iLand

Offshore Pumped Hydro-electric Storage

PIANC, Oostende, 07/05/2015

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1. INTRODUCTION

iLand Renewable Energy

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C-POWER, Oostende

WIND and SOLAR are INTERMITTENT.

STORE ENERGY at times of excess generation, RELEASE ENERGY at times of shortages.

TERRANOVA, Zelzate

LARGE SCALE ENERGY STORAGE

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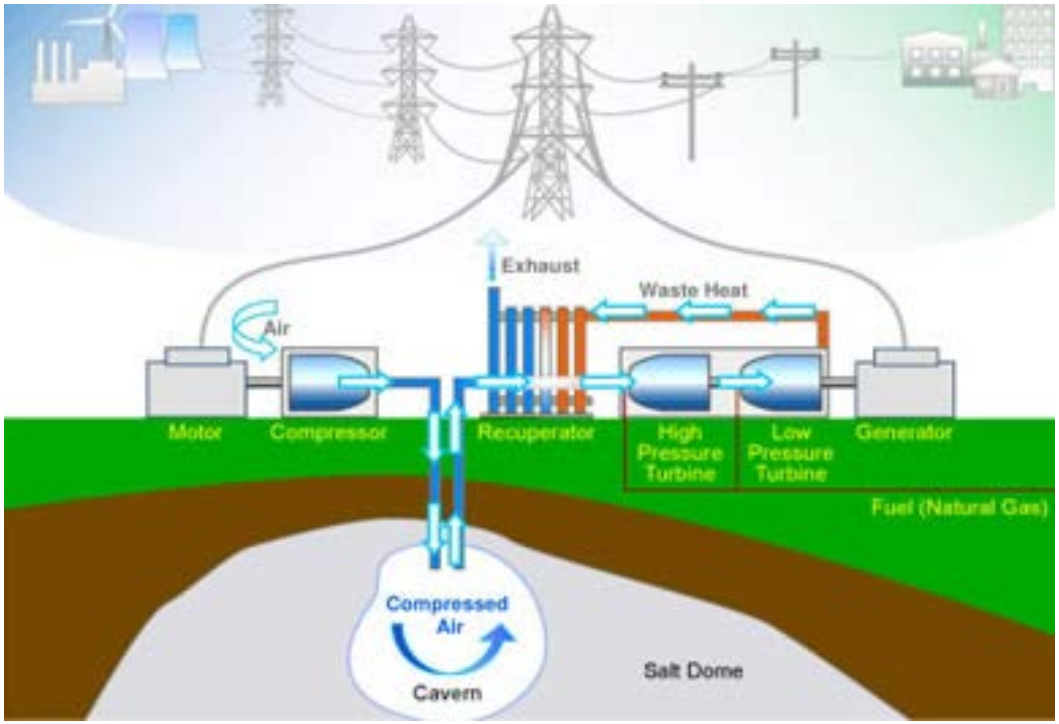

PUMPED HYDRO STORAGE:

98% of all large scale energy storage worldwide.

In Belgium: important on-shore spatial constraints.

COMPRESSED AIR ENERGY STORAGE:

2 stations (1 in USA, 1 in Germany) built since 1978.

In Belgium: unfavourable subsoil conditions.

