NATURAL TECHNOLOGY

MEET THE NATURAL TECHNOLOGY POWERING A MORE SUSTAINABLE TOMORROW

THERE IS A NATURAL TECHNOLOGY THAT CAN PLAY A SIGNIFICANT ROLE IN THE DRIVE TO NET-ZERO.

It is an incredibly efficient way to transmit heat, to provide sterilization in hospitals and pharmaceutical production, as well as provide critical processes for other industries. It can be used in an astonishingly broad range of applications, from huge petrochemical plants down to small local laundries, and from food and beverage manufacturers to paper mills.

What is this solution that is providing a sustainable tomorrow? It is steam – the tried-and-trusted energy fluid that is set to play a crucial role in a more sustainable future.

Without steam, today's industries would not exist in their current form. Managed correctly it is intrinsically clean and safe – with no fire risk or toxic waste products, leaving behind only water. As the world moves towards more electricity production from renewables, steam will become even more sustainable and environmentally friendly: it can be produced by clean electricity or in biomass boilers and is a key part of many energy solutions such as thermal storage and combined heat and power (CHP) systems and could also support heat pumps to bring them to higher temperatures.

Steam is a big market, with a total size of £4.8 billion annual revenue for specialized equipment and services[1], while the annual sales of steam boilers are valued at over £13 billion[2].

In this article, we'll look at today's steam technologies and what's coming up in the future, and how the natural technology of fossil-free steam can help you on the journey to a decarbonized future.

1 https://www.spiraxsarcoengineering.com/sites/spirax-sarco-corp/files/2021-08/Investor-Presentation-March-2022.pdf
2 https://www.alliedmarketresearch.com/steam-boiler-market-A10613

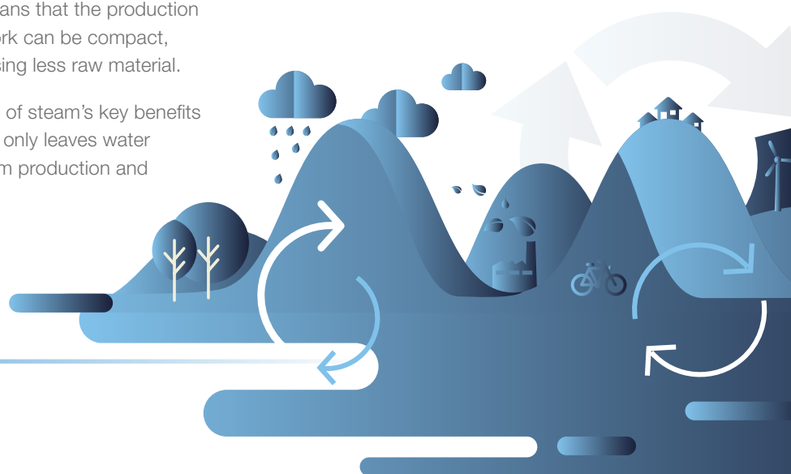
SUSTAINABLE STEAM

WHAT DO WE MEAN BY SAYING THAT STEAM IS A NATURAL, SUSTAINABLE TECHNOLOGY?

Steam provides an efficient way of transferring heat to keep losses as low as possible. Today's steam boilers are also highly efficient, minimizing the amount of energy needed to generate steam. Steam has a high heat content and energy density, which means that the production infrastructure and pipework can be compact, thus saving space and using less raw material.

As we've mentioned, one of steam's key benefits is that it is a process that only leaves water behind. Even better, steam production and distribution are circular, with a process called the 'condensate loop' capturing water for re-use and energy re-capture.

Sound familiar? It's similar to the natural water cycle of rain and evaporation that keeps our planet alive.



TIMES ARE CHANGING

We're in the middle of a climate emergency, and sustainable technology has to be a priority for all organizations. At the same time, any investment in sustainable technologies needs to be affordable and justifiable, with a sound business case.

