Same forces. New rules.

Introducing Electric Thermal Energy Storage (ETES)
– putting gigawatt hours of energy at your command.

SIEMENS Gamesa
RENEWABLE ENERGY

Impossible is just another word for never done before.

100% renewables is said to be impossible. As were the first flight, space travel, the internet ... Now here is something that makes a complete energy transition possible: Electric Thermal Energy Storage (ETES). A proven energy storage solution that is inexpensive, built with 80% off-the-shelf components, and scalable to several GWh. No need to explain that ETES is a giant step – for SGRE and for the energy industry. While the forces of nature remain the same, Electric Thermal Energy Storage has launched a new era. Find out how it will boost the energy transition and how new players, energy-intensive companies and even conventional power plants will profit from it.

Or, in short: time for new rules.

Rule #1:
Power in. Power out.

ETES is technology that can be charged with electricity or directly with heat and which then releases heat that, in return, can generate electricity. Unlike other storage technologies, it is made of rocks absorbing heat. This makes ETES very sustainable in design and the first gigawatt-hour scale energy storage that can be built almost anywhere – limiting its size and use only to your imagination.

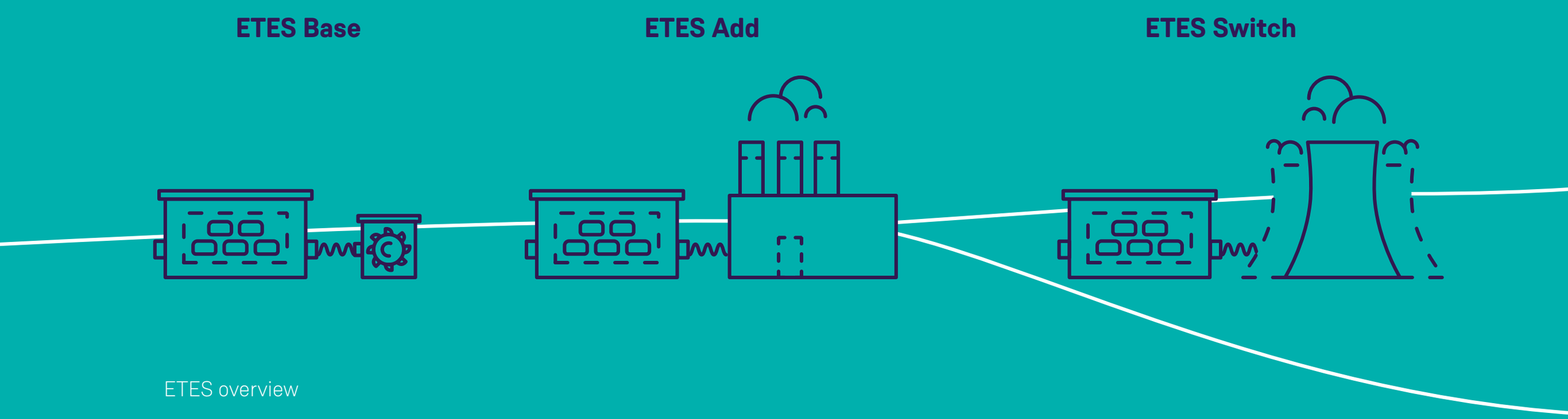
- Flexible scalability of charging power, discharging power and storage capacity.
- Proven, reliable technology – discharging technology used for more than a 100 years.
- Cost-competitive, GWh scale, multiple revenue streams.

ETES technology

Rule #2: If it works for you, it works for all.

ETES solutions basically prolong the availability of energy that otherwise would be “wasted“. No matter whether it’s from wind, solar or any other power source. ETES contributes to both common and business goals by enhancing grid stability, energy arbitrage or demand-optimized energy management.

