

FRAMO AQUACULTURE

Innovative solutions for the future of fish farming



The future of sustainable food production

Aquaculture is the future of sustainable food production. In Norway alone, experts predict a fivefold increase in the industry over the next 30 years. Achieving such rapid growth requires innovative technologies – solutions for combating sea lice and diseases, handling sludge, and managing mortalities.

At Framo, our mission is to revolutionize the aquaculture industry through close collaboration with our customers. Together, we develop innovative solutions designed to make fish farming more sustainable, promote better fish health, and – importantly – make it more profitable for farmers.

With decades of experience as a pump manufacturer, we understand the unique challenges the aquaculture industry faces – from maintaining optimal water quality to maximizing production efficiency and safeguarding both fish welfare and the environment. We've developed a portfolio of tailor-made solutions to meet these challenges. In this brochure, you'll learn about two of our key products: AquaStream and the Framo LiftUP sludge system – developed closely with fish farmers to address two major industry challenges: fish welfare and environmental impact.

Our commitment

At Framo, sustainability is at the heart of everything we do. Drawing on deep expertise from both the marine and offshore sectors, we create products and services for aquaculture that minimize environmental impact, boost operational efficiency, and help our customers improve profitability.

Our innovative products

Framo offers a wide range of products covering everything from pumps and pumping systems to sludge collection solutions for both sea-based and land-based fish farming.

All our products are developed in close collaboration with our customers and tailored to meet the diverse needs of the aquaculture industry. Whether you aim to improve water circulation or enhance waste management, we offer the expertise and technology to solve these challenges.

Framo LiftUP sludge system

Our Framo LiftUP sludge collection system represents a breakthrough in sustainable waste management for the aquaculture industry. Designed with efficiency and environmental responsibility in mind, this innovative solution enables effective pumping of waste back to the feeding platform or to land for filtration, preventing sludge buildup on the seabed and minimizing the ecological impact of fish farms. Tested and validated together with leading aquaculture companies, our Framo LiftUP sludge system offers outstanding performance. We like to say that sludge is resources gone astray.



Framo AquaStream

Framo AquaStream ensures fresher and faster-growing fish. The core idea behind the system is to pump large amounts of fresh water in a way that recreates the favorable current conditions of Norwegian fjords. Lice skirts in cages help reduce the sea lice problem, but at the same time, they decrease the water flow within the cage. With more stagnation and less oxygen, water quality worsens, affecting both fish health and growth.

With Framo AquaStream, large amounts of water are pumped from depths below the algae and lice belt. The water brought up has the correct oxygen content and temperature – free from lice and algae. When AquaStream creates flow in the cage, the fish become more active and develop a better appetite.



Framo SR2000 developed especially for Aquaculture

The Framo SR2000 is a permanent magnet, rim-driven flow generator designed to pump large volumes of water at low pressure. Featuring water-lubricated bearings and an oil-free system with no gears or shafts, it offers flow rates between 2.8 and 5.6 cubic meters per second.



Why choose Framo Active Flow Control

Framo Active Flow Control is a cost-effective combination of pumps, inlet nozzles, and sludge traps, creating an optimal environment for salmon in tanks or cages.

A healthy salmon yields a premium product – and a clean environment ensures sustainable growth.

Advantages and increased production with Framo Active Flow Control include:

