

Siemens Advanced Solutions for Future-Proof Generation



Dynamic market driving optimized solutions
Ensuring power plants can reliably meet the changing needs of customers and the grid



Innovations that matter
Advancing technologies that increase operational capability as well as reduce total installed cost



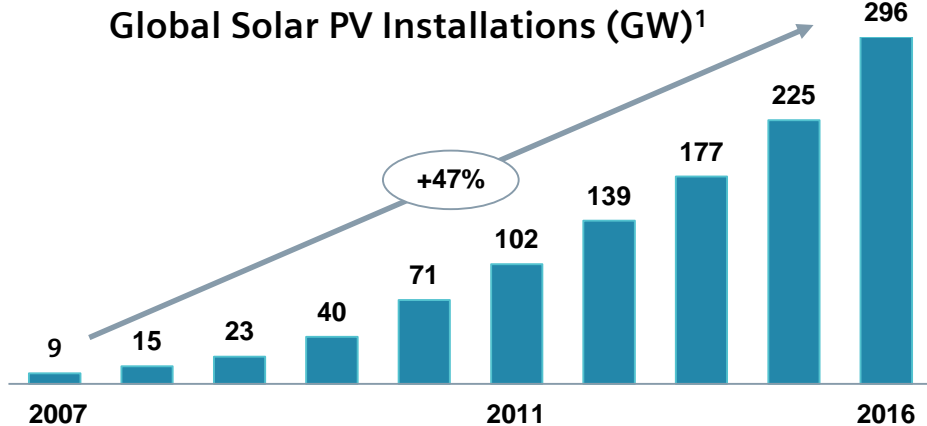
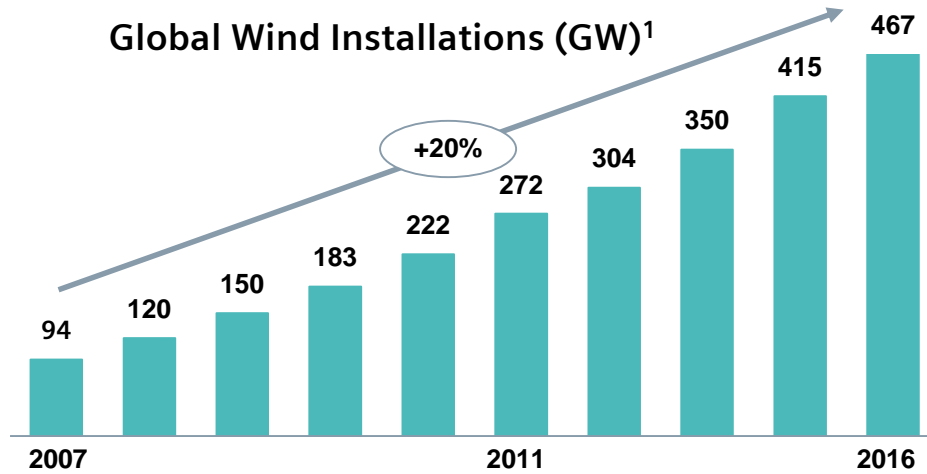
Desire for simplicity has been constant
Using digitalization to optimize operations and enhance performance

Leading innovations for Future-Proof generation

A cleaner energy future

Key element in the transition of the energy sector

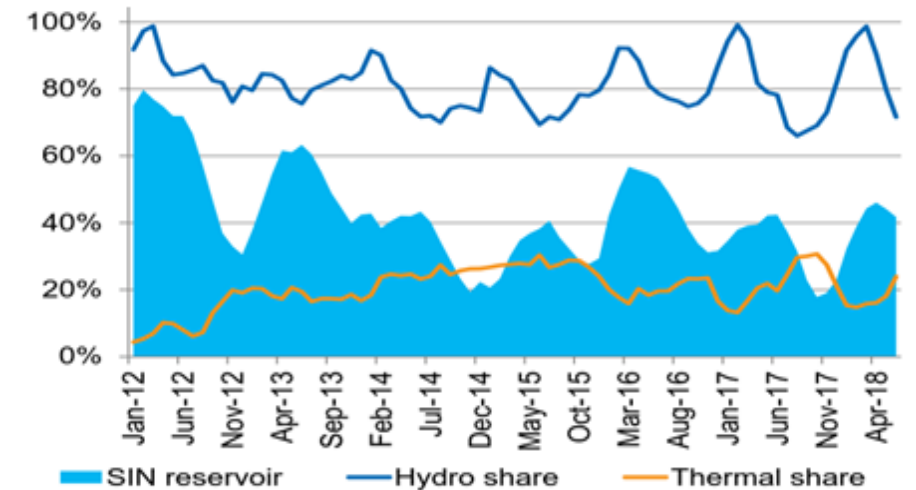
Renewables installation increase



Hydro plant challenges drives generation mix diversification

- Power generation mix **fluctuates** according to the **availability** of hydropower generation
- **Low reservoir** levels and **poor rainfall** are leading hydro generators to **underperform**

