

Game-changing cooling for data centres and blockchain operations



In the world of ever-growing data demand, Shell Immersion Cooling Fluids can reduce your environmental impact, increase cost effectiveness and boost performance.

Shell
Immersion Cooling Fluid



The growth of data centres

The use of data-intensive technologies, such as the internet, cloud computing, artificial intelligence (AI) and big data analytics, smart and connected energy systems, and autonomous vehicles, is growing.

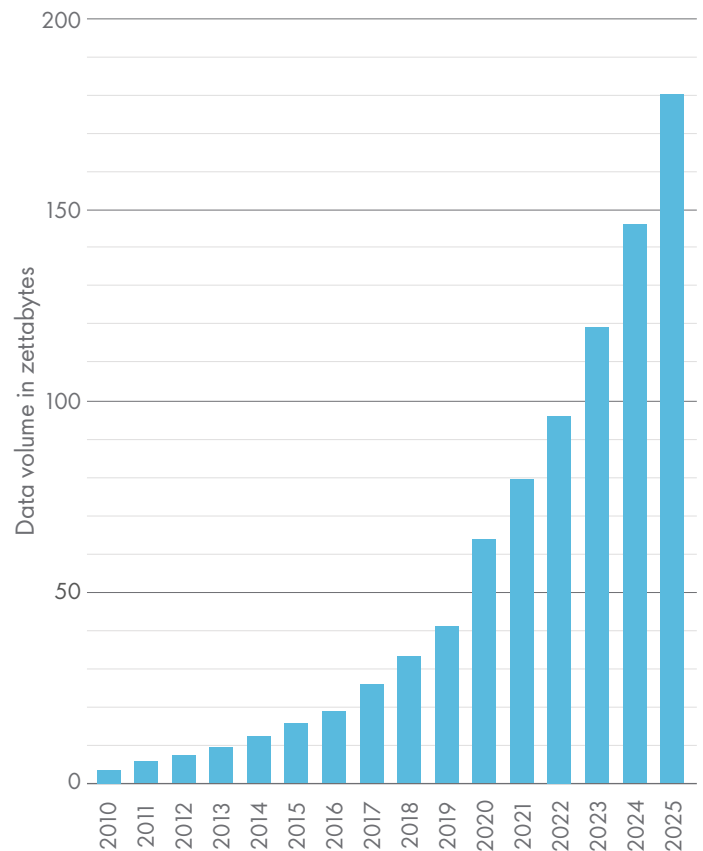
Consequently, the demand for server space is growing rapidly, placing ever greater demands on global data centres.

- Data centre infrastructure is expanding by 20% every year.¹
- The sector accounts for 1% of global electricity consumption. This is expected to grow significantly with the rapid growth in cloud and AI computing.²
- Associated carbon dioxide (CO₂) emissions will increase exponentially unless game-changing cooling solutions are adopted.

If servers get too hot, processing performance decreases while the risk of hardware damage increases.

Keeping servers at the optimal temperature, however, is energy intensive and accounts for more than one-third of a typical data centre's power consumption.

Driving the power usage effectiveness (PUE) metric down is a crucial part of reducing emissions and water consumption.

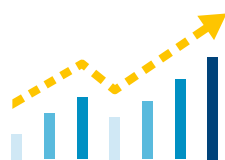


Source: Statista www.statista.com/statistics/871513/worldwide-data-created/

¹IEA www.iea.org/data-and-statistics/charts/global-trends-in-internet-traffic-data-centres-workloads-and-data-centre-energy-use-2010-2020

²IEA www.iea.org/energy-system/buildings/data-centres-and-data-transmission-networks

Without significant changes, the growth of data centres means



More energy use



Increased CO₂ emissions



More water use

Shell's ambition is to be a net-zero-emissions energy business

Shell has set itself an ambition to become, by 2050 or sooner, a net-zero-emissions energy business. We are working towards this ambition in many ways. One such way is to help data centre operators to meet their climate ambitions by offering Shell Immersion Cooling Fluids as part of our wider, integrated energy solution.

