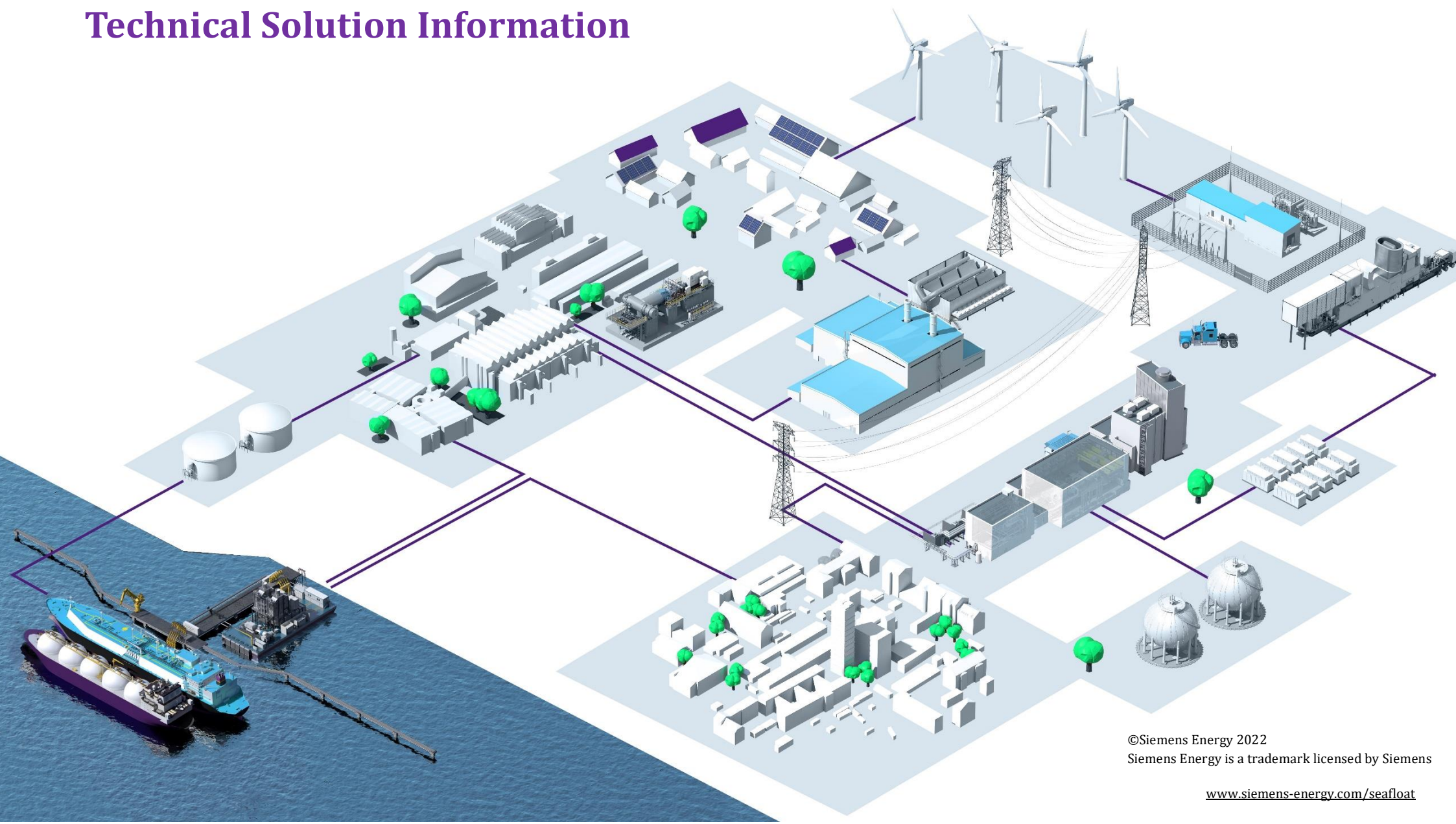


SeaFloat SCC-800

Technical Solution Information

SIEMENS
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www.siemens-energy.com/seafloat

Our reference project Estrella del Mar III

A hybrid power plant solution (SCC-800 2x1) with integrated battery energy storage.



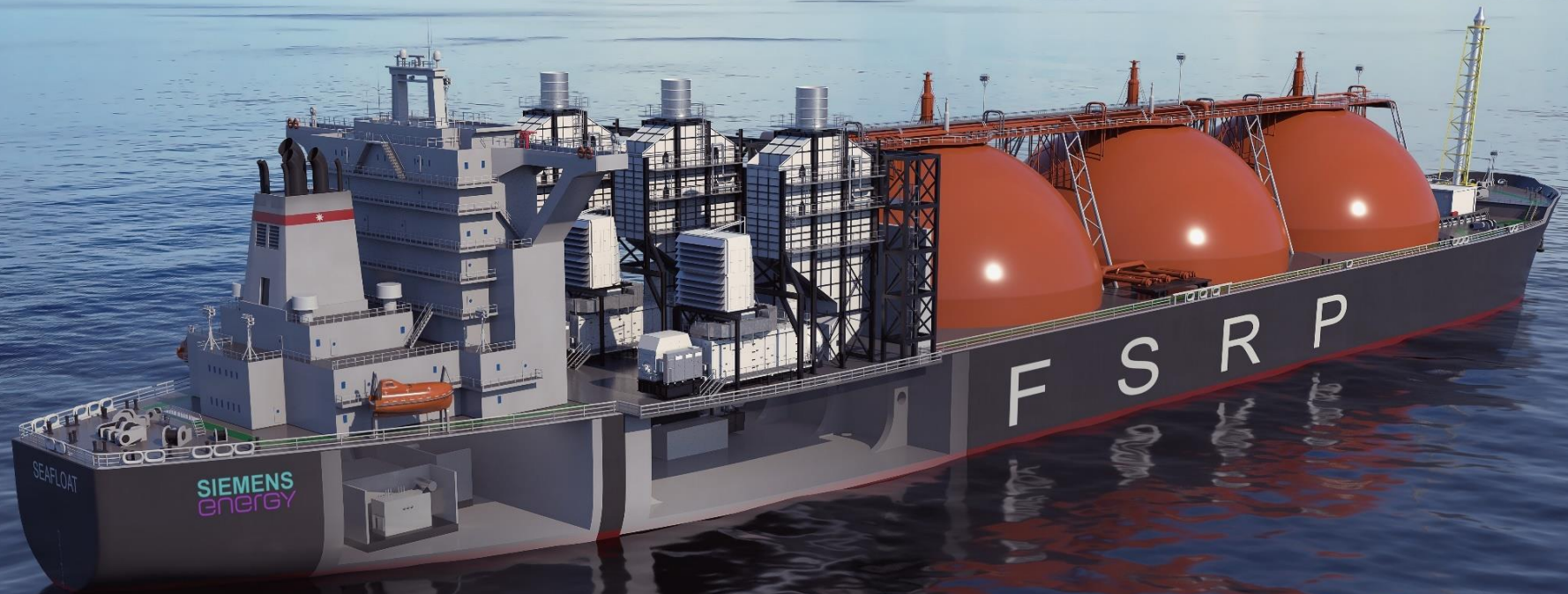
SeaFloat fully integrated solution with up to 180.000 m³ LNG storage, LNG regasification and combined cycle power plant scalable up to 300MW

The fully integrated New Build SeaFloat solution allows to provide clean and affordable power to locations without access to fuel. Installation of land-based LNG terminals are not necessary anymore.



