



SIMEC ATLANTIS
ENERGY

10MW Raz Blanchard tidal power array project

Normandie Hydroliennes

27 June 2019

Raz Blanchard tidal array project



The first multi-turbine tidal array to be built at Raz Blanchard, Normandy to commence construction in **2022**

- Anticipated financial close in 2021
- 10MW array*
- €42m capex
- 4 x 2.5MW turbines*
- Turbines connected to a single power export cable via subsea hub to shore
- Gravity-based foundations with wet mate connection system

Funding support

- With French government support and FIT no longer available, support from the Innovation Fund is crucial
- Capex grant to be match-funded with combination of debt and equity
- Early development work underway with likely support from InterReg grant for some of the development costs

*subject to continuing design engineering work



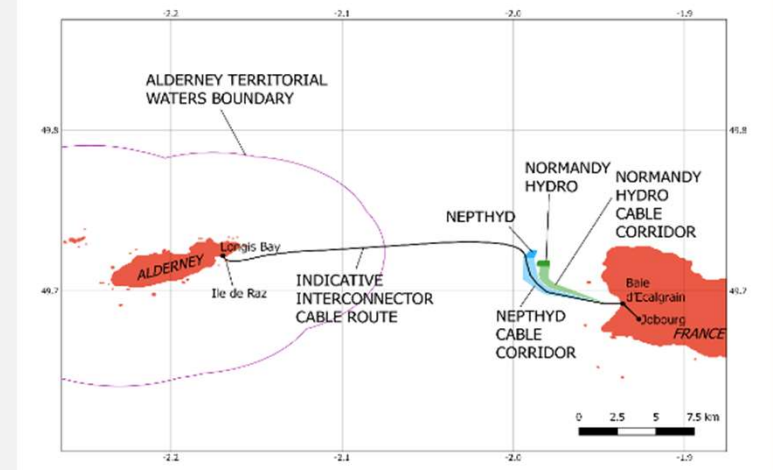
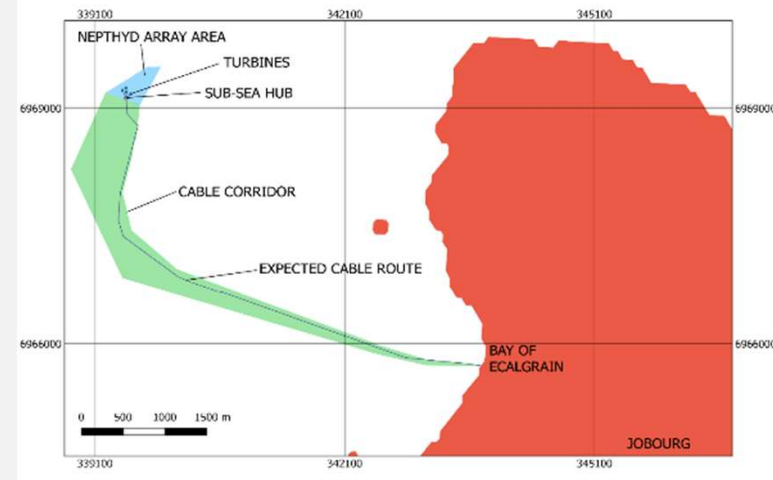
Project economics

Latest project design assumes:

- 4 x 2.5MW turbines
- Capex: €42m
- Opex: €1.5m/year
- PPA offtake arrangements are in discussion with potential offtakers in mainland France and the Channel Islands where displaceable diesel fuel costs are in the range of £200/MWh or higher
- Blended revenue requirement of €[110]/MWh to make project economically viable

Capex funding would be a combination of:

