Flexible combined-cycle power plants

With today’s increasing demands for flexible power plants, intensified by the increased amount of electricity produced by renewable energy, Siemens offers the market a flexible solution developed from fully integrated and pre-engineered systems, designed to provide extended operability, system integration services, and wrap-around performance guarantee.

Using pre-engineered modules provides a solid basis for the engineering, procurement, installation and commissioning phases, saving both time and money.

Siemens has broad experience of building power plants based on own rotating equipment. This provides continuous feedback to develop solutions which meet the needs of the market.

Our expertise in delivering world class power plants globally, assures successful design and execution of the project, leading to a sound investment and trouble-free operation of the power plant over its lifetime.
What you need is what you get

Siemens offers a variety of plant configurations and business models, of which Power Island is one, others being Components, Power Train, and Complete Power Plant.

This variation provides scope flexibility and optimization potential to suit the Customer’s specific requirements.

**Components**

- **Gas Turbine** Gas turbine(s), generator(s), auxiliaries and controls for supplied scope, inlet and exhaust systems. Support by technical field advisors during installation and commissioning.

- **Steam Turbine** Steam turbine(s), generator(s), auxiliaries and controls for supplied scope, inlet and exhaust systems. Support by technical field advisors during installation and commissioning.

**Power Train**

Gas turbine(s), generator(s), auxiliaries and controls for supplied scope, inlet and exhaust systems.

Steam turbine, generator, auxiliaries and controls for supplied scope, condenser with air removal equipment.

Support by technical field advisors during installation and commissioning.

**Power Island**

Power Train plus heat recovery steam generator(s), power plant control system, and basic design for the complete power plant.

Support by technical field advisors during installation and commissioning.

**Complete Power Plant**

Power Island plus buildings, structures, plant cooling, power control centers, electrical switchgear, fuel delivery, piping, power plant control system, balance of plant construction, installation and commissioning.
The Power Island is an attractive business model to many customers on a variety of markets. A Siemens Power Island model offers the customer such advantages as:

- Integrated Power Island, including control system, directly from the Original Equipment Manufacturer (OEM).
- Selecting and purchasing gas turbine and steam turbine from the OEM, with the option of buying the balance of plant (BoP) from a preferred EPC contractor.
- Coordinated and guaranteed delivery of all major equipment from one supplier.
- Wrap-around performance guarantees.
- Basic engineering of BoP for secure integration of major equipment into a total and operational plant.
- Overall plant commissioning.

With the pre-engineered options, Siemens can offer well-proven technical solutions and at the same time offer individual, high value solutions in every case, while paying particular attention to:

- Specific purpose of the plant.
- Specific site conditions.
- Statutory requirements.

Selecting equipment to suit the purpose of the plant
For each power plant project, it is important to optimize the configuration of selected equipment to best suit the specific purpose of the plant. Still using the same main equipment, the power island block can be adapted to suit the customer’s specific needs, for example:

- Electrical power generation.

This model pays full credit to the customer’s own direct knowledge of the local market which is invaluable in the management of possibilities and risks.

Siemens is a strong global organization and world-leading supplier of industrial power plants. As such, Siemens can facilitate project financing and offer support with contacts to financial institutions such as Export Credit Agencies.

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- Base load operation.
- Dual-fuel capabilities.

Other possibilities include:

- Multiple power blocks within one power plant, providing both generation security and operational flexibility without losing focus on efficiency and environmental compatibility.
- Island operation for remote locations without local utility grid, or in locations where there is a weak grid with frequent power cuts.
- Staged construction, increased degree of modularization and pre-testing may also be favored to adapt to the construction schedule of the specific industry and to minimize site work.
- Flexible operation with frequent starts and stops, suitable as back-up to renewable power sources in the grid.
Adapting the plant to site conditions

Based on the features of the site in question, the layout is optimized for cost-effective routing of piping and cabling and the fuel area is separated off. While keeping the core equipment – gas turbine generators, steam turbine generator, heat recovery steam generators and step-up transformers – in optimized locations, the remaining balance of plant equipment and layout of the building can be arranged to meet the customer’s specific requirements and scope, taking into consideration such influences as terminal points of the site, and prevailing wind direction.

Examples of site adaptations:

- Indoor versus outdoor installation
- Gas turbine inlet configuration
- Water-cooled versus air-cooled main condenser and cooling system
- Configuration of electrical system for connection to the grid or consumer.

The above layout shows our standard configuration, but naturally the configuration can be adapted to the spatial or architectural requirements of existing buildings and sites.
Siemens Industrial Gas Turbines

As the prime movers in our industrial combined-cycle plants, one or more medium-sized gas turbines can be used.

The Siemens gas turbine portfolio combines reliable, industrial design with the high efficiency and low emissions of the latest gas turbine technology.

Dry Low Emission (DLE) combustion is standard throughout the product range, to minimize NOx emissions and ensure that our turbines comply with both global and regional emission regulations.

