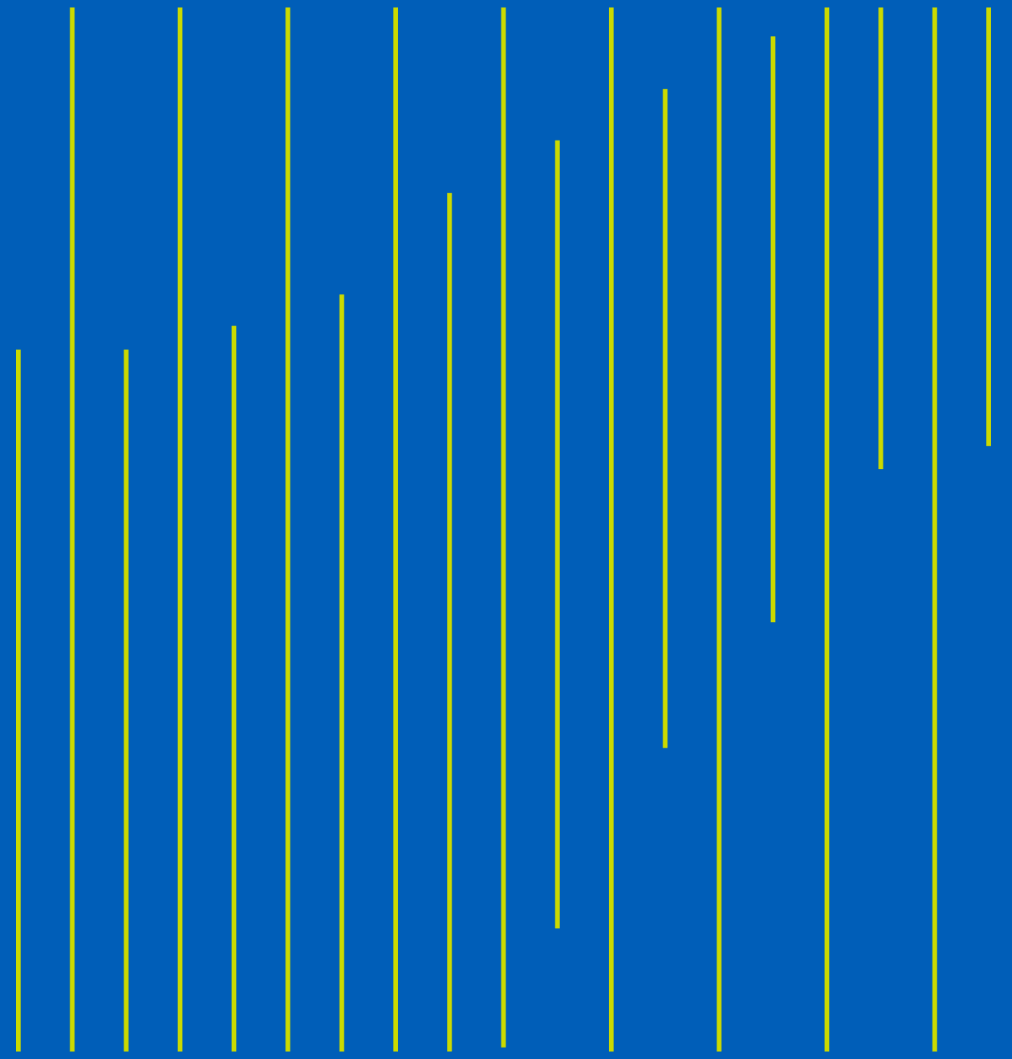
Sumitomo SHI FW (SFW)

Decarbonization - new products of SHIFW in real cases

Grzegorz Kocot, Director Business Development

Bohumil Lisner, Customer Manager

Ostravice, September 2025



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SFW response to decarbonization and climate change mitigation

Helping our customers to reach decarbonization goals

Energy generation

Energy from biomass or waste for carbon neutral or carbon negative heat & power applications

Carbon capture

Oxyfuel carbon neutral and negative CFB plants, Calcium looping for hard to abate industries and Hot potassium carbonate for biomass and WtE

Services

Life cycle solutions enabling high plant availability and efficiency

Waste to value

Gasification of solid waste into syngas, biofuels & chemicals, or plastics recycling

Energy storage

Long Duration - Enabling net zero grid systems to limit the climate change

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Our presence in Czech Republic (delivered under Foster Wheeler brand)

Start Up Year	 Account Name	Boiler technology	Electric Output MWe (Gross)	Main steam pressure (bar)	steam temperature (°C)	Primary Fuel Type	Secondary Fuel Type
2013	Teplarna Kladno s.r.o. K5	CFB	135	132,3	541	Coal - Brown	Biomass, Sludges
1998	Veolia Energie ČR, a.s.- Olomouc K5	CFB	40	134,03	535	Coal - Brown	
1996	CEZ a.s. Porici Power Plant K7	CFB	60	100	520	Coal - Brown	Biomass
1998	CEZ a.s. Porici Power Plant K8	CFB	60	100	520	Coal - Brown	
1998	Mondi Steti K11	CFB	50	94	535	Coal - Brown	Biomass - Bark
1997	CEZ, a.s. Elektrárna Hodonin K1	CFB	35	96	510	Coal - Brown	Biomass
1997	CEZ, a.s. Elektrárna Hodonin K2	CFB	35	96	510	Coal - Brown	

