DTOcean+

Advanced Design Tools for Ocean Energy Systems Innovation, Development and Deployment

T8.4- Developing Business Models for the Ocean Energy Sector

Energy Systems Catapult

October, 2020

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Ocean Technology and Offshore Oil & Gas

Value proposition

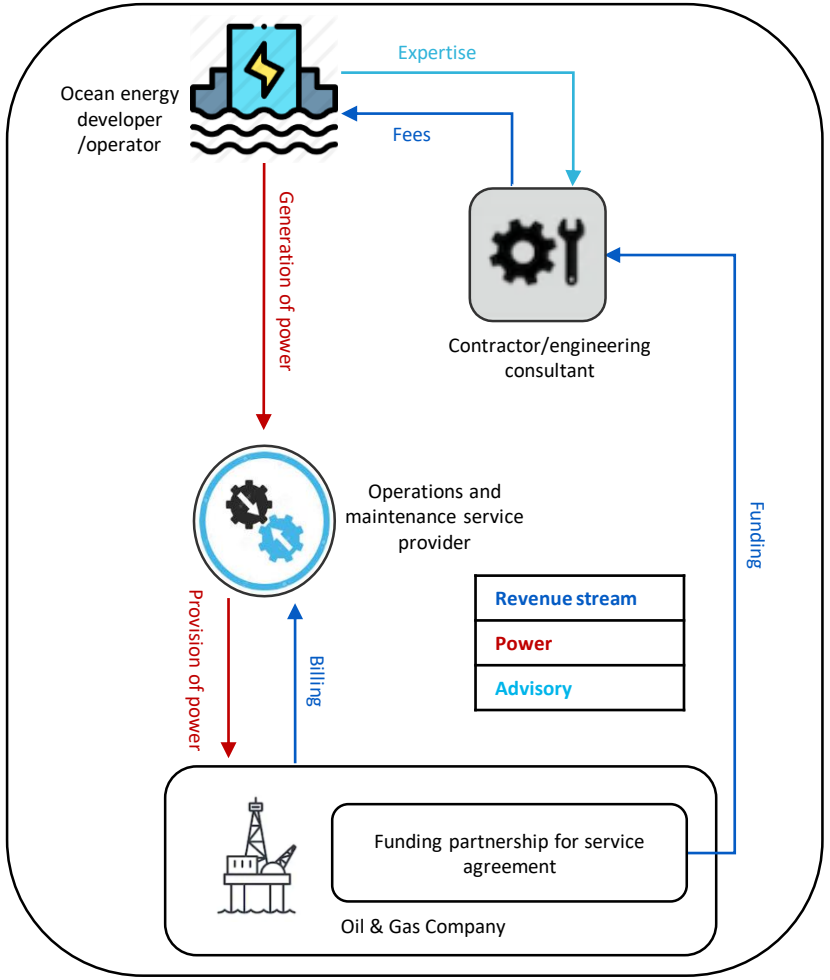
Renewable energy to power oil and gas (O&G) and subsea infrastructure.
Benefits being - proven technical feasibility, financial savings and carbon savings from using renewable energy instead of diesel/gas generators (current average diesel consumption on an O&G rig 20-30m^3 per day to fulfil a 30-40Gwh annual demand)
Assuming other renewable technology (wind) is more expensive, difficult to commission or not viable at all.

Customer and Needs

Oil & Gas majors or other operators with offshore platforms looking to:

- Diversify/secure their power requirements
- Transition to decarbonisation/ have set public targets for decarbonising (driven by need to improve overall industry reputation and create significant savings on carbon taxes currently in the region of ~$8bn per year)
- Invest in ocean technology
- Increase sales volume by reducing use of wellhead produced fuel for operations (currently at 5%)

Value Chain Map



Business Model

O&G company engages a major contractor to provide power to offshore platforms and associated subsea infrastructure. Likely to take the form of 'guaranteed service' or power purchase agreement.
The major contractor engages with the wave company for design and fitout (this may be with an installation partner/design engineer), with operations and maintenance services either contracted to existing service provider or provided by wave company.

