

GridScale

Energy storage system



Solving the last outstanding issue with renewables

Low-cost long-duration storage is here

Renewable energy has historically been held back by production and consumption rarely being balanced. When there is insufficient wind or solar power, demand is not met, and when there is an abundance of wind or solar power, production often needs to be curtailed. Solving this problem is one of the last outstanding challenges in achieving 100% green electricity supply.

The very high share of wind and solar power required to reach the world's climate targets will simply not be achievable without longer-term energy storage to mitigate natural supply fluctuation. GridScale technology offers the solution. The concept provides low-cost electric energy storage with sufficient capacity to overcome the fluctuation of renewable power supply.

Accelerating the green transition

GridScale is a pumped-heat energy storage system capable of storing huge amounts of electrical energy for hours, days or weeks. GridScale uses crushed rock as an ultra-low-cost storage medium with no degradation of the storage materials and with full lifetime nameplate capacity. GridScale addresses all relevant storage requirements for renewable energy integration.

GridScale is designed to be fully flexible in terms of project-specific configuration of charge power, discharge power and storage capacity. The modular system can be implemented without geographical restraint. All technical components are designed for low-cost industrialized manufacturing, and the crushed rock used as a storage medium can typically be sourced locally.

“Capable of storing renewable energy for hours, days or weeks”



Implement everywhere: GridScale can be implemented in greenfield applications without geographical restraint, facilitating higher renewables penetration and 24h solar PV.



Wide range of services: The GridScale system addresses relevant storage requirements for grid integration, including the variability of supply, provision of ancillary services and energy security.



Proven technology: Charging and discharging is carried out using turbomachinery that is combined to create a highly efficient proprietary unit. The components are supplied by best-in-class supplier Atlas Copco.

Powerful and sustainable

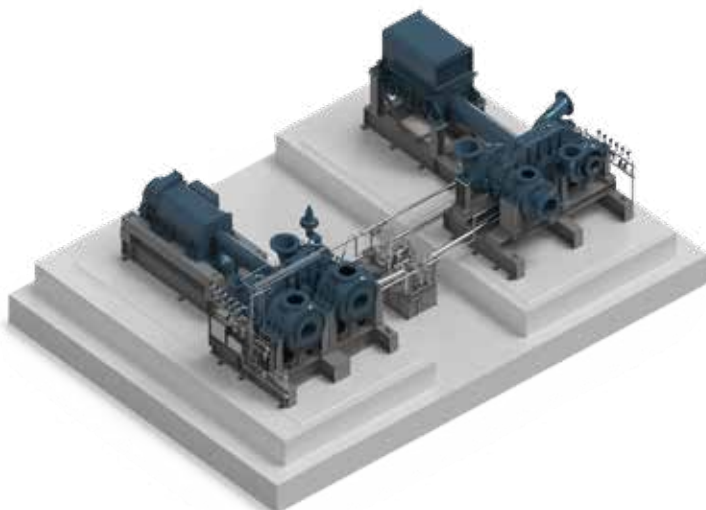
The GridScale energy storage system provides commercially and technologically sustainable storage of large volumes of energy. The GridScale range fits to both the 12-18 h duration required for day-to-day smoothing of solar PV, and the 3-7 day duration required for covering wind power production gaps during low-wind periods. This allows the storage system to facilitate much larger shares of renewable energy production than previously achieved.

Amplifying renewable energy

With present-day solar PV capacity factor levels at 25%, a GridScale energy storage system can increase the transmitted capacity factor up to 100% through 12-18 hours of day-to-day smoothing. For wind power, GridScale can provide a very significant increase in wind power penetration, approaching 80%, also in island systems.

State-of-the-art turbomachinery

GridScale's charge-discharge system comprises one compressor-turbine system for charging and another similar but differently dimensioned system for discharging. The units are based on well-proven design and technology from Atlas Copco.



Crushed rock – unparalleled price and performance

GridScale's game-changing cost reduction of medium-term energy storage is to a large extent due to the choice of crushed rock as a storage medium.

Crushed rock is an ultra-low-cost and safe energy storage medium. Provided a suitable rock type is selected, it has zero lifetime degradation.