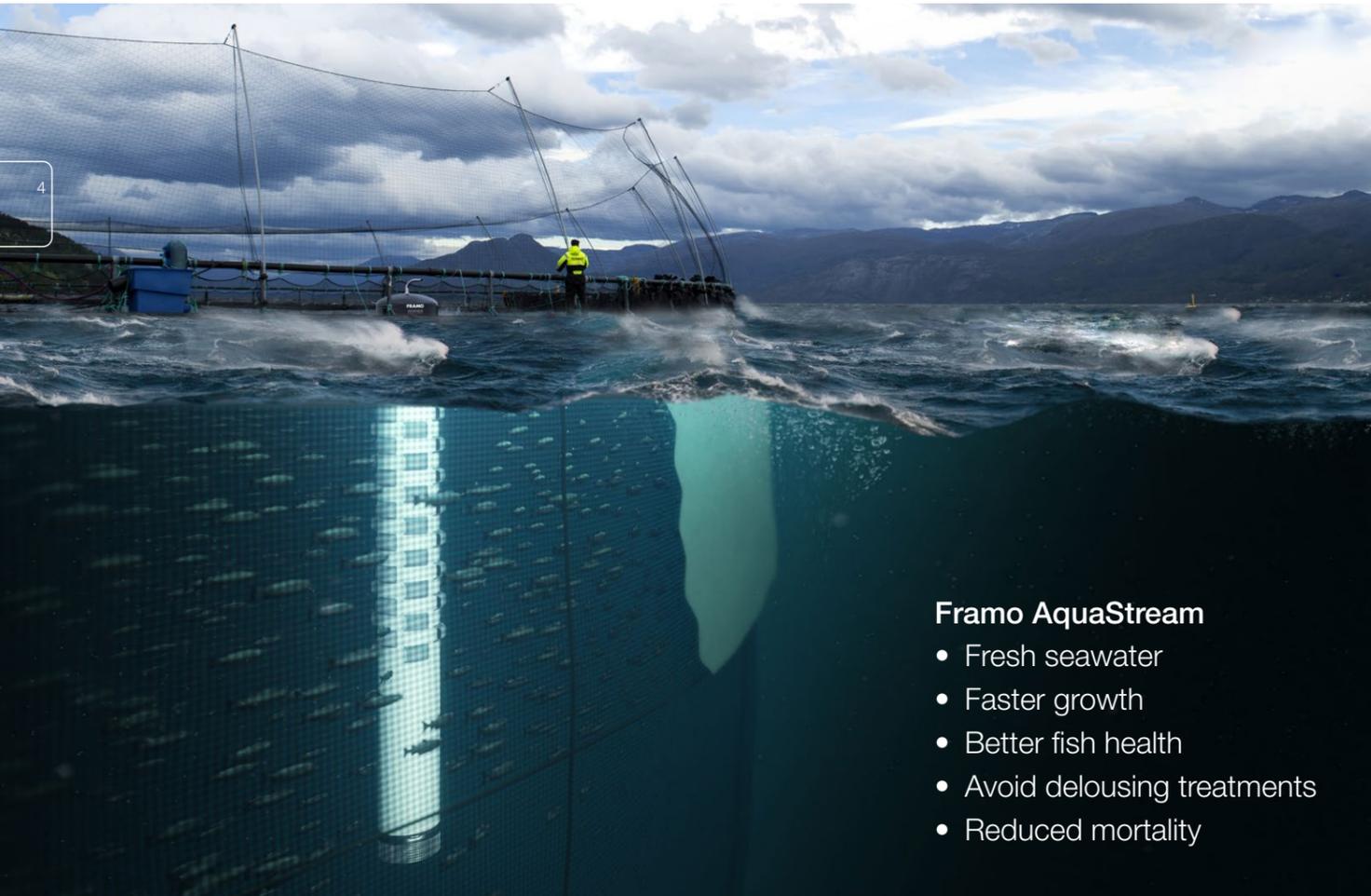
- Full control over the environment in the tank or cage.
- Increased efficiency and better fish health.
- Ensured correct water flow, oxygen level, and water temperature.
- Separation of sludge and other organic waste for concentration, storage, and recycling.
- Significantly lower energy consumption.
- Substantially lower CAPEX and OPEX.