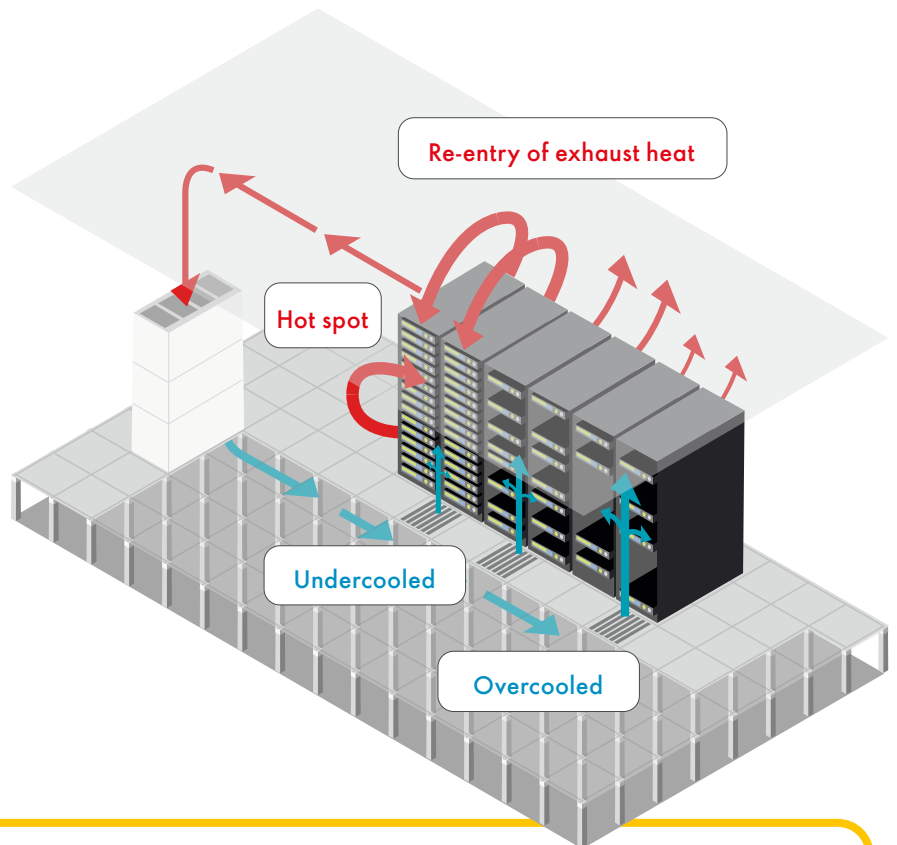


Pushing air around to provide cooling is a dated technology

Today, most data centres use air-cooling methods to cool servers and maintain optimal operating temperatures.

Although popular, air-cooling systems have several disadvantages:

- They are energy intensive and inefficient, resulting in hotspots.
- They consume large amounts of water through evaporative cooling and electricity generation.
- They require large amounts of space to enable sufficient air flow.
- They require extra hardware, including chillers, fans and bearings.
- They typically need to be located in cooler climates at the expense of latency.



Why we need game-changing cooling



More data means more computing power required. Estimates show that there will be more than 29 billion connected devices by 2023.³



Extreme processing speeds generate more heat. High-performance computing is required for machine learning, speech and facial recognition, cryptocurrency mining, blockchains, AI, and more.



Increased demand for online services. Examples include near-real-time analysis for autonomous vehicle route finding, content distribution and fintech.



Edge computing. Data centres are being built on the network edge to reduce data transfer time and increase availability; these facilities often have space and energy infrastructure constraints.

³Statista www.statista.com/statistics/1183457/iot-connected-devices-worldwide/

What is immersion cooling and why is it a game-changing solution?

Shell Immersion Cooling Fluids are fit for purpose. They are thermally conductive, electrically non-conductive (dielectric) fluids offering a highly efficient way to keep data centre hardware and computer components cool. They enable the reduction of energy consumption and CO₂ emissions while reducing costs and increasing location flexibility.



How single-phase immersion cooling works

Shell Immersion Cooling Fluid circulates by natural convection or is pumped to remove heat from the immersed components. An added benefit is that this heat can be recovered by water-cooled heat exchangers for reuse in district heating projects.

In single-phase immersion cooling, the fluid stays as a liquid without changing phase.