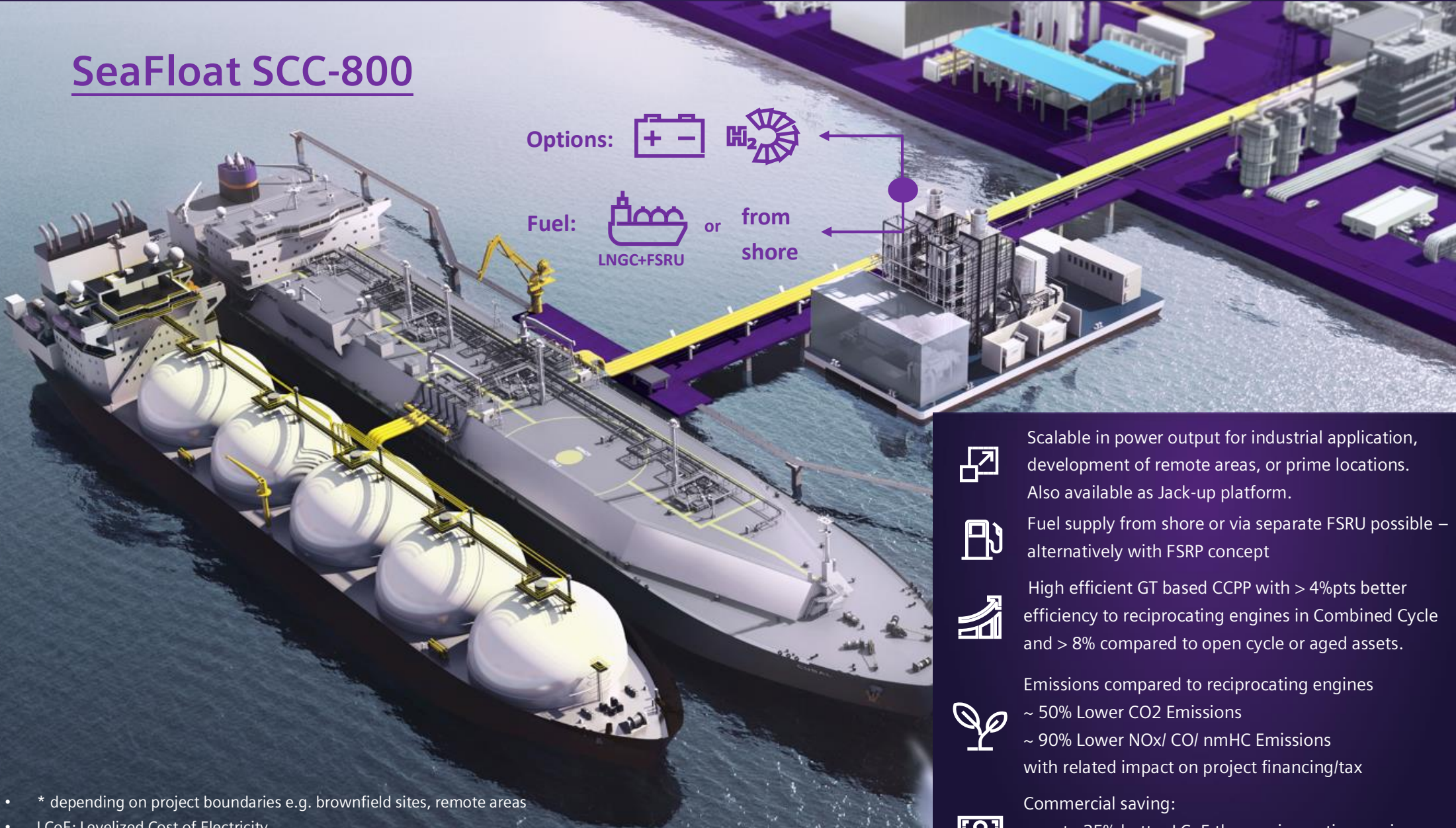
3 Export Streams with conversion of old assets

The conversion of existing assets to a SeaFloat FSRP solution brings CAPEX savings, together with low fuel consumption from high efficient equipment, low operational costs and the three export streams provide an attractive and flexible business case to our customers



SeaFloat SCC-800 barge solution complemented with LNG infrastructure






SeaFloat SCC-800



Options:  

Fuel:  or from shore
LNGC+FSRU

- * depending on project boundaries e.g. brownfield sites, remote areas
- LCoE: Levelized Cost of Electricity
- FSRP: Floating Storage Regasification and Power
- nmHC: non methane hydrocarbones

-  Scalable in power output for industrial application, development of remote areas, or prime locations. Also available as Jack-up platform.
-  Fuel supply from shore or via separate FSRU possible – alternatively with FSRP concept
-  High efficient GT based CCPP with > 4%pts better efficiency to reciprocating engines in Combined Cycle and > 8% compared to open cycle or aged assets.
-  Emissions compared to reciprocating engines
 - ~ 50% Lower CO2 Emissions
 - ~ 90% Lower NOx/ CO/ nmHC Emissions with related impact on project financing/tax
-  Commercial saving:
 - up to 25% better LCoE than reciprocating engines
 - up to 20% better LCoE than land based* solutions

Outstanding performance available in SeaFloat application

With a proven, long-term track record of more than 7 million Equivalent Operating Hours (EOH) from over 410 successfully installed units all over the world, the SGT-800 gas turbine is an excellent choice for both, industrial power generation as well as oil and gas applications. It will meet your demand for excellent performance, efficiency, reliability, and environmental compatibility at low lifecycle costs and the best possible return on investment. The SGT-800 will complement your combined cycle and cogeneration installations with its excellent efficiency. Designed for flexible operation, it is perfectly suited for base and intermediate load as well as grid support. With SeaFloat, all proven and well-known benefits are now available also on floating platforms.

The SGT-800 industrial gas turbine offers broad flexibility in fuels, operating conditions, maintenance concepts, package solutions, and ratings.