As part of our society's wider response, many companies have committed themselves to carbon reduction targets. For example, Spirax-Sarco Engineering plc, the parent company of Spirax Sarco UK, has committed to achieving Net-Zero greenhouse gas emissions by 2030[3].

These carbon goals mean that businesses need to find ways to reduce their environmental impact. There is also a reputational angle, with companies wanting to be seen to take a lead in moving away from fossil fuels and their negative connotations.

The benefits offered by steam are huge. For example, 35 per cent of all the UK's industrial heating is achieved by steam systems. As 73 per cent of the UK's total energy demand is for heat, improving the efficiency of steam generation will make a massive sustainability impact[4].

3 https://www.spiraxsarcoengineering.com/sustainability/one-planet
4 Source: Aggreko Report (March 2021), included at https://www.natural-technology.com/en

THE TECHNOLOGIES THAT MATTER

To support these environmental objectives, the steam industry is developing new technologies to move steam away from its fossil fuel past, and to ensure steam is a long-term part of our decarbonized future.

R&D-driven innovation is improving the different stages of a steam system: from renewable generation of the power needed, through to electrical refit of boilers to achieve zero carbon steam generation. Thermal storage provides another valuable part of the solution, enabling steam consumption to be decoupled from the time of electricity production.

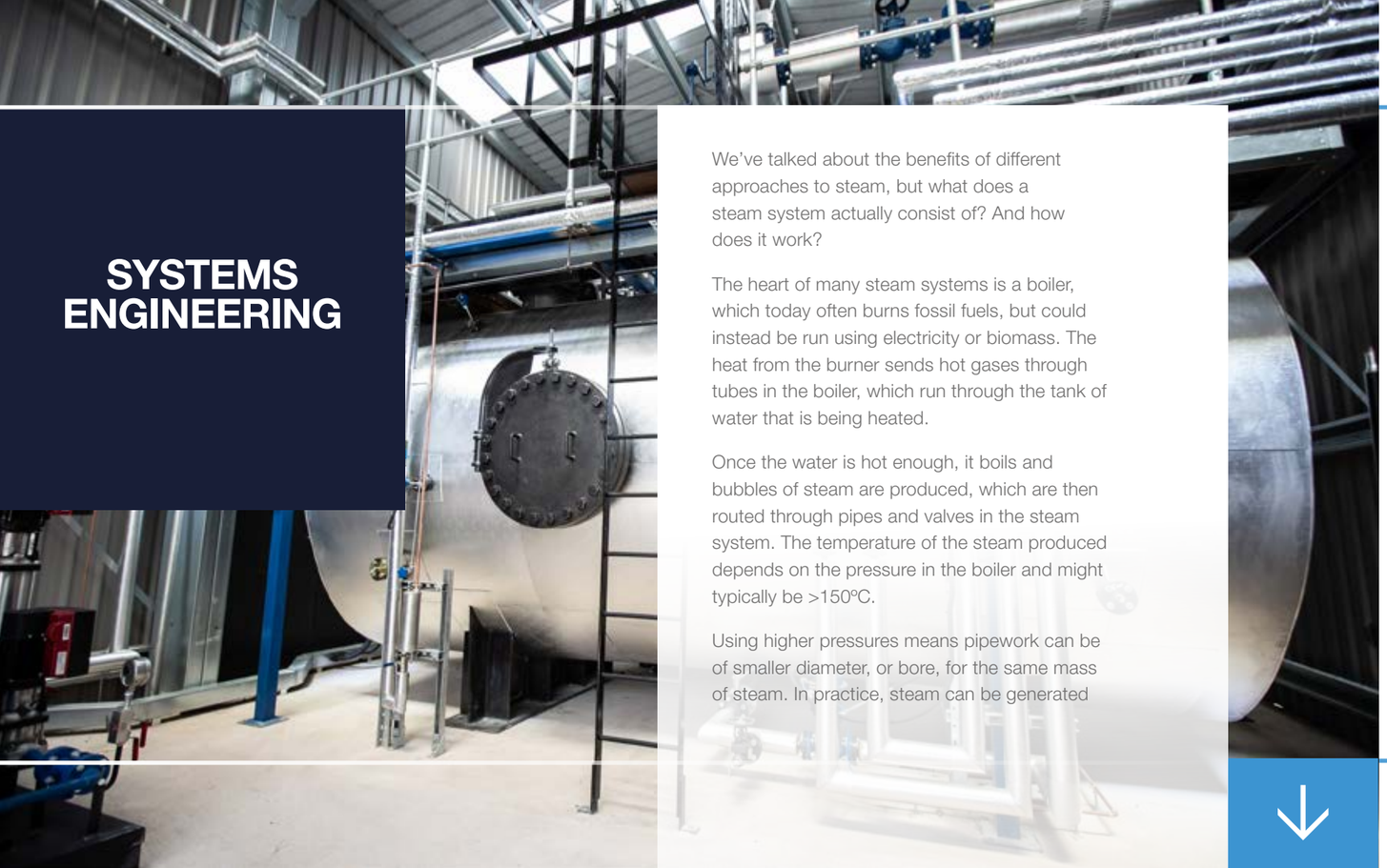
When used with 100 per cent renewable power sources, such as hydroelectric, solar and wind, electric steam generators have no emissions and generate no carbon dioxide. They can convert renewable electricity into steam at 97 per cent energy conversion efficiency.[5]

