

Liquid Air Energy Storage Technology

Making a 100%
renewable energy
future possible today

Cryogenic Energy Storage

Clean, cost-efficient, flexible and reliable

CRYOBattery™ technology makes use of a freely available resource—air—which is cooled and stored as a liquid and then converted back into a pressurized gas which drives turbines to produce electricity. Just as pumped-hydro harnesses the power of water, the CRYOBattery unleashes the power of air. It is the only long-duration energy storage solution available today that offers multiple gigawatt hours of storage, is scalable with no size limitations or geographic constraints, and produces zero emissions. Cryogenic energy storage systems are a cost-competitive clean energy storage solution for large scale, long-duration applications.

We believe energy storage technology is the game changer that can truly unlock the full potential of renewable energy by making renewable energy as dependable and affordable as conventional power.

Our partnership with Highview Power will allow us to bring gigawatthours of energy storage to the market with the full flexibility to be built practically anywhere it is needed.

Sumitomo SHI FW will lead the liquid air energy storage business within Sumitomo Heavy Industries, applying our technology development, engineering and global project delivery capability, to help our customers transform the world's energy infrastructure toward a clean and sustainable energy future.



30-40 year lifespan
with mature components



Proven technology
with established supply chain



Zero emissions
and benign materials



50+% efficiency



Cost competitive
locatable technology at utility scale



Build anywhere
with no geographical constraints



Zero water impact
no external cooling



Giga-scale
scalable to multiple GWs and GWhs



Symbiotic
Integrates with industrial waste heat/cold sources to further enhance facility efficiency



The energy market is transitioning to renewable power—energy that is clean, but intermittent. Highview Power’s cryogenic solution enables this transition by delivering performance and reliability equivalent to traditional sources of power while releasing zero emissions and storing energy for up to multiple weeks.



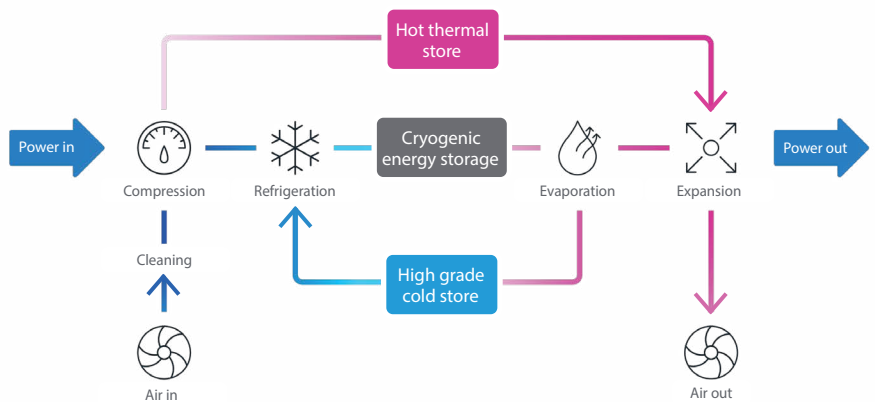
Long-duration energy storage

Applications of Highview Power’s Cryogenic Systems

Highview Power’s CRYOBatteries are adaptable and can provide services at all levels of the electricity system: supporting power generation, providing stabilization services to transmission grids and distribution networks, and acting as a source of backup power to end users.

How it works

Our patented cryogenic technology draws on established processes from the turbo machinery, power generation and industrial gas sectors.



Stage 1. Charging the system

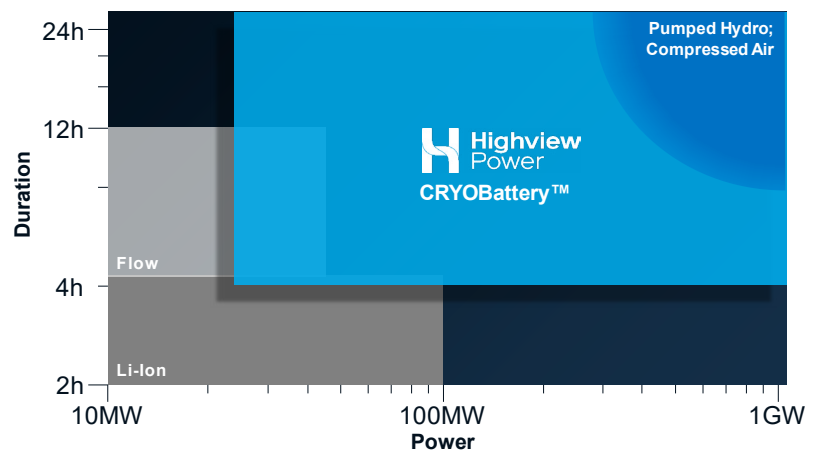
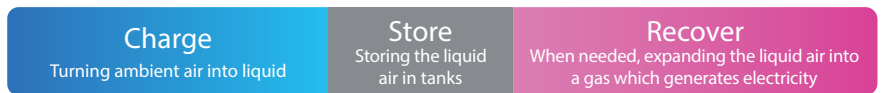
An air liquefier uses electrical energy to draw air from the surrounding environment, the air is cleaned and cooled to subzero temperatures until it liquefies. 700 liters of ambient air become 1 liter of liquid air.