Key Features:
- Robust industrial heavy duty design
- High electrical efficiency
- Dual-fuel Dry Low Emissions (DLE) technology
- Fuel changeover capability
- Established on-site service concept, eliminating need for special workshop maintenance

SGT-600 Power Generation 24.48MW(e) ISO

SGT-700 Power Generation 32.82MW(e) ISO

SGT-750 Power Generation 37.03MW(e) ISO

SGT-800 Power Generation 47.50MW(e) ISO, also available as 50.50MW(e) ISO
Siemens Industrial Steam Turbines

Siemens broad steam turbine portfolio provides versatile, reliable and proven industrial steam turbines for a wide range of power outputs, allowing us to select the optimal steam turbine to meet the specific criteria for the site and the project.

By using standard modules and customizing the steam path, the steam turbine and its auxiliaries are tailored to meet specific requirements. The steam turbine drives the generator through a speed reduction gear. The condenser is equipped with an air removal system.

**Key Features:**
- Highly efficient
- High reliability / availability
- Robust design of industrial type
- Standard turbine modules with customized steam path
- Modular auxiliary systems
- Available with axial or radial exhaust
- Suitable for air- and water-cooled plants
- Suitable for Combined Heat and Power
- Shipped assembled for easy installation at site
- Large range of exhaust sizes covering a wide range of operating conditions

SST-300  
SST-400  
SST-600  
SST-700
Typical horizontal-type Heat Recovery Steam Generator (Blackburn, UK).
Heat Recovery Steam Generator

In a combined-cycle plant, the gas turbine exhaust heat is utilized for steam production in the Heat Recovery Steam Generator(s) (HRSG). In a Siemens Industrial Combined Cycle plant, the HRSGs are typically of horizontal, self-circulating type with steam drums. The flue gas flow is therefore horizontal, and suspended vertical tubes are used. The HRSGs consist of prefabricated modules for simple and efficient assembly at site.

The dual-pressure steam cycle is selected for favorable balance of project investment and plant efficiency. Supplementary firing, emission monitoring, flue gas catalysts, and single-pressure steam cycle are examples of pre-designed options which can be tailored to specific requirements.

For Siemens Industrial Power Plants, HRSGs are sourced from suppliers with proven expertise and experience of the country of installation.

Siemens power plant control system

As a world-leading supplier of control systems for major equipment, Siemens provides a Siemens Plant Control system with integrated functions for control of the turbine control systems and those of the BOP equipment (delivered by others) with a single user interface for all functions.

Key system functions and scope:
- Operating and monitoring of the plant
- Operation and monitoring, human-machine-interface
- Plant automation system
- Plant protection system
- Engineering of the instrumentation and control system

Control diagram, plant overview
Power Islands – An Example:

The best-selling SCC-800 2x1 Power Island Block

The Siemens SCC-800 2x1 power island block with its very high efficiency is the most popular configuration of the Siemens Industrial Power Plants, thus we have selected it to illustrate our power island capabilities. Our extensive knowledge in plant design ensures plant functionality and provides for optimization of the power plant’s thermal design and steam parameters based on Siemens turbines.

The SCC-800 2x1 power island block is designed around advanced, well proven and reliable equipment:

- One Siemens overall power plant control system, controlling both turbine control system and BoP control systems.
- Two Siemens SGT-800 gas turbine generator sets with own auxiliaries
- One Siemens steam turbine generator set with its own auxiliaries
- Two Heat Recovery Steam Generators with standard auxiliaries

Other equipment is selected from approved sub-suppliers with whom Siemens works closely to ensure the delivery of equipment according to Siemens’ thorough quality program.

Main Performance Data Indication
(ISO conditions, Gas fuel)

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<th>Thermal Performance</th>
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<td>Net Efficiency</td>
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<tr>
<td>Net Power</td>
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<td>Net Efficiency</td>
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Overview of configuration and main components

Overview of a Siemens SCC-800 2x1 power island block for power generation. A power plant may comprise one or several power island blocks with associated BoP.
Siemens SGT-800 Industrial Gas Turbine

The Siemens SGT-800 industrial gas turbine is the prime mover in the SCC-800 2x1 Power Island. It combines reliable, industrial design with the high efficiency and low emissions of the latest gas turbine technology. Over 150 SGT-800 units have been sold to date, more than 80% of them in combined cycle power generation or cogeneration in intermediate or base-load plants. Fleet reliability is over 99%.

In addition to the characteristics common to all our industrial gas turbines, the SGT-800 is distinguished by the following features:

- High electrical efficiency
- High exhaust energy, giving excellent cogeneration/combined cycle characteristics.
- Cold-end drive enabling straight and simple fit with HRSGs.
- Excellent load rejection capability, <5% overspeed due to single shaft design
- Moderate gas-supply pressure