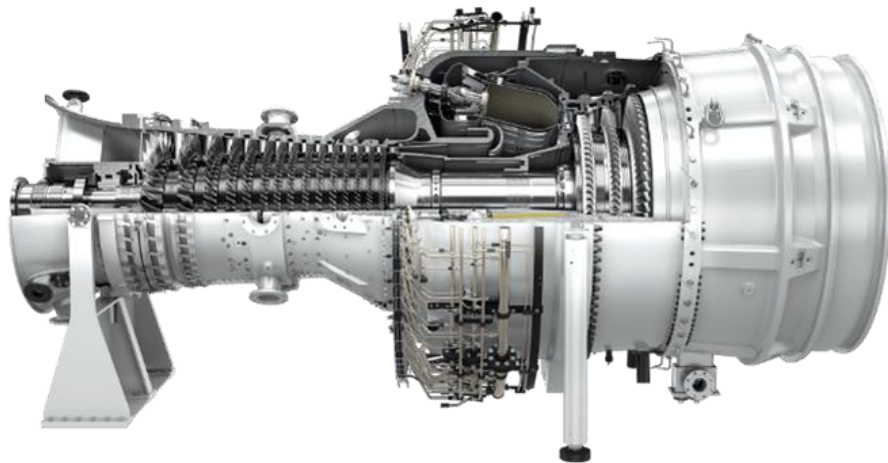
The high degree of modularization and delivery of pre-assembled and pre-tested plant modules minimizes both the manpower required at a construction yard and the hook up time at place of operation.

The plant equipment is intended for on board installation based on international codes and standards for power plants. Adaptions are implemented to suit the marine environment with respect to, but not limited

to, air intake filters, materials, surface treatments, and protection against water ingress and corrosion. Movements and deflection are addressed by technical modifications, if necessary.

Our SGT-800, integrated into the combined cycle, can also be designed as full integrated solution with a floating storage regasification power ship (FSRP) for LNG, as well as a gravity-based solution (GBS) like e.g. jack up platforms or other fixed platform types.

The combined cycle power plant provides highly efficient power output starting from 150MW and can be scaled up in 75MW steps, depending on the plant configuration.



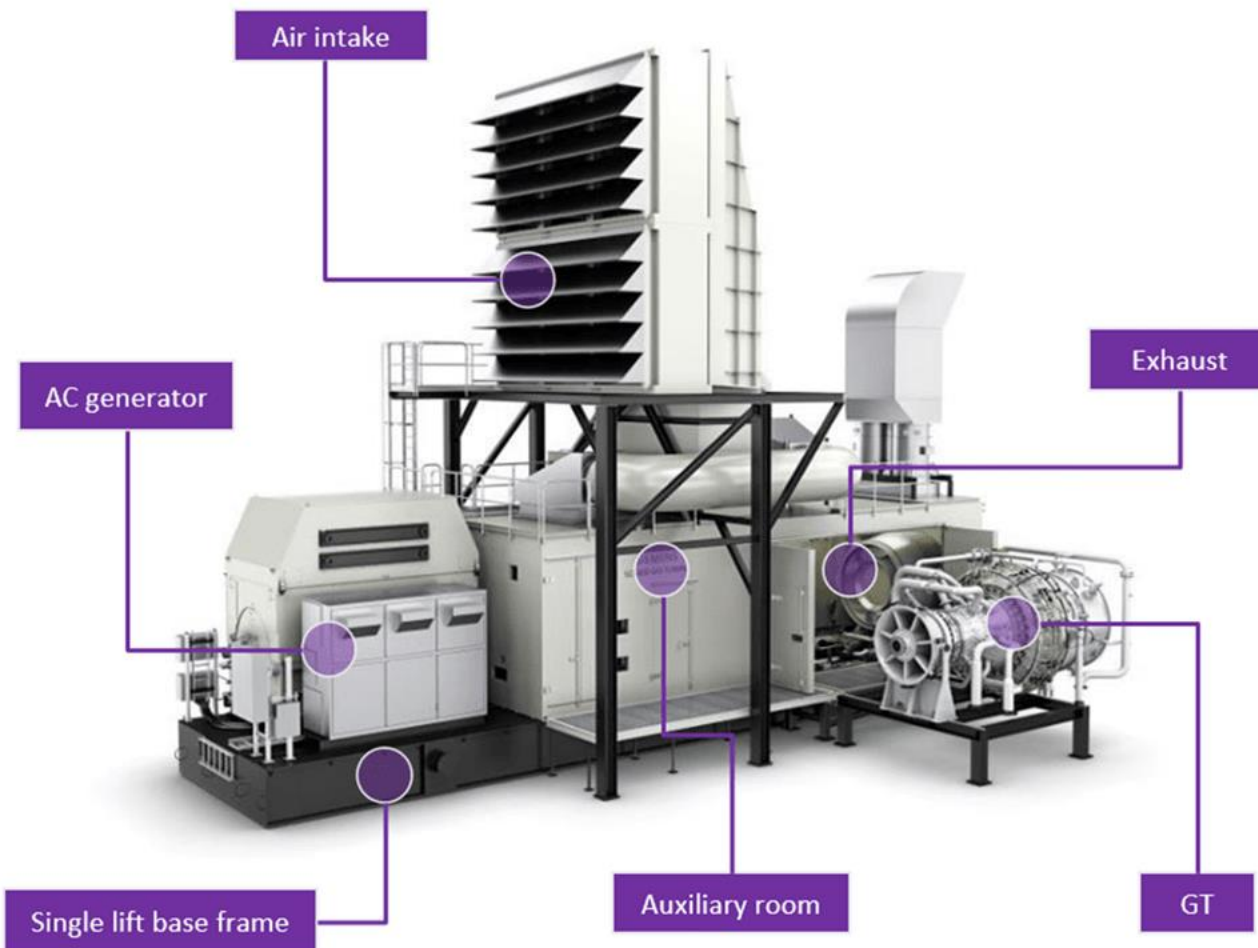
Key benefits of SGT 800

- 300MW(e) power output for a 4x1 combined cycle application
- >56% combined cycle efficiency
- More than 410 units sold
- More than 7 million fleet hours
- High reliability and availability
- Low lifecycle costs
- Robust dual-fuel (gas / liquid) DLE combustion system
- On-load fuel changeover capability
- Capable of single-digit NO_x
- Dual frequency & excellent fuel flexibility LNG, LPG, NG, ethane, propane
- Future fit: capable of burning up to 75% hydrogen

SeaFloat SGT-800 Gas Turbine

The SGT-800 gas turbines (GT) will be provided as a single lift package and 3-point mount installation, consisting of turbine, mechanical auxiliary systems, gear box, generator, and generator switch gear. This concept allows fast and easy installation at shipyards and is designed to withstand nearshore conditions. The single lift package has a weight of approx. 295t and is pre-assembled and system tested with dedicated electrical and control module. Optional factory performance testing can be conducted upon customer's request. The air intake filter house has a weight of approx. 20t and the weight of the GT enclosure ventilation system is approx. 10t.

