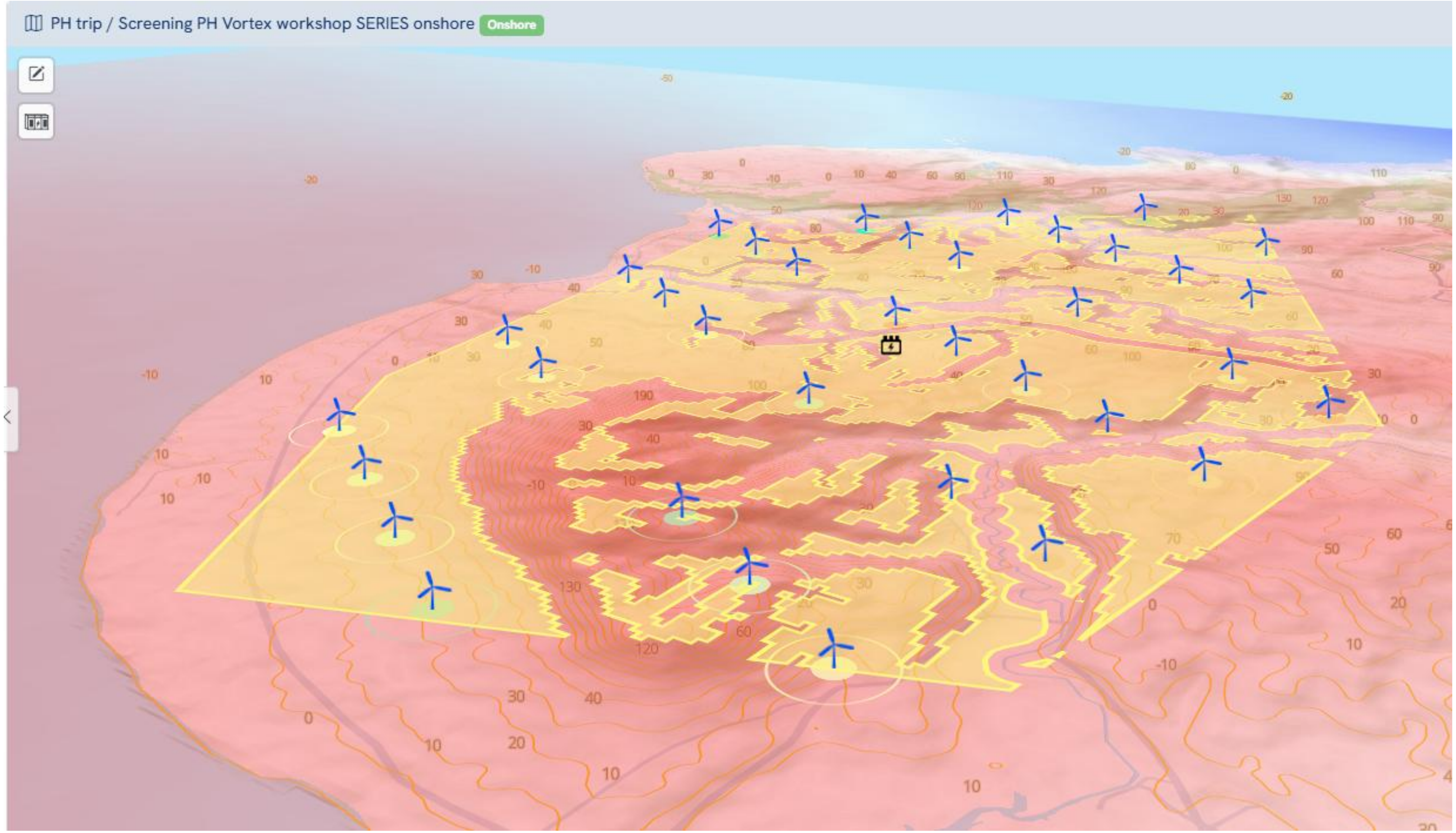
Screening


PH trip / Screening PH Vortex workshop SERIES onshore
Onshore
Layers
Legends
Filters
Upload
Download
Slope Range Filter
Incremental Mode
>12°
2D
500 m
Lat: 18.628515, Lng: 120.755725
Youwind
mapbox
© Mapbox © OpenStreetMap Improve this map

