



Bluegreen



Marine Donut

A pioneering closed containment facility addressing the needs of future fish farming





Closed fish farming solves many of the industry's challenges.

The aquaculture industry has been identified as an important part of the solution when a growing world population is to be fed. But to ensure that the growth is sustainable, there is a need for novel solutions that address the industry's challenges in terms of escapes, lice and pollution, as well as production costs.

Marine Donut is a sea-based closed containment facility that solves these challenges and offers good fish welfare and smart logistics:

Lice and escape

The facility has a water intake below the lice belt for good temperature control, between 15m and 40m, and the closed construction prevents escape.

Fish welfare

Marine Donut is a flow system that exercises the fish, where the flow can be adjusted according to the breeder's wishes, depending on the size of the fish or other needs. This recreates the natural environment that the salmon experience in the rivers. The dimensions and geometry are designed as the salmon likes best and with the right pressure when it comes to depth. The design provides good fish density in the entire facility - not just the upper part, as well as good oxygen distribution and residence time for the water flow.

Sludge collection

The plant is supplied with a system for sludge collection. The sludge is reused for valuable bio-fertiliser, natural gas or similar added-value products, and the construction is designed to adapt to an expected future environmental technology concession system. The sludge is delivered at a defined point for possible processing of the sludge depending on the location and the end customer's wishes.

Sensory and technology

Marine Donut is packed with sensors and big data capture for trend analysis and management. This gives the breeder full control over the fish and its surroundings through digitization and monitoring.

Better profitability

Despite increased capex compared to traditional cages, Marine Donut will be competitive in terms of production costs per kg.: The costs of feed and medicines go down, lice treatment is eliminated and wastage and mortality are greatly reduced. Fish health and fish quality are improving. A higher density can be permitted due to control of fish welfare, low stress and good documentation on an ongoing basis. In addition, the plant provides smarter logistics and more efficiency in terms of emptying and following for the breeder. The thermoplastic material has great potential in terms of price for mass production of such facilities.



This is how it works

Marine Donut consists of a closed breeding unit that is shaped like a donut (torus). The main construction is made from the material High Density Polyethylene (HDPE), which can be recycled, and acts as a tight barrier against the external environment to prevent lice infestation and infection entering the facility. The intake water is purified via a Bernoulli filter and UV lamp. Marine Donut has float tubes at the top and bracing tubes at the bottom in addition to vertical ballast tanks on the sides. This allows the plant to be raised and lowered. On top of the facility there will be a work platform, and green energy production in the form of solar cells. The plant has a solution for the collection of sludge and water intake under the louse belt. Marine Donut is designed to withstand high exposure to both waves and currents and is suitable for both post-smolt production and food fish. Both as a stand-alone system or in combination with other technology.

The project:

In 2019, the Directorate of Fisheries awarded two development permits earmarked for the Marine Donut concept. In the letter of commitment, the Norwegian Directorate of Fisheries writes: - As a result of the concept being able to help solve several of the environmental and area challenges facing the industry, the Norwegian Directorate of Fisheries considers that the project involves new and significantly improved production technology.

SalMar took over commitments for development permits in 2022 and construction of the first Marine Donut started in April of the same year. The facility is expected to be completed in the spring of 2023.

Suppliers

Bluegreen Fusion	Total contractor, engineering and construction
ABB	Electronics, automation and instrumentation
AGRU	Thermoplastic material (HDPE)
Xylem	Pumps
Sterner	UV lamps and Bernoulli filter
Nippon	Oxygen and emergency oxygen
Signify	Lighting in fish volume
Solar Energy	Solar panels from REC
Stressmann	Global analysis and detailed structural design
Ranold	CFD analyzes and simulations
Aquastructures	Design verification and product certification
Sintef	Pool test of scale model 1:10



Bluegreen



Technical information

- ▶ Material: High density polyethylene (HDPE) 100 RC
- ▶ Total height: 14.64 meters inside/17.51 meters outside
- ▶ Diameter: 55 meters plus jetty
- ▶ Width: “mantel cross-section”: 16.2 metres
- ▶ Volume: 22,000 m³
- ▶ Capacity: 1100 tonnes MBT
- ▶ Water flow speed: < 0.8 m/s
- ▶ Hs, Vs, Tp: 3m, 1.5m/s, < 6.7sec
- ▶ Water intake depth 15 to 40 metres
- ▶ UV purification of intake water
- ▶ Start of construction: April 2022
- ▶ Completion/postponement of fish: < June 2023

