

SMARTER BUSINESS WITH FRAMO OIL AND GAS PUMPING SOLUTIONS

Think outside the pump room



## Rethink simplicity

The simplest way to do things is not necessarily the way they've always been done. As technology develops, old truths give way to new and smarter possibilities.

Possibilities to avoid hull penetrations.

Possibilities to eliminate stress-prone line shafts.

Possibilities to do away with pump rooms altogether.

At Framo, we see – and create – possibilities for the oil and gas industry. Our world-leading pump technology has already revolutionized marine cargo pumping. And today it's driving greater short-term and long-term profitability in hundreds of oil and gas installations.

Before you design, build or rebuild, rethink what you know about pumping.

Discover the Framo advantage.



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## Why it pays to think outside the pump room

Pumps are the heart of all oil and gas processes. But traditional pumps in a central pump room mean wasted space, added risk and increased operating costs.

Framo submersible pumps are different. Installed in caissons, which are either outside or integrated into the hull, they offer safe assurance of better business.





## Why it pays to think outside the pump room

### **The pump that changes everything**

Framo began with an idea, that a pump should be where the action is – not isolated in a pump room. Using a hydraulic drive or the unique electric Framo cable-free concept (see pages 18–19), individual pumps can be submerged right in the place where they do their job.

This idea has had a huge impact in the marine cargo operations, where Framo solutions have become the unquestioned standard. But as an increasing number of companies are discovering, it makes equal sense in the oil and gas industry.

### **Minimized risk. Maximized savings.**

When the pumps are submerged, the entire pumping installation can be moved outside or integrated into the hull. Instead of a massive internal pump room and extensive piping, simple side-mounted caissons do the job with no hull penetrations.

This reduces risk, which is perhaps the single most important factor for any oil and gas business. When hull penetrations are removed, so is the possibility of uncontrolled flooding. But as the next chapter shows, doing away with the pump room also means lower total CAPEX and far lower OPEX.



## The shortest route to reliability

Not all caisson solutions are created equal. If caisson pumps are installed with the drive motor topside, the long rotating line shaft makes tension and vibrations inevitable. This creates unnecessary wear and tear, which means more expense and increased risk over time.

In Framo solutions, both the pump and its drive motor are submerged. This eliminates the long rotating line shaft, and with it, the strain that can lead to excessive maintenance and breakdowns.

## Total peace of mind

The reliability of Framo pumps is only equalled by the reliability of Framo itself. Framo experts are available worldwide and around the clock. Service is dispatched within hours of a call. Without exception, our focus is keeping pumps – and oil and gas businesses – running smoothly.

All of our pump systems come with support for Framo Insights, our 24/7 online service. With continuous monitoring, performance predictions and early warnings, this service allows you to combine your operation's knowhow with Framo's extensive experience. Together with a Framo Performance contract, Framo Insights gives you a confident guarantee of the best possible availability and reliability of your pumping system at all times.



## The Framo cable-free concept

Framo submersible pump technology has improved business at sea for over fifty years. The revolution that began with our unique hydraulic pumps continues with our cable-free electric submersible pumps, which lie at the heart of most oil and gas applications.

### **No submerged penetrations**

An intact hull means a higher degree of safety. The unique Framo cable-free concept eliminates submerged penetrations and the cable handling otherwise associated with electric submersible pumps. Each pump is suspended from a riser pipe, which contains a built-in transmission system for the electrical power.

### **Protected and integrated power**

Flanged at both ends, the protective riser pipe sections contain a built-in cooling system and three power conductors spaced by insulation pieces. When the pipe sections are stacked, spring-loaded sliding connectors on the conductors create a safe and reliable electrical connection. The oil pipe sections are fitted with connectors, and the flanges are bolted together to complete the assembly.



## Continuous condition monitoring

The finished pumping system is insulated, cooled and lubricated by a small external oil circulation unit, which creates an internal overpressure that prevents any ingress. Double sealing further ensures that no oil is leaked to the seawater side. The external circulation unit continuously monitors the condition of the submerged pump/motor, providing information about temperature, pressure, cleanliness and seal integrity to the control system.

## In brief

The Framo cable-free concept, based on the Framo submersible electrical pump, is certified for hazardous areas and means:

- Fully integrated pump motor unit with short stiff shaft eliminates vibration issues
- Cable-free design means no risk for cable failure or damage, as well as no cable handling during installation or the withdrawal of the pump
- End suction design always gives you the best possible NPSHa
- No flexible coupling ensures you never have alignment issues
- Easy installation and handling thanks to a compact, low-weight and cable-free design



## We don't just promise performance. We guarantee it!

All Framo pumping systems come with our 24/7 online service Framo Insights. Together with a Framo Performance contract, it ensures you get guaranteed performance for your pumps.