Brazil - SIN reservoir levels versus supply mix



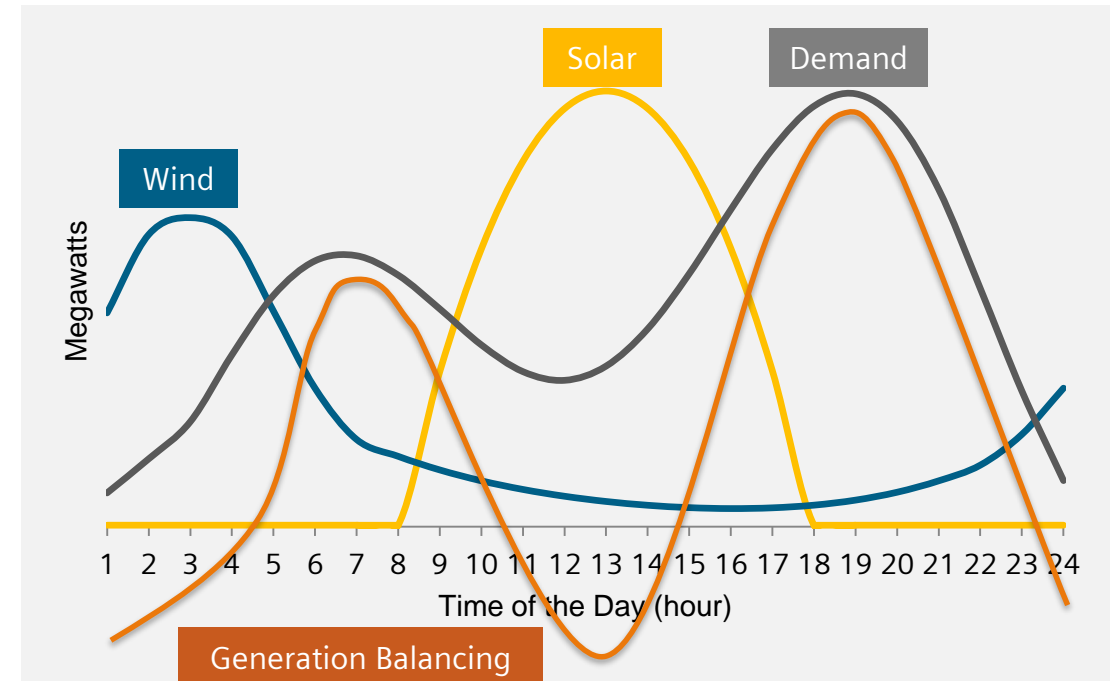
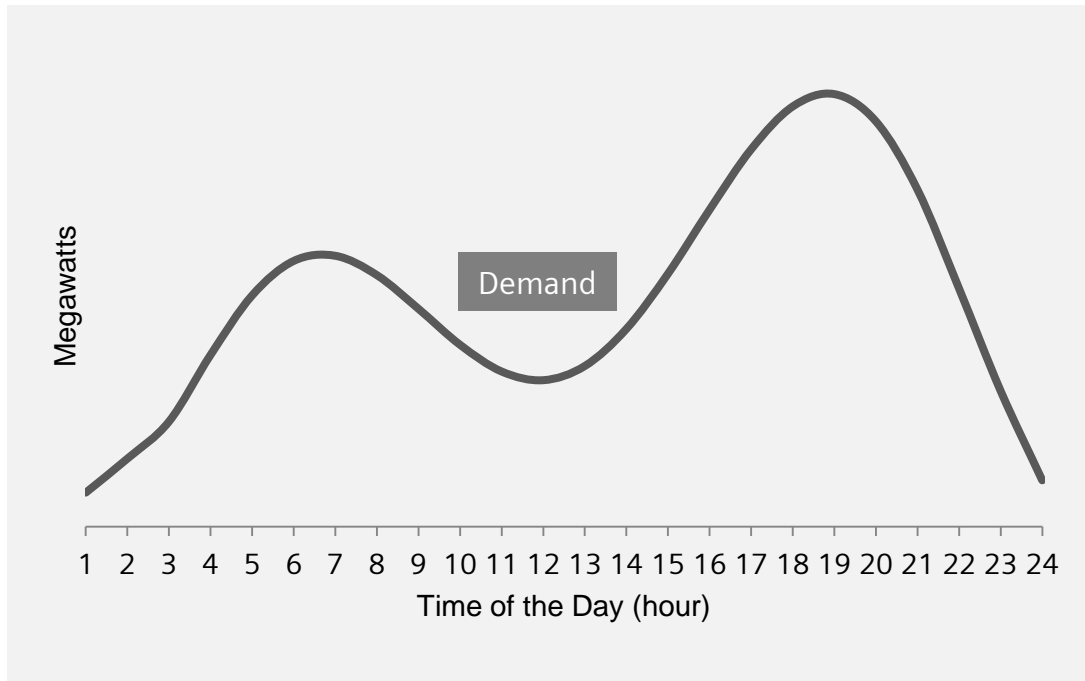
Source: IHS Markit, ONS