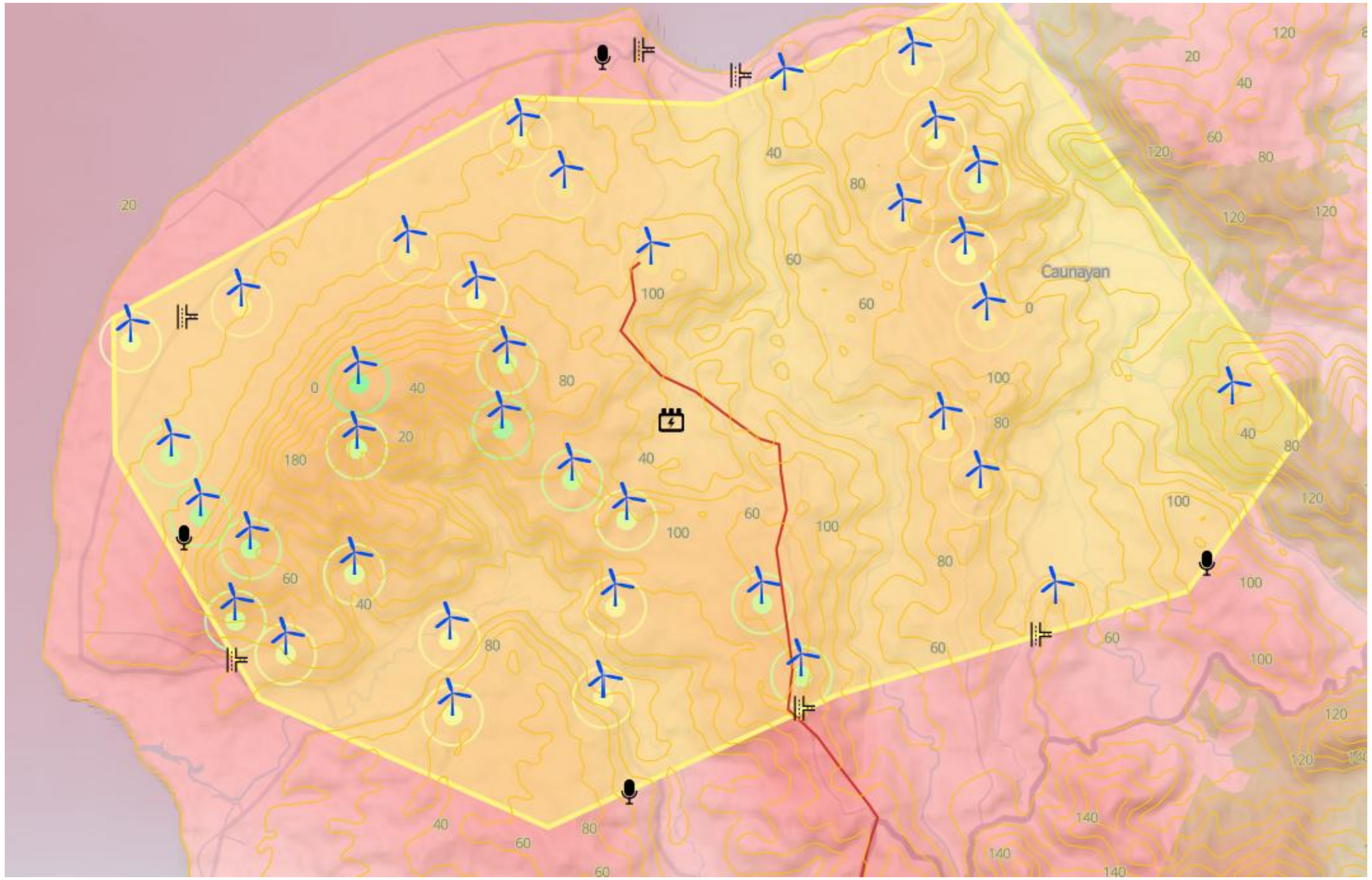
Screening


Exclusion screening for screening area (1)
Exclusion Zone Settings
Map Elements
Geolayers
Layer name
Buffer
Power Lines
50
m
Slope Ranges (selected: >12°)
0
m
Cut from area
Save to scenario
Map Preview
king fisher
Palma de Grove Hotel
Beach
mapbox
© Mapbox © OpenStreetMap Improve this map