ETES and all of its components are fully scalable to specific needs. It can be set up as a stand-alone **(Base)**, to enhance your core business **(Add)**, or even help to redefine it. Especially when moving from a fossil fuel plant to a green storage plant **(Switch).**



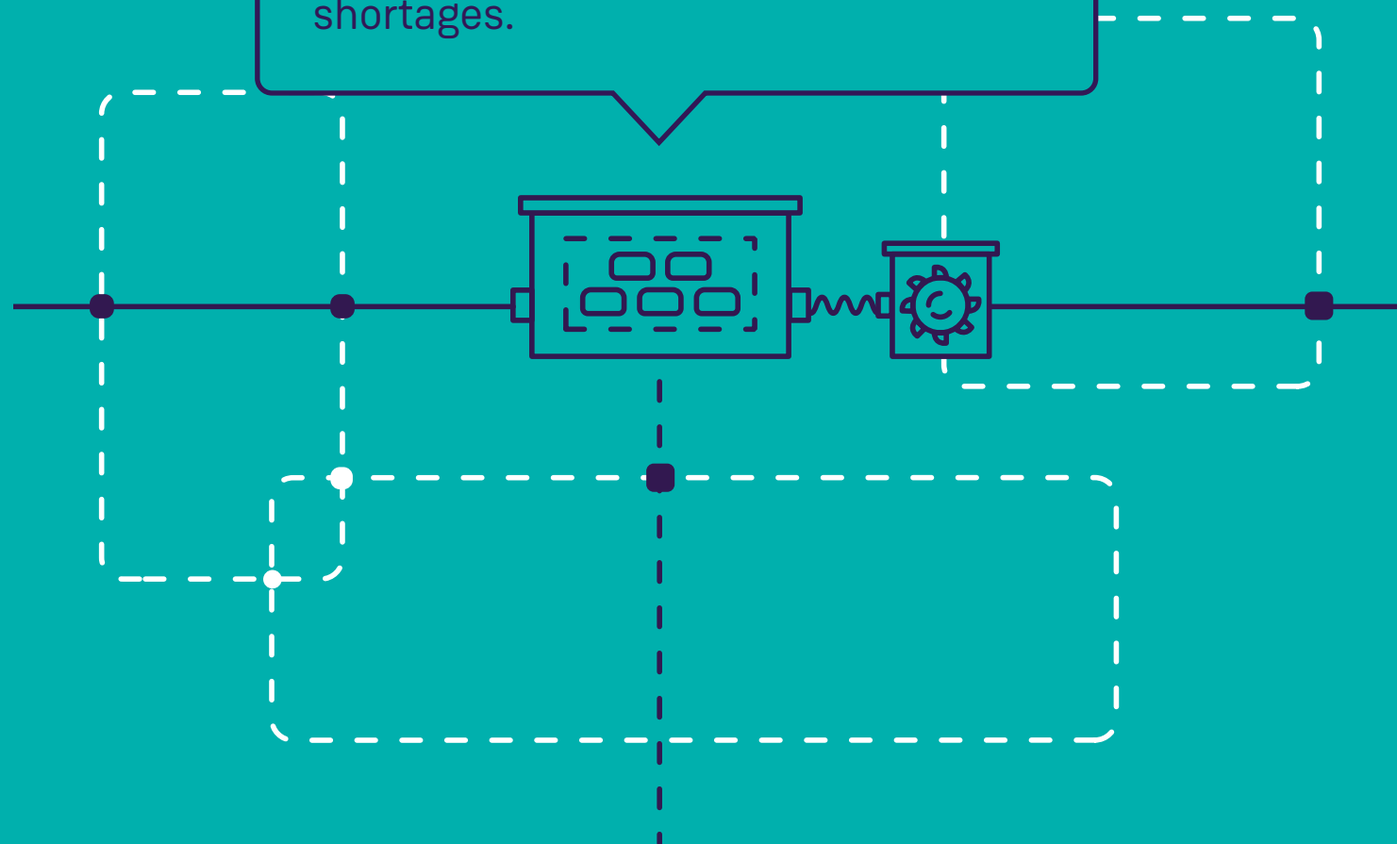
ETES overview

Rule #3: A revolution can start everywhere.

Wherever, whenever: **ETES Base** is a stand-alone energy storage plant that can be installed almost anywhere. It is not limited to certain geographical locations – unlike pumped hydro storage. Nor is it limited to certain uses.