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Agenda

Carbon Capture – Capsol Technologies

Hot Potassium Carbonate (HPC) – pilot plant test campaign and results

Long Term Energy Storage

LAES – Liquid Air Energy Storage – plant in Hiroshima, Japan

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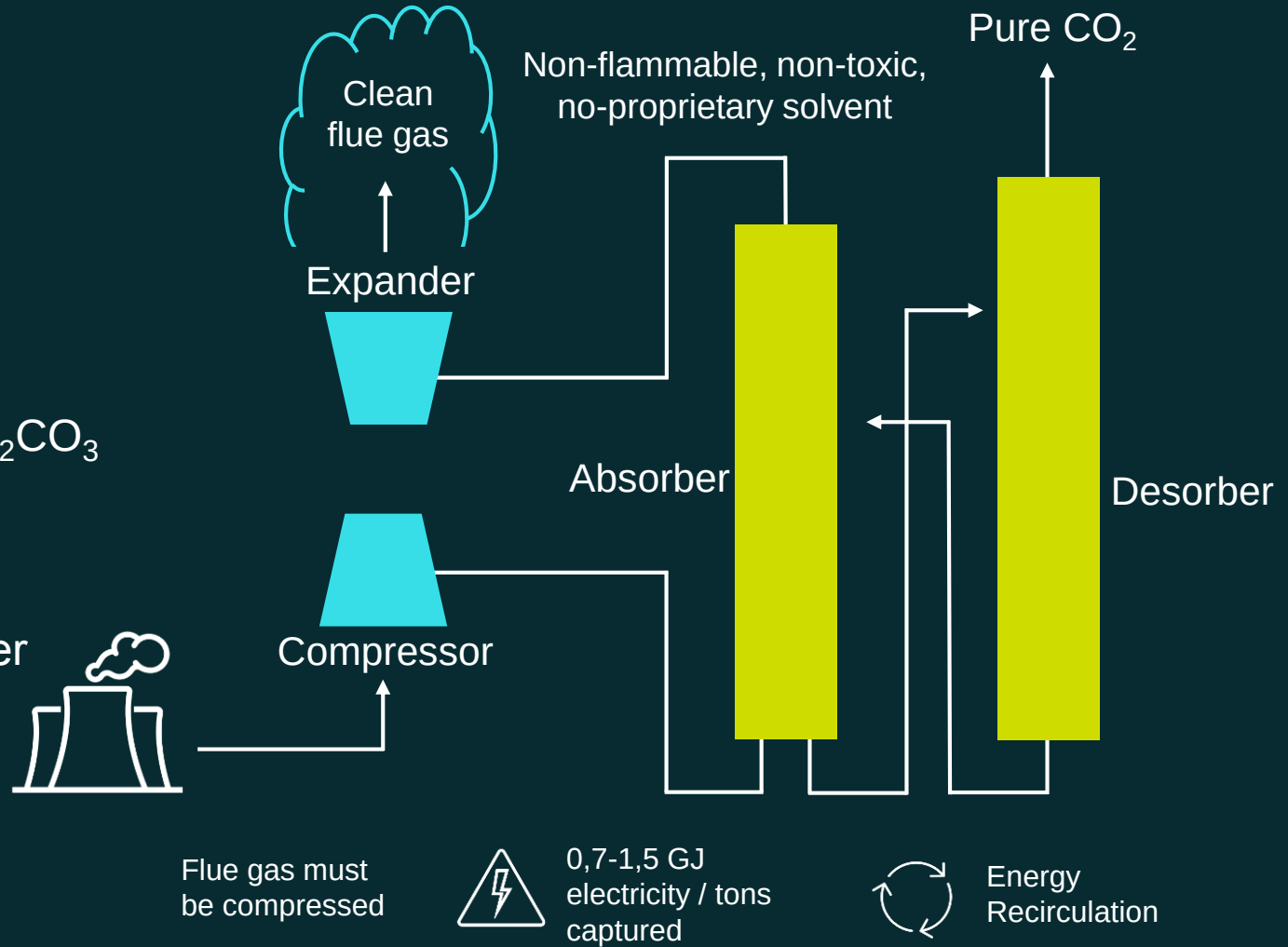
How does it work?

Technology based on efficient heat recovery for low energy penalty and increased district heat production:

- Uses aqueous **safe solvent** of 25 wt.% K_2CO_3
  - Proven as solvent in 100s carbon capture plants
- Uses pressure swing and waste heat for regeneration
- Recovery compression energy in expander
- **Capture rate over 90%**
- **Produces high purity CO_2 > 99%**
- Can be powered by **electricity only**, steam only, or combination
- **Electricity consumption 0,7 - 1,5 GJ / ton of CO_2**
- Low-temperature heat can be used in **district heating**



$$K_2CO_3 + CO_2 + H_2O \leftrightarrow 2KHCO_3$$

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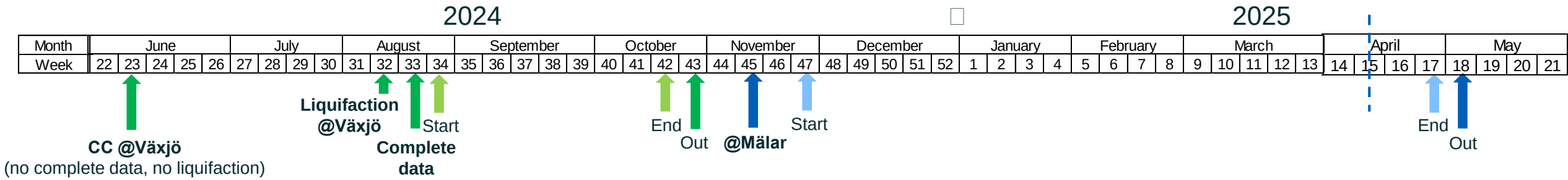
CapsolGo 2 testing campaigns in Sweden – schedule and plan as of 10.Apr.2025

