Heatcube®

Long Duration Thermal Energy Storage

The new standard for industrial process heat.

Why decarbonize industry with net-zero heat?

40% of global CO2 emissions come from heat generated by fossil and non-renewable fuel sources.

To reduce these global CO2 emissions, industry must replace its CO2 intensive heat generation with renewable, green energy sources in a cost-effective way.

However, as opposed to fossil-fueled burners, you cannot control the energy production from renewable sources such as wind and solar. The amount of power that solar PV plants can generate is a direct consequence of cloud movements during daylight hours, while wind power generation is affected by the variability of wind speed.

The solution?

Store the energy from renewable sources when it is abundant and at low cost.

Since most of the energy used in industrial production is in the form of heat, we have created Heatcube to consume energy from green sources and convert it into stable heat production, removing CO2 emissions entirely. And all at a cost-competitive price

The energy transition requires energy storage

Heatcube can charge either with low-cost electricity from the electrical grid or off-grid renewable installations. Its state-of-the-art control system ensures that it chooses the most cost-effective form of charging and discharging

“Heatcube stores a lot of energy within a minimal space, so it can easily be placed at your existing processing facility.”

on-demand - providing your production processes with steam whenever needed, either several times per day or without interruption.

Plug-and-play, no EPC projects needed

Heatcube is prefabricated and delivered to your facility for easy assembly. And thanks to Heatcube’s modular design, it can be easily integrated into any production plant and connected to existing steam facilities.

Usable storage density

Heatcube stores a lot of energy within a minimal space. Featuring a compact design, Heatcube is capable of storing anywhere from 280 kWh/m.

Response time of less than 3 seconds

Heatcube is fast! No need for complex procedures before starting to charge or discharge. Heatcube has an incredible short ramp-up time for both charging and discharging. This enables Heatcube to participate in the ancillary services market to assist in balancing the electrical grid, and could mean an additional revenue stream for you (your facility).

Charge and discharge simultaneously

Heatcube can do something few other batteries can - charge and discharge simultaneously.

Why is this important? Because it is how Heatcube removes the variability of the power produced by green energy sources. Heatcube is charged whenever renewable energy is available without interrupting the supply of heat.

Heatcube charges fully in a few hours and can provide stable steam 24/7.

This is possible because of three main components:

1. Electrical heater for charging
2. Storage system for keeping the energy
3. Steam generator for discharging.

In other words, Heatcube is a 3-in-1 solution: consume low cost and clean electrical energy, convert it into thermal energy and store it for when it is needed in molten salt - all at a competitive low-cost per MWh.

All three components are well-known and proven technologies.