Stage 2. Energy store

The liquid air is stored in insulated tanks at low pressure, which functions as the energy reservoir. Each storage tank can hold a gigawatt hour of stored energy.

Stage 3. Power recovery

When power is required, stored heat from the charging system is applied to the liquid air via heat exchangers and an intermediate heat transfer fluid. This produces a high-pressure gas that drives a turbine and generates electricity.



Power generation

- Firming renewables
- Energy arbitrage
- Peak shaving
- Improved heat rate

Transmission

- Transmission constraints
- Inertia services
- Responsive flexibility services
- Voltage support

Distribution

- Reactive power
- Voltage support
- Local security
- Distribution losses

End users

- Power reliability
- Energy management
- Waste heat recovery
- Waste cold usage

Metsänneidonkuja 10
FI-02130 Espoo, Finland
T +358 (0) 10 393 11

Relanderinkatu 2
FI-78201 Varkaus, Finland
T +358 (0) 10 393 11

ul. Staszica 31
41-200 Sosnowiec, Poland
T +48 (0) 32 368 1300

ul. Młynarska 42
01-171 Warsaw, Poland
T +48 (0) 22 535 50 65

Lindövägen 75
602 28 Norrköping, Sweden
T +46 (0) 11 285 330

Petersstrasse 120
47798 Krefeld, Germany
T +49 151 108 51366

53 Frontage Rd, PO Box 9000
Hampton, NJ 08827 USA
T +1 908 713 2700

Unit 01~07, 5th Floor,
Shanghai Kaisa Financial Centre
1188 Minsheng Rd, Pudong New Area
Shanghai 200135, China
T +86 (0) 21 5820 0123

C-3A-45, IOI Boulevard, Jalan Kenari 5,
Bandar Puchong Jaya, 47100 Puchong,
Selangor, Malaysia
T +603 8075 0887

20th Floor Bhiraj Tower
at EmQuartier, 689 Sukhumvit Rd
Klongton Nuea, Wattana
Bangkok 10110 Thailand
T +66 (0) 2 0417140 3

Suite 706-708, 7th Floor, Central Bldg
31 Hai Ba Trung St
Hanoi, Vietnam
T +84 (0) 4 39393809

7th floor, 621, Yeong-dong-daero,
Gangnam-gu, Seoul, Korea 06087
T +82 2 3446 8325

Room 901A, 9th Floor
Vicente Madrigal Bldg, Ayala Ave
Makati City 6793, Philippines

WISMA GKBI #1606, Jl. Jend. Sudirman No.28,
Jakarta 10210 Indonesia
T +62 (21) 5795 1095

ThinkPark Tower, 1-1 Osaki 2-chome
Shinagawa-ku, Tokyo 141-6025, Japan
T +81 (0) 3 6737 2000

www.shi-fw.com

Our vision is to provide sustainable energy solutions through decarbonization, decentralization and digitalization of the energy industry. Our capabilities cover customer needs in the fields of power generation utilizing circulating fluidized bed (CFB) technologies, long term energy storage, and related network services. We continuously broaden our portfolio of products and services by advancing our in-house technologies and developing further alliances with new partners.

Our Values

Respect for people.

Valuing and inviting differing views and ideas

Committed to customers.

Exceeding expectations and providing value

Safety, integrity and teamwork.

Incorporating ethics in everything we do

Ownership of results.

Personally ensuring that success is achieved

Passion to innovate and grow.

Setting challenging goals for growth



Sumitomo
SHI **FW**