Unique Selling Propositions (USP):

- Diversification of energy supply to increase security, reliability and independence
- Decarbonisation of rig operations as well as providing significant safety benefits and long term costs savings (reduced number of personnel, lower requirements for transport to/from shore)
- Improvement in immediate air quality for rig residents

Additional value

- Combine with small localised desalination set-up to supply fresh water requirements of rig residents (and potentially nearby island communities)
- Potential to combine with wind power and energy storage solutions to mitigate against intermittency (will require a third party consultant)
- Addition of wave technology to rigs may increase valuable lifetime of rig as it can be re-purposed for other applications (i.e.. Marine research, docking stations for shipping/cargo)

Ocean Technology and Coastal Resilience

Value proposition

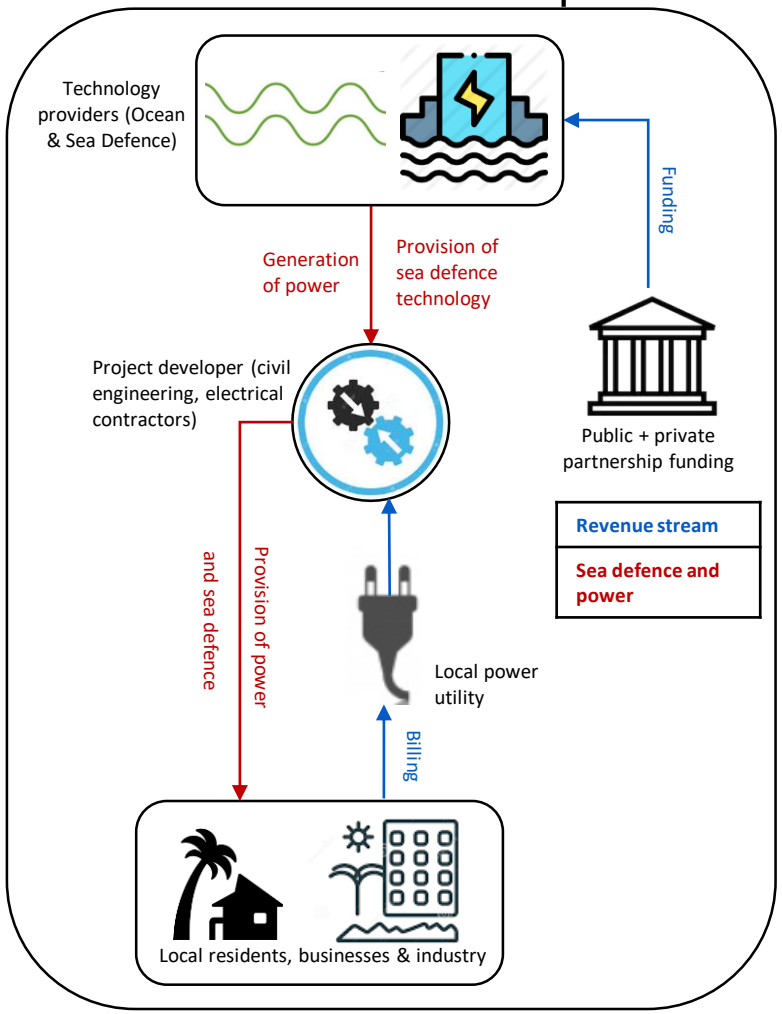
Ocean technology coupled with sea defence infrastructure for coastal communities susceptible to extreme weather events.
New sea defences can be constructed with integrated ocean technology for power generation which can be plugged into existing grid, create localised micro-grid or provide priority to power critical infrastructure (e.g. healthcare, water provision).

