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Albatros Technology B.V. - Rejection of application for development licenses

We refer to the application from Albatros Technology B.V. ("Albatros" or "applicant"), dated March 18, 2017. The application's objective is to realize Albatros' concept AquaBarge.

The application

Albatros applied March 18, 2017 for nine development licenses to develop a sea-based farm (The AquaBarge) for grow-out of salmon in closed containment system, using recirculating aquaculture system (RAS)-technology. The AquaBarge is a closed salmon farm supported by an IMO/DNV GL classed offshore barge. The barge will maintain its geographical location via a conventional anchored four-point mooring system.

A barge is a flat-bottomed vessel that is not self-propelled. The AquaBarge will consist of a steel barge. The overall size of the barge will have a length of 195 m, a breadth of 55 m and a depth of 22 m. The barge will have fish tanks on three decks, two levels with fish tanks below main deck and one level on main deck. There will be five growth stages from smolt to full grow-out. The applicant plans to have five smolt intakes per year and a year round production output. The planned production is 10 000 tons per year.

All necessary systems for operation will be installed onboard the barge except from the main power supply, which is supposed to come from the land network. The concept is designed in a modular way that according to the applicant offers the fish farmer a fit for purpose facility that can be blended into the end client's existing infrastructure. The basic systems are; support structure for the modules, ballast tanks, harvest system, laydown areas, safety and escape routes, one smolt system, one post-smolt system, two pre-grow out systems, five grow-out systems and a purging system. In addition, the utility systems feed storage and distribution, wet sludge storage, main laydown area, fish transport, fish grading, power management module, office module, water treatment, HVAC and oxygen generation.

The main system of the RAS consist of oxygen generator, ozone generator, pumps, drum filters, protein skimmer, protein skimmer pumps, fans for CO2-degasser, mixers in biofilter/moving bed biofilm reactor (MBBR), blowers for MBBR and UV for replacement water. According to flow chart by AquaOptima there will be a fresh water feed of normal max 225 m3/h and sea water feed of normal max 449 m3/h.

The Sauda fjord in Rogaland is a nominated site for full scale testing of the concept.

Regulations

The regulations regarding development licenses are found in *Forskrift om tillatelse til akvakultur for laks, ørret og regnbueørret* (administrative regulation regarding allocation of license for aquaculture with salmon, trout and rainbow trout). In addition, The Ministry of Trade, Industry and Fisheries has produced guidelines with complementary information about the criteria established in the administrative regulation.[1] However, both the administrative regulation and the guidelines are only available in Norwegian. In this document parts of the administrative regulation and the guidelines has been translated unofficially. Hence, for the complete and correct understanding we refer to the original versions in Norwegian.

According to the administrative regulation regarding allocation of licenses for aquaculture with salmon, trout, and rainbow trout section 22, 2nd paragraph the objective behind the development licenses is to contribute to the development of technology for the common good of the aquaculture industry.

Section 23, 1st paragraph, states that the Directorate of Fisheries may, at its discretion, allocate licenses to aquaculture with salmon, trout and rainbow trout for consumption to specific purposes.

Section 23b, 1st paragraph states that an applicant may be allocated licenses for aquaculture with salmon, trout and rainbow trout to projects that can contribute to the development of technology. The projects that are allocated licenses must involve considerable innovation and considerable investments. The objective of the development licenses is to facilitate the contribution of new or existing knowledge from research or practical experience towards the development of technology needed to address the environmental and costal area challenges the aquaculture industry is facing. According to the 2nd paragraph the developmental work must differ significantly from established knowledge and technology already in commercial use in the aquaculture field. The proposed work therefore cannot merely be a natural continuation of what is currently an industry standard.

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1 https://www.fiskeridir.no/content/download/16367/235525/version/41/file/retningslinjer_utviklingstillatelser-2016.pdf

The Directorate of Fisheries' assessment

In accordance with practice established July 15, 2017 the applicant was given a three week deadline to supplement the application with additional information. The Directorate considers the application to be adequately clarified to make an administrative decision, cf. the Public Administration Act section 17, 1th paragraph.

The decision to allocate development licenses is discretionary, cf. the above mentioned administrative regulations. The guidelines also state that both the assessment of the projects and the decision of whether the criteria for allocation of development licenses are fulfilled are discretionary. The applicant does not have a legal claim to one or more development licenses even if the project involves considerable innovation and investment. The applications are assessed strictly and the bar for being allocated development licenses is set high.

Innovation

The applicant may be allocated development licenses for aquaculture with salmon, trout and rainbow trout for projects that, among other things, involve considerable innovation. According to the guidelines, the process by which the level of innovation is assessed is an administrative discretionary decision. The administrative authorities will start with the definition of development work and undergo a specific assessment of whether the project involves sufficient innovation.

The guidelines refer to Statistics Norway's definition which defines development work as a systematic enterprise that makes use of existing knowledge from research or practical experience, and is directed at the manufacturing of new or considerable improved materials, products or devices.

The main criteria for developmental work is that it must consist of new elements and that there has to be some degree of uncertainty regarding the results. The Directorate of Fisheries has to assess whether the concept can be compared to existing technology, how the concept distinguish itself from previous technologies in the field, and to what extent this distinction affects the uncertainty regarding the results and the potential for innovation.