- Schedule



- Pressure 4 - 6 barg
- L/G: 6 - 10
  - Solvent: 900-1300 kg/h
  - Flue gas: 100-120 Nm3/h
- All heat recovery config.
  - Reboiler only
  - Reboiler + lean flash
  - Reboiler + condensate flash
  - All (2 tests only)
- 25% K_2CO_3
  - No additives
  - 1.4 & 2.6% H_3BO_3
  - No V_2O_5
- Essentially no CO2 liquefaction

- Pressure 4 - **8** barg
- L/G: 6 - 10
  - Solvent: 900-1300 kg/h
  - Flue gas: 100-**180** Nm3/h
- All heat recovery config.
  - Reboiler only
  - Reboiler + lean flash
  - Reboiler + condensate flash
  - All
- 25% K_2CO_3
  - No additives
- Liquefaction only daytime

- Pressure, L/G, and heat recovery configurations subset from previous period (including “champion run” for max capture rate)
- 25% K_2CO_3
  - 2.6 & **5.0%** H_3BO_3
  - 0 & **1.4%** V_2O_5
- Liquefaction long operation

(Additional tests agreed with E&E, Capsol and Mälar)

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CapsolGo 2 testing campaigns – biomass and WtE

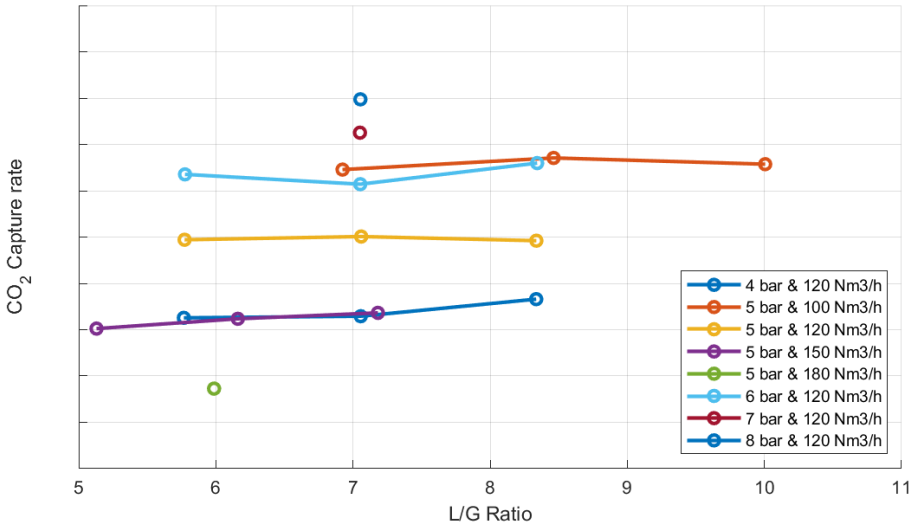
Status at MälarEnergi

On schedule:

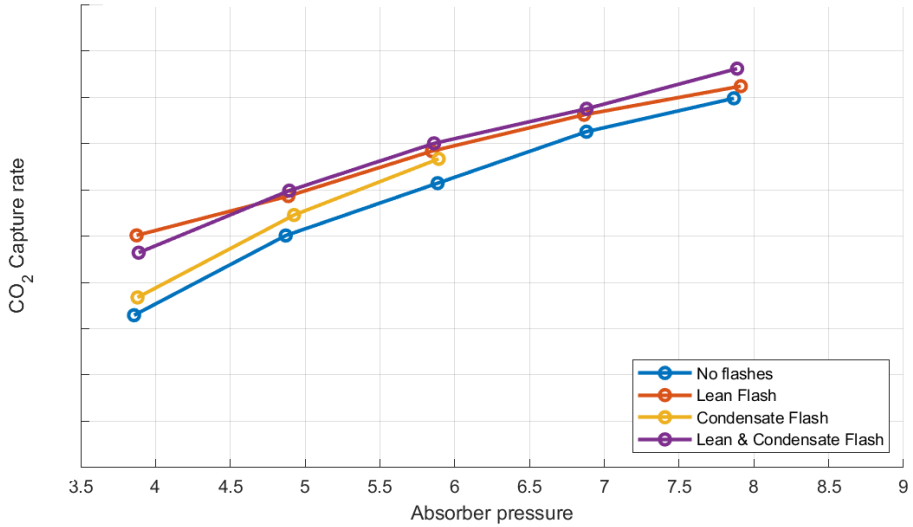
- Tests at Mälar started on November 18th
- 78 tests conducted so far of which 64 accepted and with analyses ready and checked.
  - Liquefaction unit has beed in continuous operation since 6.Mar.2025
- So far, 20 tests exceeded 90% CO_2 capture rate, and 8 tests exceeded 95%
  - Highest capture rate: 96,5% at high pressure (8 barg), L/G ratio (10), low flue gas flow (100 Nm3/h) and solvent K_2CO_3 25% + H_3BO_3 5% (boric acid).
  - Effect of pressure and flue gas flowrate quantified; optimum L/G range confirmed
  - Effect of heat recovery solutions (flashes) quantified
  - Fate of contaminants (oxygen, acid gases, heavy metals,…) measured
  - Effect of H_3BO_3 additive quantified (effect of V_2O_5 under testing)