© 2018 IHS Markit

SIN: National Interconnected System

Source: 1) IRENA, Renewable Capacity Statistics 2017

The grid of today



Today

- Load is relatively predictable
- Renewable integration is limited
- Majority of generation from dispatchable units

Future grid

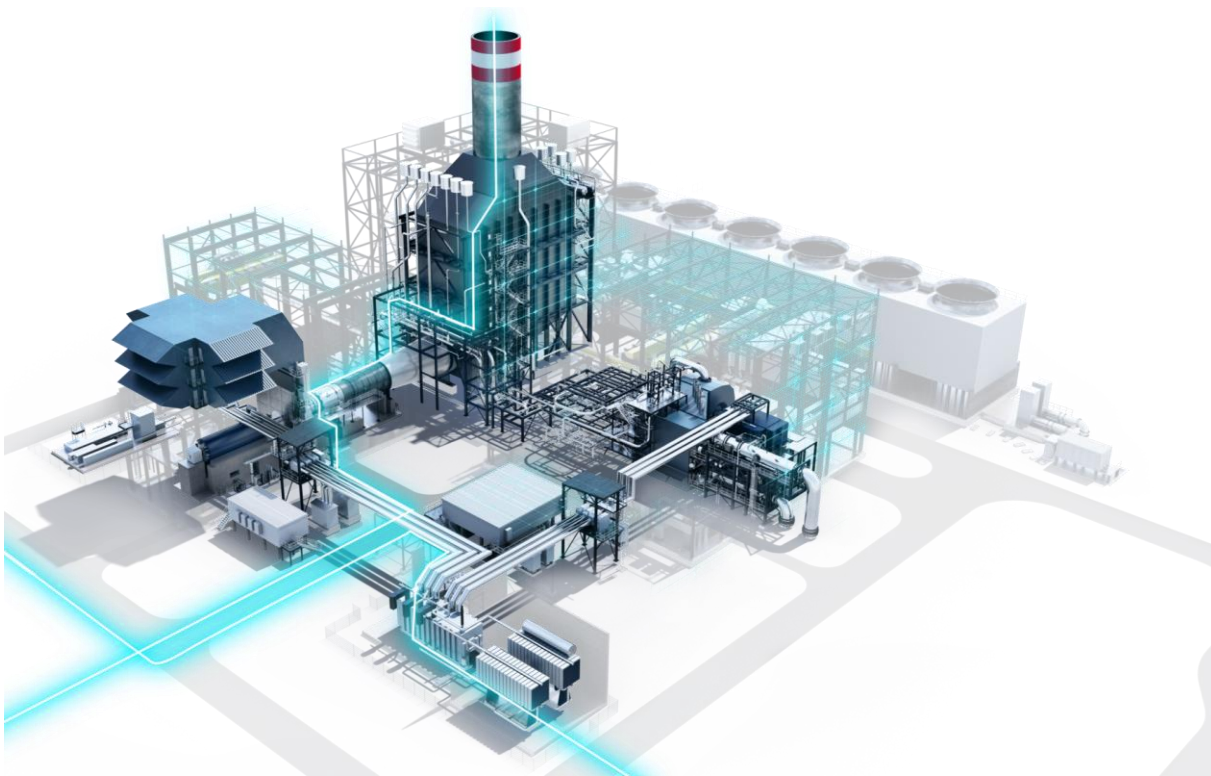
- Increase in renewable penetration
- Peaks are out of sync
- Fast, flexible resources required to balance grid

Flex-Plant Combined Cycles

Maximizing adaptability

SIEMENS
Ingenuity for life

Combined cycle plants have been an efficient, reliable way to deliver baseload generation for decades.