Another option is using green hydrogen as the fuel to heat water and generate steam – with an annual target by 2030 of 10 million tonnes of green hydrogen production just in the EU, this provides another pathway to produce steam with zero carbon emissions. [6] While the hydrogen infrastructure needs more development, there is no cost premium right now for investing in a zero-carbon hydrogen-ready burner for steam generation at scale. The technology also reduces flue gas volumes by 10 per cent, thus significantly improving boiler efficiency.

Steam can also be generated by the combustion of organic waste materials such as olive pulp, rice husks and palm kernel shells, which are the by-products of food production. This biomass can be used to generate electrical energy as well as heat, when used in a Combined Heat and Power (CHP) systems. The reduction of organic waste and the utilization of biomass improves environmental sustainability, while also reducing energy bills.

When combined with renewable electricity generation, thermal storage can provide substantial emission and cost reductions. They harness renewable electricity, which is stored as thermal energy. This means they can take electricity at times of peak production, for example from solar cells in the middle of the day, and then use it to release steam on demand or to help manage peaks for industrial processes.

5 https://www.anu.edu.au/news/all-news/anu-scientists-set-solar-thermal-record
6 https://ec.europa.eu/commission/presscorner/detail/en/IP_22_3131



SYSTEMS ENGINEERING

We've talked about the benefits of different approaches to steam, but what does a steam system actually consist of? And how does it work?

The heart of many steam systems is a boiler, which today often burns fossil fuels, but could instead be run using electricity or biomass. The heat from the burner sends hot gases through tubes in the boiler, which run through the tank of water that is being heated.

Once the water is hot enough, it boils and bubbles of steam are produced, which are then routed through pipes and valves in the steam system. The temperature of the steam produced depends on the pressure in the boiler and might typically be >150ºC.

Using higher pressures means pipework can be of smaller diameter, or bore, for the same mass of steam. In practice, steam can be generated centrally at high pressure, distributed, and then reduced in pressure at the point of use. For example, in a large hospital, a single high-pressure boiler could provide steam to suit the different needs of ward heating, equipment sterilization, food cooking and air humidification.

We mentioned the condensate loop earlier; this is the process of returning condensed water to the boiler. As the steam inevitably cools down at some point after leaving the boiler, it condenses and runs to the bottom of the steam pipe. A device called a 'steam trap' is used to release condensate from the pipework whilst preventing the steam from escaping.