HPC pilot CapsolGo3: selected results

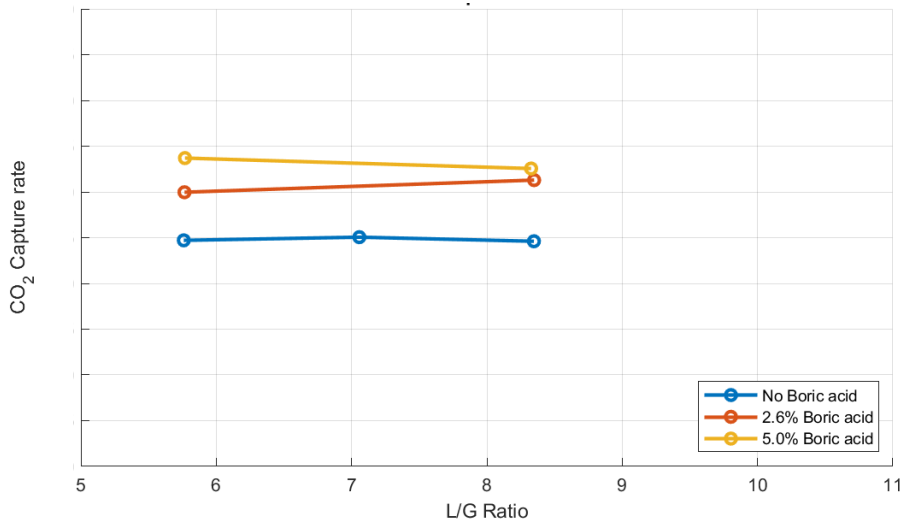
Effect of FG flowrate



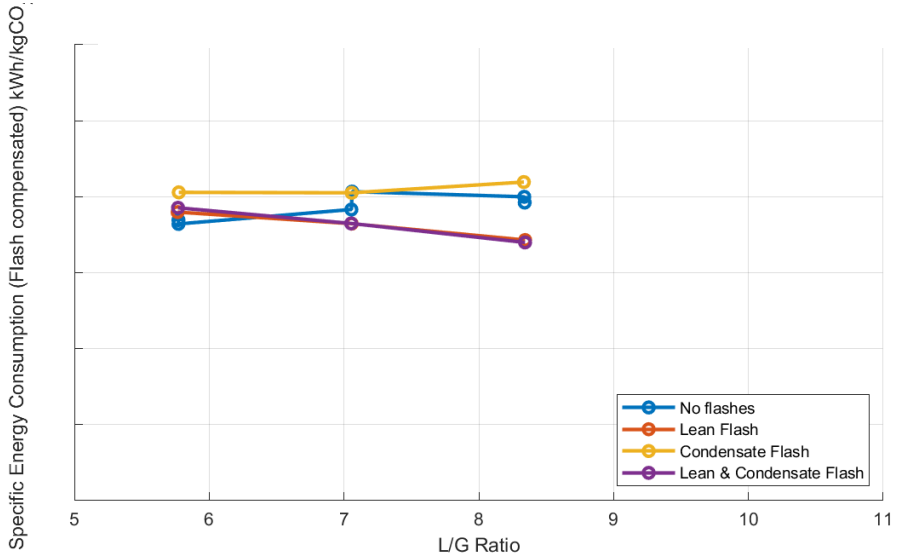
Effect of pressure



Effect of Boric Acid (H_3BO_3)



Effect of heat recoveries



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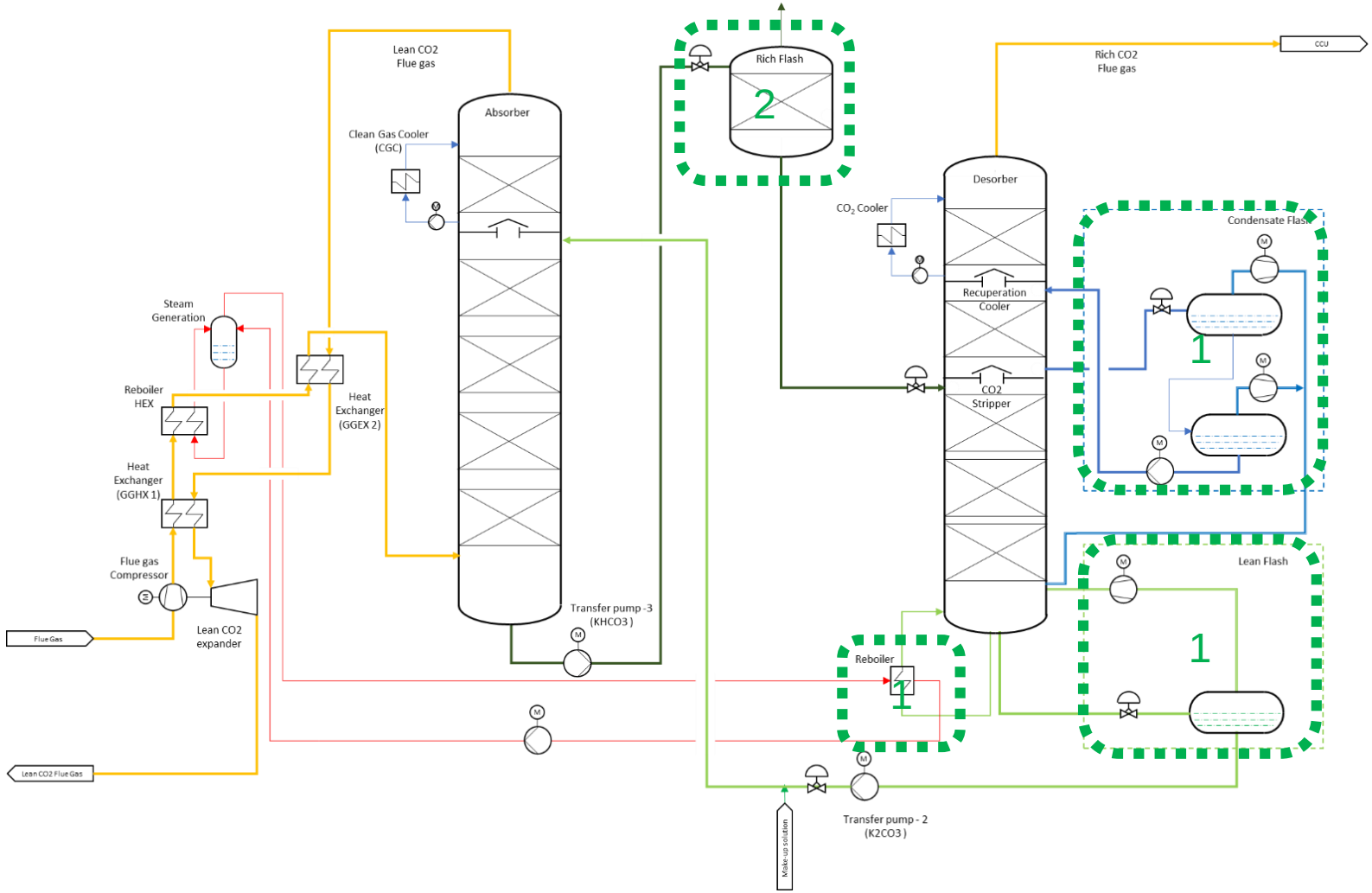
CapsolGo3 pilot – inclusions critically focusing on energy efficiency