Heatcube is based on proven technology

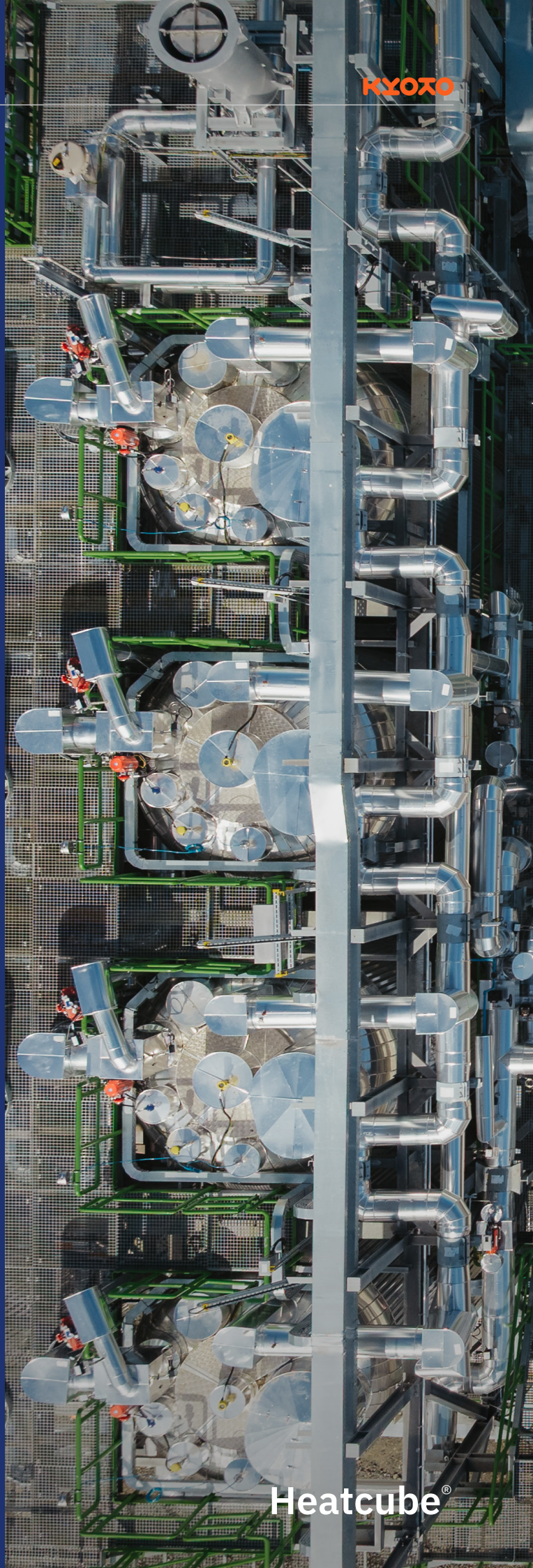
Molten salt-based thermal energy storage is a well-known technology
utilized in Concentrated Solar Power (CSP) plants. As opposed to solar PV plants that generate electricity, CSP plants capture thermal energy from the sun.

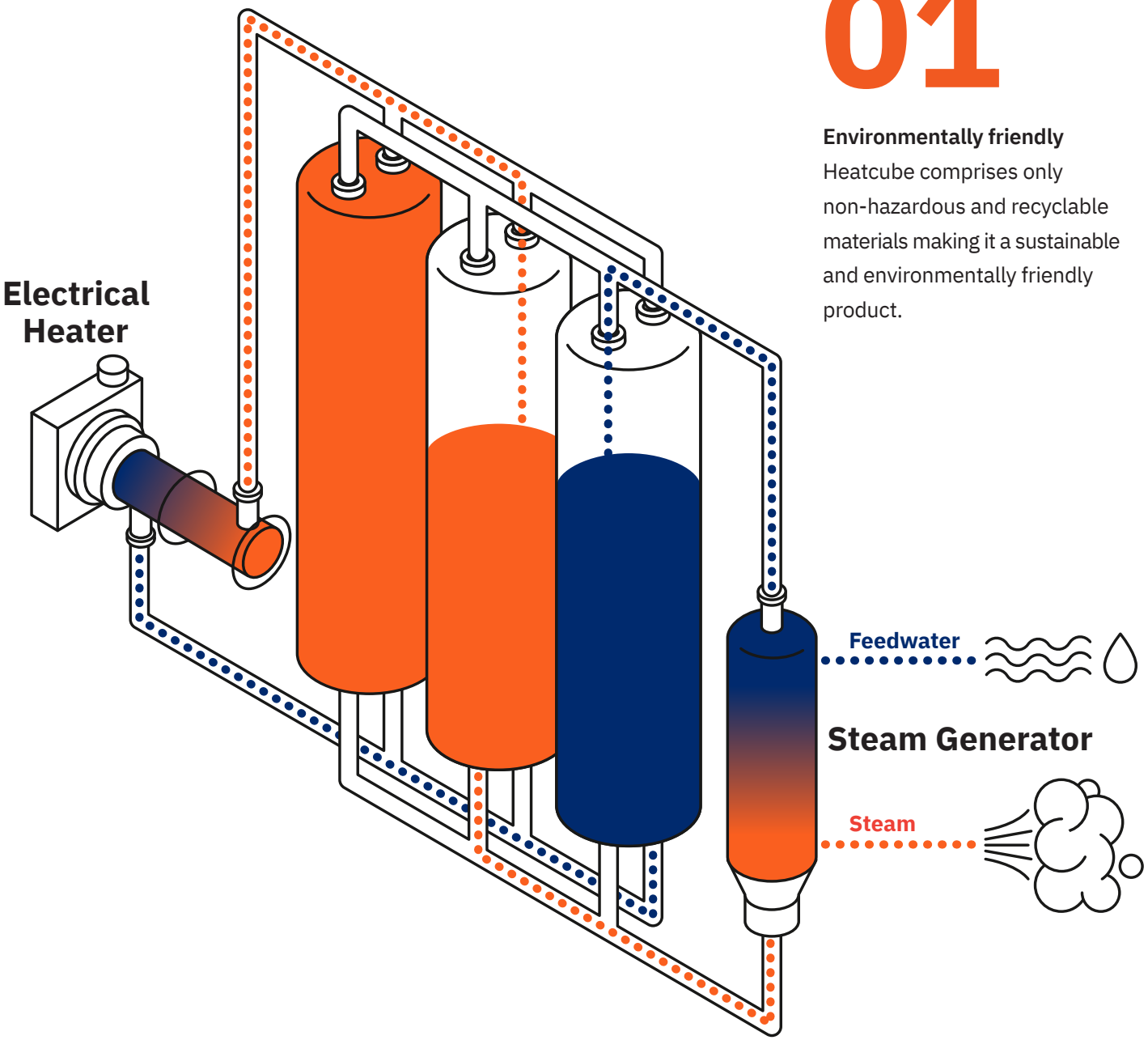
28 CSP plants all over the world use molten salt storage systems, and they have been in operation for more than a decade.