Framo Aquaculture customer stories

Page 4–6: AquaStream at Northern Lights Salmon and Sørrollnesfisk

Page 8–11: Framo LiftUP sludge system at Lerøy Sjøtroll



Framo AquaStream

- Fresh seawater
- Faster growth
- Better fish health
- Avoid delousing treatments
- Reduced mortality



Terje Ljones at Framo Aquaculture. Photo: Framo

CUSTOMER STORY – FRAMO AQUASTREAM

Effective sea lice solution

The combination of lice skirts and Framo AquaStream is a guaranteed winner in the fight for better fish health.

Framo AquaStream is a pump system that can be used in any cage equipped with a lice skirt. The new technology was tested last year, and the results were excellent: Better growth, better quality, lower mortality, and most importantly, the fish were produced without a single delousing treatment.

“We developed Framo AquaStream with the goal of improving fish health, reducing mortality, and enhancing fish quality. The tests show that the technology meets all expectations. We are extremely pleased to contribute to good fish

health and to create results for Norwegian aquaculture companies,” says Terje Ljones, Director at Framo Aquaculture.

90 percent superior

Northern Lights Salmon and Sørrollnesfisk tested a new cage concept against sea lice last year, where Framo AquaStream was a key element.

When the fish were harvested in autumn 2023, they achieved a superior rate of over 90 percent, a growth index (EGI) of 108–117, and a biological feed factor of 1.04–1.10. These excellent numbers have led the companies to plan for new stocking in the summer.



Framo AquaStream

Important water circulation

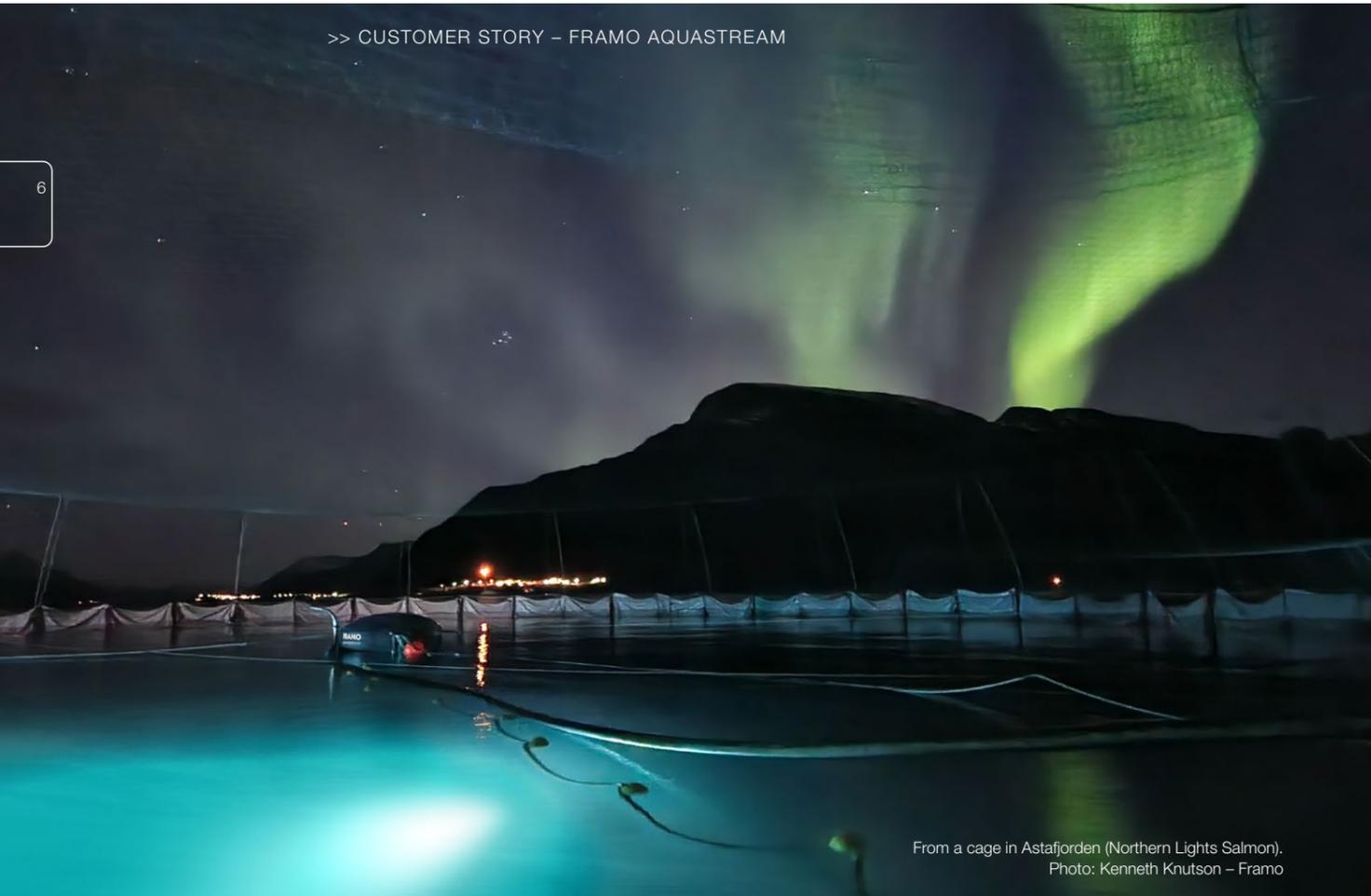
Lice skirts generally help reduce the lice problem but also reduce water circulation in the cage. With more stagnation and less oxygen, water quality deteriorates. This impacts both fish health and fish welfare due to poor flushing of waste and oxygen consumption by the fish.