1. Includes all critical heat-recovery systems: reboiler, condensate flash, lean flash
2. Includes energy-efficient means to increase CO_2 purity: rich flash



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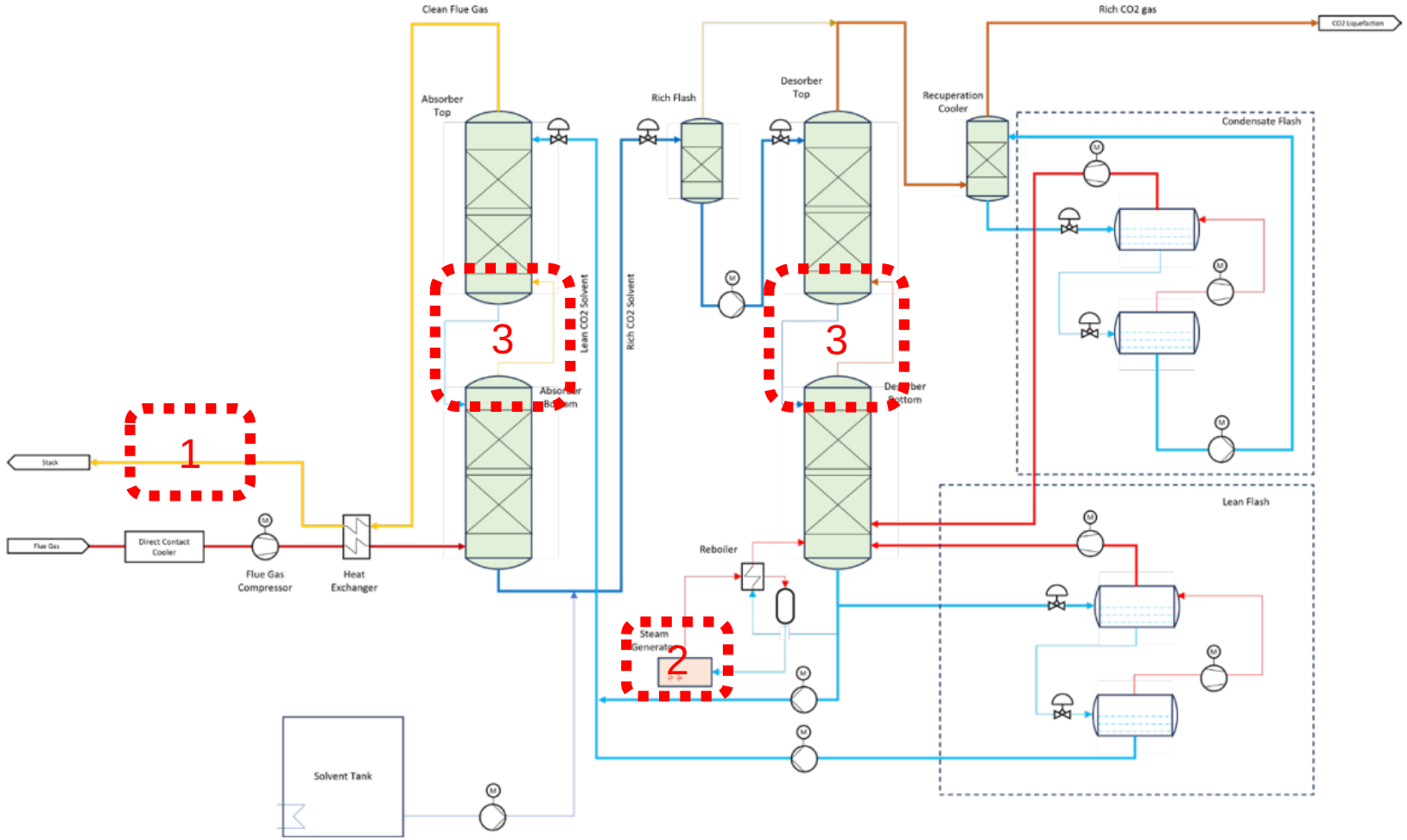
CapsolGo3 pilot – main differences from commercial unit

1. No expander
2. Heat recovery from compressor to reboiler simulated with electric input
3. All key components (including absorber & desorber) split into two columns