Basalt is one such suitable rock type for GridScale. It is formed by the cooling of lava, and due to its volcanic origin, it is very resistant to rapid heating and cooling. Basalt is abundant, easily accessible, and readily available in large volumes all over the world.

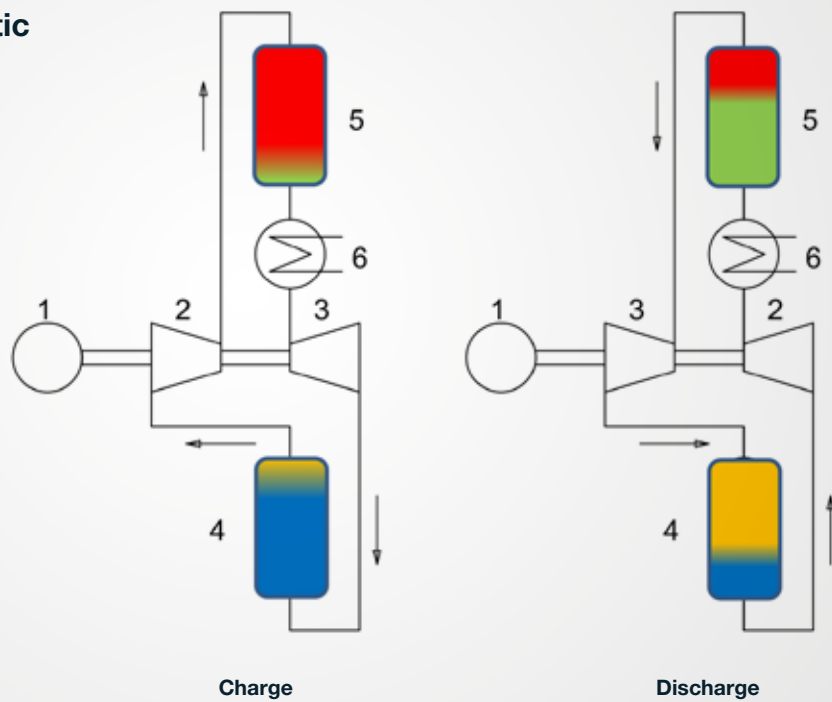
Iron ores, such as magnetite and hematite, are other suitable rock types for GridScale, which benefit from their higher material density but are not quite as abundantly available as basalt.



Read more at
www.stiesdal.com

GridScale system schematic

- 1 Motor / generator
 - 2 Compressor
 - 3 Turbine
 - 4 Cold storage tank
 - 5 Hot storage tank
 - 6 Cooler
-
- 600 deg.C
 - 385 deg.C
 - 75 deg.C
 - -30 deg.C



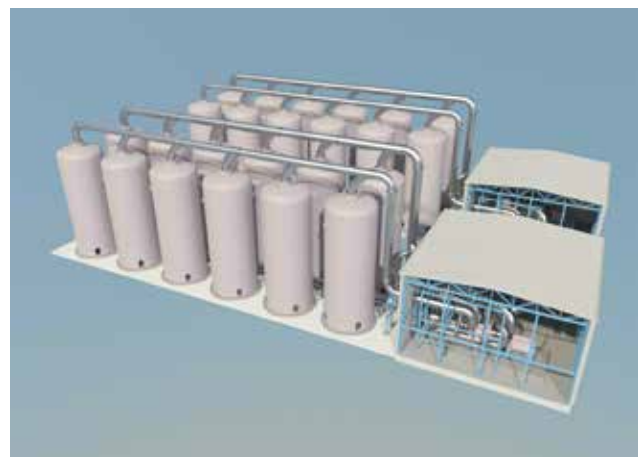
How GridScale works: The GridScale system works by converting excess electricity into heat at high temperature, up to 600 deg.C, and storing the heat in crushed rock. The charging system is configured as a heat pump, with compressors and turbines pumping heat energy from one or more storage tanks filled with cool stones to a corresponding number of storage tanks filled with hot stones. The discharging system is configured as a gas turbine, with compressors and turbines releasing the heat energy from the hot tanks to the cold tanks.

