

SYNCHRONOUS CONDENSERS



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Synchronous condensers, also called synchronous capacitors or synchronous compensators, are synchronous machines which can provide voltage regulation, reactive power, short circuit power, and inertia to the grid.

They play a key role due to the increased production from renewable sources and shutting down of conventional power plants that leads to a worsening of electricity supply services, voltage quality and grid stability. A strategic deployment of synchronous condensers stabilizes the grid and helps to reduce the risk of blackouts. Simple, very reliable industrial solutions use turbogenerators or salient pole generators as synchronous condensers.

Thanks to its experience with more than 1,300 units installed worldwide, Ansaldo Energia can provide a wide portfolio of proven and reliable generators equally suitable for both power generation and synchronous condensing applications. Now grid owners looking for the most reliable and simple solution to stabilize their grids can take advantage of the accumulated know-how gained about our generators in the energy sector in terms of proven design, state-of-the-art technology and robustness.

Types of Generators / Synchronous Condensers



Up to 1200 MVA

HYDROGEN - WATER COOLED TURBOGENERATORS



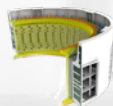
Up to 700 MVA

HYDROGEN COOLED TURBOGENERATORS



Up to 440 MVA

AIR COOLED TURBOGENERATORS



Up to 420 MVA

HYDROGENERATORS

Stand alone package

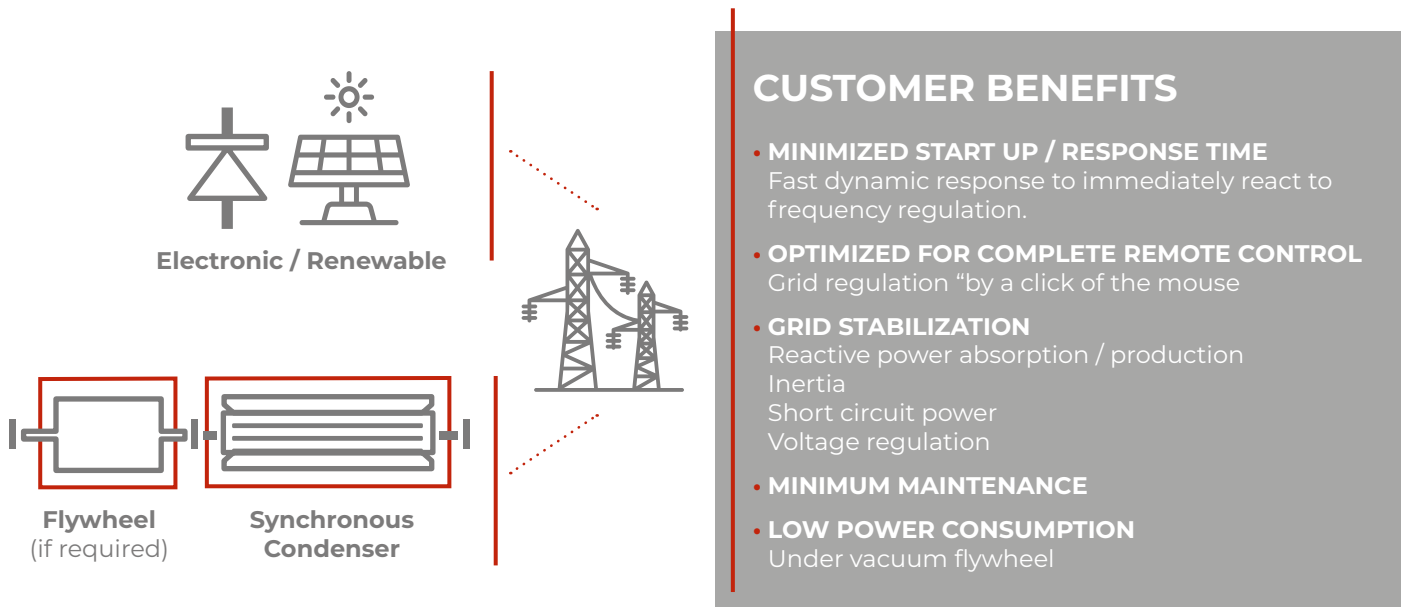
Stand-alone packages are particularly useful for grid nodes where power electronics or renewable energy sources are connected.

The electrical generator is installed specifically as a synchronous condenser, a quick, proven and compact solution for grid stabilization.

