



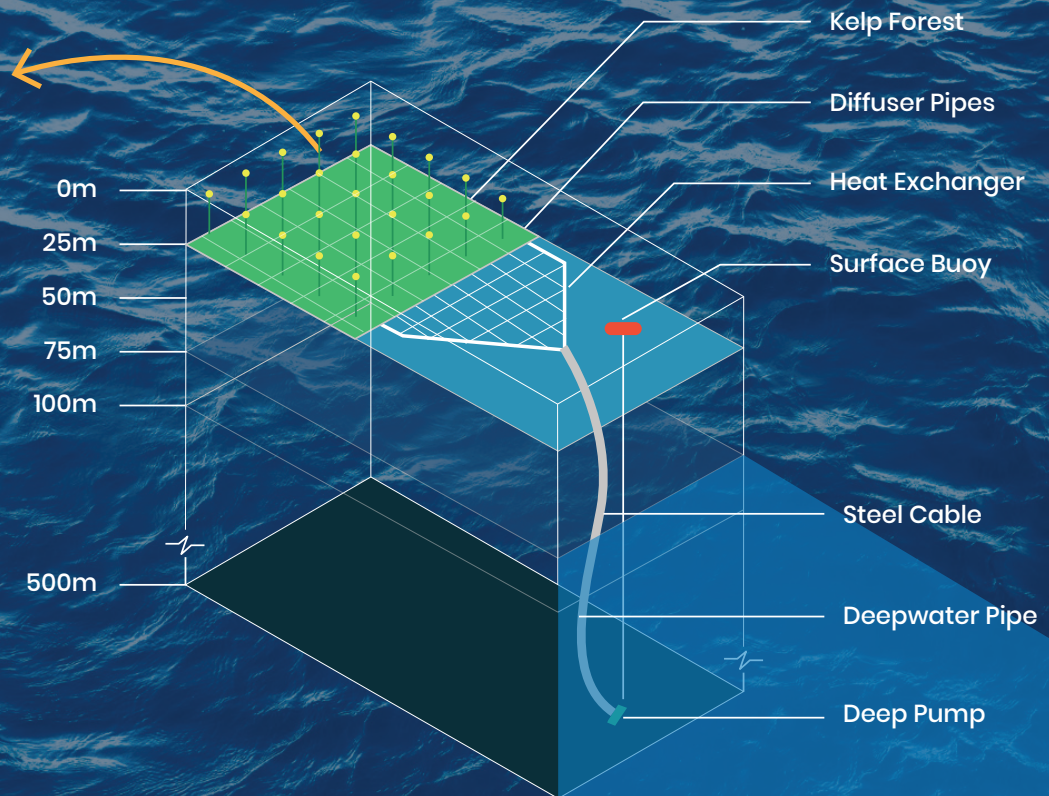
Marine Permaculture  
Array Executive Summary



## What is a Marine Permaculture Array (MPA)?

Marine permaculture arrays are a sustainable and innovative approach to aquaculture that offers a range of economic and environmental benefits. These systems are designed to mimic the natural ecosystem found in the ocean, allowing for the cultivation of a diverse range of marine species, including fish, shellfish, and seaweed. One of the key advantages of marine

permaculture arrays is their reliance on natural processes and native species to create a self-sustaining ecosystem. This means that they require fewer inputs such as feed, chemicals, and energy, making them more economically efficient and cost-effective compared to traditional aquaculture methods.



In addition to the economic benefits of marine permaculture arrays, they also have the potential to significantly reduce the negative impacts of traditional aquaculture practices on the marine environment. For example, these systems can help to minimize the release of excess nutrients and chemicals into the water, which can lead to water pollution and the proliferation of harmful algal blooms.

They can also reduce the risk of disease and parasites spreading among farmed fish, as the use of native species and natural processes helps to create a more diverse and resilient ecosystem.

Marine permaculture arrays have the potential to provide a source of food and income for coastal communities, particularly in developing countries where aquaculture is an important source of livelihood. They can also help to meet the growing demand for seafood in a sustainable and responsible way, as the world's population continues to grow and the demand for protein increases. Overall, the adoption of marine permaculture arrays represents a promising solution for balancing the need for food production with the need to protect and preserve the ocean's natural resources.



## Main Areas Benefited

### SEAWEED

Globally, cultivated seaweed was the largest marine aquaculture production by tonnage in 2015, with over 29 million tons produced. However, productivity has been declining due to marine heatwaves. For example, in Indonesia, over one million people depend on seaweed farming for their livelihood, but the seaweed is dying from warming water and low nutrient levels.