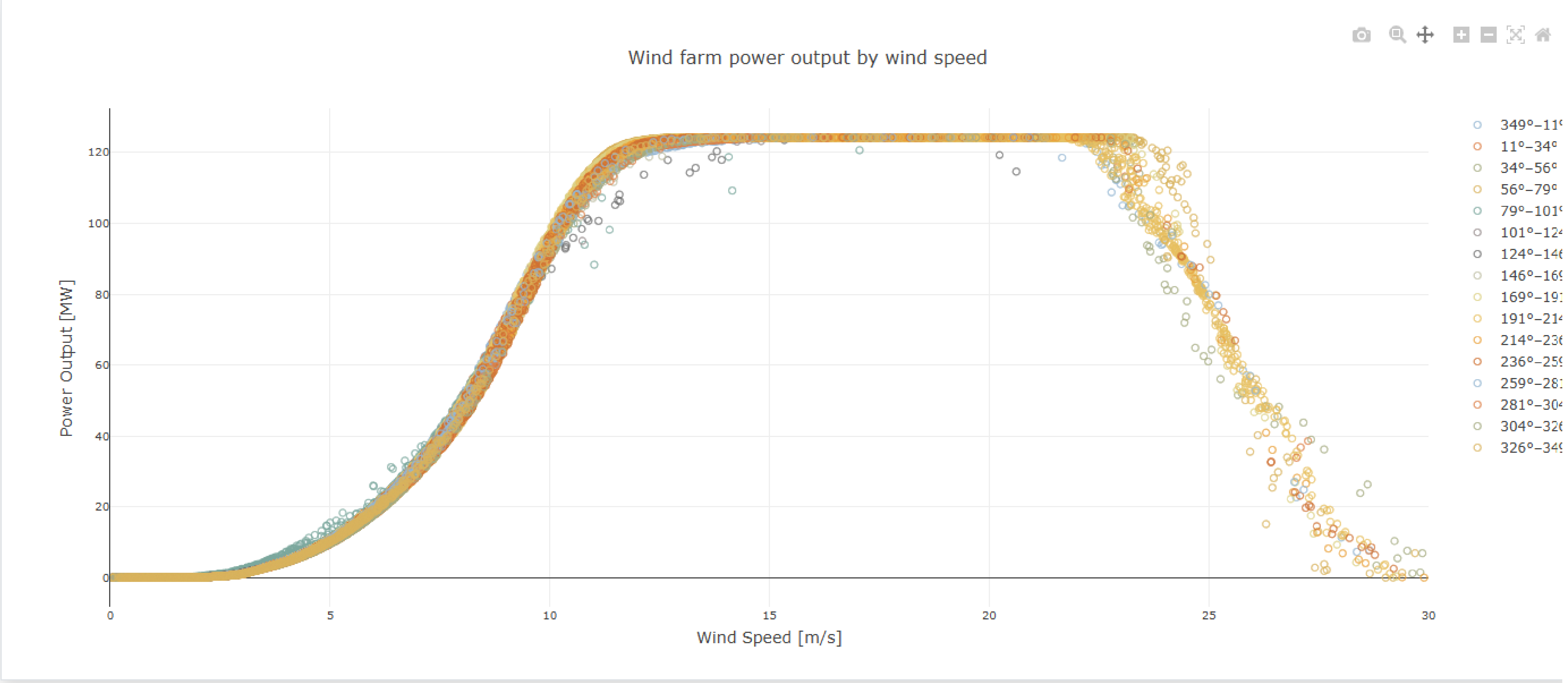
Screening


PH trip / Screening PH Vortex workshop SERIES onshore
Onshore

Layout optimisation Max AEP with SERIES and WRG file – 1.4% Increase in yield

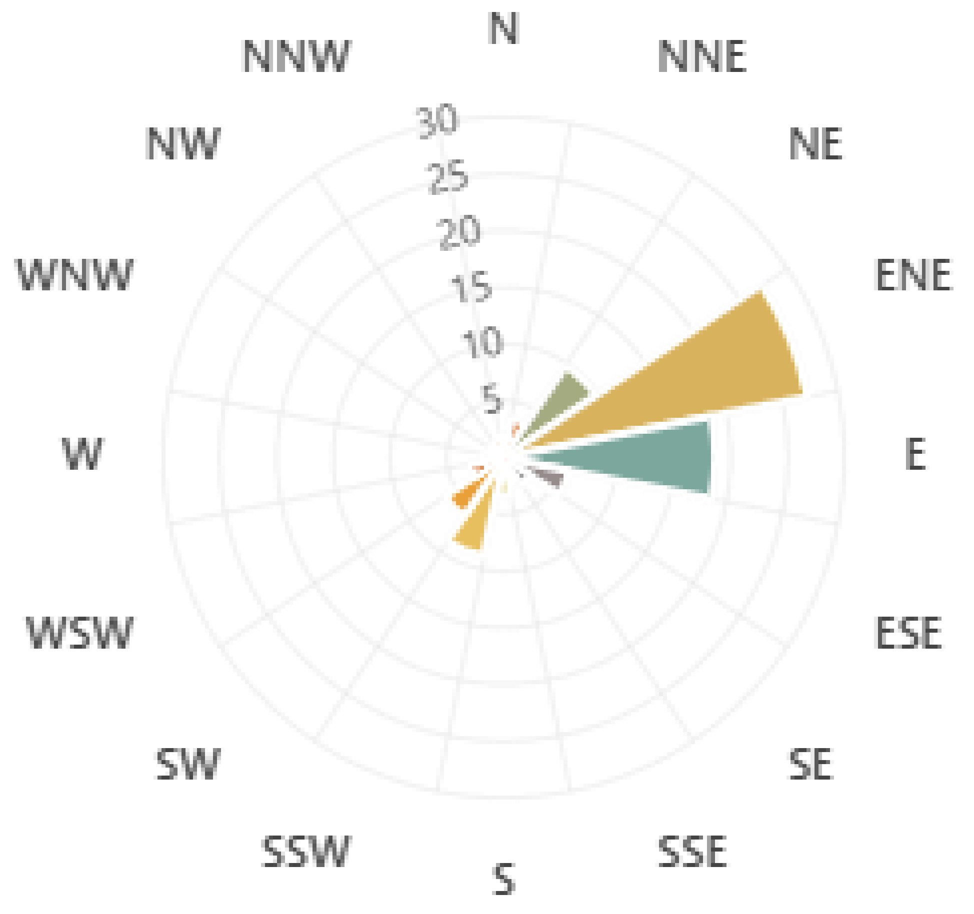