Customer and Needs

Consortium of partners (national government, local communities, NGOs, utilities, the private sector and civil engineering) looking to create new green power source specifically aimed at coastal communities that is:

- Reliable (specifically for communities that struggle with access and power security)
- Resilient to rising sea levels and increasing frequency of extreme weather events (e.g. the Netherlands where storm surge barriers have been equipped with tidal turbines, parts of UK coastline susceptible to storm surges)

Value chain map



Business Model

Partnership between ocean energy and civil engineering firms to provide integrated solution for sea defence protections and power generation. Power to be supplied to local grid/micro-grid through local utility provider. Solution can take the form of:

1. An emergency power source coupled with power storage for critical infrastructure in the case of weather events (recovery phase, black start).
2. A preventative/pre-emptive measure that can be kept running (more in line with the generation profile of ocean energy)

USP:

- Pre-emptive defence may encourage greater private development in the community if risk of flooding is reduced and access to power is improved.
- Increases energy security and reliability of supply where other generation may fail.
- Decarbonises energy supply as well as improving air quality
- Will create jobs and 'green growth', allow communities to meet carbon targets whilst improving and protecting local community

Additional value

- Integration with desalination partner to provide combined water and energy supply for more remote areas
- Potential to couple with energy storage solutions to smooth supply and mitigate against intermittent nature of generation
- Potential for a packages service to more than one customer in more than one location (i.e. multiple contracts to cover different stakeholder needs like in the case of critical infrastructure operators)

Ocean Technology and Disaster Recovery

Value proposition

Integrated wave and desalination solution that can be deployed quickly for disaster hit areas for provision of temporary emergency power and clean drinking water for local community.

Customer and Needs

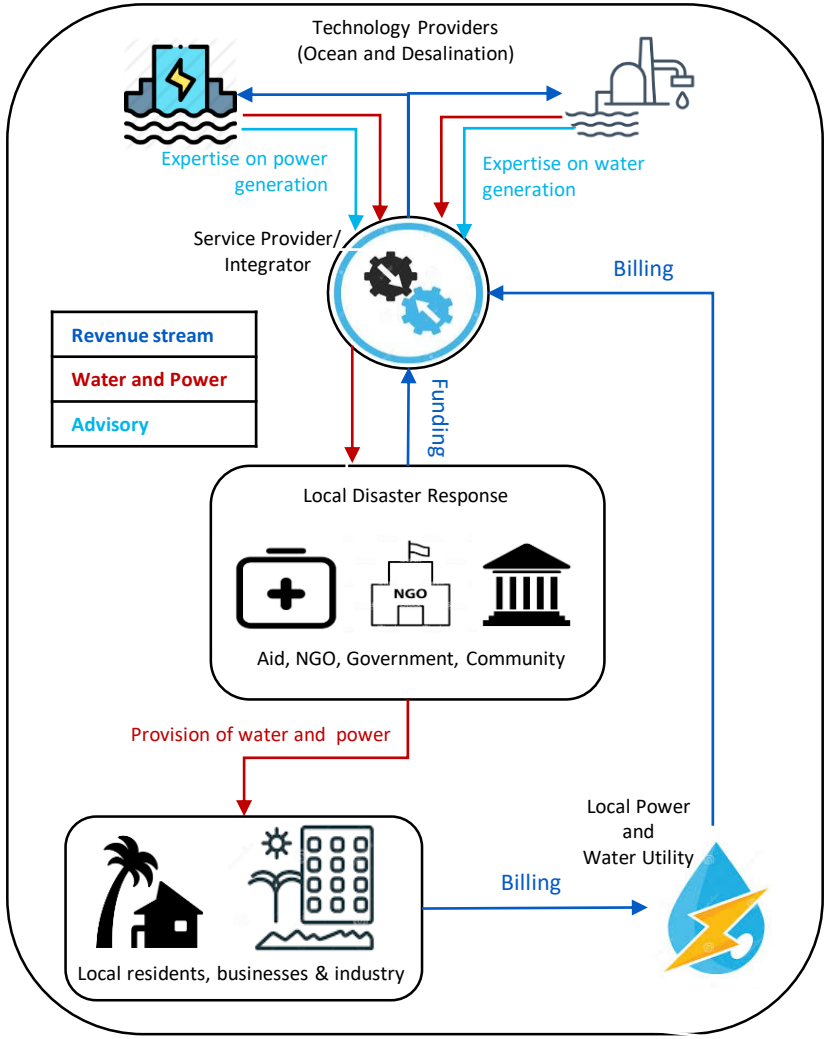
Combination of government, military, NGOs and other players typically involved in disaster response and planning. Looking for:

- Rapid response on safety and well-being of local community (e.g. clean drinking water, cleaning, comfort, refrigeration)
- Getting critical infrastructure back online
- Redevelopment of community and damage repair (extreme weather events between 1998 and 2017 amounted to $3.47tn in losses)

Other customers could be:

- Local utilities looking for a temporary replacement to existing services (i.e. for power plant shutdown, contingency planning)
- Remote (and otherwise self-sufficient) coastal communities that are contingency planning for emergencies (luxury resorts, medical facilities, military bases, industry and agriculture that requires uninterrupted power supply)
- Marine vessels such as cargo ships, submarines, etc

Value chain map



Business Model

Integrated wave and desalination technology is created either by a single organisation or a service provider. Technology is packaged into a disaster recovery service module to allow for quick deployment. Two potential routes to market:

1. The product is sold outright to organisations responsible and budgeted for in local disaster response budget
2. Or a service contract is agreed with Local Disaster Response and Local Utilities to provide power and water on a purchasing agreement

USP:

- Modular nature allows service to be easily scaled depending on size of community.
- Provides a 2-in-1 solution for power and fresh water reducing cost and operational burden

Additional value

Modular nature of solution means it can be upgraded to include provision of other services (cleaning, refrigeration, heating) depending on local needs and priorities. These can be established through community-led model allowing control over key utilities in rapidly changing situations

Ocean Technology for Microgrids and Remote Coastal Locations

Value Proposition

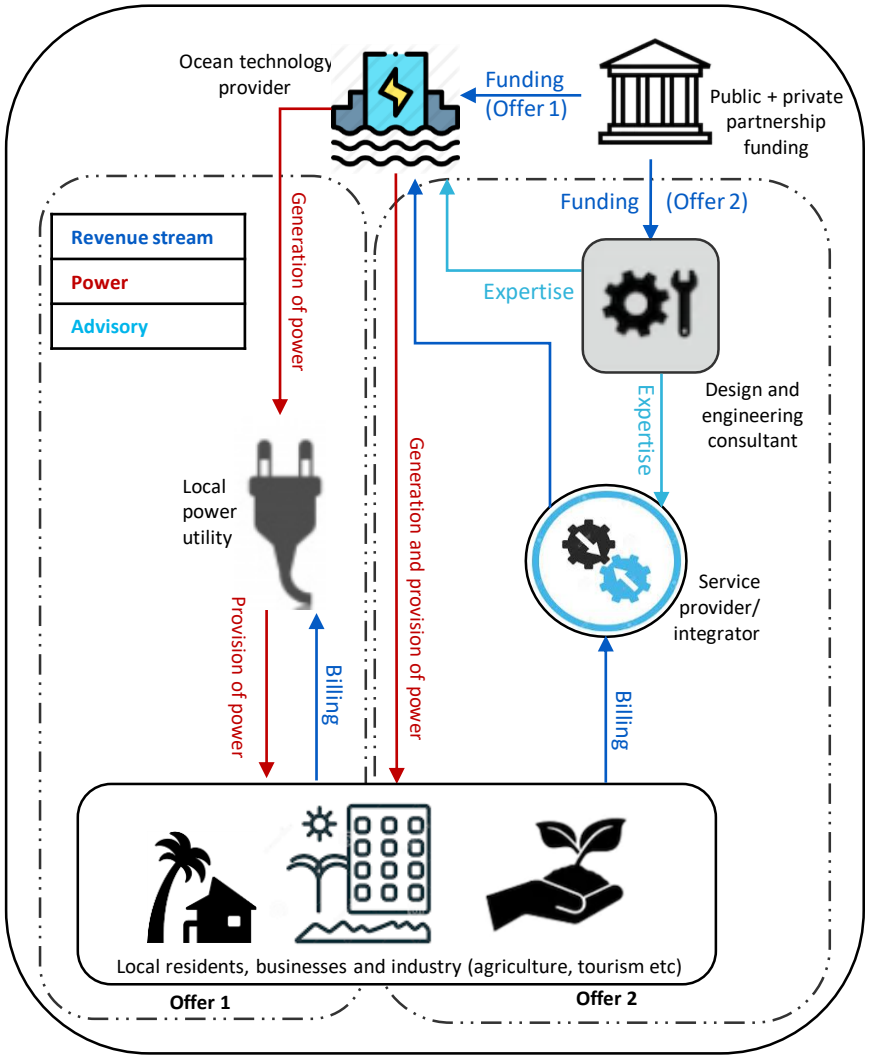
Ocean technology for electricity generation and supply of remote coastal communities where other forms of renewable generation aren't possible.