At Kyoto Group, we based Heatcube on this proven technology and scaled it down to make it available for industrial production facilities.

Heatcube consists of steel, salt and steam

With molten salt, Heatcube can provide a steam temperature range from 150°C and 300°C. And since we designed Heatcube to be modular and configurable, we can tailor Heatcube to meet your requirements for charging, storage capacity, and steam output. Have a look at some of the configurations under Technical Specification.





01

Environmentally friendly
Heatcube comprises only non-hazardous and recyclable materials making it a sustainable and environmentally friendly product.

02

Simultaneous charging and discharging
The molten salt circulation system is designed for separate charging (electrical heating) and discharging (steam generation).

03

Safe to operate
Heatcube operates with fluids and materials that are non-flammable and non-explosive, so Heatcube area does not require ATEX/ IECEx approvals.

Digitization with Kyoto's Heatcube

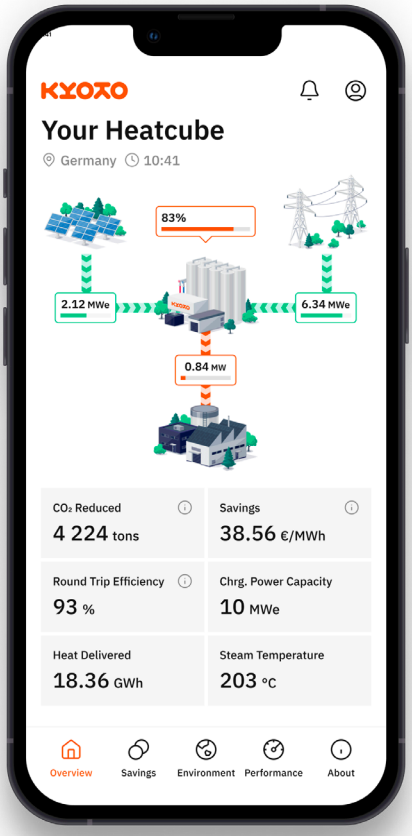
Enabling our customers to stay ahead of the curve in a rapidly changing energy market.