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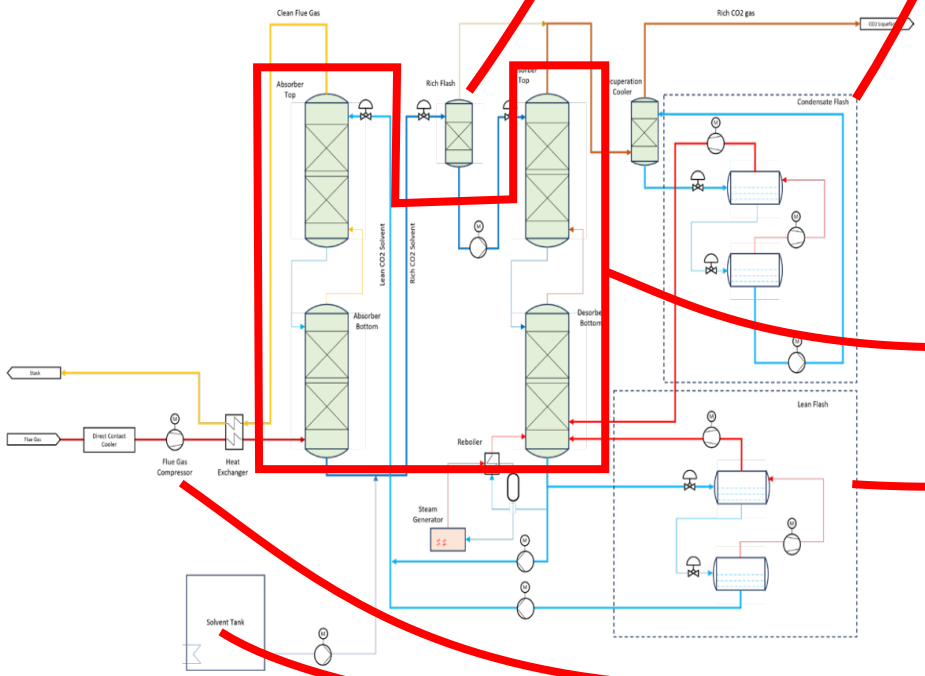
HPC pilot CapsolGo3 at Mälar

What you are going to see



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LAES (Liquid Air Energy Storage) – plant components, theory

LAES – pilot scale plant Hiroshima, Japonia

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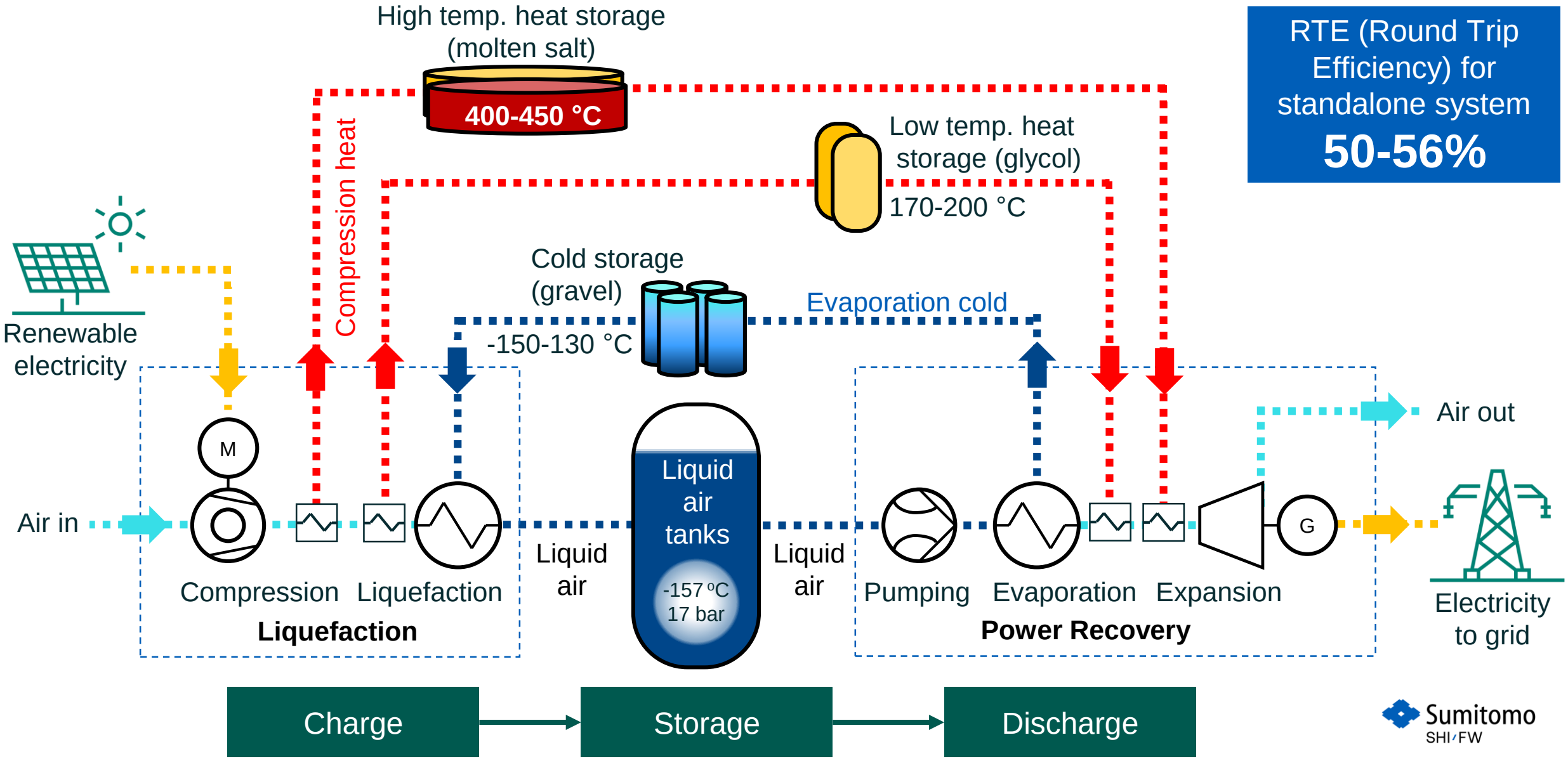
Liquid Air Energy Storage schematic