- Energy traders make use of arbitrage opportunities: buying cheap (charging the storage) and selling expensive (discharging the storage)
- Arbitrage across time and across energy commodities
- Wind farm owner: curtailed energy can be sold later instead of “wasted”
- Possible outputs: process steam, electricity, district heating

Congestion management for grid operators.
Renewables depending on weather conditions create a mismatch of demand and supply – by amount and by region. ETES can relieve landlines at their capacity limits by feeding electricity to the storage – and, vice versa, supply electricity to avoid shortages.

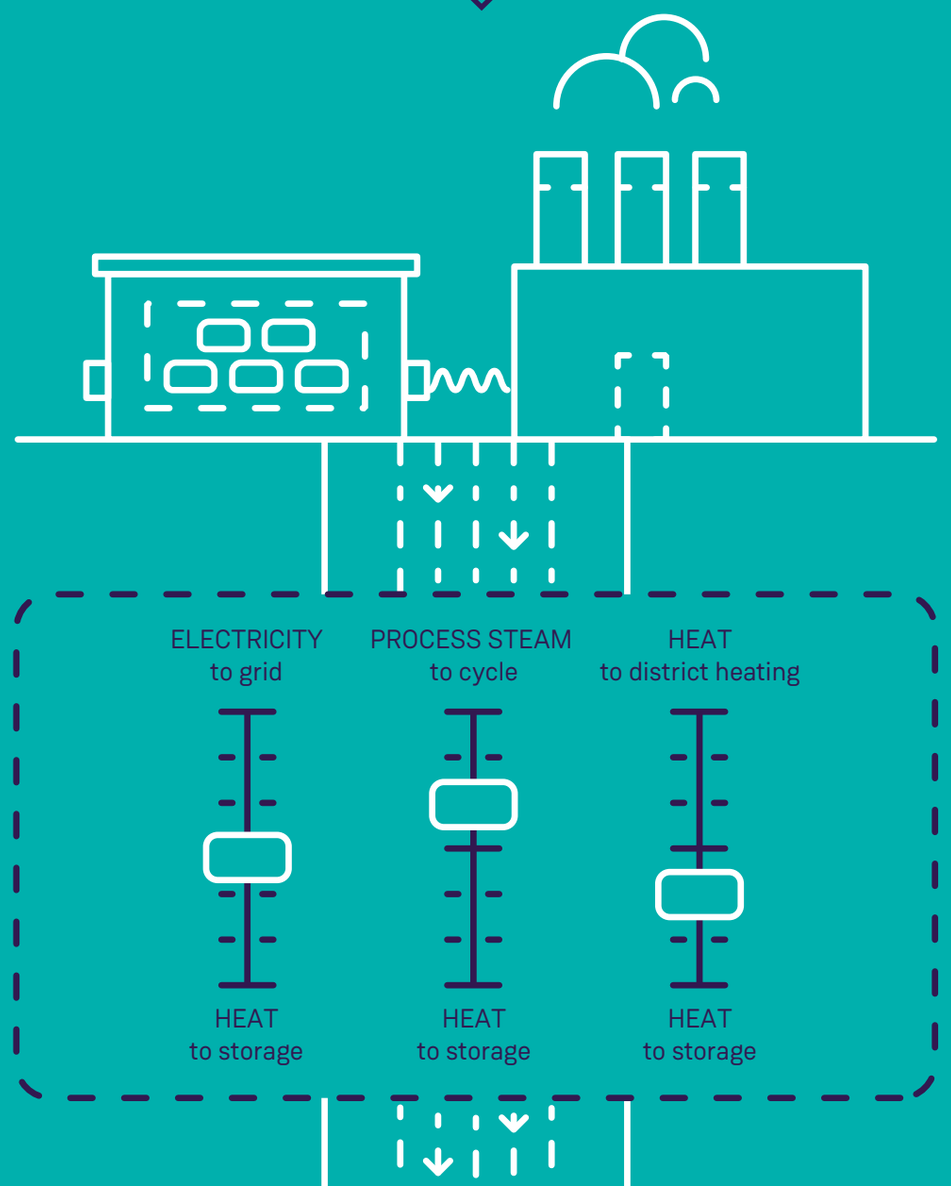


Rule #4: New value chains need new links.

Imagine your heat, steam, or energy cycle is capable of time shifts. This is what **ETES Add** will do. A modular and fully adaptable design that operates within the grid, allowing the creation of new services along the power supply chain.