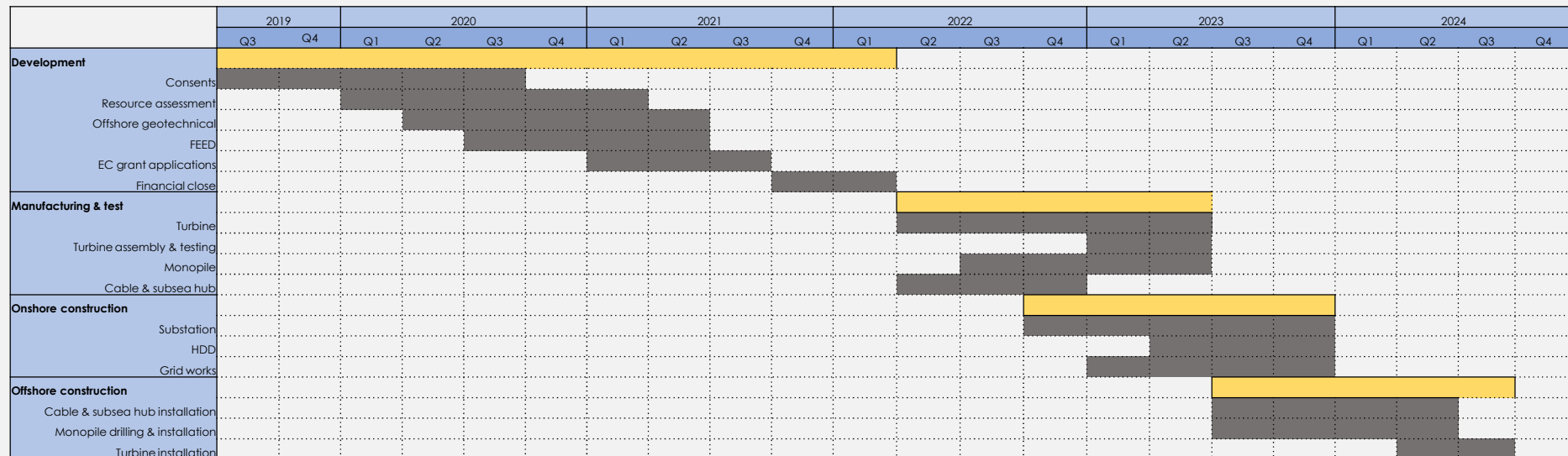
- Equity from French joint venture, Normandie Hydroliennes
- EC Innovation Fund grant funding
- InnovFin debt from EIB



10MW Raz Blanchard project program



- Development: Q2 2019 – Q1 2022
 - InterReg grant funding to part-fund development expenditure associated with the Raz Blanchard site
 - Administrative steps to transfer an existing site consent are underway
 - Surveys and front-end engineering design will feed into final array design
- Financial close anticipated at end of 2021
- Construction to commence early 2022 finishing by end of 2024



Normandie Hydroliennes



- Atlantis has been working with the Agence de Développement Normandie (ADN) and Efinor, a metals engineering and manufacturing specialist, to create a French joint-venture, *Normandie Hydroliennes* (NH), to take advantage of the resource-rich waters off the coast of Normandy
- NH will benefit from Atlantis' experience in tidal turbine technology and project development (the MeyGen project, in particular), ADN's expertise in the regional landscape and supply chain, and Efinor's manufacturing skill
- Development activities are underway amongst project partners with initial administrative steps underway to transfer an existing seabed consent





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Levelized Cost of Energy

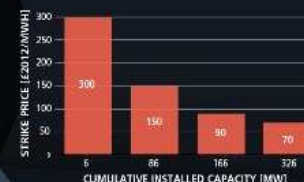
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TIDAL POWER: HOW THE COSTS ARE COMING DOWN

TIDAL POWER
PREDICTABILITY
PROVIDES BENEFITS
TO THE GRID

**RAPID COST
REDUCTION**




5GW
TIDAL STREAM
CAPACITY
France

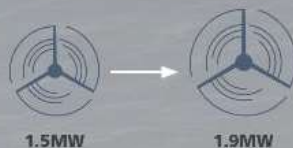
TURBINE DEVELOPMENT

Reducing capex, increasing yield

Increased rotor diameter



Increased rated capacity

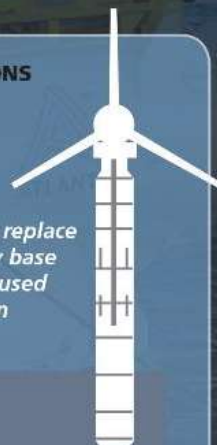


Specification improvements

- 25% yield improvement per turbine
- Power generated at grid frequency
- Voltage to shore increased, reducing losses
- Onshore power electronics simplified