Framo AquaStream pumps large amounts of water from depths below the algae and lice belt – water that has the correct oxygen content and temperature and is free from lice and algae. Moreover, the generated current stimulates fish activity and appetite.

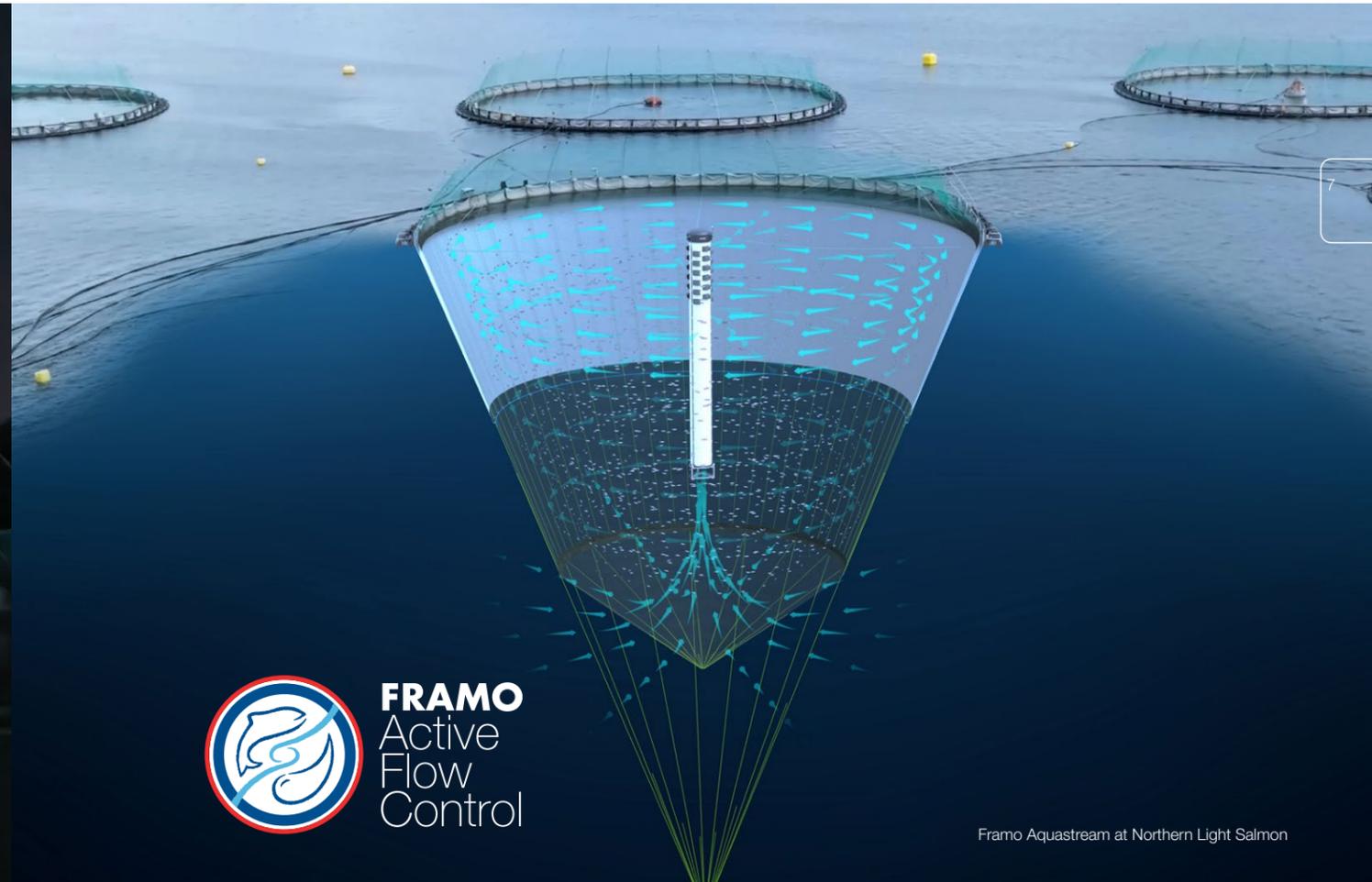
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From a cage in Astafjorden (Northern Lights Salmon).
Photo: Kenneth Knutson – Framo