Compared with air cooling, immersion cooling provides:

- Less noise
- Smaller footprint
- Lower complexity
- Lower energy consumption
- Enhanced cooling: the fluid has more than a thousand times the thermal capacity of air (by volume)
- A higher PUE

- Lower risk of hot spot generation in the hardware
- Higher hash rates
- Virtually zero water loss
- Cooling without the need for electricity (if the system is designed without pumps)

With immersion cooling, there is no need for...



... chillers



... fans or bearings



... evaporative cooling

Shell Immersion Cooling Fluids

Made from natural gas using Shell's industry-leading gas-to-liquids (GTL) process, Shell Immersion Cooling Fluids are designed to maximise the energy efficiency and performance of data servers and IT components.

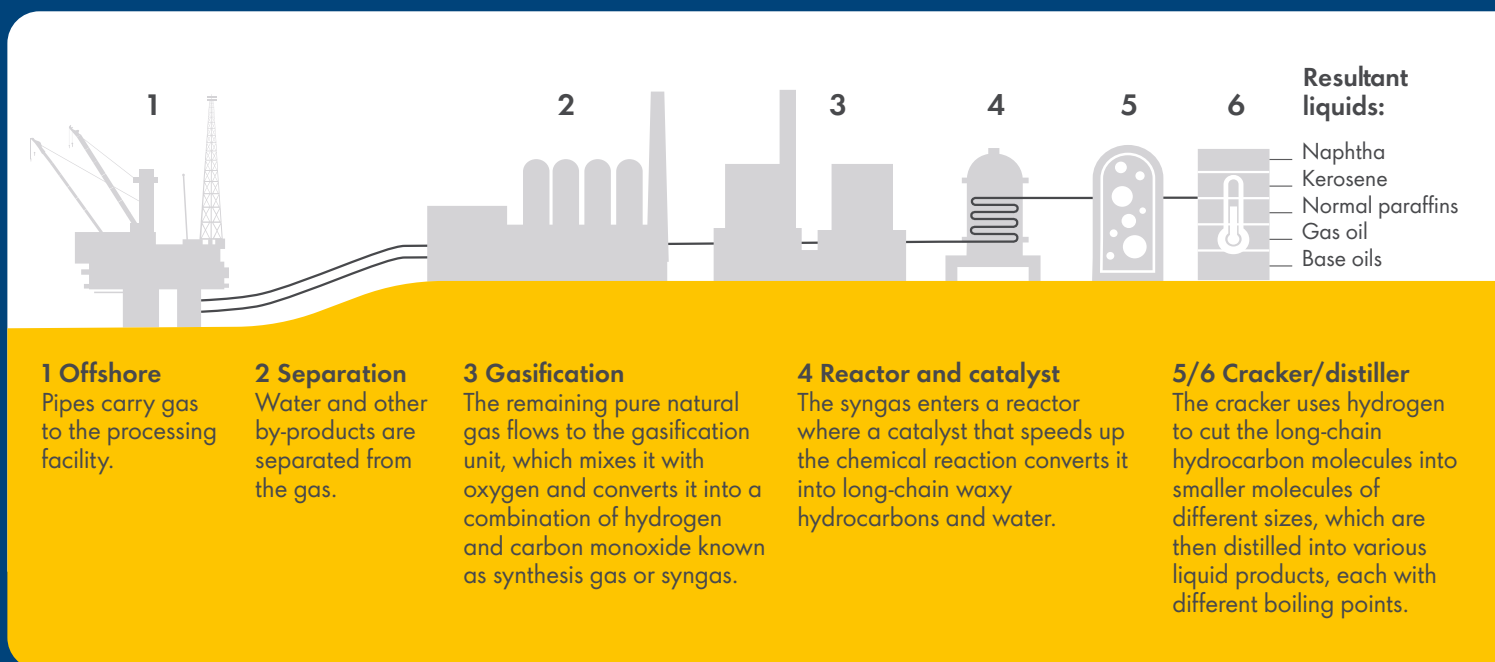
Our GTL products made from natural gas are synthetic fluids. They are biodegradable to different extents, stable and provide superior performance and material compatibility.