FOUNDATIONS

Standard monopiles replace the gravity base structures used on MeyGen Phase 1A

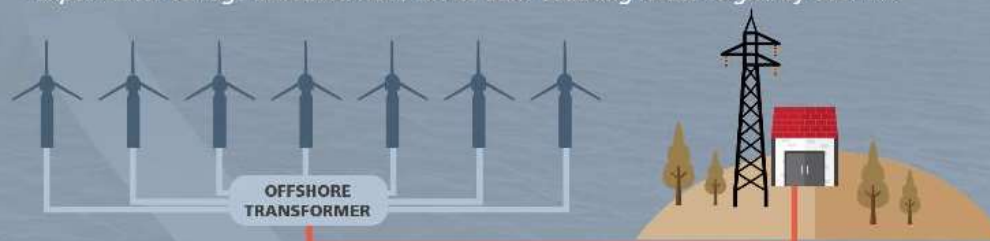


Use of steel



TURBINE ARRAY – REDUCING THE NUMBER OF CABLES REQUIRED

- Single subsea transformer and export cable shared by up to 7 turbines
- Export cable voltage increased from 4kV to 33kV reducing losses to grid by over 6%



INSTALLATION

Wetmate connection systems halve the required installation time offshore

INSTALLATION COSTS

65%
LOWER

UNDER

60 MINUTES
INSTALL EACH TURBINE ONTO
ITS FOUNDATION

70%
REDUCTION IN ONSHORE
FOOTPRINT



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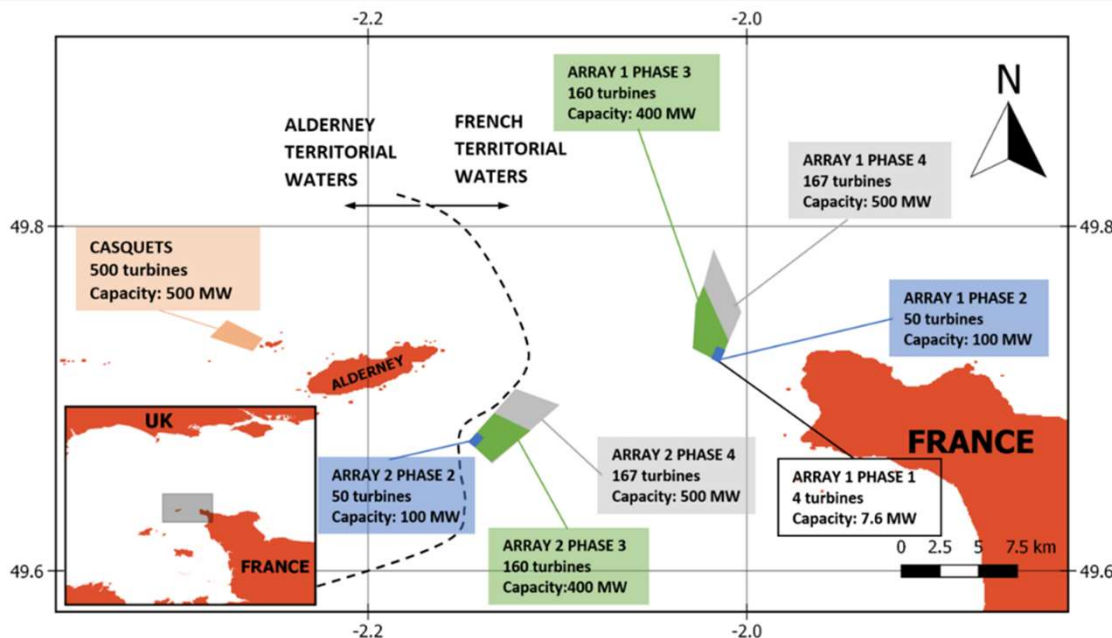
French tidal power market potential