Framo insights provides valuable feedback to your operators, support and management. By combining Framo's extensive experience with your team's knowhow, you can count on the best possible availability and reliability for your Framo pumping system.

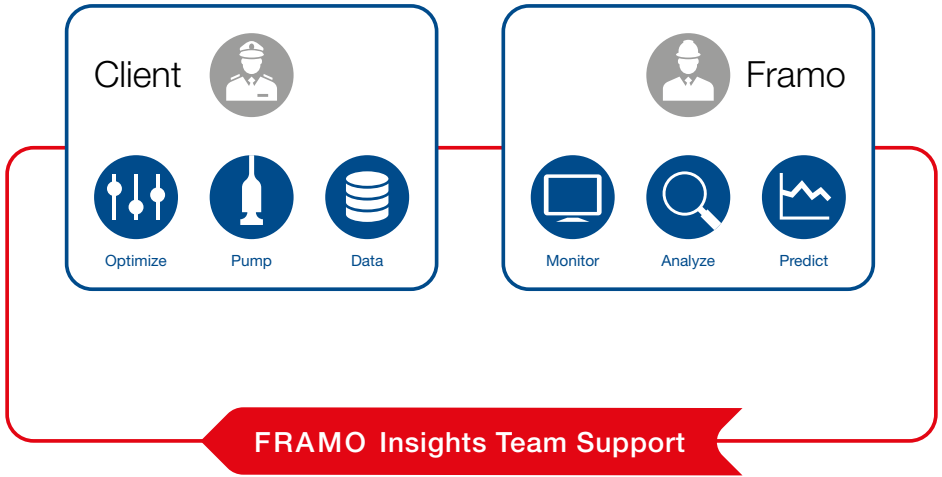
Framo Insights monitors your pumping system 24/7, providing instant information and regular operations feedback to optimize your performance and reliability

System performance predictions, notifications of anomalies and early warnings make it easy for you to plan maintenance and enable low/unmanned operation

Optimized user experience, with alignment of work processes between you and Framo to reduce waste

2-year free service, with an option to roll over to a Framo Performance contract, your next-generation service agreement.





## Considering all of the numbers

Numbers matter in any investment. However, it takes all of the numbers to provide a true picture. CAPEX is important in selection, but OPEX is important over time – because it accumulates over the 20-year lifetime of the pumping system.

Framo caisson pumping systems offer clear savings in both CAPEX and OPEX. The numbers in this chapter are real-life examples, taken from a recent FPSO conversion. To find out exactly how much you can save, contact Framo to discuss your particular project and its needs.



## Considering all of the numbers

### Selecting a pumping concept

Capacities for seawater lift pumps vary depending on production rates and temperatures. Normally, the pumps are configured in N+1 units to ensure redundancy. In recent projects, the 100% design capacities have been as high as 15,000 m<sup>3</sup>/h.

This creates big challenges when considering a pump room installation: large sea chests on each side of the vessel, 52" suction manifolds, 52" closing valves and suction strainers with isolation valves before the pumps, followed by filters and a discharge manifold to route water to coolers up to 300 m away.

By choosing a Framo caisson pumping system, these complications are eliminated. Installed off the hull or integrated into it, the caissons place the submerged pumps much closer to the consumers, which removes a great deal of piping. Because no pump room or additional sea chests are required, a tremendous amount of valuable space is also saved within the vessel.





## Considering all of the numbers

### Determining CAPEX

When all factors are accounted for, the difference in CAPEX between a traditional pumping concept and a Framo caisson pumping system can be surprising. While the pumps themselves may be more expensive, the elimination of sea chests, piping and added machinery space – including any stairs, lighting, ventilation and emergency facilities needed for it – more than compensates.

A recent FPSO conversion project serves as a good example. As shown in the table, the client made a thorough comparison between a pump room system and a Framo caisson pumping system. Although the price of the submerged pumps was 85% more than that of the dry-mounted pumps, the total cost of the caisson solution was 50% lower.