RTE (Round Trip Efficiency) for standalone system **50-56%**

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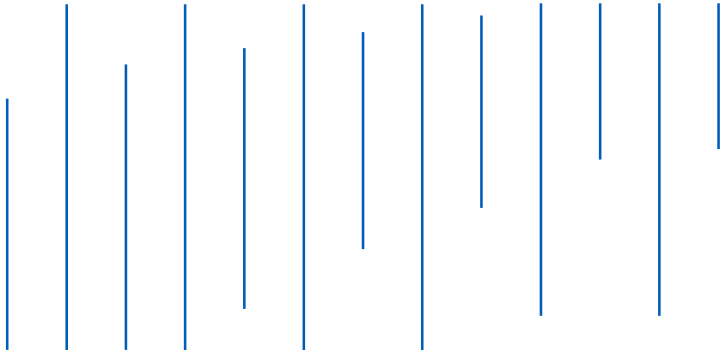
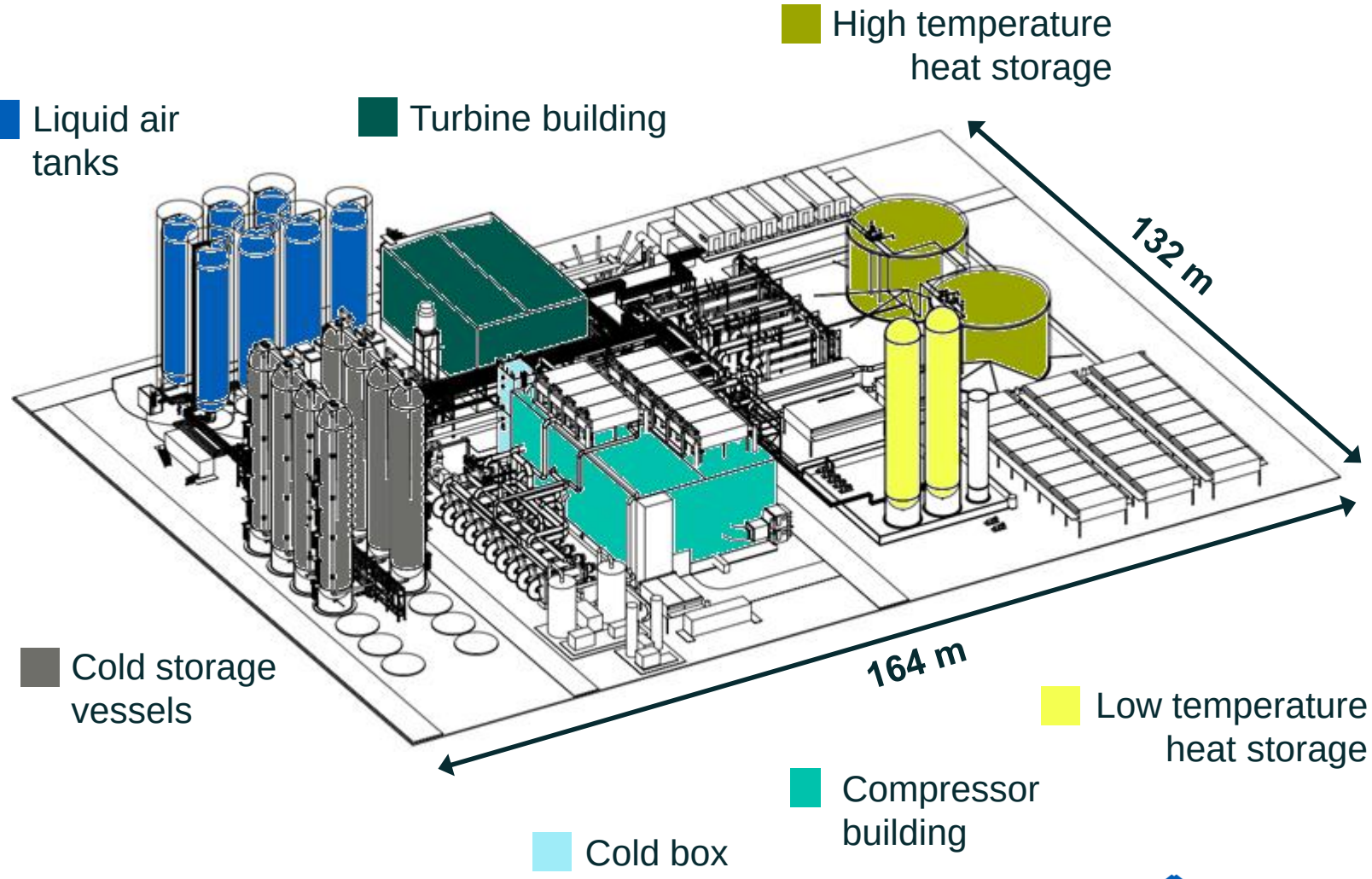
Reference LAES plant layout

50 MW LAES plant require approximately 20 000 m^2

LAES discharge capacity	**50 MW**
LAES charge capacity	**100 MW**
Duration	**8 hours**





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20 MWh LAES – projekt demonstracyjny

Projekt wspólny Sumitomo Heavy Industries and Hiroshima Gas Co., Ltd

Image of construction site

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20 MWh demonstration scale commercial plant in Hiroshima