Layout optimisation Max AEP with SERIES and WRG file – 1.4% Increase in yield

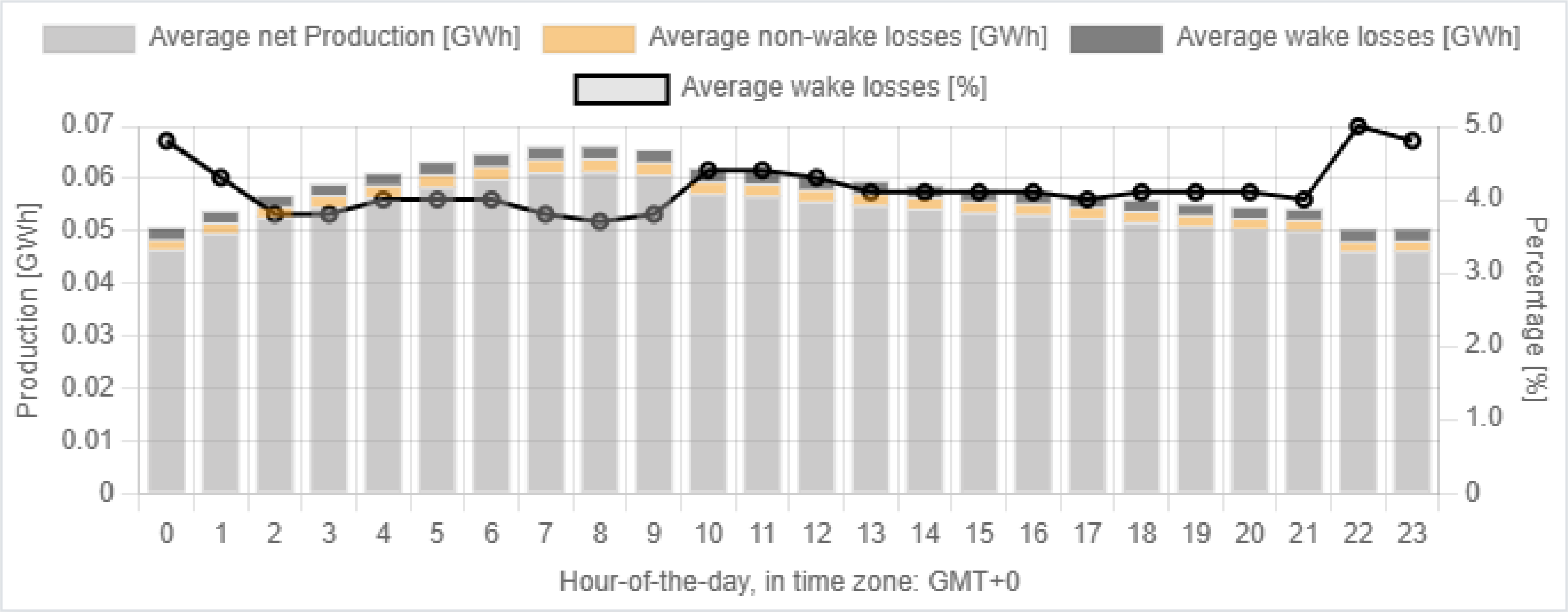


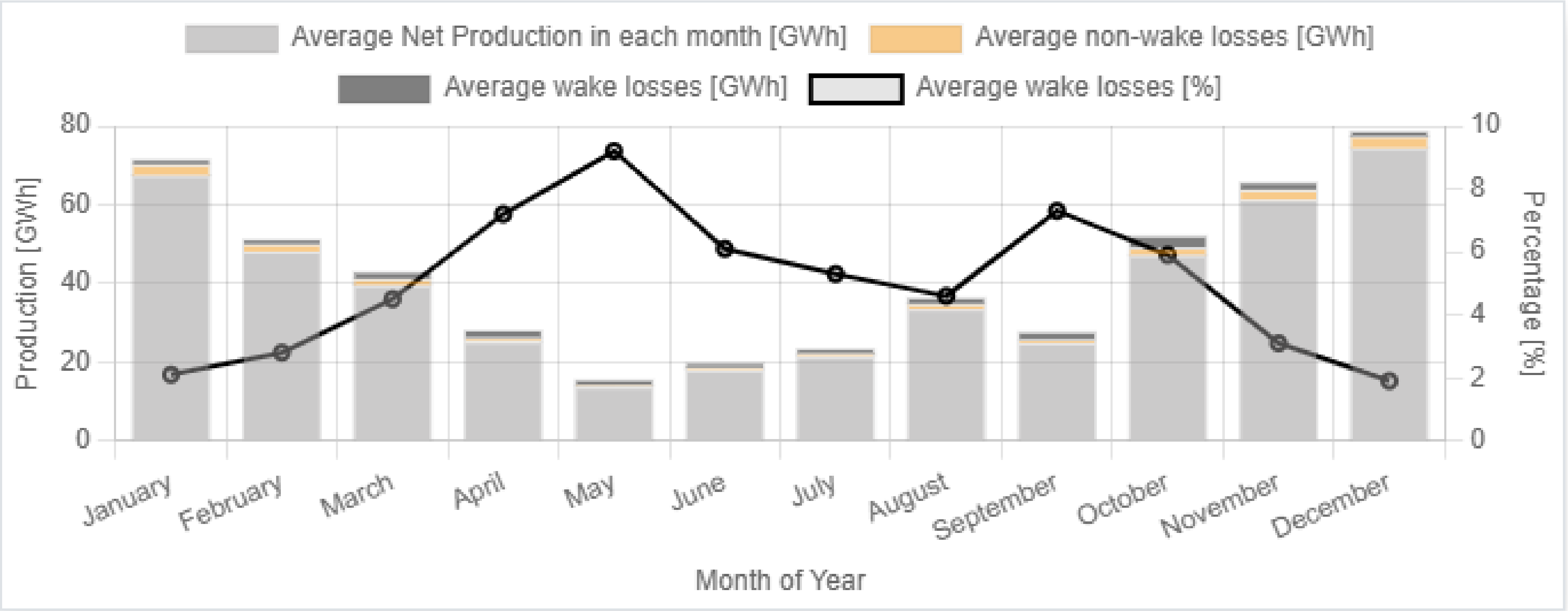
Wind Rose of Vortex SERIES

Source: Timeseries data (18.5, 120.75)