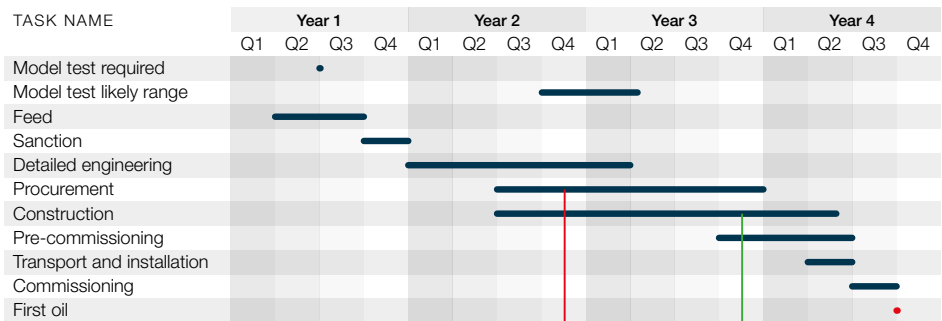
	<b>Pump room system</b>	<b>Framo caisson pumping system</b>
<b>Unit cost</b>	39%	72%
<b>Machinery space</b>	56%	--
<b>Caissons</b>	--	24%
<b>Sea chest</b>	24%	--
<b>Material handling</b>	8%	--
<b>Piping</b>	12%	2%
<b>Power cables</b>	8%	1%
<b>Instrument cables</b>	5%	1%
<b>TOTAL</b>	<b>152%</b>	<b>100%</b>

## Delaying CAPEX

The CAPEX savings in the example are typical of the difference between Framo caisson pumping system and a traditional pump room installation. But the difference in CAPEX is only the direct benefit of a caisson solution.

The indirect benefit is the fact that installation (and therefore procurement) of the caisson pumps can be delayed by up to a year. This leaves more time for process adjustments, which ensures a more optimized solution when the project is complete.

Moreover, the deferred procurement results in additional savings.



Fast track FPSO Project Execution Schedule

Installation in pump room

Installation in caissons

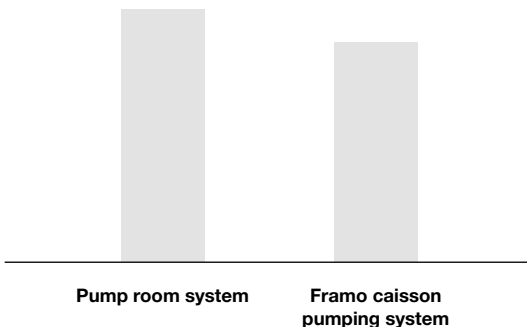
## Considering all of the numbers

### Evaluating OPEX

Savings in CAPEX are both attractive and important, but the true measure of a pumping system is how it performs in the long run. Even a large difference in CAPEX can be quickly overshadowed if the system's day-to-day costs are high.

Here too, a pump room is at a disadvantage compared to a Framo caisson pumping system.

Because a traditional pumping system involves much longer distances between pump and consumer, high friction losses can be expected. In addition, a traditional system places a larger number of critical valves and manually maintained strainers under the water. When higher HVAC costs and other factors are also considered, the expected maintenance and operational costs are substantially higher.



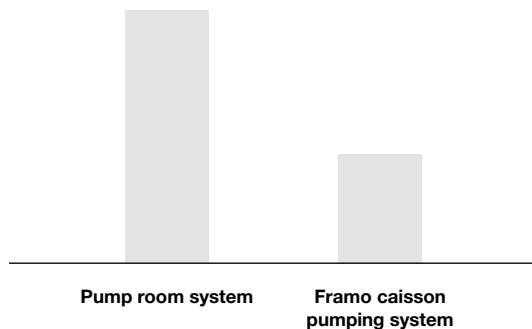
The bar chart here shows the difference for the FPSO conversion previously discussed.



## Looking at lifecycle cost

A pumping system is designed to function for up to 20 years, which makes balancing OPEX against CAPEX a must. While total lifecycle cost depends on many factors, major savings can be expected from a Framo caisson pumping system in any seawater lift or fire water pumping application.

The bar chart shows the total savings in lifecycle cost for the FPSO conversion, accumulated over a 20-year lifetime. What cannot be seen here – or valued in money – is the peace of mind in having no hull penetrations and no risk of uncontrolled flooding.



## The difference is more than the caisson

Framo is not the only supplier of caisson pumping systems. But only Framo caisson pumping systems have submerged pumps with short stiff shafts.

Other caisson pumping systems have topside motors and long rotating line shafts with bearings every few metres. High starting torque, vibrations and alignment are just a few of the challenges for these systems.