iLand = ENERGY STORAGE at SEA

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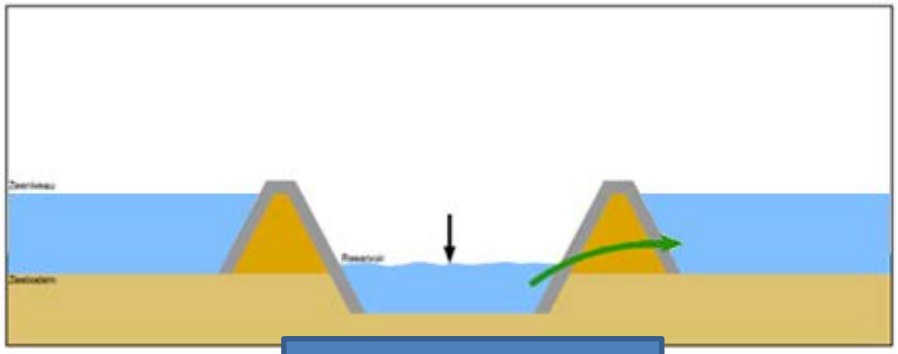
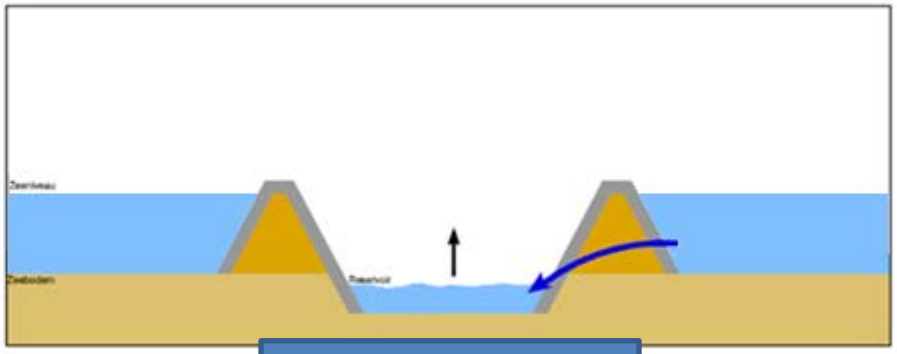
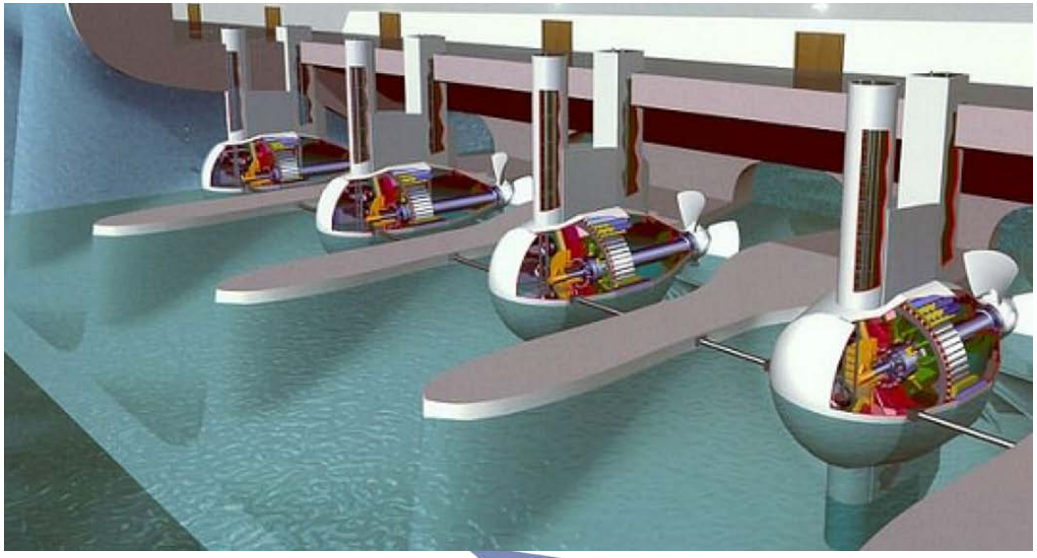