Framo Aquastream at Northern Light Salmon

Many advantages

The battle against sea lice costs the aquaculture industry around NOK 13 billion a year. By using lice skirts and Framo's pumping system, the number of stressful delousing treatments is reduced. There is less use of chemicals and cleaner fish.

Framo AquaStream also ensures more consistent water temperatures in the cages. In summer, fresh, oxygen-rich, tempered water is pumped up. In winter, warmer water is brought to the cold surface, reducing the risk of winter sores and giving the salmon optimal growth conditions.

"Framo AquaStream can be installed in all existing cages along the Norwegian coast and works excellently even without specially designed solutions," says Terje Ljones.

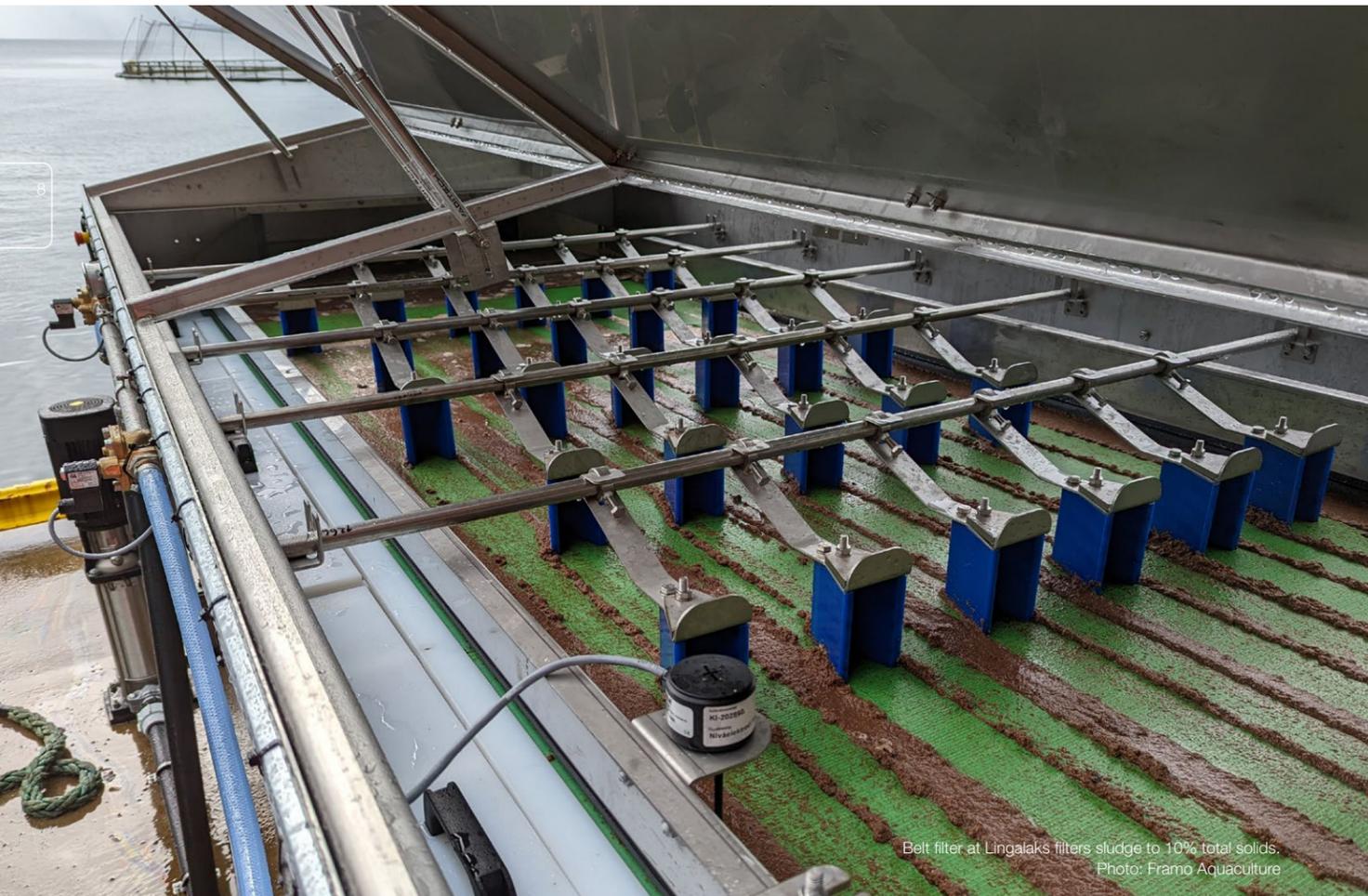
Framo is a world-leading supplier of quality pumps for shipping and the offshore industry. This technology has been further developed and customized for use in aquaculture facilities.

Framo AquaStream

- A complete pump system especially useful in combination with lice skirts.
- Framo AquaStream provides better supply and distribution of fresh water to fish farming cages.
- The two-meter diameter pump stands in the middle of the cage and can be used in existing and new cages of any type.
- AquaStream pumps fresh, lice-free water from a depth of 20–25 meters up to the upper water layers.
- The system has a capacity of about 15,000 cubic meters per hour and can replace all the water inside the lice skirt every hundred minutes.
- Integrated in Framo AquaStream are an SR2000 flow generator, duct tunnel with nozzle tower, strainer, float, and control system.