The single lift package concept enables 48h core engine exchange for plants with the highest requirements on availability. The easy "roll out" capability of the gas turbine core engine enables onboard maintenance and overhaul. On the core engine "roll out trolley" the core turbine is moved to the on-board overhaul area of approx. 175m² where an 8-ton gantry crane is used for turbine inspections/ overhauls. Hot Gas Path Inspection (HGI) and Major Overhaul (MO) are conducted at every 30/60 thousand Equivalent Operating Hours (EOH).



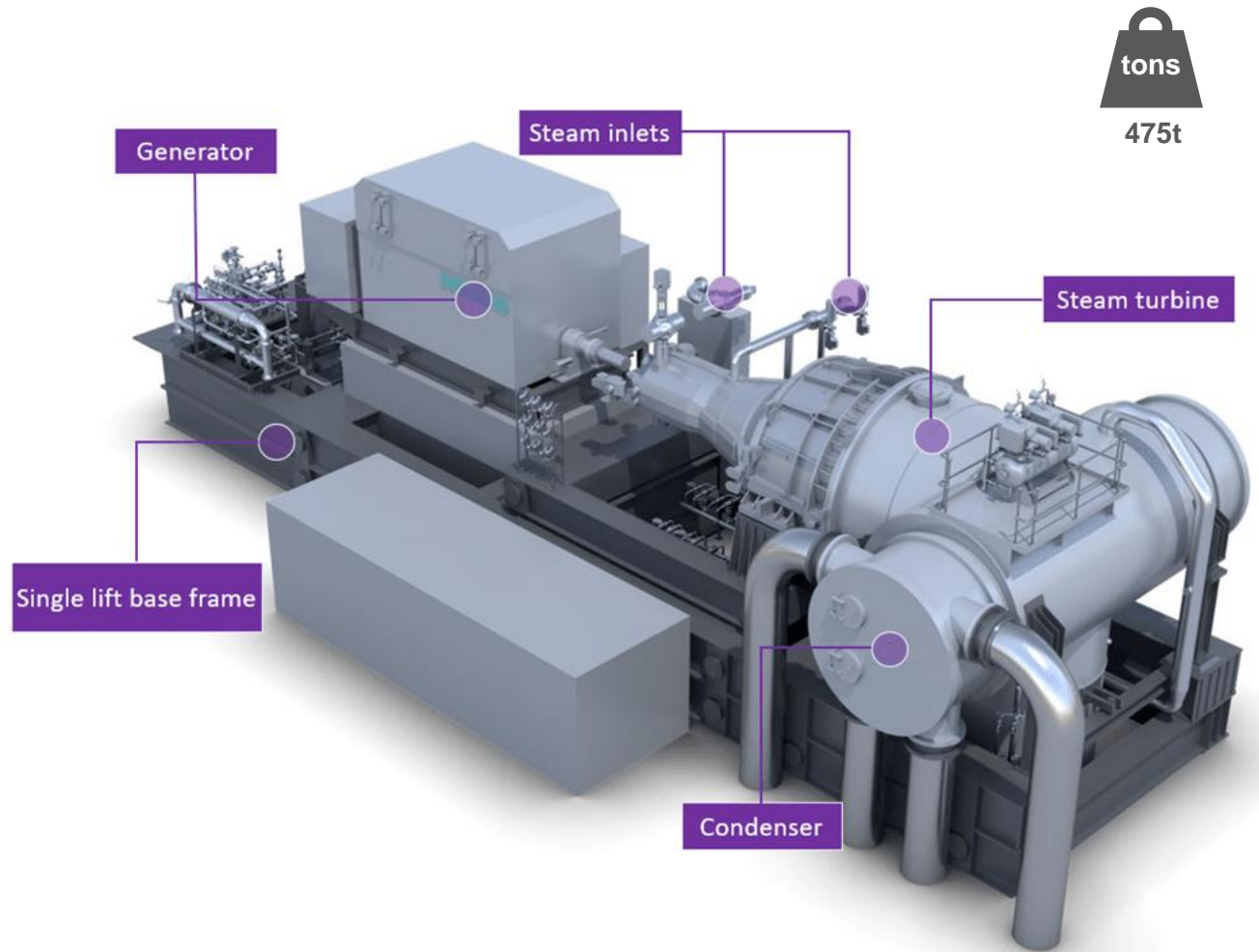
SGT-800: 22.0m x 4.7 m x 5.3 m (length, width, height)

SeaFloat SST-600 Steam Turbine

The well proven SST-600 steam turbine (ST) will be provided as a pre-assembled and system tested single lift package on a 3-point mount base frame. It has a weight of approx. 475t in 2x1 configuration. The steam turbine single lift package consists of steam turbine, condenser with evacuation systems, generator, and generator switch gear. The turbine is directly coupled to the generator on the admission and has an axial steam exhaust.

Siemens Energy in-house once through steam generator is utilized, ensuring all major components of the combined cycle power plant are provided from one source, allowing optimized design coordination.

Planned preventive maintenance is done onboard. The Steam turbine area is covered by a building and includes a gantry crane with capacity for the various inspection activities.