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Further opportunity

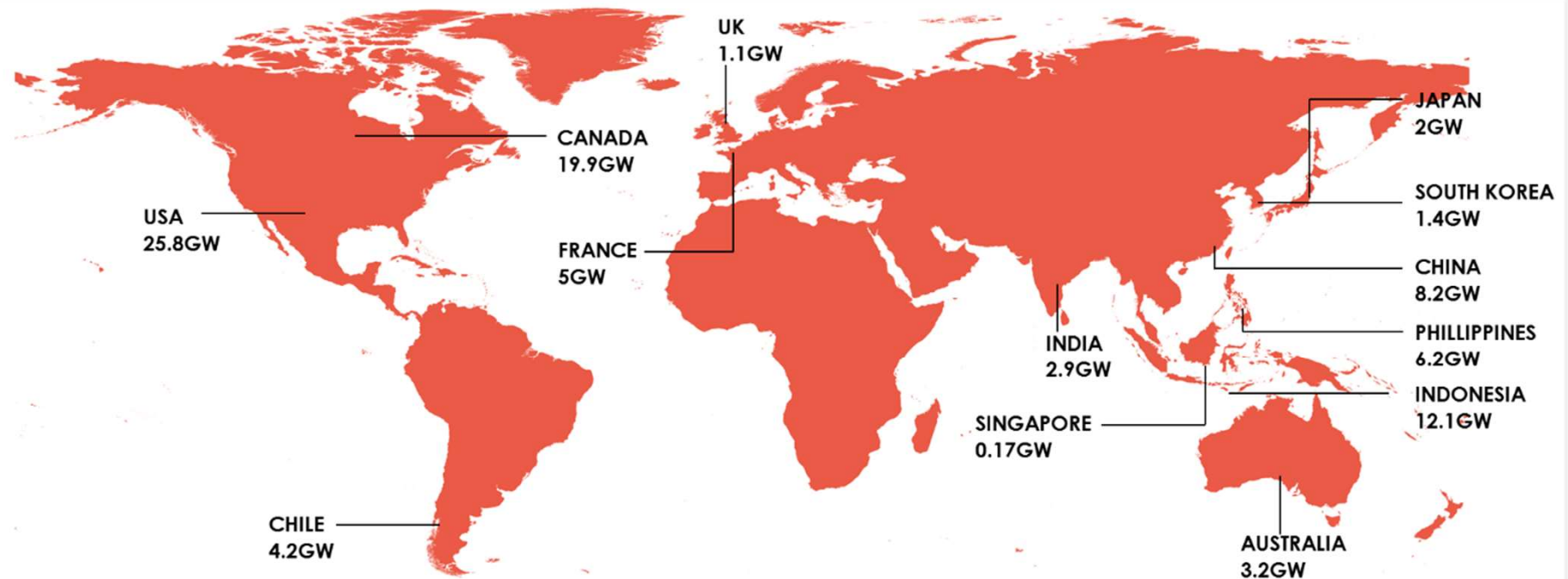
- Demo array at Raz Blanchard will lead to direct benefits including:
 - **Local supply chain experience** with marine technologies and **growth of the nascent tidal industry** in Europe
 - **Reduced LCOE** from proven cost saving innovations including larger turbine design and subsea hub to reduce cabling, reducing overall cost per MWh
- Future build-out will also make use of monopiles rather than gravity bases, further reducing costs
- Potential for approximately **5GW of tidal stream energy in French waters**, 2GW of which could follow from this demonstration array in Raz Blanchard



- Further economic benefit from connecting Raz Blanchard arrays with Alderney and other Channel Islands