- Make the existing heat cycle flexible without interfering with the core process
- Possible outputs: process steam, electricity, district heating
- Additional revenue streams: ancillary services, electricity arbitrage, energy cost reduction, district heating

Demand-side management for energy-intensive industries.
With ETES storage added, the core process is decoupled from the electricity supply. Thus, the company can better react to price signals – keeping its core process stable while opening new revenue streams.



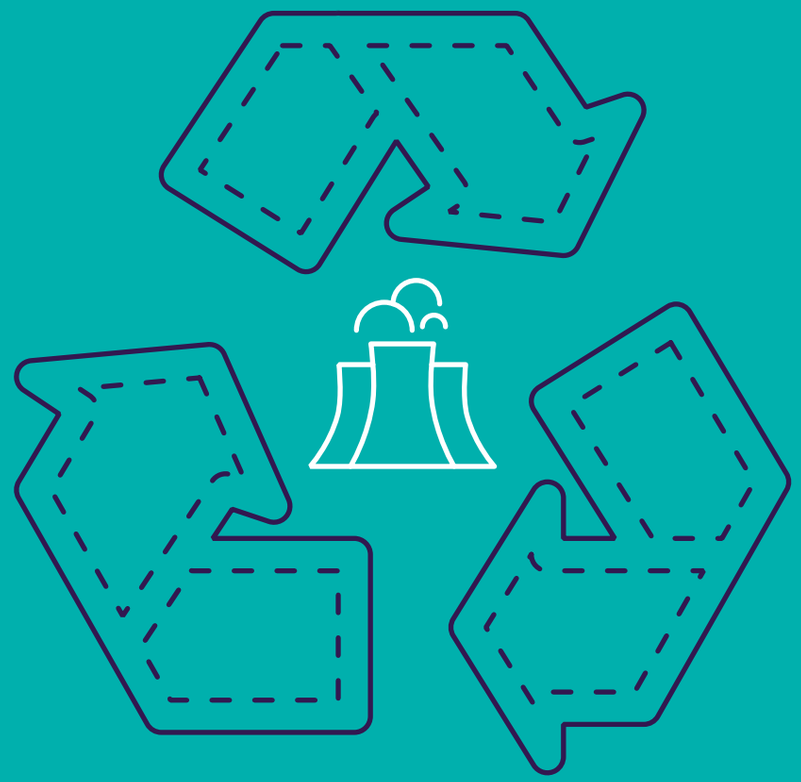
ETES Add

Rule #5: Brownfield is the new green.

Even a radical change needs something to build on. So while most people think it's either conventionals or renewables, we think it's both – in transition. **ETES Switch** can extend the life span of your investments by decarbonizing assets. Turning polluting power plants into green storage.

- ETES provides sustainable second-life usage of existing power plant infrastructures
- Use of existing grid connection point, steam turbine, generator, condenser
- Continued employment of the steam cycle operation and maintenance staff

From dirty coal to overall goal.
To reach the emission targets of the Paris Agreement the phase-out of coal power plants is a must – just as real GWh scale storage is needed. ETES Switch will support the energy transition by turning preventers into driving forces. Because building a hybrid – or even zero emission – plant from an old one avoids shutting it down. An opportunity for regions economically dependent on power plant jobs.