Framo SR2000



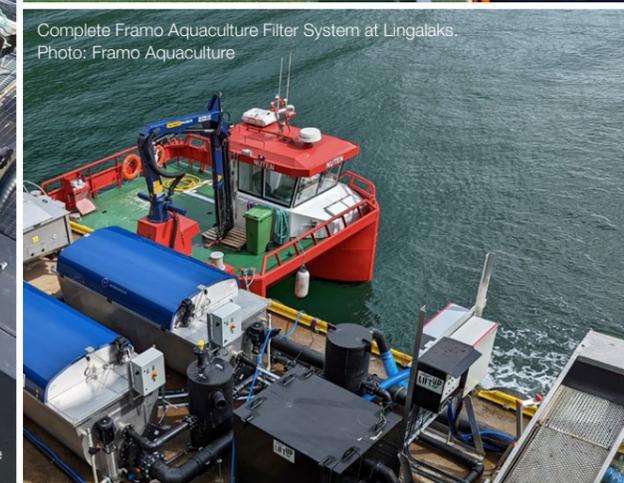
Belt filter at Lingalaks filters sludge to 10% total solids. Photo: Framo Aquaculture



Belt filter at Lingalaks filters sludge to 10% total solids. Photo: Framo Aquaculture



Lerøy Nye Skiftå. Photo Framo Aquaculture



Complete Framo Aquaculture Filter System at Lingalaks. Photo: Framo Aquaculture

CUSTOMER STORY – FRAMO LIFTUP SLUDGE SYSTEMS

Creating a new industry in sludge

At Framo Aquaculture, contracts for Framo LiftUP sludge systems are pouring in. Deliveries to the aquaculture industry have been much larger than expected.

Sludge collection has become a new industry that creates jobs and saves the environment, and Framo Aquaculture is proud to be part of this green shift in aquaculture. "The collected sludge can be used to produce electricity, district heating, fertilizers, and phosphorus, which can be reused in fish feed and fertilizer production," says Magnus Holmefjord of Framo Aquaculture.

The company has signed contracts continuously throughout the autumn, and more are in the pipeline. So far, eight contracts have been signed, with several more expected to be finalized in the near future.

The market awakens

"Now the market is waking up, and we will deliver sludge systems to several major aquaculture players. We notice that more and more are willing to invest in this technology because removing sludge and feed residues benefits both the seabed and the water quality at aquaculture sites. With this technology, sites can recover faster, and farmers can enjoy shorter fallow periods.

This could enable annual stocking of, for example, 800-gram post-smolts with just 10 months at sea before harvest," says Holmefjord.