STORE ENERGY



RELEASE ENERGY



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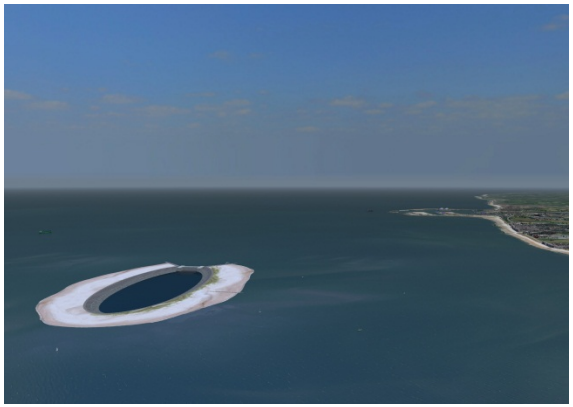
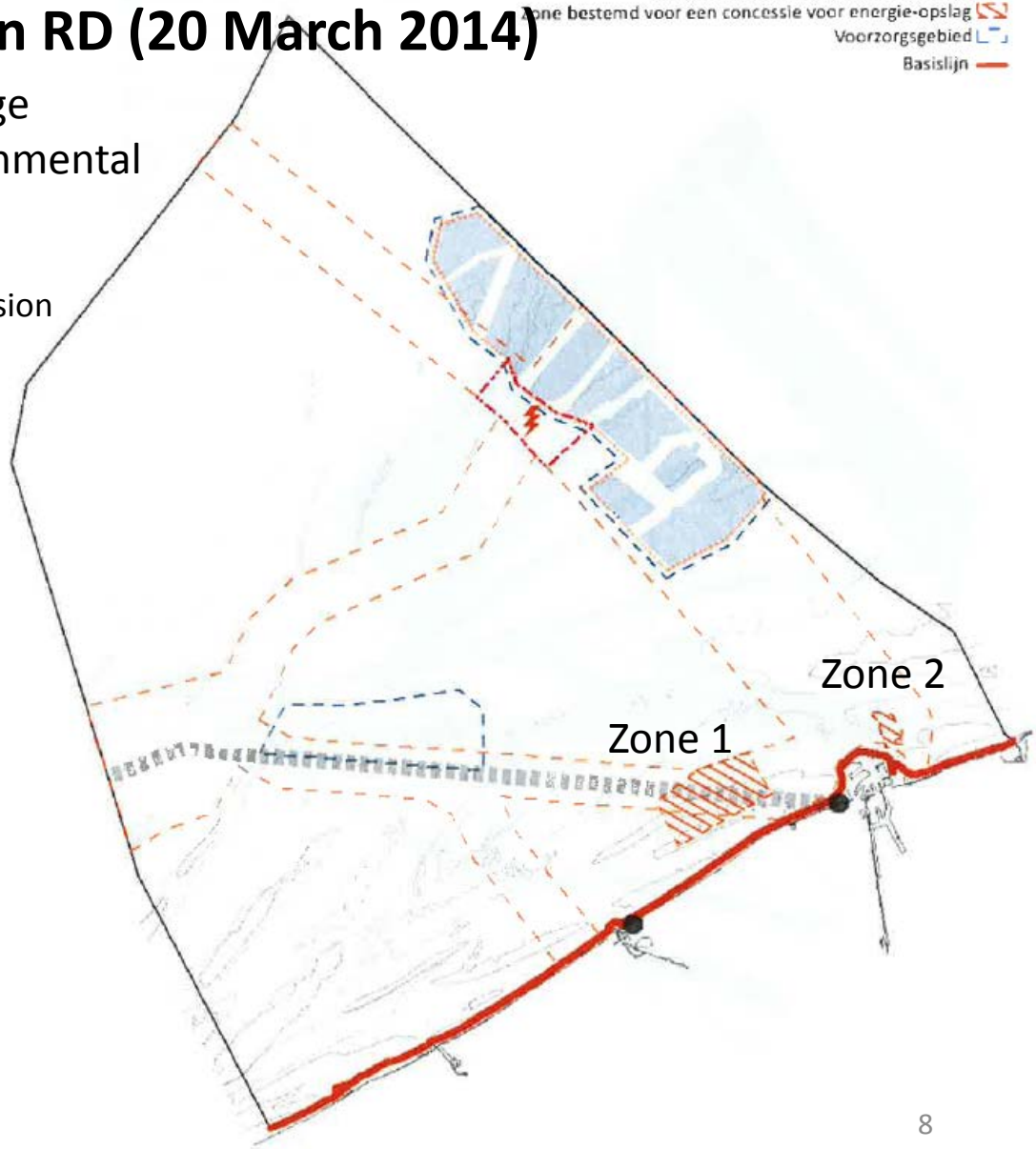
2. LEGAL ASPECTS