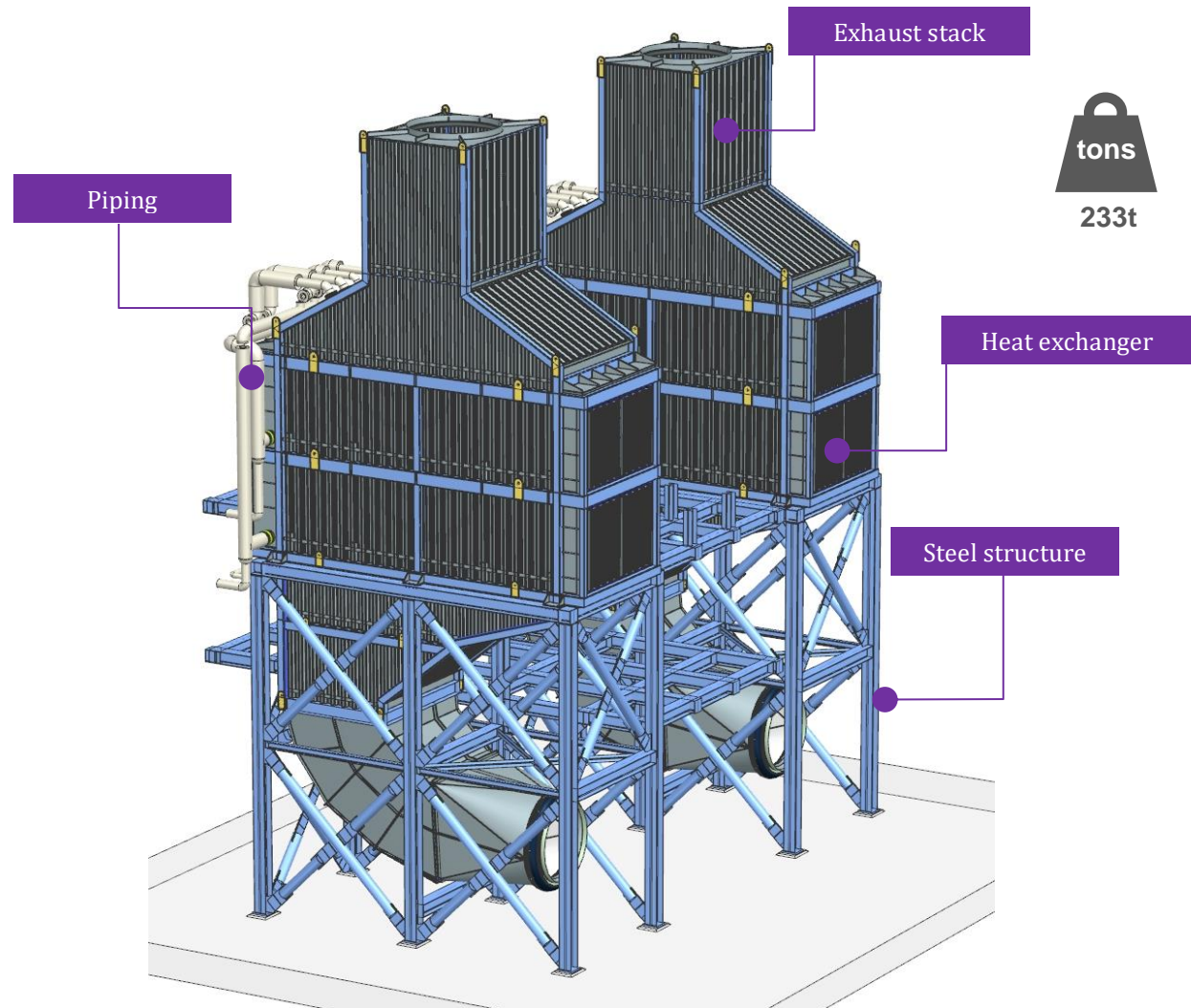
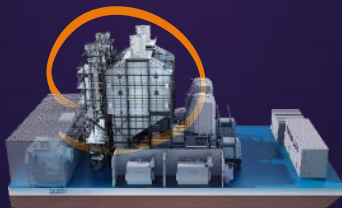
SST-600: 25.2 m x 7.0 m x 5.5 m (length, width, height)

SeaFloat OTSG

The Once Through Steam Generator (OTSG) will be provided as a package with maximum modularization. This modular approach has been applied in dozens of units worldwide and results in safer and better-quality fabrication under optimized shop conditions. The arrangement enhances faster and smoother installation at the shipyard. The steel structure for the OTSGs is designed as one combined block. In this way a rigid structure is formed to withstand marine environment conditions and to minimize the footprint dimensions.

The OTSG is based on Siemens Energy Benson Technology which incorporates a steam separator in the HP section of the boiler. With over fifty proven references globally, the steam separator provides power plants a secure start-up operation. The OTSG is of a robust design requiring low maintenance and inspections which can conveniently be performed during gas turbine inspections and overhauls.

Each OTSG package has a weight of approx. 233t.



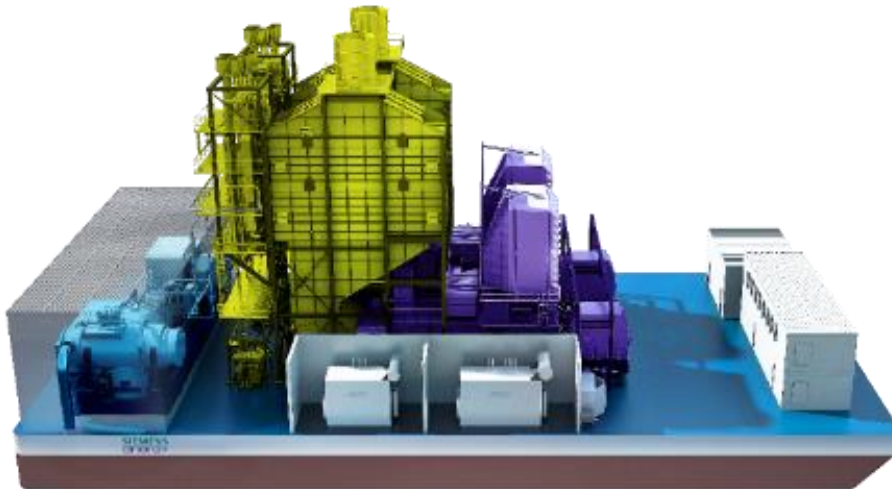
OTSGs: 12 m x 19 m x 24 m (length, width, height)

Footprint, main machinery

SCC-800 2x1

2 x GTs, 2 x OTSGs, 1 x ST with condenser, N+1 feed water pumps, feed water treatment system, steam and feed water dosing and sampling system, 2 x gas fuel preheaters, 2 x GT I&C control containers, 1 x ST I&C container, 1 x GT main two-winding generator transformer, 1 x main transformer ST/GT, HV GIS switchgear (can also be located on shore)

The number of equipment will be multiplied accordingly for a SCC-800 3x1 or 4x1 configuration



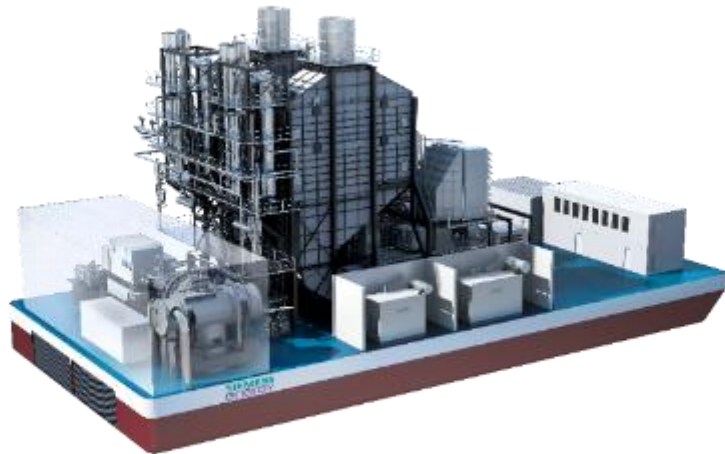
Weights of main equipment for a SCC-800 2x1 configuration

- GTs, 295 tons each
- Gas fuel preheaters, 8 tons each
- ST with condenser, 475 tons
- I&C modules, 35 tons each
- OTSGs, 466 tons
- Steam cycle auxiliaries, 50 tons
- Main transformers, 1 x 130 tons, 1 x 120 tons
- HV GIS switchgear, 20 tons
- Aux transformers and switchgears, 90 tons
- DCS & 110VDC UPS systems, < 5 tons