Joint development by Sumitomo Heavy Industries and Hiroshima Gas Co., Ltd

Hiroshima Gas Co., Ltd.
Hatsukaichi Plant

LAES Hiroshima Hatsukaichi – Oct. 2024

LAES Hiroshima Hatsukaichi

Power	5 MW
Storage	20 MWh (4h)
Area	0.62 acres 2 500 m^2

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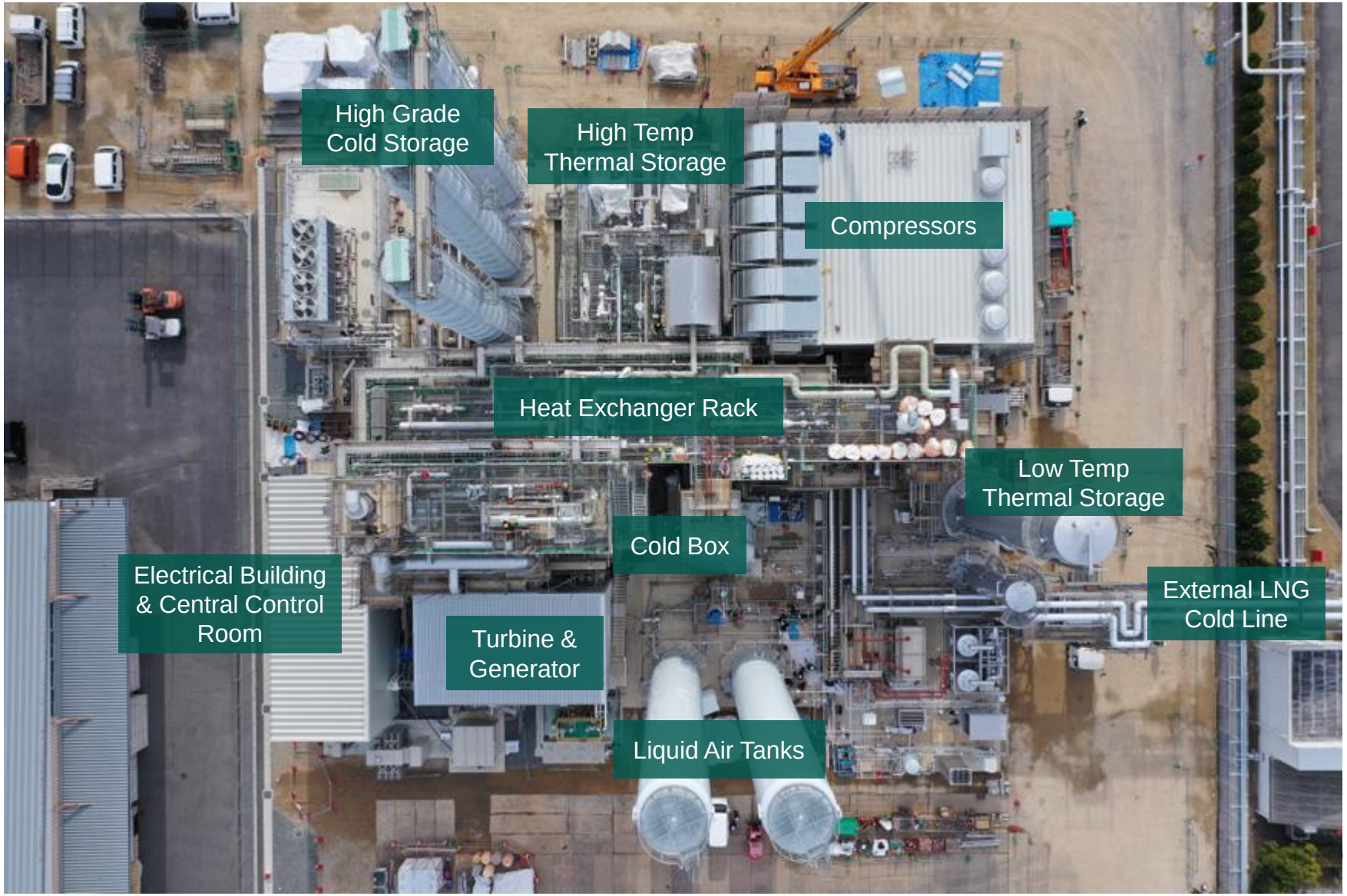
Hiroshima plant configuration and site overview

Discharge	**5 MW**
Duration	**4 hours**
Site footprint	**50m x 60m**

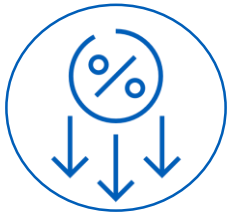


Status September 2025

- Mechanical installation completed.
- The commissioning is happening right now and is on schedule.
- COD is on schedule for November.
- The plant is welcoming visitors after COD, so basically after November

100% carbon free electricity – always!

LAES systems provide crucial services for the power grid and support electrification of rural areas



Energy Shifting	Net zero eco system	Grid ancillary services	Islands and off-grid mining
▪ Intra-day ▪ Inter-day ▪ Weekly storage	▪ Integration with external sources of heat or cold such as LNG plants	▪ Rotational inertia ▪ Frequency support ▪ Voltage support ▪ Reactive power ▪ Spinning reserve	▪ Decarbonizing smelting operations ▪ Reducing fuel consumption ▪ Enhancing security of energy supply

LAES is a scalable, ultra-flexible, location agnostic long duration energy storage system

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LAES OPERATION CHARACTERISTICS

LAES performance is comparable to a peaking power plant

Solid performance with synchronous generation for secure grid operation

Charge

- Startup time to full power: 5 minutes
- Partial load operation: 75-100%
  - Multiple charging trains improve partial load capability, specially for large plants

Discharge

- Startup time to full power: 10 minutes
  - Startup ramp rate: 12.5%/min after synchronization
- Partial load operation: 25-100%

Minimal constraints

- No minimum uptime before turn-off
- No minimum downtime between runs
- No cap on depth of discharge

Dziękuję za uwagę!

Thank you

Więcej informacji na:

www.shi-fw.com

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