Once the steam reaches its destination in a factory or plant, there are many ways it can be used, such as:

- To sterilize medical equipment, using an 'autoclave', which is a steam-filled chamber
- To boil or cook food, using a 'jacketed pan' which surrounds the pan with a jacket filled with steam
- For space heating, by running the steam through coils which heat air as it passes over them
- For process tank heating, similarly by running steam through coils, this time in a tank of liquid

Typically, the flow of steam will be measured at multiple points throughout the system, enabling energy consumption and efficiency to be closely monitored. Steam is easy to monitor using flowmeters, and products compatible with the industrial SCADA system.

Steam provides a more suitable solution than alternatives such as hot water systems in many applications, which can be backed up by hard facts obtained from these measurements. Steam plant is also often more compact than hot water alternatives, and more flexible in the range of tasks it can undertake.

DIGITALIZATION AS A DRIVER OF CHANGE

There is a growing use of digital technologies in industry, including the shift to the Industrial Internet of Things (IoT). This presents an opportunity to optimize and automate current and new steam technologies. With more measurement and performance data, businesses can set relevant key performance indicators (KPIs), helping them to deliver even greater efficiencies over the longer term.

This data is also invaluable to monitor equipment for any problems, which could be as simple as lower pressure showing a leak, or a more complicated combination of symptoms indicating a boiler failure is likely. By spotting problems early, there's an opportunity for preventative maintenance, before more severe issues arise.

Digital solutions make it easier for steam systems to integrate into larger platforms as part of a full decarbonization site project. Data from the steam systems gives full visibility to decision-makers and enables different solutions to be used depending on what is best at any particular time – for example, choosing when to generate and use steam in response to excess electricity available from solar cells.

MAKING A DIFFERENCE

Steam is based on specific, measurable outcomes, with no need to resort to greenwashing. It is supported by organizations with decades of engineering expertise. In fact, Spirax Sarco's steam products sold in 2020 have saved 18.2m tonnes of CO_2 emissions annually, which is equivalent to 8.8 million new cars taken off the road, or 828 million mature trees planted[7]. Meanwhile, sister company Gestra – part of Spirax-Sarco Engineering plc since 2017 – was established more than 120 years ago, making it one of the world's most knowledgeable providers of steam system technology.

Natural Technology and steam are just one of the many ways we can fight the climate crisis, of course. But the benefits of steam may not be well known throughout an organization, and therefore can provide new ideas and impetus for sustainability professionals to present to C-level executives.

Steam also provides opportunities for technologists and engineers who want to deliver innovative solutions and environmental change. It's an exciting time, with renewable energy, electric systems and green hydrogen making steam a part of important routes to net zero.

> *"STEAM ALSO PROVIDES OPPORTUNITIES FOR TECHNOLOGISTS AND ENGINEERS WHO WANT TO DELIVER INNOVATIVE SOLUTIONS AND ENVIRONMENTAL CHANGE"*

7 https://www.spiraxsarcoengineering.com/sites/spirax-sarco-corp/files/2021-08/Investor-Presentation-March-2022.pdf

A VISION OF THE FUTURE

Natural Technology gives industry an opportunity to decouple from fossil fuels and embark on a more sustainable route to heat, power, and sterilization.

Steam is a tried and trusted technology, based on well-understood principles with reliable outcomes. Steam provides a low-risk, low-cost way to reduce emissions on the route to zero carbon, without requiring the ‘rip and replace’ of existing infrastructure.

The benefits of cleaner steam systems are tangible, measurable and substantial enough to make a real difference. They enable organizations to demonstrate their commitment to sustainability.

Through optimization and digitization, Natural Technology will continue to provide a flexible, efficient and reliable source of steam that can help companies take their first steps toward a Net-Zero future - with a rapid pace of innovation bringing new opportunities continually in the years ahead.

“NATURAL TECHNOLOGY GIVES INDUSTRY AN OPPORTUNITY TO DECOUPLE FROM FOSSIL FUELS AND EMBARK ON A MORE SUSTAINABLE ROUTE TO HEAT, POWER, AND STERILIZATION”

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