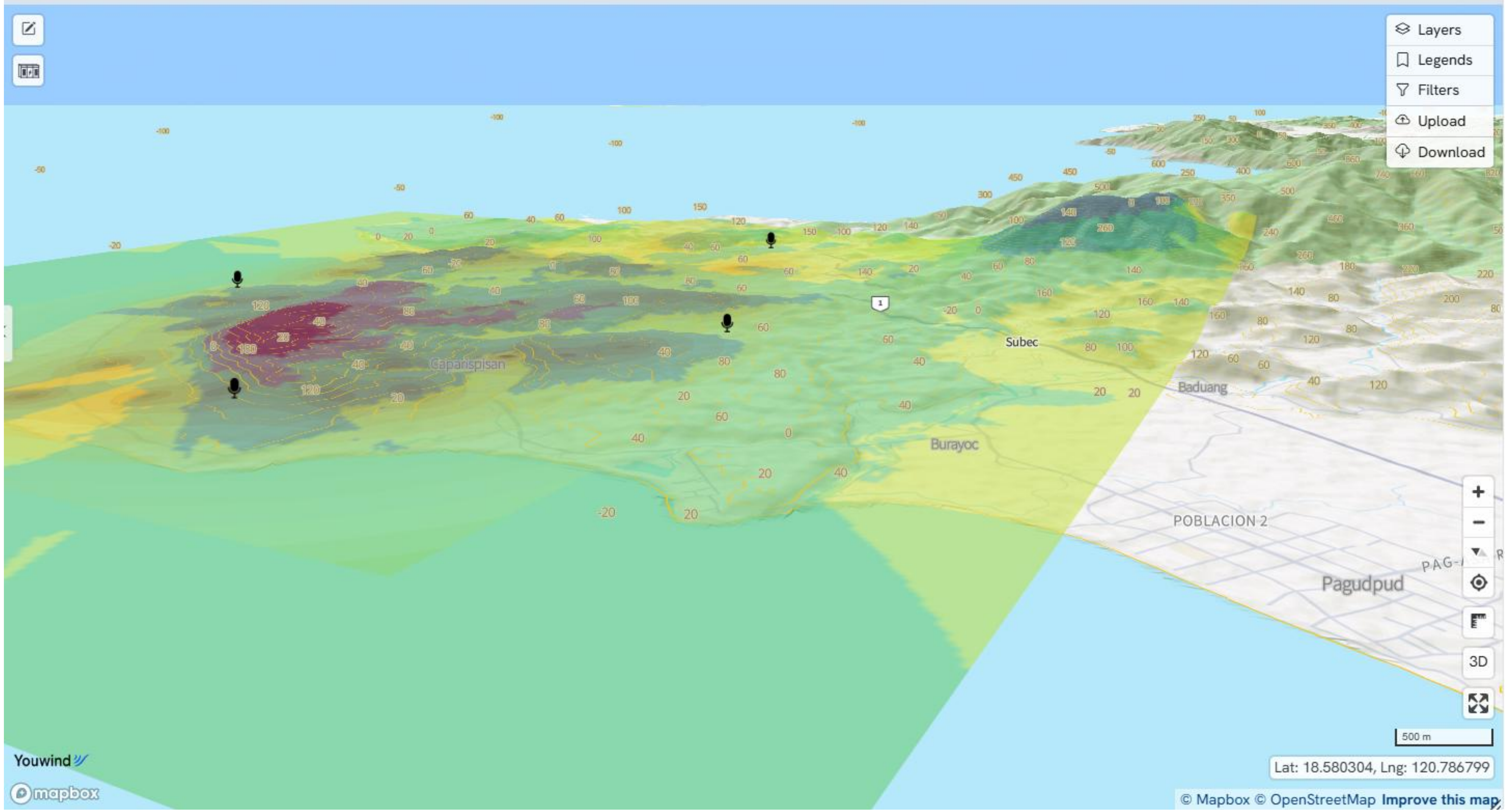


Daily and seasonal variation of production

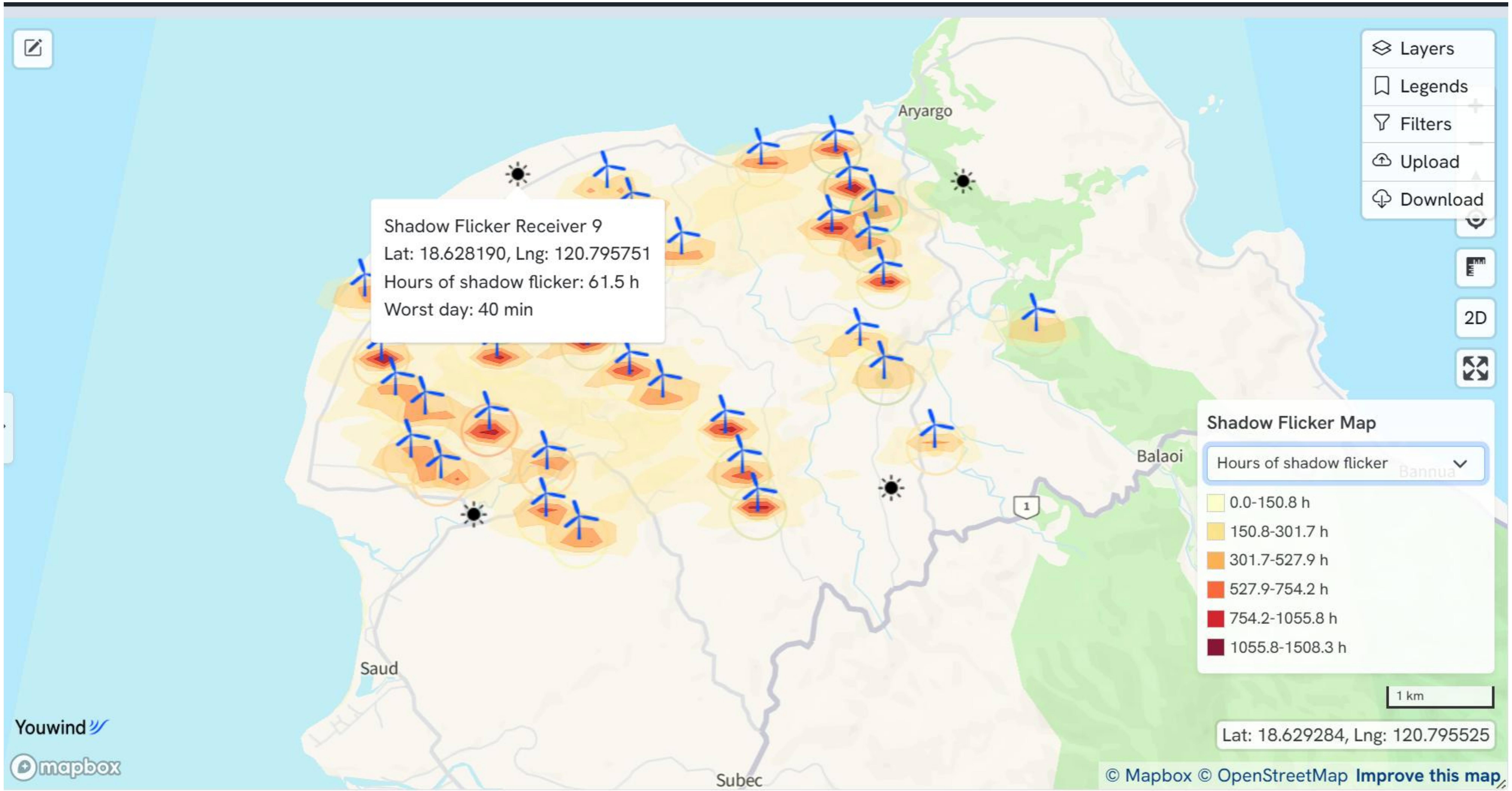




Environmental studies

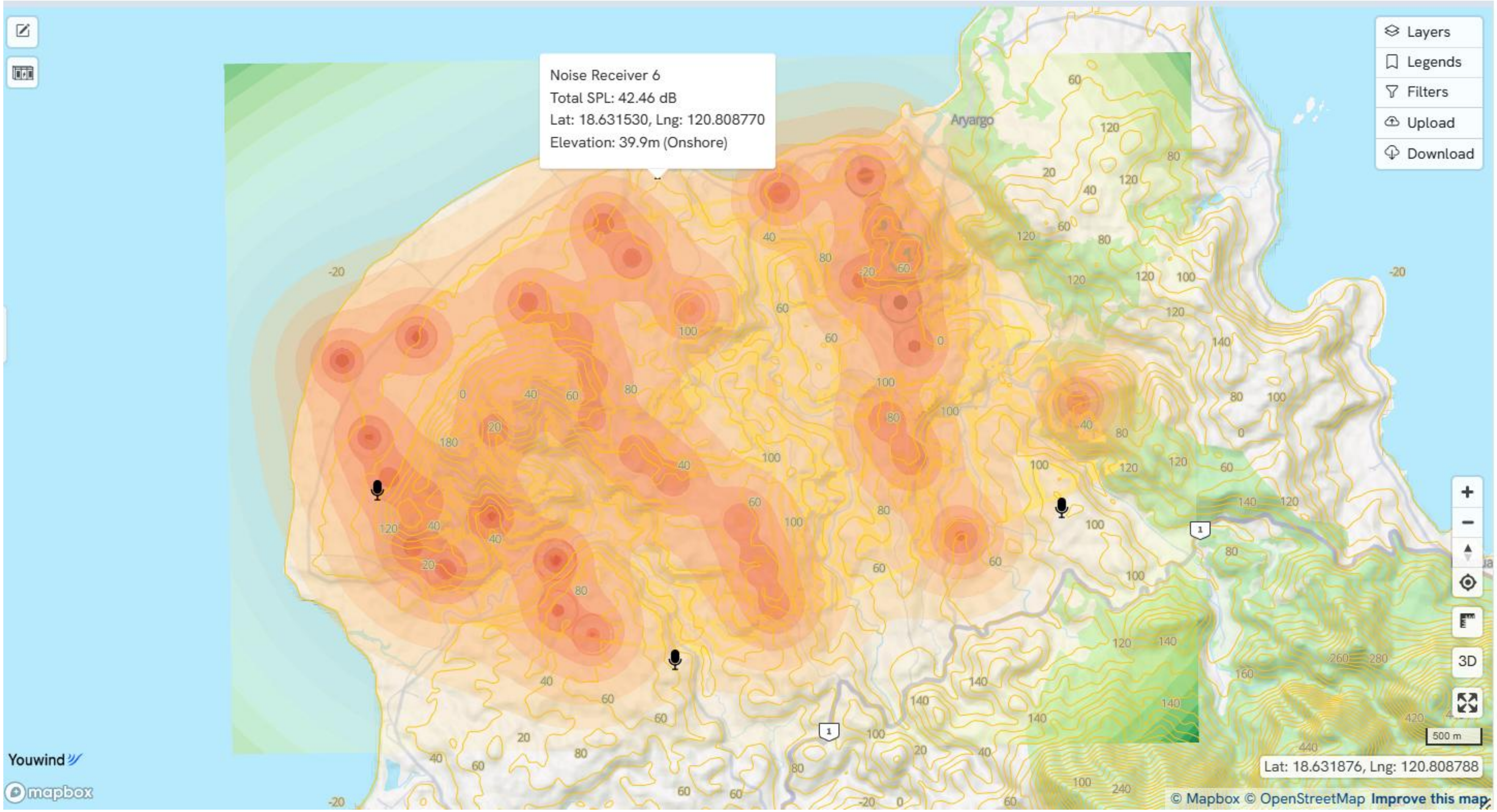