Siemens Flex-Plants add capabilities to combined cycle to meet changing market needs

- ✓ Fast Load Change Up & Down
- ✓ Low Water Usage
- ✓ Low Start Up Emissions
- ✓ Low Emissions while ramping

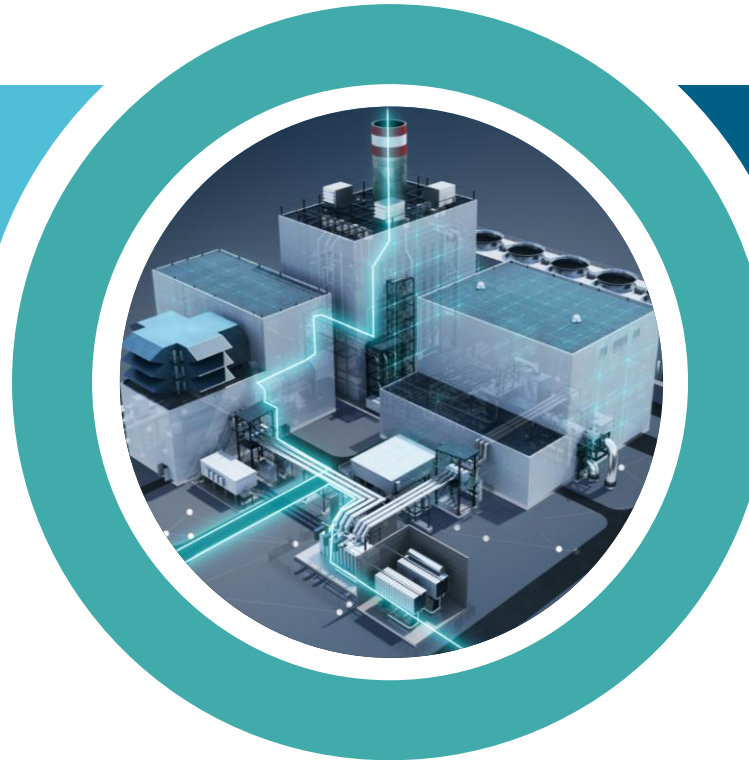
Siemens is the world leader in flexible combined cycles with 26 plants in commercial operation with > 500,000 operating hours and > 15,000 starts

Power plants – Individualized to our customers' needs

Power plant solutions

Central power generation

Main products:
Utility-size simple and combined cycle power plants



Decentral power generation

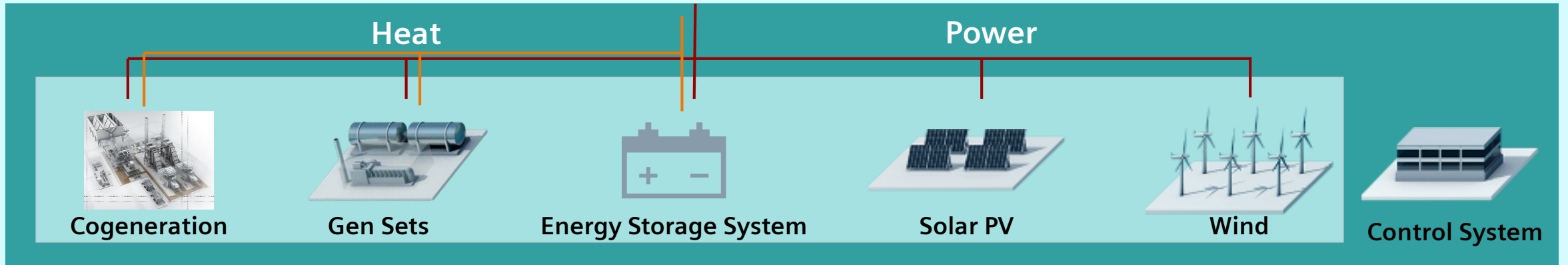
Main products:
Industrial-size simple and combined cycle power plants



Decentralized Hybrid Solutions (DHS)

Reliable generation to meet specific market requirements

Decentral Offtaker



Decentralized System

- Localized generation
- Close to end-user
- Includes power, heat, cooling, water and other applications

Hybrid

- Combines different technologies to deliver a solution more capable than either technology on its own
- More than one type of "fuel"

Solution

- Holistic service and control systems that integrate different technologies and enable easy plant operation and maintenance.