Global market potential

- The domestic and export market in France could directly and indirectly employ up to 10,000 people by 2030 if the tidal energy industry can successfully access the government support it needs at this critical point in time
- Innovation Fund will be key to unlocking the growth of the tidal industry globally



FRENCH TIDAL POWER RESOURCE



ALDERNEY | 1.7 GW

RAZ BLANCHARD | 4.2 GW

RAZ BARFLEUR | 2.8 GW

PAIMPOL-BREHAT | 4.1 GW

USHANT | 0.7 GW

RAZ DE SEIN | 0.6 GW

Site	Area	Array capacity	Number of turbines	Annual generation	Employees (construction)
Alderney	70 km ²	1.7 GW	895	6.1 TWh	127,500
Raz Blanchard	171 km ²	4.2 GW	2,235	11.0 TWh	318,500
Raz Barfleur	114 km ²	2.8 GW	1,482	7.7 TWh	211,300
Paimpol-Brehat	545 km ²	4.1 GW	2,144	11.0 TWh	305,600
Ushant	64 km ²	0.7 GW	365	1.8 TWh	52,100
Raz de Sein	108 km ²	0.6 GW	306	1.5 TWh	43,700

Potential for up to 14.1 GW off the coast of Normandy and Brittany

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Source: Methodology for estimating the French tidal current energy resource' by Rose Campbell et al., 2017, International Journal of Marine Energy, 19: 256-271



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Manufacturing facility Cherbourg