Environmental studies



05 onshore wind study

Environmental studies



Civil work

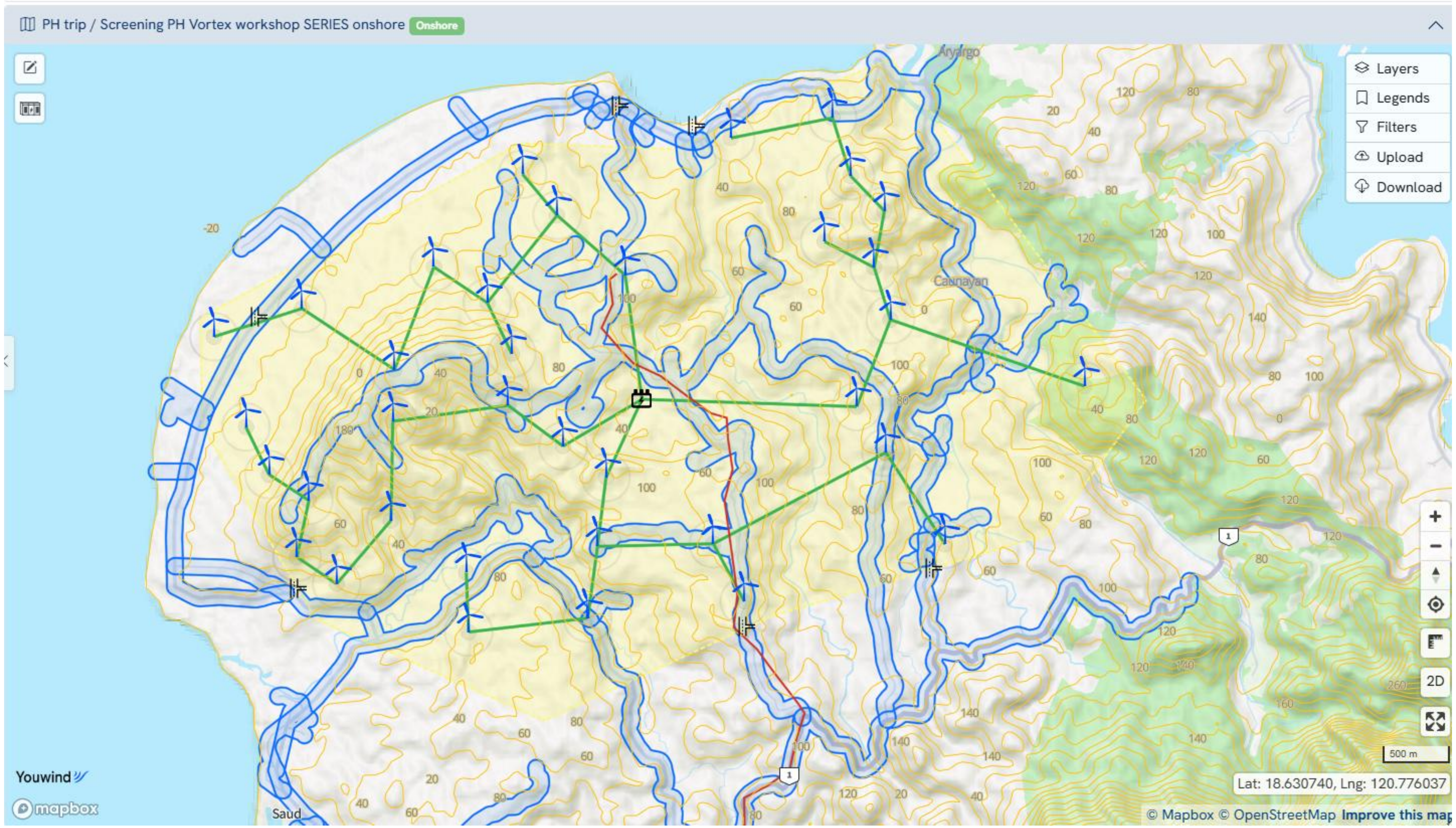

PH trip / Screening PH Vortex workshop SERIES onshore
Onshore
Save
Layers
Legends
Filters
Upload
Download
Caunayan
Saud
2D
500 m
Youwind
mapbox
Lat: 18.636551, Lng: 120.780901
© Mapbox © OpenStreetMap Improve this map