Modular design provides flexible solutions

A basic GridScale system comprises a power unit and one or more sets of cold and hot storage tanks. The power capacity is increased by adding more parallel units, and the energy storage capacity is increased by adding more tank sets to each unit.



The basic design of GridScale: A single power unit and multiple pairs of hot and cold storage tanks.



A project-specific GridScale system: Two power units and double the storage time.



Ready for the clean energy revolution

The global push for an accelerated clean energy transition requires solutions that facilitate more renewable energy without losing energy security. This, GridScale can deliver on.

One example is 24-7 solar PV. With the typical present-day solar PV capacity factor of 25%, GridScale can increase the amount of solar electricity provided to the grid by a factor of four. Similarly, on-site behind-the-meter application will reduce the grid capacity required for a solar plant by the same factor.

GridScale represents an economically viable and resilient storage solution, ready for large-scale deployment.

- Low-cost manufacturing of power system based on well-known components
- Ultra-low-cost crushed rock storage medium
- Fully configurable to project-specific power and capacity needs
- Easy installation of system based on factory-made components

4

MW. Minimum power rating of GridScale charge system

2

MW. Minimum power rating of GridScale discharge system

10

hours. Minimum storage duration of GridScale system

The Stiesdal approach

At Stiesdal, we define ourselves by our ability to innovate with impact.

The Stiesdal Company was founded with the purpose of developing and commercializing technologies that have major impact on mitigating climate change. This purpose is fundamentally rooted in a conviction that more needs to be done, and that real impact can be achieved through innovation.

The creation of jobs is an additional and highly important purpose of the Company. Our aim is to positively impact and benefit local communities and to think job creation into our activities.

We pursue innovative solutions that are suitable for industrialization in the belief that cost reduction is the strongest single driver of clean technology implementation.

Our approach is therefore the same across all our technologies. To achieve true impact, we always strive for game-changing levels of cost reduction. We continuously challenge ourselves, questioning what it takes for every aspect of every technology to become the cheapest without sacrificing on safety or performance.

We know from experience that volume and scale are the ultimate cost-cutting factors, which is why we optimize all our solutions for standardization and modularization to achieve streamlined industrial processes and mass production.

No new technology leaves our design offices, laboratories or workshops without a clear strategy for industrialization. If an innovative technology promises to make meaningful impact on the decarbonization of society, it must be ready-to-scale from the very beginning. This is the path that gives innovation true impact. And this is what lies in our DNA.



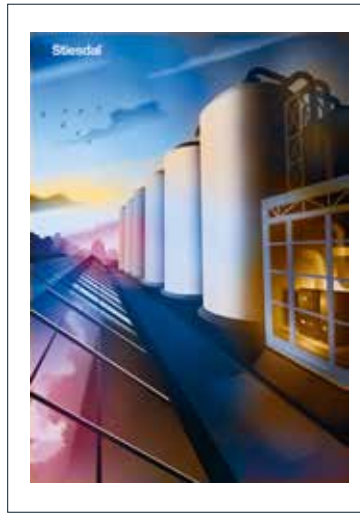
“Innovation with impact. It is in our DNA”



Stiesdal Offshore

Target: Unlimited low-cost offshore wind energy made globally available.

Means: The modular Tetra foundation concept, the world's first industrialized floating wind foundation.



Stiesdal Storage

Target: Firm power and energy security from renewables.

Means: The GridScale thermal energy storage system with 10 hours to 10 days capacity.



Stiesdal Hydrogen

Target: Application of renewable electricity across all sectors.

Means: The HydroGen electrolyzer unit for low-cost green hydrogen production.



Stiesdal SkyClean

Target: Affordable carbon capture and sequestration.

Means: The SkyClean system combining green fuel production and carbon capture and sequestration.

Stiesdal®

www.stiesdal.com
info@stiesdal.com

©2023 Stiesdal A/S. All rights reserved.
 All specifications in this document are for information only and are subject to change without notice.
 No expressed or implied representations or warranties regarding the adequacy or accuracy of the information are given. Certain technical options, services and wind turbine models may not be available in all locations or countries.