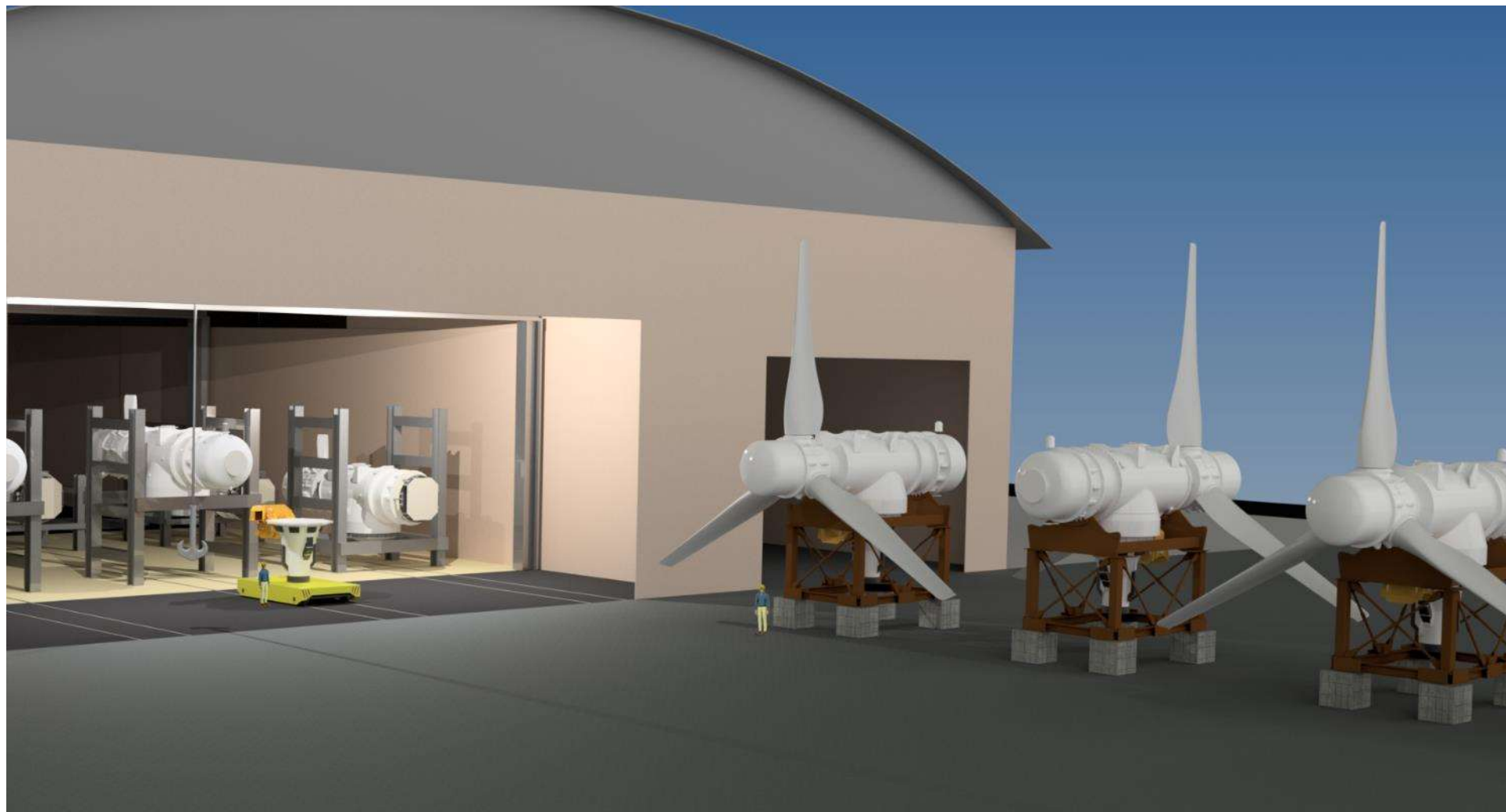
Cherbourg assembly facility



For illustration purposes only. Facility can be located further north in new reclaimed land area as needed.