Legal framework in Belgium: Marine Spatial Plan RD (20 March 2014)

- ✓ Definition of 2 zones for Energy storage concessions, including "active environmental measures":
  - Zone 1 – near Wenduinebank
  - Zone 2 – east of Zeebrugge harbour extension
- ✓ Visitor's centre included





Legal framework in Belgium: Concession RD (8 May 2014)

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1. Subject:
Conditions and procedure for awarding a domain concession for an energy storage island with parallel environmental function.

2. Award criteria are similar to those for Offshore Wind Farms, except:

- Redesignation after expiry of legal concession period of 50y+25y max.
- Located within contour of zone 1 / zone 2 (Marine Spatial Plan)
- Quality of active environmental measures
- Strength of the JV at technical, economical and societal level

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3. BASE CASE

Base case: location

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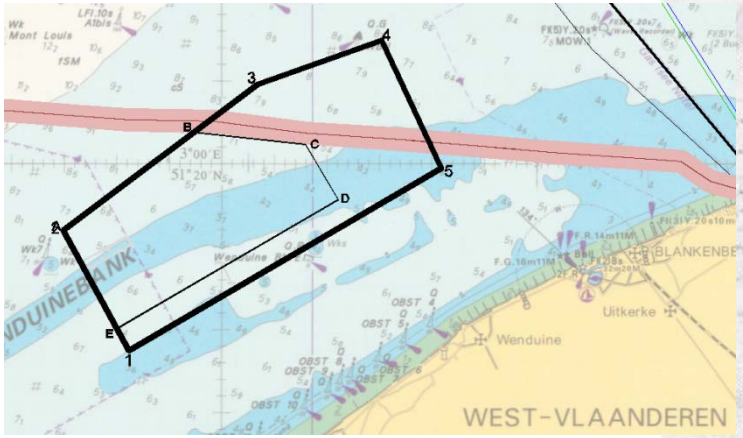
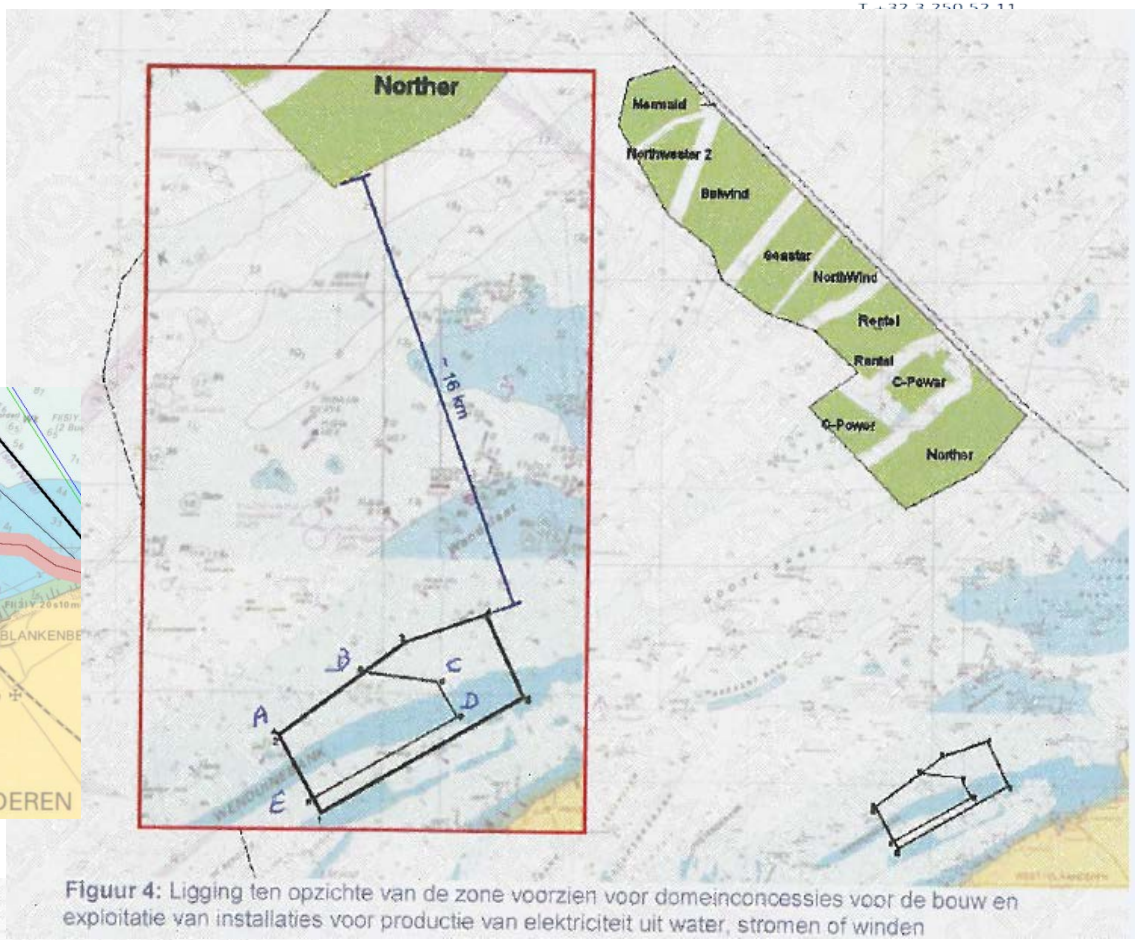
Requested domain concession ABCDE within zone 1 (Wenduinebank) of the Marine Spatial Plan.