Decentralized Hybrid Solutions provide flexible generation to adapt to local needs

SIESTART™ integrates the benefits of fossil-fired power generation and battery energy storage systems (BESS)

BESS enables additional use cases



Simple cycle power plant



Combined cycle/
Simple cycle

GT / SC / Combined Cycle Power Plant (CCPP)



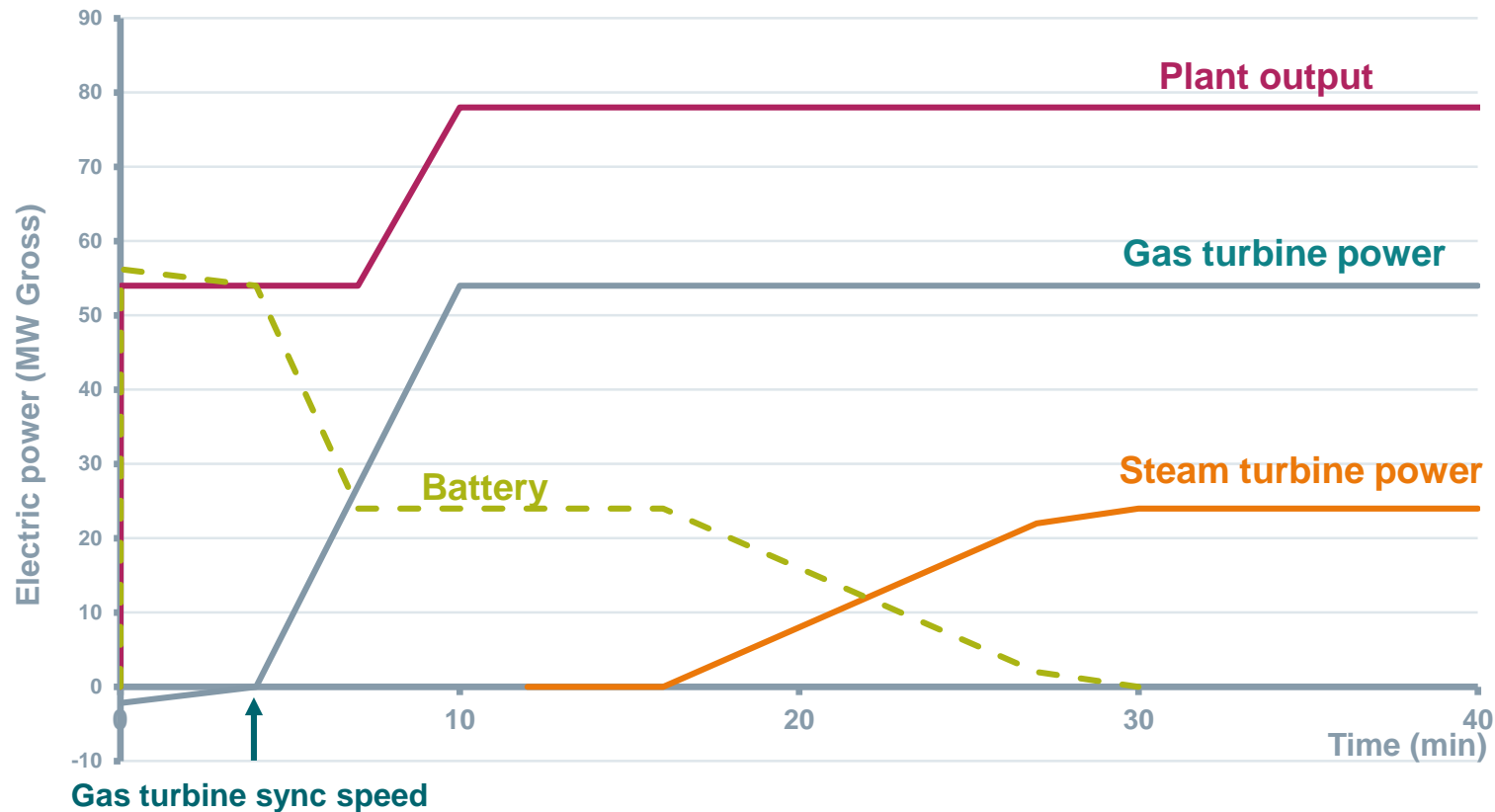
Stationary battery storage

Battery Energy Storage System (BESS)