Configuration	Typical deck space requirement	Weight
SCC-800 2x1	~80x38m	~3000t
SCC-800 3x1	~95x38m	~4100t
SCC-800 4x1	~115x38m or different depending on arrangement	~5300t

Main features and performance information

- High GT reliability of 99.5%
- High GT availability of 98.7% with core engine exchange in 48 hours
- All maintenance possible on board
- High efficiency, refer to below table
- Dry Low Emissions (DLE)
- Low water consumption for steam cycle make up, minimal water treatment plant on board
- Design for roll & pitch, ≤ 3 degrees
- Less emissions (e.g. COi, NOx, unburned hydrocarbons, Noise)
- High grid stability through large inertia/ rotating mass
- Low auxiliary consumption
- Longer maintenance intervals over the entire plant lifetime of 25 years
- High power density requiring less space on the barge



Configuration	2x1	3x1	4x1
Gross Power output*	~147 MW(e)	~221 MW(e)	~297 MW(e)
Gross plant efficiency*	~56%	~56%	~56%
Number of SGT-800	2	3	4
Steam turbine model	SST-600	SST-600	SST-600
Fuel gas consumption	~5.7 kg/s	~8.5 kg/s	~11.3 kg/s

Table: Typical Performance values

- Emissions, NOx [ppmV / mg/Nm³] - <25 / 51.3 @ 15% O₂ (>50% GT load)

- Emissions, CO [ppmV / mg/Nm³] - <5 / 6.3 @ 15% O₂ (>50% GT load)

- Installed performance at:
 - 25°C ambient air temperature
 - 25°C sea water temperature
 - 60% relative humidity
 - *) Gas fuel supply 30 Bar(a), 25°C, 48.6 MJ/kg LHV (Siemens Energy standard gas composition).

Table: Typical Performance values

SGT-800 based plants provide high combined cycle plant efficiency, even at part load operation, due to the unique part load control algorithm of the SGT-800. Dry low-NOx single or dual fuel burners ensure low NOx emissions without need of water injection.

Automation and control

A high degree of automation and control with a fully automatized start-up and shut-down procedure provides an efficient and safe operation of the plant from an onboard control room as well as from a remote location, such as a load dispatch center.

Optimized operator and engineering environments have been considered with a large flexibility for localization in various operations rooms onboard the vessel/barge. Interfaces are available for any dedicated automation or control systems onboard by means of OPC interface to superimposed systems, SCADA etc.

Data logging, compression, and storage into history database servers ensure the evaluation of events and performance over time including a valuable feature for maintenance planning. Connection to Siemens Energy service centers for operations support and various services can be provided as part of service contracts.

Typical project details

A typical project is characterized as a floating or fixed offshore power generation installation near to shore or moored to a jetty close to an electrical substation for import of the generated power via cable or overhead lines.

Basic design support from Siemens Energy:

The combined cycle power plant (CCPP) equipment is installed onboard the vessel/barge with gas & steam turbine packages, OTSGs, main transformers, HV switchgear and electrical and control equipment modules for turbines.

Siemens Energy provides generic 2D/3D models as guidance towards an optimal layout.

The power plant is equipped with a highly compact and highly reliable Gas Insulated Switchgear (GIS), two incomers (2x1 & 3x1, three incomers for 4x1) from the generator transformers and one export feeder breaker for either cable or overhead line connection to an onshore tie in point.

Main Generator Circuit Breakers (GCB) for the gas and steam turbine generators are installed on the base frames of the turbine generator sets for 2x1, hence no separate generator switchgear structures are required.

Auxiliary power required for plant operation is derived from the auxiliary transformers. To keep the plant energized at plant stand still and for starting of the GTs, power is supplied from the HV grid via the main generator step up transformers. An optional onboard black start generator enables the start of the GTs even if the grid has fallen black. Such black start generators are typically part of the onboard utilities and not part of Siemens Energy scope.

Steam cycle auxiliaries, MV and LV switchboards, protection and DCS panels for the power plant are to be mounted onboard in dedicated equipment rooms.

The operation of the CCPP is based on the exhaust heat from the gas turbines without duct firing and without water injection for power augmentation. The robust Siemens Energy standard DLE combustion system does not require water injection to meet the required low NOx emission levels, by this keeping the capacity of the water treatment plant low, which benefits the on-board layout.

The plant is intended for operation on gaseous fuel. Back-up operation with liquid fuel is available as an option.

An additional option is to equip the gas turbines with heat exchangers (glycol/water to air) in front of the gas turbine air intakes. In this arrangement, the inherent heat of the air assists vaporizing the LNG flow to the gas turbine. In turn, the air is cooled down which, in consequence, results in higher base load power output.

The regasification plant can also be designed not only for providing LNG to the gas turbines but to provide excess re-gasified LNG for other purposes, such as to the onshore gas grid. The use of low-grade heat from the steam turbine condenser for re-gasification is an efficient option. This arrangement can increase the overall plant efficiency up to almost 90%.

The power plant consists mainly of the gas turbines, the OTSGs, and one condensing type steam turbine with a sea water cooled condenser. All as per Siemens Energy “Standard Reference Plant” (SRP) design for SCC-800 combined cycle installations. For further details please refer to scope of supply and performance information below. In case of restricted cooling water availability the steam turbine exhaust can also be cooled via an air cooled condenser.