Figuur 4: Ligging ten opzichte van de zone voorzien voor domeinconcessies voor de bouw en exploitatie van installaties voor productie van elektriciteit uit water, stromen of winden

Domeinconcessie binnen afgebakende zone 1

ETRS89 coordinatensysteem

ID	WGS84 Geographical						UTM Zone31 (WGS84)		WGS84 Geographical			
	Oost (OL)			Noord (NB)			X	Y	Oost OL		Noord NB	
	°	'	"	°	'	"			°	'	°	'
A	2	56	58,628	51	19	11,388	496489,15	5685393,38	2	56,977	51	19,190
B	2	59	28,864	51	20	21,912	499397,58	5687570,72	2	59,481	51	20,365
C	3	1	37,196	51	20	13,128	501880,75	5687299,96	3	1,620	51	20,219
D	3	2	14,741	51	19	33,384	502607,87	5686072,22	3	2,246	51	19,556
E	2	58	0,163	51	18	0,756	497679,33	5683210,60	2	58,003	51	18,013

Oost OL	Noord NB	Oost OI	Noord NB
2,949619	51,31983
2,991351	51,33942
3,026999	51,33698
3,037428	51,32594
2,966712	51,30021

iLand requests Zone 1 as constructional advantages are expected.

Base Case: location

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iLand from the air, viewed parallel to the coastline

(realistical visualisation by 3D Engineering company CSO-Lievense)