Offer 1. Standalone solution that can supplement existing grid/micro-grid where intermittency/reliability of supply is an issue
Offer 2. Integrated service solution that acts as primary supply for set up of new micro-grid for off-grid communities

Customer and Needs

- Coastal communities where solar power not viable due limited land capacity/ risk of land loss due to rising coastlines (e.g. South East Asian Archipelago, Netherlands)
- Regions where power security is of high concern (e.g. Sub-Saharan Africa where annual outages are between 50 - 4,600 hours)
- Small Island Developing States (SIDs)with ambitious renewable targets who currently rely on imported liquid fuel (e.g. Nigeria where cost of electricity from diesel is $1.6bn/year, California where cost of blackouts to business is extremely high)
- Luxury remote eco-resorts, military and defence bases, campuses (university, medical) who require their own micro-grids and have capital to even build technology into architecture of resort (would require third party consultancy)

Value chain map



Business Model

Offer 1
- Ocean technology provider provides supplementary power to existing grid/micro-grid through local utility provider

Offer 2
- Service provider sets up and operates micro-grid for totally off-grid community in partnership with technology provider.
- Community has relationship with service provider in terms of billing/set up

USP:
Local residents, businesses and industry benefit from stable and secure independent power supply (use of ocean energy results in a stable supply making it worth the higher LCOE)

Additional potential value

- Coupled with wind/solar and energy storage to stabilise supply and mitigate against intermittent nature of generation
- Possible integration with sea-level rise mitigations (sea walls, surge barriers, water pumps)
- Integration with desalination partner to provide combined water and energy supply
- Better control of electricity operations for more isolated sites (defence bases, campuses) who can become involved in local grid planning

Ocean Technology for offshore Aquaculture

Value Proposition

Ocean energy generation to replace/supplement diesel power requirements for new offshore or shore adjacent aquaculture and algae production activities. Driven by new entrants to the market or expansion of existing activities.