05 onshore wind study

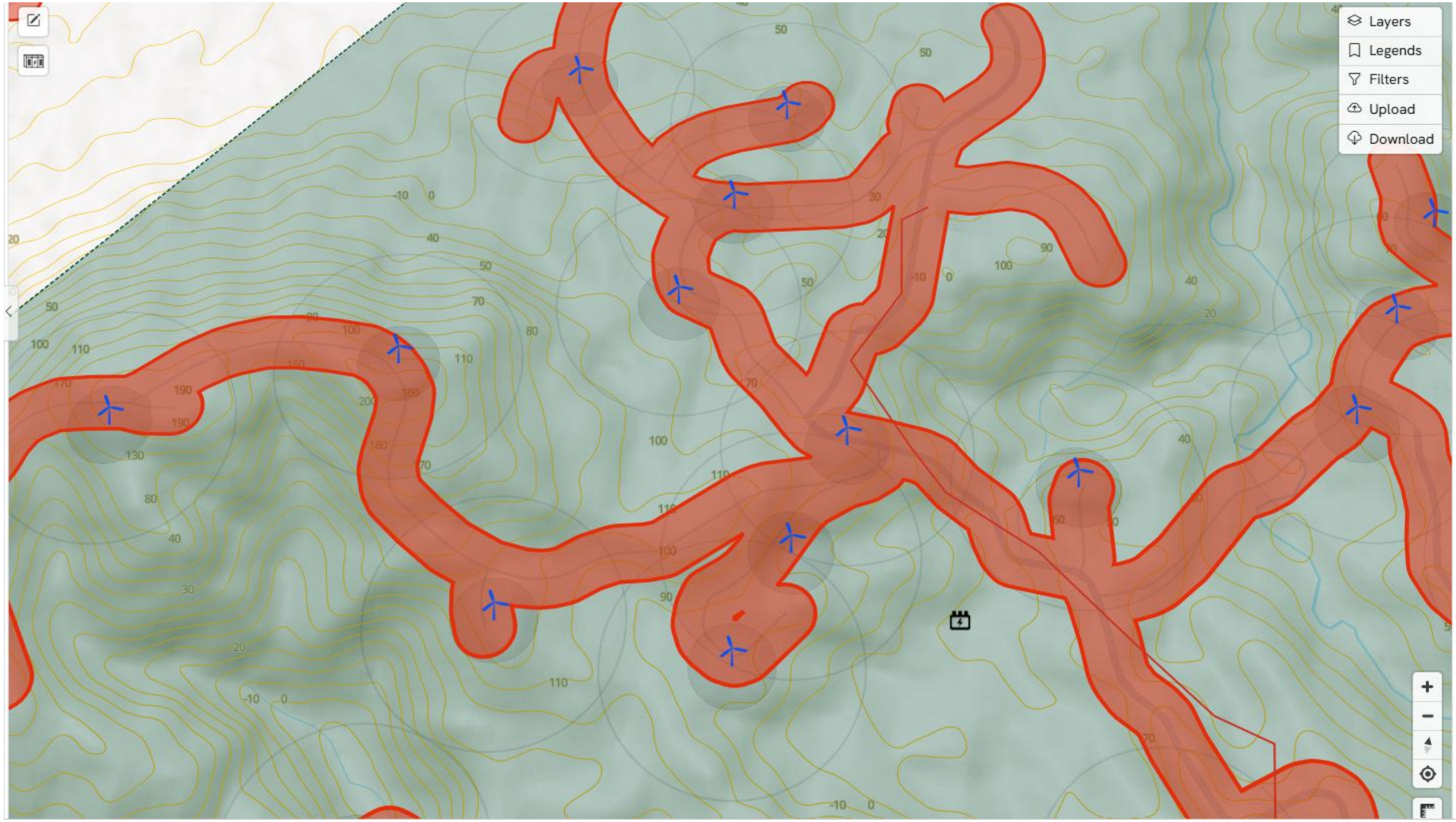
Civil work

05 onshore wind study

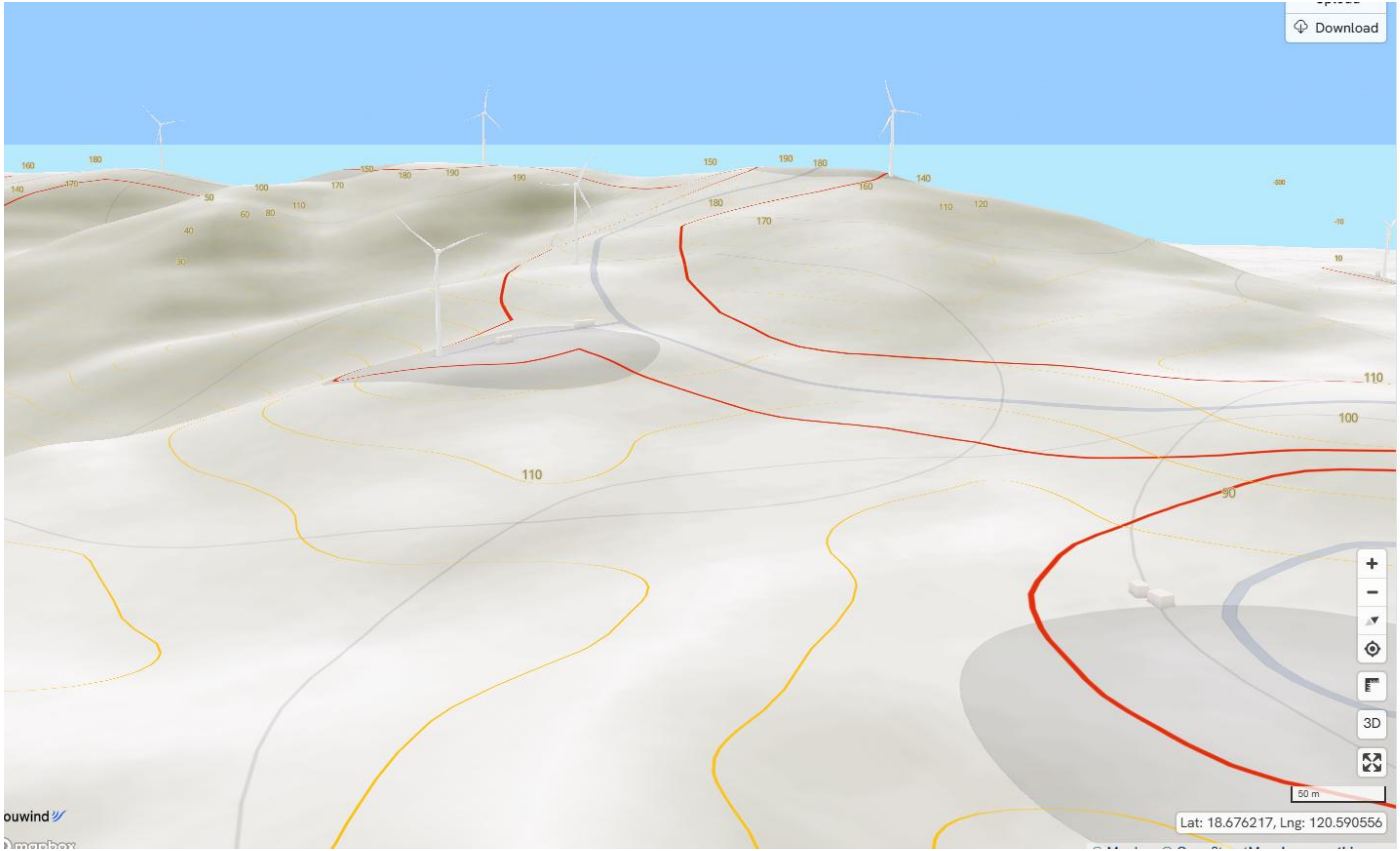
Civil work



Civil work



Civil work


Download
110
100
110
90
3D
50 m
ouwind
Lat: 18.676217, Lng: 120.590556

THANK YOU!