Base Case: Conceptual design

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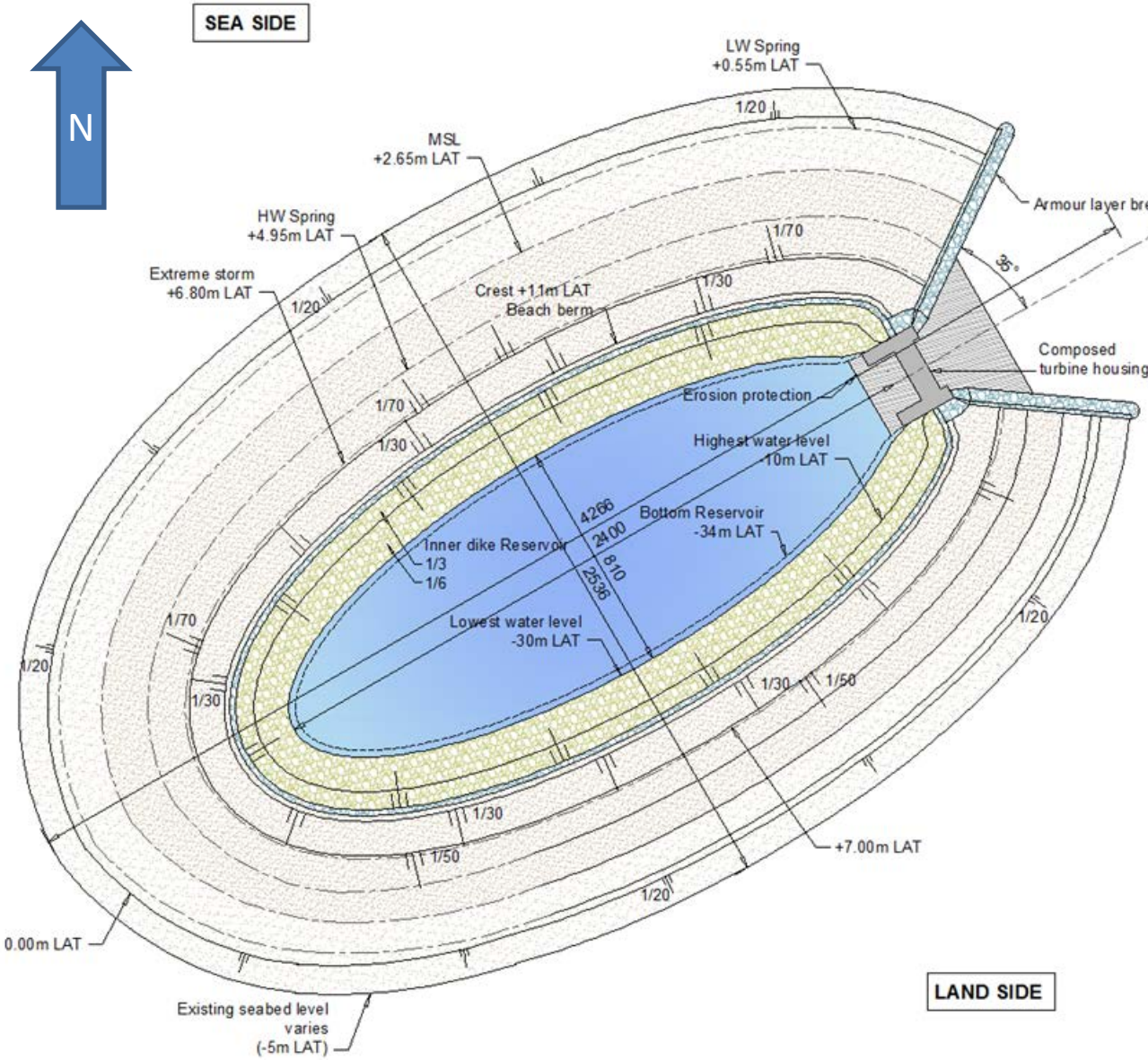

GEOMETRICAL

Elliptic ring dyke with:
- crest <10m below mean sea level
- long axis +/- 2.800m
- short axis +/-1.200m
- Bottom +/- -34m LAT
- Circumference +/- 6.500m
- *iLand beach at land side:*
+/- 250m at high tide
+/- 500m at low tide
➔ *no "dune" nor "wall".*

Elliptic footprint on the sea bed:
- long axis +/- 4.200m
- short axis +/- 2.500m

Water level in reservoir varies between -10m LAT en -30m LAT

ELECTRICAL / ENERGETIC

- Energy contents +/- 2.220 MWh hydraulically, i,e, +/- 2.000 MWh net output
- Pump-turbine power +/- 550 MW