Experience a transformative edge with Kyoto's Heatcube as we introduce real-time monitoring and control through digital innovation.

Digitizing Heatcube provides precise heat storage optimization, enabling seamless integration with variable renewable sources and facilitating demand response.

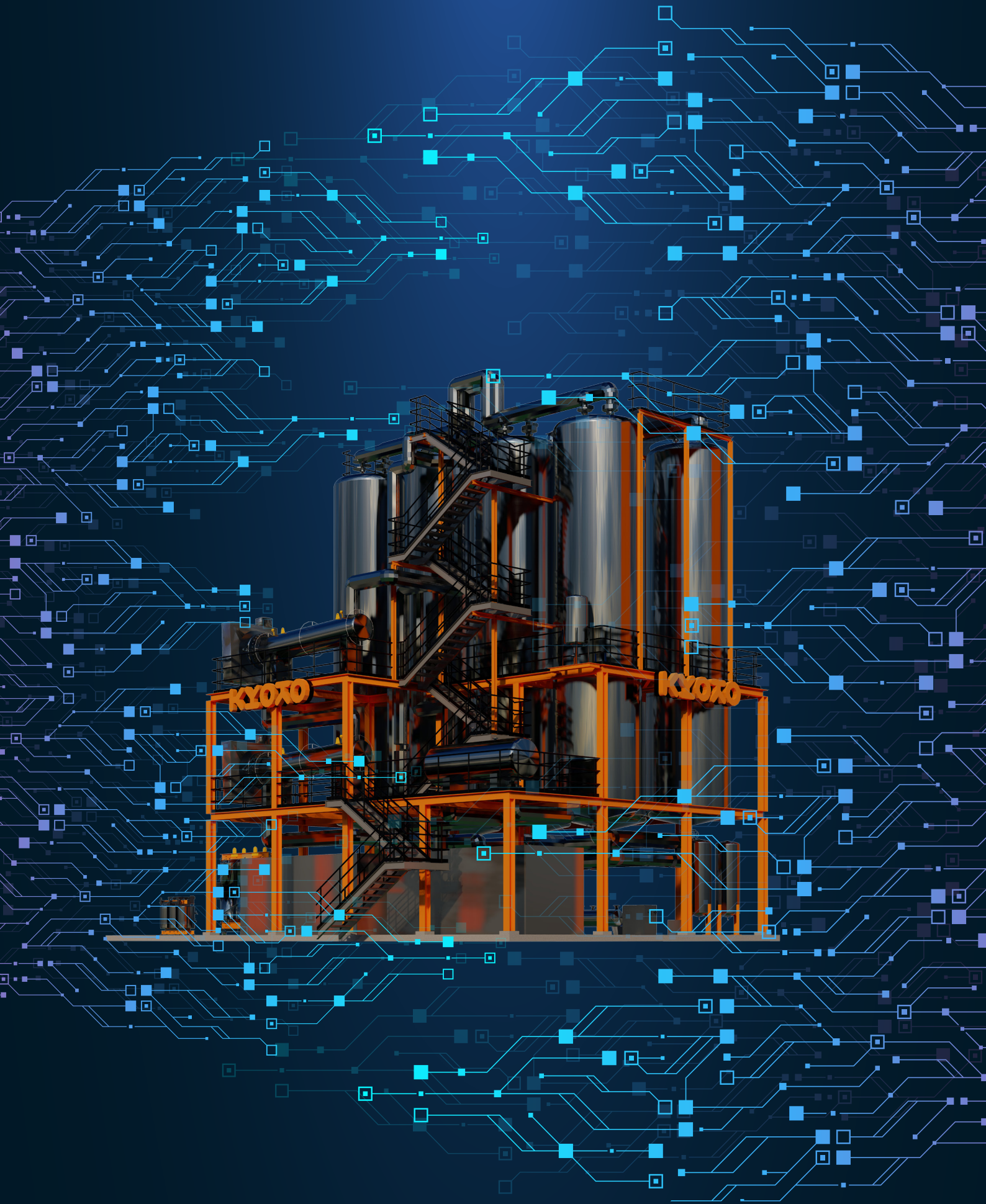
It brings a new era of operational excellence, reducing operational expenses and offering state-of-the -art preventive and predictive maintenance.