Overview of Siemens Energy scope

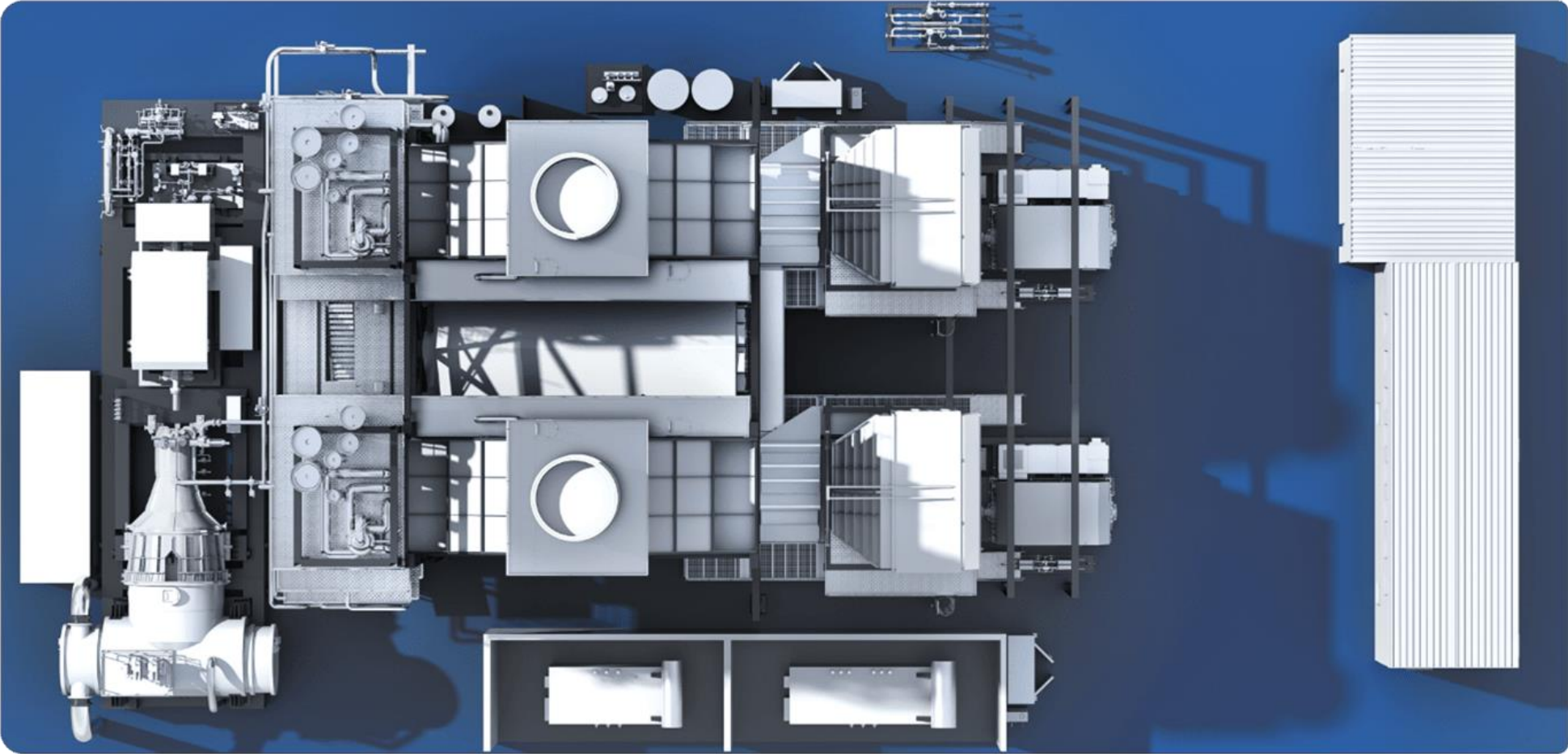
- Basic engineering for full power plant functionality and guaranteed performance
 - SGT-800 gas turbine packages on common base frame with 3-point mount, water-cooled lube oil and generator coolers
 - Electrical and control module with all electrical and I&C equipment for the GTG
 - Generator (GCB) and auxiliary power circuit breakers (ACB) as part of the GTG skid
 - All equipment prefabricated and pretested
 - One OTSGs per gas turbine
 - Steam cycle auxiliaries, redundant feed water polishers, sampling and dosing equipment, redundant evacuation systems, N+1 feed water pumps
 - One SST-600 condensing steam turbine on 3-point mount with axial steam exhaust, directly mounted condenser with enlarged hotwell, fresh water-cooled lube, and generator coolers
 - Electrical and control module including all electrical and I&C equipment for the STG
 - Generator GCB and auxiliary power circuit breakers as part of the STG skid
 - All equipment prefabricated and pre-tested
 - Main step-up transformers in three winding designs for GT/ST combination, complete with protection relay system and on-load tap changer for ratio control on HV side, freshwater cooling, OFWF
 - Main step-up transformer of two winding design for one GT, complete with protection relay system and on-load tap changer for ratio control on HV side, freshwater cooling, OFWF
 - Single busbar gas insulated HV switchgear (GIS), two incomers from generator transformers, one outgoing export feeder (option two feeders) for cable or overhead line to shore, complete with protection and automations system integrated with plant DCS system
 - Naturally air-cooled epoxy insulated 7 MVA auxiliary power transformers, 11 or 13.8/ 6.3 or 4.16 kV for 50/60 Hz systems, for mounting in transformer/switchgear room on board (11/13.8 kV supply from HV shore connection, starting power via main generator transformers and Auxiliary Circuit Breakers (ACB) on GTG skid)
 - Naturally air-cooled epoxy insulated 3 MVA 6.3 or 4.16/0.69 kV auxiliary power transformers for mounting in transformer/switchgear room onboard
 - 0.69 kV switchgear for auxiliary power distribution to CCBP consumers. Feeders for N+1 configuration of condenser cooling water pumps. Pumps and motors supplied by the yard. Naturally air-cooled epoxy insulated 1 MVA 6.3 or 4.16/0.4 or 0.48 kV auxiliary power transformers for mounting in transformer/switchgear room on board
 - 0.4 or 0.48 kV switchgear for auxiliary power distribution to CCBP consumers
- Plant DCS for the above scope with engineering and operator stations for placing in a control room arrangement on board
- 110V DC UPS system for above scope
 - 230V AC UPS distribution board, UPS supply from vessel main AC UPS system

- Supervision of installation at yard at daily rates
- Cold Commissioning supervision at yard at daily rates
- Training at yard at daily rates
- Fire fighting system
- First fill of lube oil