Base Case: environmental potential

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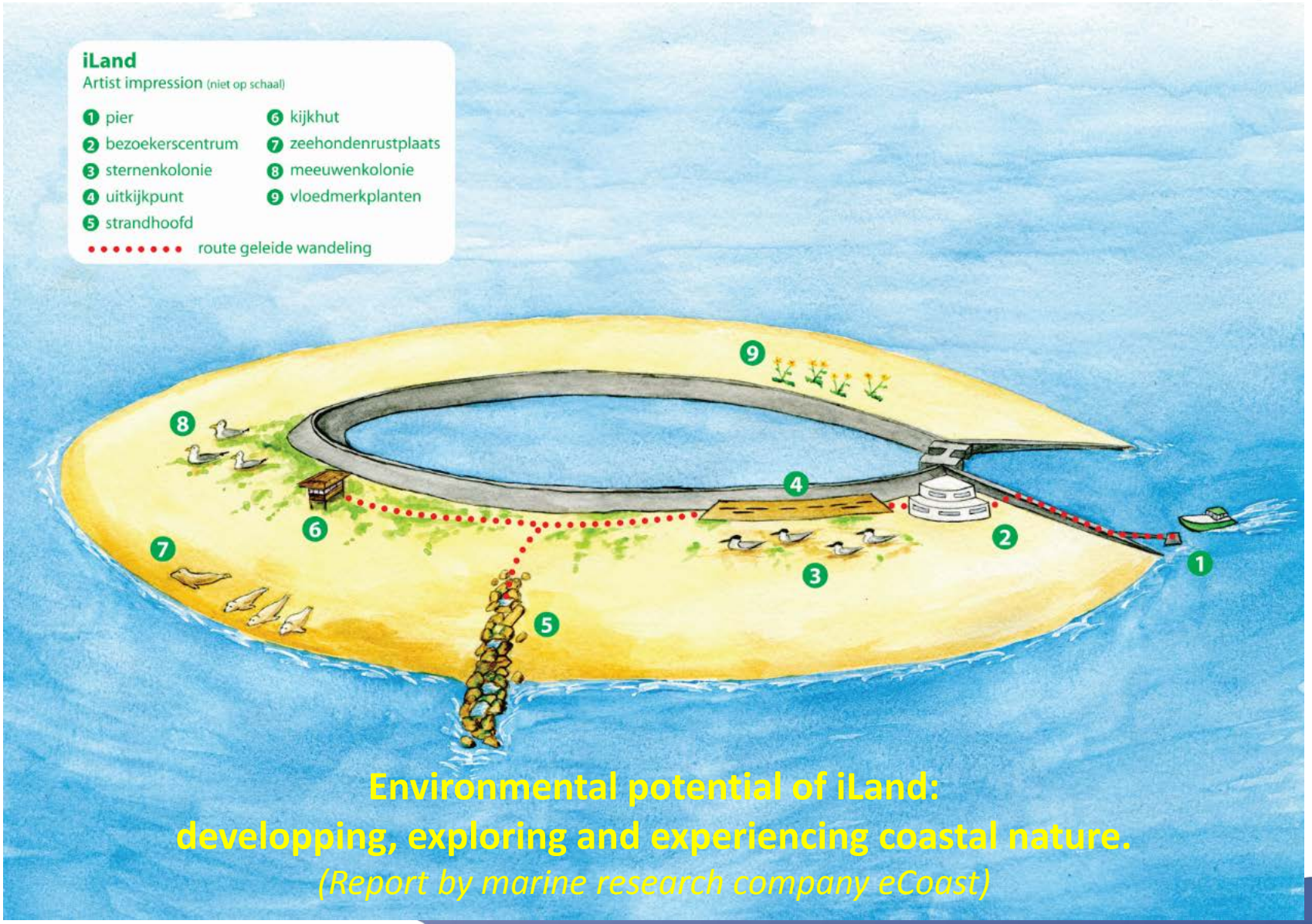

Environmental potential of iLand:
developping, exploring and experiencing coastal nature.
(Report by marine research company eCoast)

4. Further Planning

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Planning in concession file:

- Awarding concession: mid 2015
- Permitting/Engineering/Studies: mid 2015 – mid 2018
- Construction: mid 2018 – mid 2021
- Operation: mid 2021