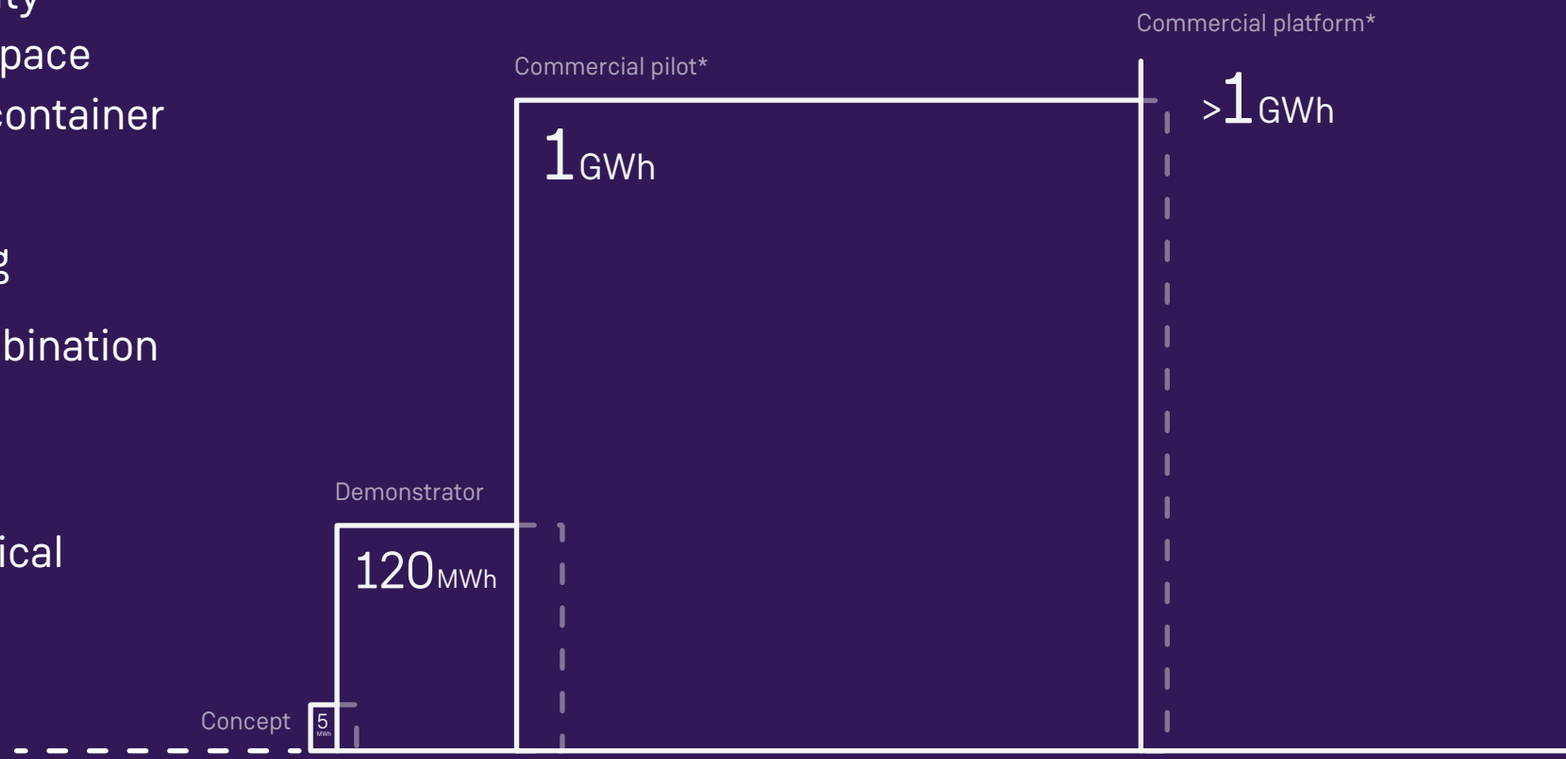


Rule #6: The giga, the better.

It works. It scales. It’s up for new challenges. ETES’s flexible scalability of charging power, discharging power and storage capacity allows a multitude of scenarios. The space required for the rock-filled insulated container being the only limit.

- Low cost scalability, sector coupling
- Tested thermal components in combination with an off-the-shelf steam turbine
- Varied sizes and output classes, and thus always extremely economical

*Examplary values, actual is subject to specific use case and application requirements.



Timeline	2014	2019	2020	2022+
Storage material [t]	40	1.000	10.000	> 10.000
Charging [MW]	0,7	5,4	85	> 100
Discharging [MW]	0,7	1,2	30	> 100

Rule #7: Talking about the weather means talking business.

Without a doubt, ETES is the most promising technology on the energy market – and also the most proven. Following testing since 2014, the next step is to build a pilot unit with >30 MW and a capacity of around 1 GWh. Using 80% off-the-shelf components makes it the most cost-competitive solution, too. Furthermore, ETES opens additional revenue streams and prolongs the return on existing investments – while accelerating the energy transition.

Renewable energy, made versatile.

New markets, made accessible.

Ambitious goals, made achievable.

Summary

Rule #8: With ETES
it’s your turn every time.

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