The administrative regulation regarding allocation of licenses for aquaculture with salmon, trout and rainbow trout, section 23b, 2nd paragraph, states that the developmental work must differ significantly from established knowledge and technology already in commercial use in the aquaculture field. The proposed work therefore cannot merely be a natural continuation of what is currently an industry standard.

The key technologies within the AquaBarge-concept are an offshore industry barge design and a RAS. It is the Directorate of Fisheries' understanding that the RAS that will be utilized is similar to known land-based systems, but fitted for the production onboard the AquaBarge. Both RAS- and barge technology are well known and proven technologies.

According to the applicant, the integration of both technologies in a marine environment is, however, unique and therefore requires new knowledge. The Directorate of Fisheries considers the concept to involve an element of novelty by way of combining two known technologies and being the first floating RAS.

Further assessment of the concept's innovation potential includes an assessment of whether or not the concept represents an improvement on existing technology. The question is therefore whether the AquaBarge-concept has the potential to outperform today's technology in meeting the challenges the industry is facing.

According to Albatros; "*their application is directed at developmental licenses for marine purposes and therefore, land based RAS farms will not be reviewed as existing technology to be distinguished from the RAS integrated in the barge*". According to the administrative regulation regarding allocation of licenses for aquaculture with salmon, trout and rainbow trout section 23b, 2nd paragraph, the technology has to differ significantly from previous knowledge and technology in the *aquaculture field*. The RAS technology is a known technology in the aquaculture field. Thus, the Directorate of Fisheries considers land-based RAS farms as existing technology, and the technology in the application must differ from the known RAS technology.

The RAS technology described in the AquaBarge-concept consists of the same main systems as known from land-based RAS farms, however it is scaled to fit the production planned onboard the AquaBarge. The applicant has not described any new or improved technology with regards to the RAS, which will be developed and used in the project. The Directorate of Fisheries assesses the AquaBarge's RAS technology as standard and well known technology, which only needs to be adjusted and scaled to size.

From the first version of the application to the current version, the production capacity in the AquaBarge has increased from 6600 tons per year to 10 000 tons. The applicant argues that there is a need for development of aquaculture farms for the full grow-out of salmon on a large scale. As far as the Directorate can see the main reason for increasing the scale is to improve the profitability. As the applicant is aware of, there are a handful of operational grow-out land-based RAS farms and a dozen grow-out farms currently under construction. Examples of existing farms[2] are Jurassic Salmon in Poland designed for a production of 1000 ton per year, Xin Jiang in China designed for a production of 1000 tons per year, South African Salmon designed for a production of 3000 tons per year and Atlantic Sapphire in USA designed for a production of 5000 tons per year. Compared to these the AquaBarge's capacity will be twice the scale of the largest existing facility. However, several large-scale concepts are currently being planned or are under construction. Atlantic Sapphire is planning to upgrade their farm in Florida to produce 90 000 tons per year by 2026.[3] Whole

[2] http://tekset.no/wp-content/uploads/2017/02/25-Olsen.pdf
[3] https://www.undercurrentnews.com/2018/03/29/atlantic-sapphires-land-based-salmon-will-be-more-eco-friendly-than-imports-ceo-says/

Ocean is due to begin construction in Maine, USA this year on a land-based RAS facility that will produce 20 000 tons per year, with a long term goal of producing 50 000 tons of salmon.[4] The Directorate of Fisheries assesses such increase in capacity as a natural further development of the technology.

The applicant maintains that a fully integrated production from smolt to grow-out, which does not require separate post-smolt production, is an innovation. The Directorate of Fisheries does not regard this as an improvement when compared to the land-based RAS farms that often will have the whole production cycle. As an example the Jurassic Salmon in Poland has the whole production cycle from egg to salmon up to an average weight of 5 kg.[5]

The applicant states that the development of the RAS on-board the barge includes an analysis of the motions and behavior of the barge, potential sloshing effects in tanks, coating and the related fish welfare. The Directorate of Fisheries agrees that this is needed for this concept to be realized, however such analysis would not be needed for a land-based RAS farm.

According to the applicant, the concept will have full monitoring of the intake and outlet water quality, which results in minimized risk of pollution or impact on the environment, fish or equipment. As this is the case for other known land-based RAS farms, the Directorate of Fisheries does not consider the AquaBarge to produce any improvement regarding risk of pollution or impact on the environment, fish or equipment compared to land-based RAS farms. However, the environmental impact to the surrounding environment, as well as the risk of lice, parasite and pathogen exposure in the AquaBarge-concept is considered to be significantly reduced when compared to open net pens in the sea.

According to the applicant, the monitoring of the intake and outlet water system will incorporate a "fail safe" system, which entails that the system will automatically switch to a pre-programmed mode in case of a failure. To the Directorate of Fisheries' knowledge, modern RAS farms have systems for monitoring and controlling important water parameters. Some land-based RAS farms also have the capability of switching to flow-through if issues with the water quality/chemistry arise. According to the applicant, the concept will use a RAS, which allows the concept to recirculate a large portion of the water, while only a small amount of replacement water is required. In the flow chart by AquaOptima, a fresh water feed of normal max 225 m^3/h was referenced (5 400 m^3/day). A fresh water source is needed for the production. The water source to be used for the concept has not been specified in the application.