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5. APPLICATION EXAMPLE

5. Application example: iLand and security of supply

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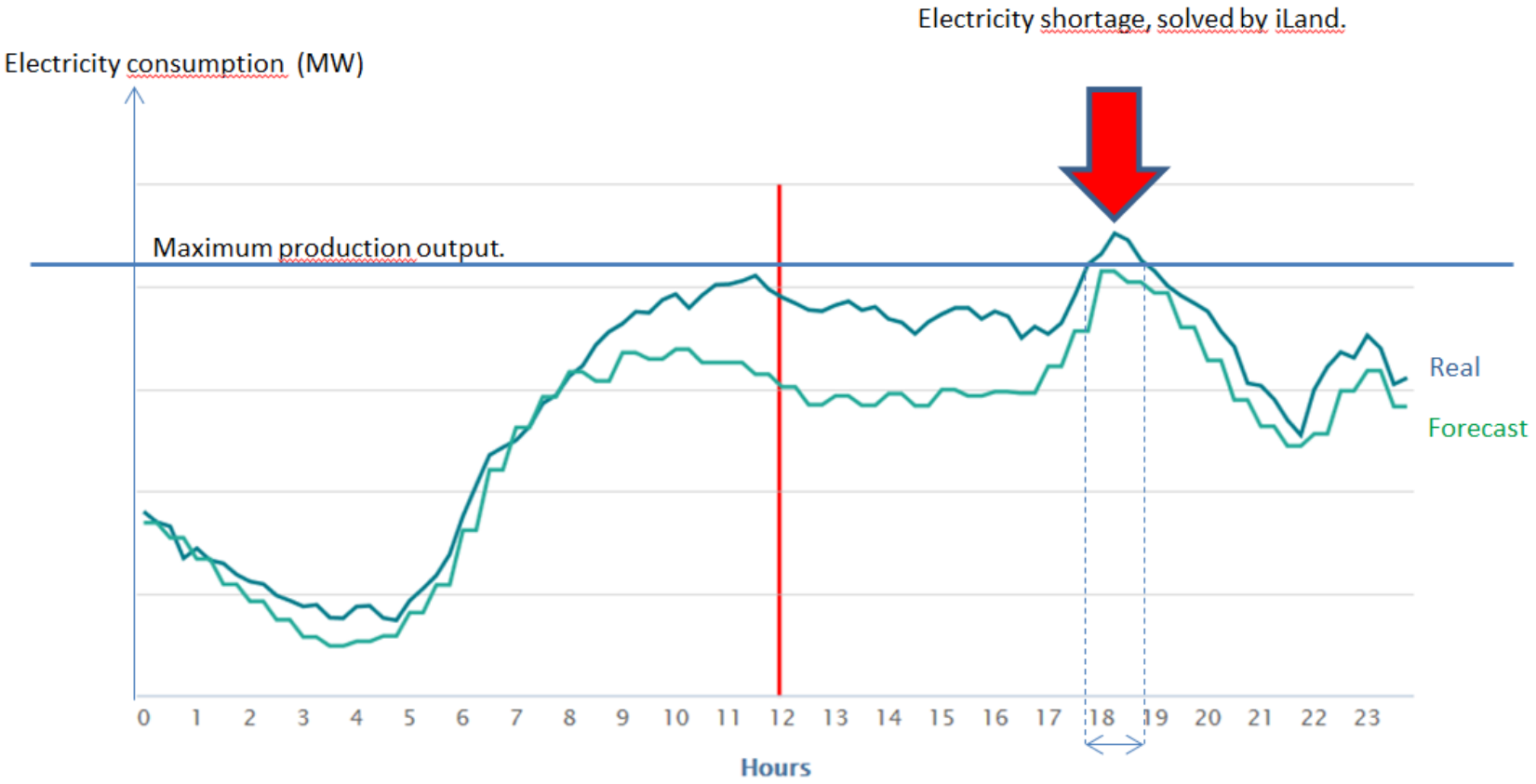

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Thank you!

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