Integrated and controlled by SPPA-T3000
the most modern DCS system on the market

Expanding plant capabilities with SIESTART™ for grid support and ancillary services



Customer benefits:

- ✓ Provides 100% of the gas turbine output within milliseconds (<1 sec)
- ✓ Provides black start power to gas turbines
- ✓ Battery output tapers off as turbines come online and ramp up
- ✓ **Plant output -immediately and continuously**

SIESTART enables higher efficiency, reduced emissions and additional revenue streams

Siemens SeaFloat Power Plants enable various applications with different plant sizes

Floating Vessel Options



Siemens Power Plant Portfolio



SGT-A65 up to 300MW



SGT-800 up to 450MW



SGT-8000H up to 1.3 GW

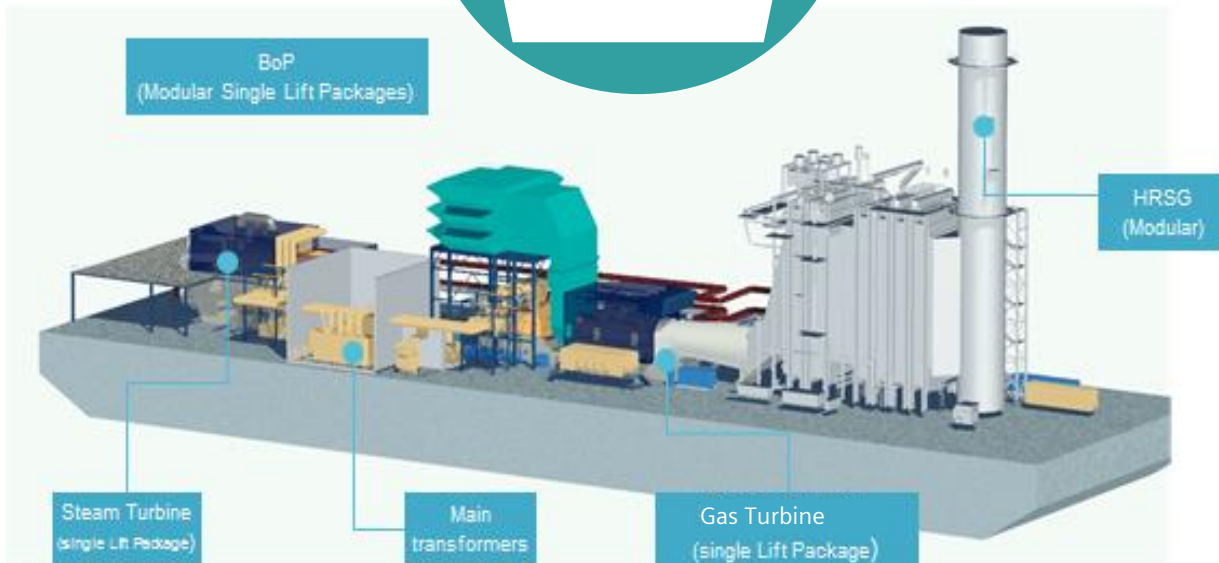
SeaFloat Use Cases

- Development and deployment in **remote areas** with sea or river access - industrial application or (isolated) national grids
- **Temporary power** or **emergency power** - **mobile asset**
- Limited **space availability** or intensive investments for **land acquisition**
- **Replacement power** - Substitution of old power plants (e.g. coal fired power plants)
- **Gas to Wire** solutions on offshore platforms

SeaFloat provides the right solution for each use case

SeaFloat provides additional project benefits

Pre-designed and pre-constructed package modules



- ✓ **Lower construction cost**
Less erection costs, less on-site construction hours, less on-site infrastructure necessary
- ✓ **Reduced risk**
Less dependence on local skilled labor, avoid typical soil risks, safer site construction, pretested, proven, reliable design
- ✓ **Faster project execution**
Enables shorter project schedule, earlier engineering deliverables, parallel activities, fast and easy installation of components