This digitalization not only enhances operational efficiency but also positions Heatcube to align with emerging power market players, providing flexibility and potential new revenue streams for industrial plant owners.



Designed by zlatko_plamenov / Freepik

The information shown in the above image is based on anticipated accumulated results for our most common Heatcube shown on page 08.



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Technical specification

Heatcube's storage capacity can be configured from 39 MWh to over 104 MWh, and with a discharge effect up to 14 MW. Its modular design allows us to meet your particular needs.

Example of three different configurations

	Smaller	Most common	Larger
Electrical charging effect (MW)	10	**15**	20
Storage capacity (MWh)	39	**52**	104
Thermal discharging effect (MW)	1.5 - 7	**1.5 - 14**	1.5 - 14
Annual production (GWh)	20 - 35	**30 - 45**	50 - 65
Annual CO2 reduction (Tons)	> 4.000	**> 7.000**	> 11.000

General Heatcube specifications

Parameter	Value	Unit
Electrical Heater capacity (charge)	10 - 20	MWe
Thermal energy storage capacity	up to 104	MWh
Thermal energy storage capacity per tank	13	MWh
Steam generator capacity (discharge)	up to 14	MWt
Steam temperature	150 - 300	°C
Steam pressure	3 - 25	Bar(a)
Charge response time (ramp up time)	< 3	sec
Discharge response time	< 300	sec
Round-trip Efficiency (RTE)	> 93	Percent (%)
Lifetime	25	Years

10-20 MW
Electrical charging effect

39-104 MWh
Storage capacity

up to 14 MW
Thermal discharging effect

up to 65 GWh
Annual production

up to 15.000 Tons
Annual CO2 reduction

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Heatcube FAQs

How do you decarbonize industrial heat demand in a cost competitive way?
The increasing share of intermittent renewable power production together with decommissioning of fossil-based power generation creates more price volatility in the power markets. In the hours with high wind and solar power output and low demand, the power prices become very low, while in hours with less wind and solar, the power prices are consequently very high.

With Heatcube, we are utilizing the increasing price volatility in the power markets to store energy in hours with high renewable production and low prices. When charging Heatcube with cheap electricity from excess renewable power production, we can deliver renewable heat whenever needed at a very low cost. At the same time, we are replacing fossil fuels with renewable electricity as the energy source for heat production, and so removing close to all carbon emissions associated with the industrial heat demand.

How do you operate Heatcube?
Heatcube is supplied with a Battery Management System (BMS), which can be connected with the local Energy Management System (EMS) using a standard industry interface. The storage tanks do not require any preventive or periodic maintenance. The auxiliary systems (pumps, valves, etc) require minimal ongoing maintenance and training will be provided.

How efficient is Heatcube?
Based on one cycle per day, the round trip efficiency from electricity to steam is minimum 93%.

Do we need to refill salt?
No, the salt is stable under our process conditions.

How much steam can a Heatcube generate?
Heatcube is equipped with a 7 MW steam generation system. The temperature and pressure do depend on the feed water supply and energy storage volume, but our standard configuration (52 MWh storage) delivers more than 10 hours of 7.5 tons per hour at 16 bar(a), with a feedwater temperature of 100°C (equals 5 MWh for 10 hours).

What is the steam temperature range of Heatcube?
Heatcube is designed with a steam temperature range from 150°C to 300°C and can generate up to 14MW of discharge capacity. The saturated steam temperature is between 150°C and 215°C, with a steam pressure between 3 and 25 bar(a). To achieve 300°C (superheated steam) a superheater can be added to Heatcube steam generator.

Read more about Heatcube on our website.

Get in touch:

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