Marine permaculture arrays, which include solar-powered upwelling technology, can be used to restore cool, nutrient-rich water to existing seaweed farms. Kelp forests are also declining rapidly, particularly in Tasmania, and Western Australia has lost nearly 1,000 km<sup>2</sup> of Ecklonia kelp forests. A 100-hectare marine permaculture array has the potential to restore productivity and generate approximately \$1 million in revenue from seaweed (about 3,000 tons) each year.



## FISH

Marine permaculture arrays can help to restore fish habitat and promote the growth of fish populations. Once fully operational, these arrays have the potential to support the harvest of several hundred tons of fish each year, generating an additional \$1 million in revenue per 100 hectares. Additionally, marine permaculture arrays do not rely on nets, allowing some of the fish production to be returned to the sea.

## FISH FEED

Aquaculture companies often use supplements made from fish oil to provide omega-3 fatty acids (DHA and EPA) to their fish stocks. However, marine permaculture arrays can provide a more sustainable and vegetarian-friendly source of these long-chain omega-3 fatty acids through the production of EPA and DHA.

## AQUACULTURE

Commercial aquaculture companies produce large amounts of fish waste, which can have negative impacts on nearby water bodies by reducing oxygen levels. In an effort to improve their environmental reputation, some major salmon aquaculture companies are looking for ways to reduce their waste production and negative impacts on the environment. One potential solution is the adoption of marine permaculture arrays, which can provide a more sustainable alternative to traditional aquaculture methods.



## Economic Benefits

It is difficult to quantify the economic benefits of marine permaculture arrays in terms of specific dollar amounts, as these benefits will depend on a variety of factors, such as the size and location of the array, the species being cultivated, and market conditions. In addition, the economic benefits of marine permaculture arrays will vary over time as the industry continues to develop and mature.

That being said, the adoption of marine permaculture arrays has the potential to bring significant economic benefits to the communities where they are located. For example, they can provide a source of food and income for coastal communities, particularly in developing countries where aquaculture is

an important source of livelihood. In addition, marine permaculture arrays have the potential to help meet the growing demand for seafood in a sustainable and responsible way, which could lead to increased sales and profits for farmers and businesses.

Finally, the adoption of marine permaculture arrays could also lead to the creation of new job opportunities in the aquaculture industry and related fields, providing a source of employment and income for local communities. It is important to note, however, that the economic benefits of marine permaculture arrays will depend on a variety of factors, and it is difficult to predict the specific dollar amount of these benefits with certainty.



There are several economic benefits associated with marine permaculture arrays:

**1 Cost-effective production:** Marine permaculture arrays rely on natural processes and native species to create a self-sustaining ecosystem, reducing the need for inputs such as feed, chemicals, and energy. This can make them more cost-effective compared to traditional aquaculture methods, which often require large amounts of these inputs.

**2 Increased food security:** Marine permaculture arrays can provide a source of food and income for coastal communities, particularly in developing countries where aquaculture is an important source of livelihood.

**3 Meeting the growing demand for seafood:** As the world's population continues to grow, the demand for protein is also increasing. Marine permaculture arrays have the potential to help meet this demand in a sustainable and responsible way.

**4 Diversification of income:** Marine permaculture arrays can produce a variety of seafood products, including fish, shellfish, and seaweed, providing opportunities for diversification of income for farmers and communities.

**5 Job creation:** The adoption of marine permaculture arrays has the potential to create a range of job opportunities in the aquaculture industry and related fields, providing a source of employment and income for local communities.

Overall, the economic benefits of marine permaculture arrays include cost-effective production, increased food security, the ability to meet the growing demand for seafood, diversification of income, and job creation.



## Job Creation for the Community

Marine permaculture arrays have the potential to create a range of job opportunities in the aquaculture industry and related fields. These could include:

**1 Aquaculture technicians:** These professionals are responsible for the day-to-day care and management of marine permaculture arrays, including tasks such as feeding and monitoring the health of the marine species being cultivated.

**2 Aquaculture managers:** These individuals are responsible for overseeing the operations of marine permaculture arrays, including managing budgets, scheduling, and personnel.

**3 Aquaculture researchers:** Researchers in the field of marine permaculture can work on projects related to improving the efficiency and sustainability of these systems, as well as studying the ecological impacts of different aquaculture techniques.

**4 Sales and marketing professionals:** Marine permaculture arrays can produce a variety of seafood products, including fish, shellfish, and seaweed, which will need to be marketed and sold to consumers. Sales and marketing professionals can play a key role in promoting these products and finding new markets for them.

**5 Engineers and technicians:** Marine permaculture arrays often require specialized equipment and infrastructure, such as pumps, filtration systems, and floating platforms. Engineers and technicians can be responsible for designing, installing, and maintaining these systems.