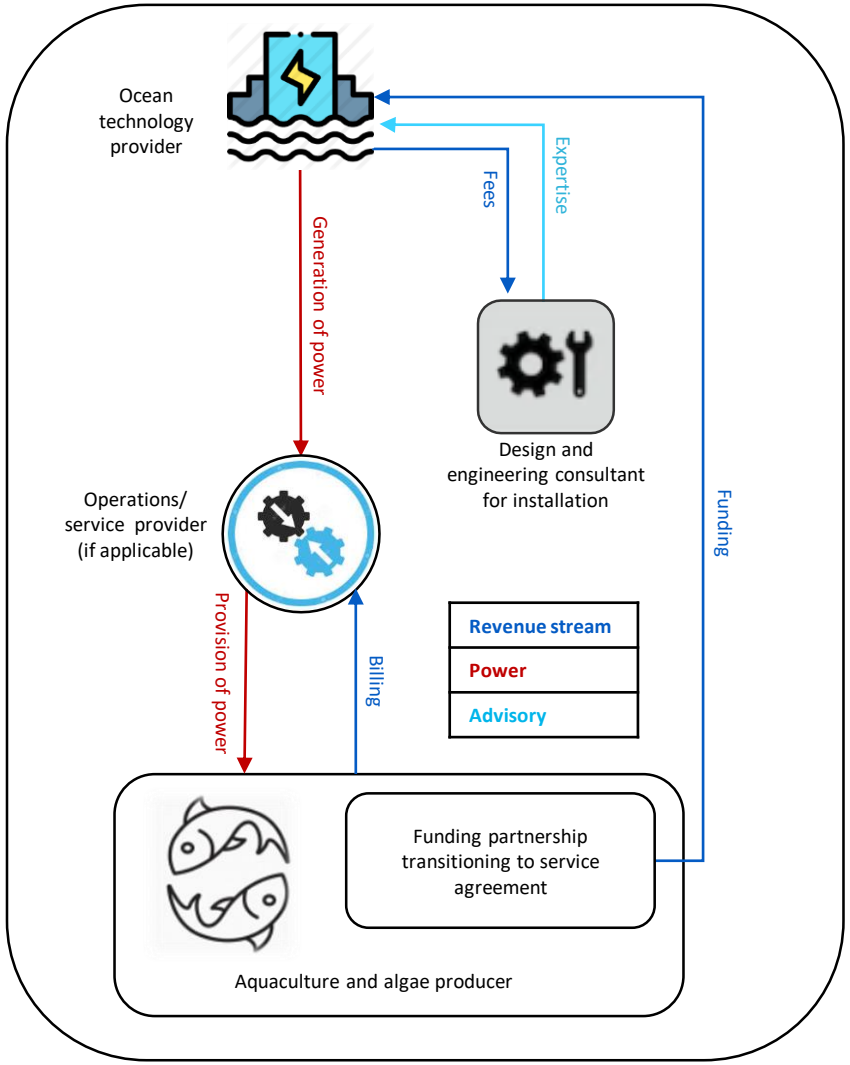
Customer and Needs

Finfish and algae production companies (or operations/service providers to them) looking to:

- Remove reliance on diesel in response to environmental targets (more relevant to EU based companies)
- Improve operating conditions (air and water quality) resulting in better product quality allowing for higher pricing
- Build new offshore production in response to growth in demand (offshore locations have greater expansion capacity, less space competition and better air and water quality)

(Offshore aquacultures farms which are long distances from land are also less likely to be able to use other renewables)

Value chain map



Business Model

Ocean technology provider in partnership with design and engineering consultant builds integrated ocean technology solution to power new aquaculture production facility.
The ocean technology provider then continues to provide operation and maintenance services for on site energy demand

USP:

- Better air and water quality will result in a higher quality product which will allow for higher pricing.
- Minimises site visit requirements, making operations more self sufficient

Additional value

- Modular nature of technology (turbines) allows for expansion capacity
- Couple with energy storage for grid export potential to manage excess
- Integration with wind/solar to combat intermittency of both and stabilise overall supply
- Possible integration with sea-level rise mitigations (sea walls, surge barriers, water pumps)
- Integration with desalination partner to provide combined water and energy supply for installations residents