Pilot project cooperation

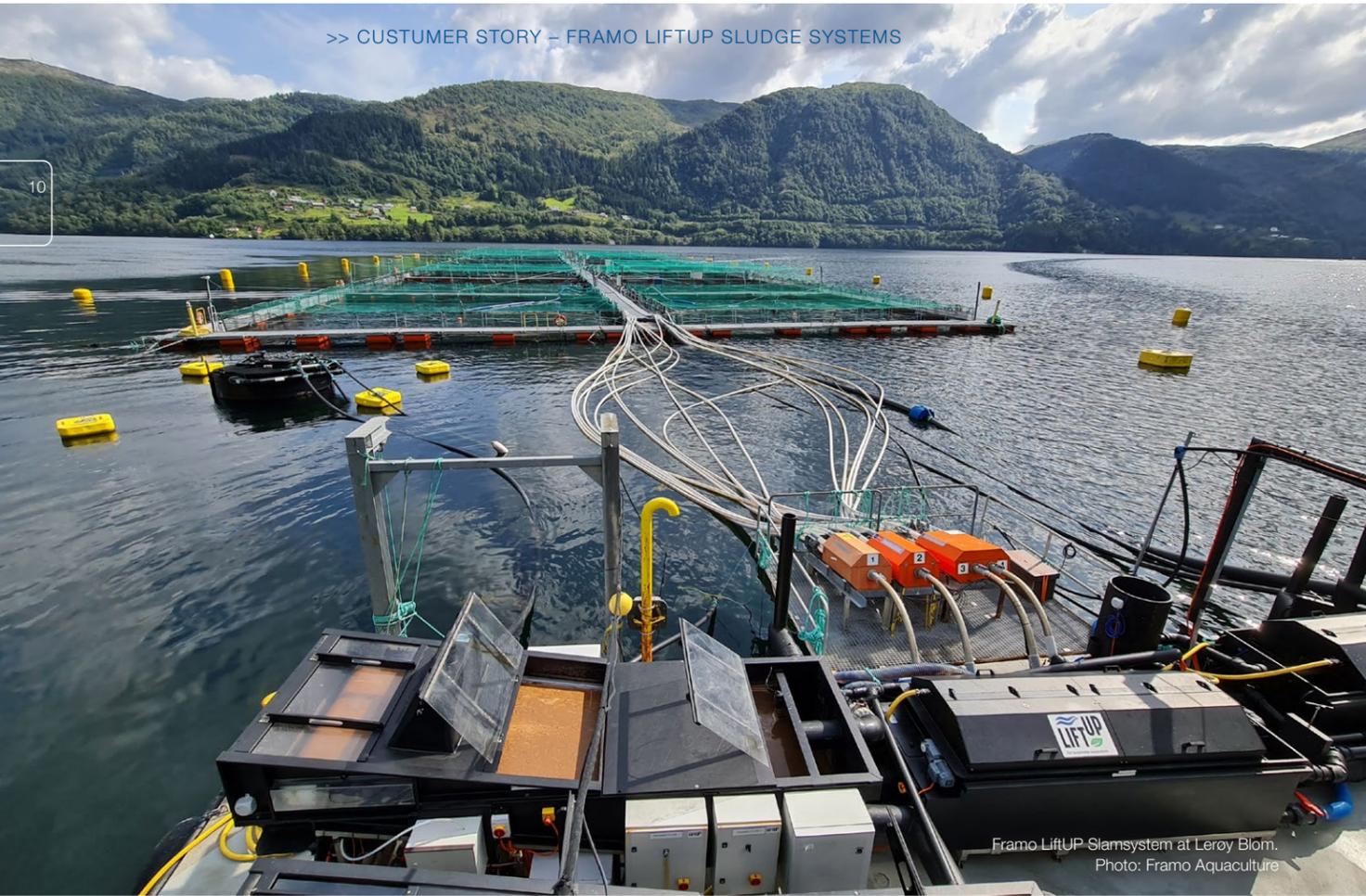
Framo Aquaculture began its sludge collection journey in earnest through a collaboration with Lerøy.

"The pilot project allowed us to gain a lot of knowledge, and the results are impressive when you see what Lerøy Sjøtroll has achieved at their sites around Osterøy," says Magnus Holmefjord.

A large-scale project has collected sludge and feed waste from open cages at one of Lerøy Sjøtroll's locations in Sørfjorden.

The experiences gained here have been carried forward by Framo Aquaculture. Until now, seabed conditions have significantly limited the production levels of fish. With new technology, farmers can change this.

We are now moving forward with the commercialization of the product together with several exciting customers who have chosen to invest in sludge collection. Not least, they have taken the lead in developing new methods within fish farming," says Magnus Holmefjord of Framo Aquaculture.



Framo LiftUP Slamsystem at Lerøy Blom.
Photo: Framo Aquaculture



Sludge collected by the new sludge system.
Photo: Framo Aquaculture



Magnus Holmefjord at Framo Aquaculture. Photo: Øystein Klakegg

A step further

Customers have taken the aquaculture industry a step further. Lingalaks, the first customer after pilot testing, is now working with the closed farming concept 'Stadium Basin' together with Framo Aquaculture.

KJ Eide Fiskeoppdrett will become the world's first freshwater fish farm with a sludge collection system for cages. Eide Fjordbruk is also working with closed cages and sea-based sludge collection. In the north, Vesterålen Havbruk is establishing the world's first cod farming facility with sludge collection.

Equipment supplier LiftUP became part of Framo in October 2021. The company has moved into larger production and office facilities at Framo Fusa to accommodate market growth.

"In addition to the customers we have signed with, we are in the final phases with others who see the advantages of a smaller footprint, shorter sea time for salmon, and minimal following," says Magnus Holmefjord.



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