**6 Administrative and support staff:** As with any business, marine permaculture arrays will also require administrative and support staff to handle tasks such as accounting, HR, and customer service.

Overall, the adoption of marine permaculture arrays has the potential to create a range of job opportunities in the aquaculture industry and related fields, from hands-on technical positions to management and support roles.



## Efficient Green and Eco Energy to Power a City

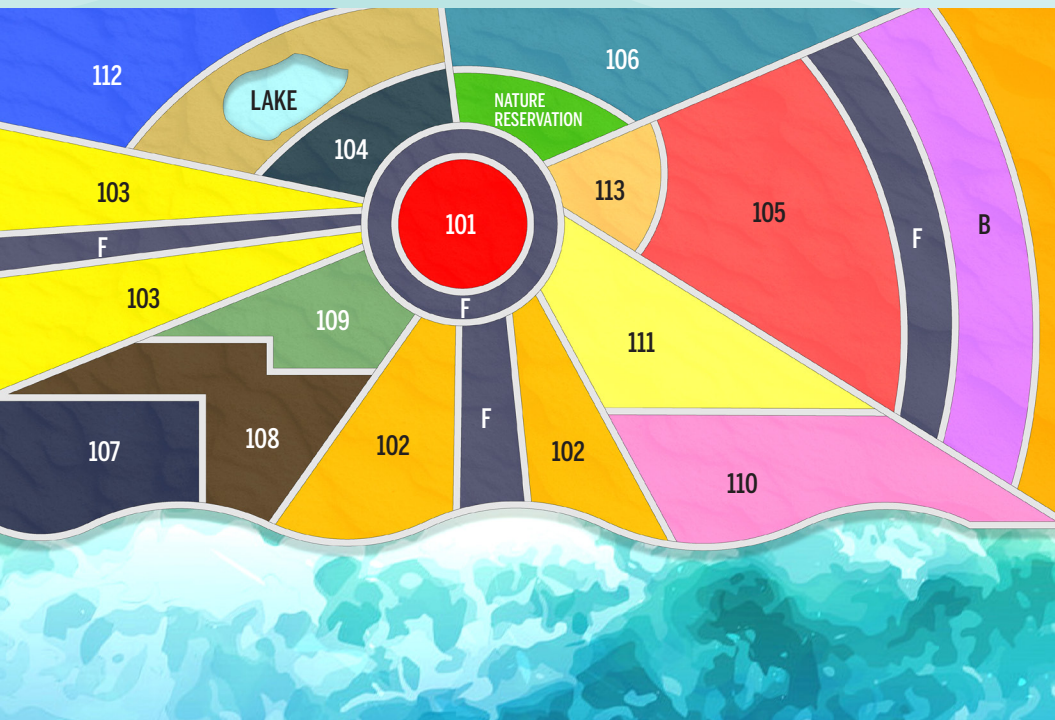
MPA's have the ability to provide green and eco friendly energy at substantial economic benefits through biofuel generators. In addition, using MPA's to provide efficient eco energy, does not hurt the environment, in fact it helps it.

Environmentalists get angry with biofuel concepts because of where biofuel is sourced from. For example cutting down a forest for timber to produce biofuel is not efficient and is incredibly environmentally irresponsible. It can take hundreds of years for a tree to become mature in height. In comparison, kelp can grow 18 inches per day. A kelp forest can be harvested sustainably, allowing marine life to continually benefit it. Unlike

a traditional forest, a kelp forest when properly harvested will never be depleted and will grow back within months; not years.

Once the kelp is harvested, it can be converted into a biofuel. The biofuel, can then be used as the fuel stock for a biogenerator. Biogenerators are lean and nimble, and can provide electricity almost anywhere.

Using this system in tandem with other green energy sources, a properly constructed MPA project can provide enough electricity to run a city, special economic zone or free trade zone.



### KEY PLAN

**B - BAMBOO FOREST**

**F - FOREST, PARK**

- 101 - Main City Center, Offices, Residences, Government Buildings, Commercial
- 102 - Tourism, Hotel, Resort
- 103 - More City Center
- 104 - University, Colleges
- 105 - Agriculture Institute, Indoor Farming, Land
- 106 - Solar Energy
- 107 - Port
- 108 - Free Trading, Warehouse, Offices, Convention Center
- 109 - Electronics, Machinery, Other Manufacture Industry Park
- 110 - Seashore Farming, Algae Farm, MPA
- 111 - BioFuel, Bio Energy Industry Park
- 112 - Airport
- 113 - Medical Park