The barge is a floating support structure and therefore it is possible that the barge can sink. According to the applicant, the potential causes of such an event include impact from

[4] https://www.undercurrentnews.com/2018/02/23/second-land-based-salmon-farm-planned-for-us-state-of-maine/
[5] http://jurassicsalmon.pl/en/

another boat or structure, freezing of surrounding waters, corrosion of the hull, or human impact. Because the proposed area of operation is not visited by large ships to participate in a high impact collision and because the AquaBarge will be much more visible for all ships than open net pens, the applicant has assessed the risk of collision to be negligible. According to the applicant, the corrosion of the hull is controllable when correct maintenance is performed.

Compared to open net pens in the sea, the Directorate of Fisheries assesses the risk of fish escape to be lower due to the closed tanks within the steel barge and the smaller units/tanks ensuring reserve buoyancy in case of damage. Compared to land-based RAS farms the escape risk is assessed to be similar.

The applicant maintains that pump capacity requirements will be low due to location at sea-level. A power consumption of 8829 kW is estimated in the AquaOptima design report. As the barge has three decks with grow-out tanks, the benefit of being at sea level is limited to a certain extent as the water has to be lifted. The Directorate of Fisheries does not have an overview of the power usage on land-based RAS farms, hence a comparison cannot be made. However, the power consumption on a RAS farm is not considered a main challenge and is not part of the objective behind the development licenses.

The question is whether any other advantages arise from placing the RAS on a barge at sea instead of on land. The development licenses shall facilitate development of technology that can help solve one or more of the environmental and coastal area challenges that the aquaculture industry is facing. According to the guidelines this will, among other things, include the development of fish farms that can be used further out at sea and at the head of fjords. This can help ensure that areas formerly considered as unsuitable for fish farming can be used, and that the area utilization in the coastal zone in total can be more effective.

The AquaBarge does not require any land utilization. However, access to sites on land is not currently being assessed as one of the challenges the aquaculture industry is facing and is thus not part of the objective behind the development licenses. The area the barge will occupy in sea will be 10 725 m2 (about 0,011 km2), mooring not included. Based on a production of 10 000 tons per year, this results in a production per area of about 930 kg/m2. Based on information in the Directorate of Fisheries' Aquaculture Map an estimate of production per area of approved locations is about 13 kg/m2. This estimate includes all approved locations, which will not provide a correct picture, as many of the locations are not currently in use. However, this indicates that the sea surface area occupied by the AquaBarge for the full production cycle from smolt to full grow-out fish is by the Directorate of Fisheries regarded as significantly smaller compared to sea based aquaculture farms.

According to the applicant the AquaBarge will contribute to expansion of the industry's production in existing and previously abandoned locations, and that the major benefit of this concept is that it can make use of existing logistics and methods of transport. The Directorate

of Fisheries agrees that the barge can be used in existing locations and locations not used due to environmental issues. Nevertheless, the AquaBarge also has limitations regarding its possible locations, as the production requires a nearby freshwater source and onshore power supply.

The AquaBarge-concept does contain some improvements as compared to traditional open net pens. However, the Directorate of Fisheries does not assess that a RAS farm on a barge involves significant improvement compared to land based RAS farms. Furthermore, the application fails to demonstrate how a RAS at sea will have an advantage over a RAS on land when it comes to the objective of the development licenses, which is to solve one or more of the challenges concerning the environment and coastal areas. All in all the AquaBarge-concept is assessed as not producing considerable innovation.

Since the Directorate has concluded that the project does not involve "*considerable innovation*", we will not assess whether the project fulfills the other criteria for allocating development licenses. Nevertheless, even if all the criteria were fulfilled, the decision of whether development licenses are to be allocated is discretionary. In the assessment of whether licenses are to be allocated the common good of the aquaculture industry is central, c.f. the administrative act section 22, 2nd paragraph. On July 1, 2016 an amendment to the administrative regulation regarding allocation of licenses for aquaculture with salmon, trout and rainbow trout made it possible to apply for licenses on land at any time with no other charges than administrative fees. As far as the Directorate is concerned, the government with this amendment already facilitates the development of the kind of technology that is dominant in this application, which would be a further reason not to allocate licenses to this project.

Decision

The Directorate of Fisheries has concluded that the project does not fulfill the criteria concerning "*considerable innovation*", c.f. the administrative regulation regarding allocation of license for aquaculture with salmon, trout and rainbow trout section 23b. The Directorate consequently declines Albatros Technology B.V.'s application for nine development licenses.

Right to appeal
The decision can be appealed, c.f. the Public Administration Act section 28, see attached form.

Yours sincerely

Øyvind Lie
Head of Departement

Anne B. Osland
Head of Section

This letter is approved for electronic submission and does not need a handwritten signature

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Enclosure
Notification of the right to appeal against an administrative decision.Albatros