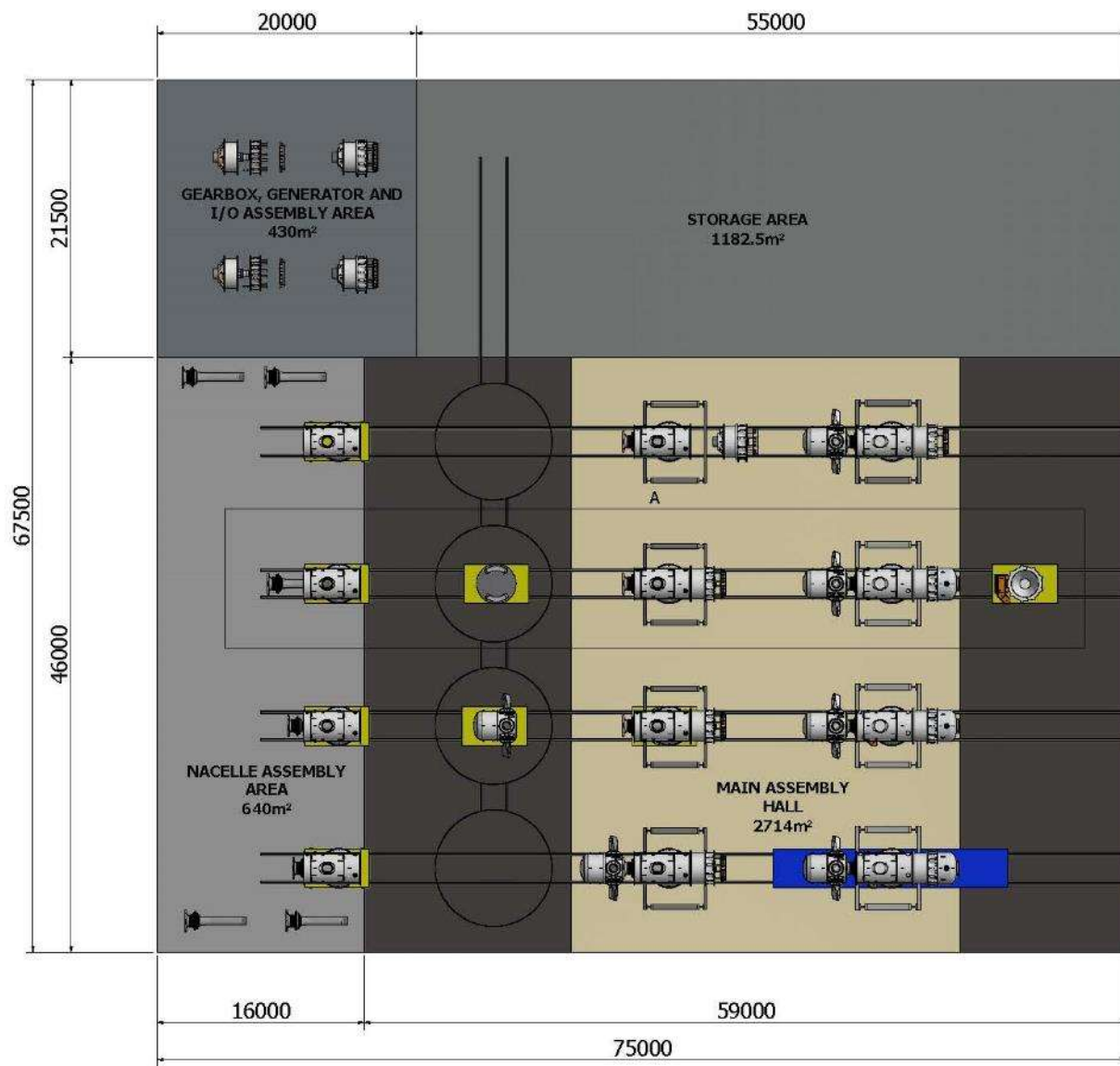


Cherbourg assembly facility



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Cherbourg assembly facility



Cherbourg assembly facility





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Local Supply Chain

Regional integration



Blades



Fabrication of purpose built blade manufacturing facility adjacent to turbine assembly facility.



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Major steelwork

FOURÉ
LAGADEC



Nacelle and Shaft, castings



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Major steelwork

Stabs and Monopile foundations



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Minor steelwork & assembly services

Transportation frames, castings, tooling,
Connection management system.



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Specialist component services



Yaw Drive and Variable Blade Pitching Systems



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Mechanical components

Generator and Gearbox



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Electrical systems



Control system, power systems, drives, slip rings, I/O.



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Cables



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Offshore construction



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Bespoke vessel



Bespoke turbine installation vessel



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Assembly



Opportunity to use existing Cherbourg facility for demonstration array and beyond as a sub-assembly supply point



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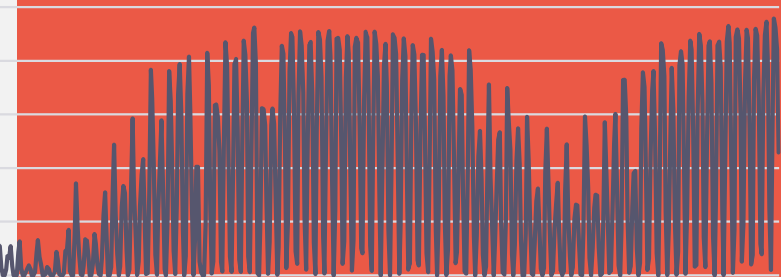
The MeyGen Project

Atlantis' MeyGen array

- The MeyGen project is the largest tidal stream project in the world and the leading generator of tidal stream energy.
- The first phase of the project, **Phase 1A**, commenced construction in 2015 and entered operations in March 2018.
- Construction of Phase 1A of MeyGen was funded by:
 - £13.3m in UK and Scottish government grants
 - £7.5m in senior debt from Scottish Enterprise
 - £10m in senior debt from Crown Estate (now Crown Estate Scotland)
 - £21.8m in equity
- MeyGen has a 6MW accreditation for generation subsidy under the Renewables Obligation (Scotland) Order providing c.£300/MWh in revenue



- ▶ 4 × 1.5MW turbines in operation
- ▶ >17GWh of generation
- ▶ 86MW consented capacity
- ▶ 400MW total site capacity
- ▶ Up to 5m/s flow speeds



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The MeyGen project