Ocean Technology and Desalination

Value Proposition

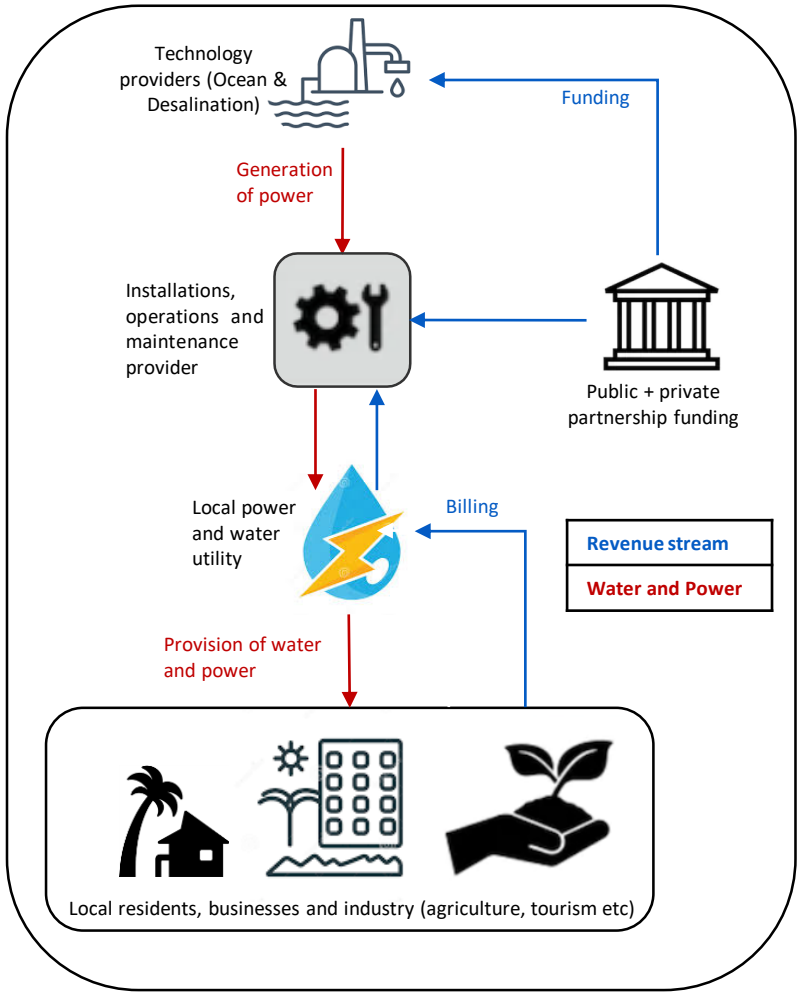
Integrated ocean and desalination solution for the provision of electricity and water supply to coastal communities.

- Ocean power to provide high pressure seawater for Reverse osmosis (RO) feed (low carbon alternative to diesel powered pumps) reducing cost of freshwater production.
- Ocean power to generate usable electrical power

Customer and Needs

- Highly water stressed remote coastal communities
- Communities where other renewables are expensive/not viable (e.g. California, Singapore where cost of land could limit solar power production). Currently only 1% of global desalination capacity is powered by renewable sources
- Regions for whom water and power security are of high concern (geo-political factors also e.g. East Africa, Middle East, South East England)
- More commercial applications including self sustaining island, tourist resorts, and local agriculture and industry

Value chain map



Business Model

Public and private partnership funds allow for an integrated ocean and desalination technology created by single organisation/ service provider. Resulting water and power made available to local market through utility provider

USP:

- Uses ocean power to provide high pressure seawater feed for RO desalination ideally eliminating need for conventional power and reducing cost of freshwater production.
- Improves air quality of location

Additional value

- Water and battery storage to smooth supply and mitigate against intermittent nature of generation
- Integration with wind/solar to combat intermittency of both
- Repurposing brine effluent as input for seawater mining processes where applicable.
- Can be used to strategically improve air quality by making the switch to ocean from diesel generation.

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Thank you for your attention!

Energy Systems Catapult

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Disclaimer: This presentation reflects only the author's views and the Agency is not responsible for any use that may be made of the information contained therein.

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