Framo systems, by contrast, have low starting torque, low vibrations and no alignment issues, as well as oil-lubricated pump bearings that are lubricated even during standby. Not only do they avoid wear and tear, they have a higher recommended capacity that can reduce the total number of pumps.

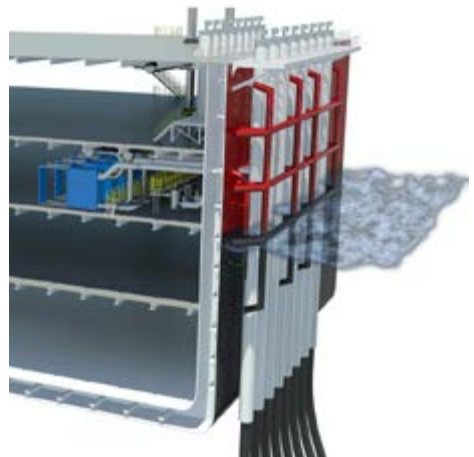
## Framo at the forefront

Framo pump technology has proven its worth in marine cargo pumping, where it is the indisputable industry standard. But it holds even more potential for the oil and gas industry – where leading installations are already profiting from its simplicity, safety and cost effectiveness.

### Applications of the Framo cable-free concept

The following applications can all benefit from the unique advantages of the Framo cable-free concept (see pages 18–19):

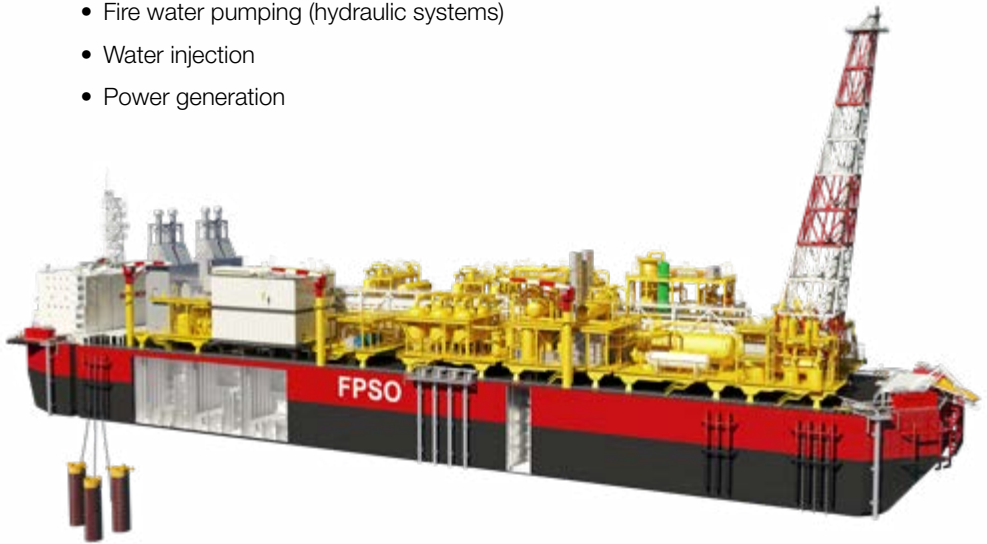
- Seawater lift
- Fire water pumping (electric systems)
- FLNG cooling
- FSRU heating
- Cavern pumping (in land-based storage)





### Other Framo applications

- Fire water pumping (hydraulic systems)
- Water injection
- Power generation



## What can you achieve?

Trusted worldwide, Framo has a belief that pumps should never be isolated from the task they perform. Having already revolutionized marine cargo handling, it's an idea that now offers savings and peace of mind to the oil and gas industry – and you.

### **From Norway to the world**

Framo is a recognized leader in pumping systems for oil and gas needs. We have proud roots that stretch back to 1938, and for the last 50 years our sole business has been pumps and pumping systems. We design and manufacture Framo solutions at our own facilities in Norway, where we also test them in full scale before delivery.

Customers around the globe turn to us, both for pumps and for expertise in meeting their challenges.



## From examples to reality

As this booklet describes, there are many ways in which Framo technology can lower costs and improve operations in oil and gas. Our pumping solutions free up space, reduce risk and save money – both initially and over time.

The next step is to see what our solutions can do for you. We can provide more arguments and examples, but the best way is to meet with us and explore the possibilities in your own specific project.

To get in touch with Framo, visit us at [www.framo.com](http://www.framo.com)





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