Shell GTL: Products of innovation

Shell's immersion cooling fluids offer is the product of almost half a century of continued GTL research and development. Shell's Pearl GTL facility in Qatar is the largest in the world and provides liquids of outstanding quality and consistency worldwide.

This ensures the same high-quality products wherever you are.

To ensure we can meet a wider range of immersion cooling needs, we are developing further immersion cooling solutions.





Safety and purity

Being made from natural gas gives **Shell Immersion Cooling Fluids** outstanding safety and purity. They are non-halogenated, free from allergens and have extremely low volatility.

Performance

Shell Immersion Cooling Fluids have excellent thermodynamic properties, low density and high flash points. They are non-evaporating.



Protection and reliability

Shell Immersion Cooling Fluids have high compositional consistency and very high oxidation and thermal stability. They contain virtually no sulphur, nitrogen or aromatics, and are non-corrosive.

Shell Immersion Cooling Fluid S3 X is a synthetic, single-phase immersion cooling fluid designed for the needs of high-performance computing, edge computing and blockchain applications.

Typical physical characteristics of Shell Immersion Cooling Fluid S3 X

Property	Test method	Value
Colour (Saybolt)	ASTM D156	> +30
Density at 15°C, kg/m ³	ASTM D4052	808
Flash point, °C	ASTM D92	198
Pour point, °C	ASTM D97	-42
Kinematic viscosity at 40°C, mm ² /s	ASTM D445	9.9
Kinematic viscosity at 100°C, mm ² /s	ASTM D445	2.7
Neutralisation value, mgKOH/g	IEC 62021-1	< 0.01
Breakdown voltage (1 mm gap), kV	ASTM D1816	> 30

Benefits

- **Reduced energy costs and emissions:** high cooling efficiency, excellent flow behaviour and outstanding thermodynamic properties mean you need less energy to run your network
- **Cost advantage:** cheaper to manufacture than alternative products such as fluorocarbons and engineering fluids
- **High compatibility:** suitable for use with almost all computer components
- **Safe and easy to handle:** can contribute to a safer working environment for your staff



When compared with air cooling, the simple architecture of single-phase cooling offers:*

- Up to a **33%** lower total cost of ownership
- Up to a **48%** reduction in energy footprint
- Up to potentially **30%** less CO₂ emissions
- Up to **80%** less floor space
- Up to **40%** more computing performance
- **40%** or less operating and capital expenditure
- **High reliability** with minimal moving parts
- **Independence from climate:** it works in challenging environments, including high ambient temperatures (up to 45°C [130°F]), humid environments and industrial settings.

*These figures are based on the report "Global immersion cooling market in data centers – Growth, trends, forecast (2019-2024)," Mordor Intelligence (2019); Asperitas' test results; and Shell's internal evaluation. The benefits achieved will vary according to the actual site deployment.

Single-phase immersion cooling technology
as an integrated solution offers up to

48%
reduction in
energy footprint



Benefits by user

Cloud providers and **hyperscale data centres** can optimise their efficiency and achieve their sustainability goals while standardising facilities for a variety of hardware requirements.

Telecom providers can operate edge data centres anywhere. They can also use existing buildings within power and cooling availability constraints.

Co-location providers can facilitate high density and performance computer users in a simple and scalable manner.

Enterprises can simplify their on-premises data centres for high-efficiency and decreased dependency on the public cloud by adopting next-generation hardware.

Research institutes can facilitate on-campus high performance computing environments without the need for advanced data centres with their associated energy and cost demands.

Blockchain operators can set up their networks anywhere, without worrying about the environment interfering with hardware. Shell Immersion Cooling Fluids provide a cost-effective way of maximising ASIC or GPU-based miner hash rates.

Immersed computing technology can cut energy use by up to 48%, boost computing performance by up to 40% and reduce capital and operating expenditure up to 40%.





Speak with our experts

We recognise the crucial role that immersion cooling fluid plays in reducing energy use in data centres and blockchain operations. We offer expert consultation and technical advice to support your business needs. Make sure you are adopting leading-edge technology and explore how immersion cooling can transform your business by reducing energy costs and CO₂ emissions.

For further information, please contact our experts:

www.shell.com/immersion



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