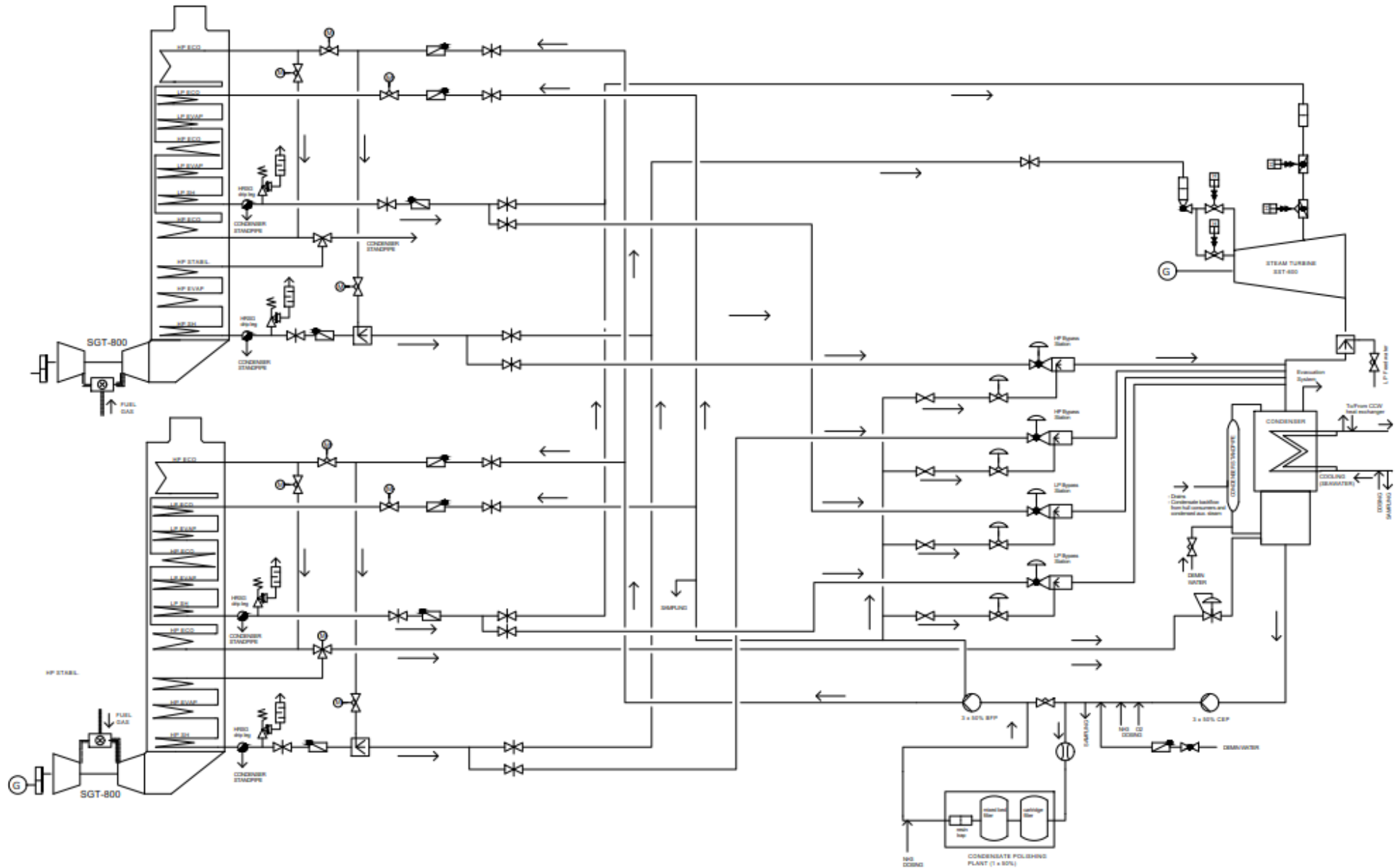
Overview of shipyard's obligation

- Installation of equipment
- Cold and hot commissioning of equipment (under Technical Field Assistance by Siemens Energy)
- Interconnecting piping and cabling between equipment
- Pipe and cable racks
- Supporting steel structures for equipment
- Platforms and stairs
- Steam turbine building, including 85-ton gantry crane for maintenance
- Maintenance building (~175m²) for GT, including 8-ton gantry crane if GT maintenance is to be made on board
- Electrical rooms for aux. power transformers and switchgears
- Rooms for installation of DCS UPS equipment, plant DCS panels
- MV/LV transformer(s) and sub-distribution for on board utilities
- 6.3 or 4.16 kV switchgear for auxiliary power distribution to CCPP and utility consumers of the vessel including two feeders as dedicated supply for the transformers and sub distribution of the vessel, normally not part of Siemens Energy scope
- AC UPS system for plant DCS
- Control room area and necessary furniture
- Make-up water treatment/demineralization plant
- Service and instrument air system
- Fresh water-cooled circuit for GTs, ST, generators, feedwater pumps, main transformers and sampling rack for steam and water sampling
- Sea water cooling system including condenser cooling water pumps
- Drain system from power plant drains
- Gas fuel supply, 25-200°C, 30 bar (a)
- Any black start/emergency generator

Typical plant layout SCC-800 2x1 (~80x38m)



Configuration SCC-800 2x1, typical main flow diagram



SGT-800 SeaFloat “plug and play” power application

Benefits for yards and end customer

Pre-engineered concept

- Pre-engineered “plug and play” equipment, including all main components for a complete power plant
- Optimized general plant arrangement provided in electronic format; 3D, 2D
- Performance and functional guarantees from Siemens Energy
- Design once - build many => highest quality and lowest price

Installation advantages

- Optimized power plant footprint giving highest power density
- Siemens Energy installation guidelines for yards
- 3-point mount single lift base frames with fastest installation of gas and steam turbine packages with minimal supervision
- Gas and steam turbine packages are system tested with dedicated electrical and control modules before shipment

Best-in-class reliability & availability

- World class reliability
- Optimized design for on-board turbine maintenance
- Gas turbine core engine exchange in 48 hours for maximized availability
- Brownfield transformation: Can be installed in parallel to an operating plant to be replaced, with no interruption of power production

Excellent performance

- World class efficiency by Siemens Energy well proven products
- Combined cycle power plant with highest turn down efficiency at plant part load
- High fuel flexibility; natural gas, ethane, propane, LPG, diesel
- Robust Dry Low Emission (DLE) combustion system
- LNG gas supply to gas grid in case of FSRP solution

Flexible Long-Term Programs

Siemens Energy Long Term Service Program (FlexLTP) is tailored to support our customers achieving real outcomes



- Operational flexibility, based on actual operation
- Tailored maintenance interval and aligned maintenance planning
- Priority service, guaranteed mobilization time
- Project manager and maintenance planning services



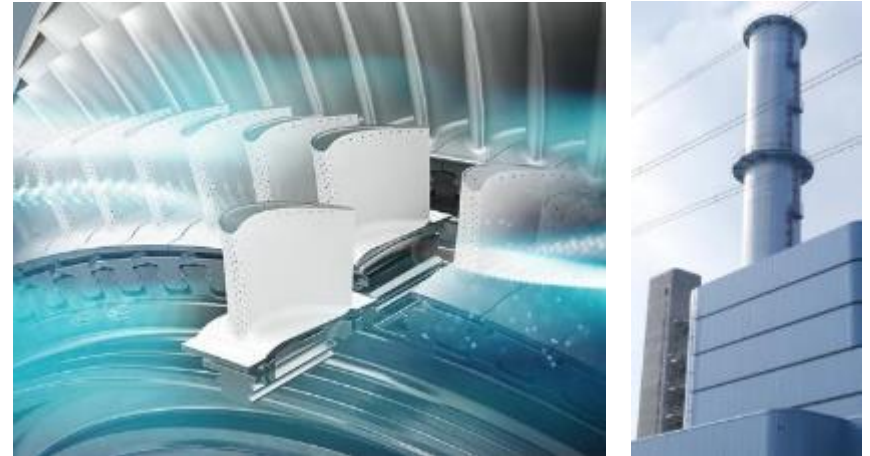
- Remote on-line service and support
- Spare part management and spare part pool
- Forecasting of component life based on actual operation
- Access to continuous R&D activities in failure pattern recognition & advanced diagnostic algorithm and tools
- O&M support on all levels up to complete organization



- Minimized cost of ownership (equipment condition based)
- Solid foundation for prediction of maintenance expenses



- Extensive guarantees
- Term warranty for replacement parts
- Combined agreement for Siemens Energy rotating equipment, if required



**Your needs.
Our knowledge.
Better value.**



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