Based on the shaft inertia and electrical parameters required by the grid, this package is configured by combining standard turbo generators with minor adjustments (e.g. thrust bearing, phonic wheel, etc.), or using as alternative a fully tailored salient pole machine.

A flywheel can be supplied to provide the best match with the specific project requirements.

The standard, under vacuum, flywheel for direct and rigid coupling with 3000 rpm turbogenerators has extensive operational records thanks to the units connected to the Italian HV grid.



Under vacuum flywheel

The flywheel is used to increase the rotating mass of synchronous condenser for enhancing grid stability services, this is made by direct coupling of an additional inertia to the synchronous condenser rotor.

Ansaldo Energia, starting from specific constraints of required inertia, minimization of power consumption, and availability defined a standard under vacuum flywheel, which is installed in different projects in Italy.

The standard referenced flywheel, with more than 2 meters in diameter, gives an addition of about 1.35 GVAs inertia to the synchronous condenser shaft and it is accompanied by an innovative liquid seal technology allowing for high vacuum operation, thus minimizing windage losses.

The liquid seal technology allows to online transition to operation without vacuum in case of emergency, hence increasing plant availability.

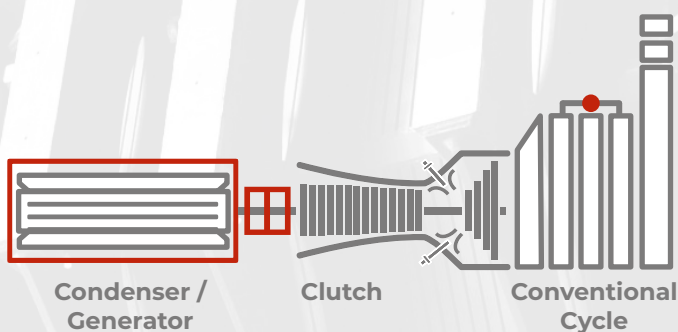
The design and operational experience gained on the first units supplied give Ansaldo Energia to propose a fully referenced solution that can be tailored to provide even higher inertia values.

Power Plants with synchronous condensing capacity

In conventional, combined or open cycle plants, the turbine driven generator is decoupled from the turbine by a clutch and operated as a condenser; this solution is suitable for Customers needing to supply reactive power to the grid and no active power (turbine not in operation), as well as to reconnect the turbine(s) in the event of active power demand, ensuring the maximum level of operating flexibility for the Customer.

Two operating modes are therefore possible:

- Power Mode (turbine engaged)
- Synchronous Condenser Mode (turbine disengaged)



CUSTOMER BENEFITS

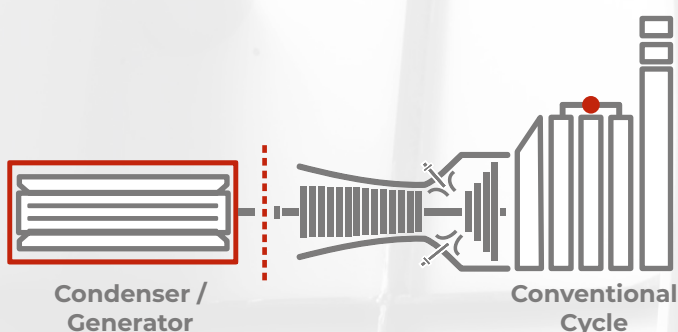
• OPERATING FLEXIBILITY

Maximum capability to catch market opportunities in terms of active power production or providing grid services only and most favorable participation to ancillary service markets (where allowed by National Grid Codes).

NB: It is also possible to switch from Power Mode to Synchronous Condenser Mode by disengaging the clutch when the turbine is already supplying power to the grid. In this case, the turbine is shut down, while the generator remains connected to the grid, working as synchronous condenser.

Retrofit solutions for existing power plants

Ansaldo Energia provides full support to convert existing or obsolescent power plants to synchronous condensing facilities, adding new value to present assets. We can tailor the most suitable option according to Customer needs, ranging from the easiest solution, i.e. mechanically decoupling the turbine and using the generator as a stand-alone package, to more specific ones such as identifying the suitable operating points for the turbine in order to move the generator with no active power delivered to the grid or concurrently providing reactive power to the grid and active power for energy storage.



CUSTOMER BENEFITS

• MAXIMIZE YOUR INVESTMENT RETURN FROM EXISTING PLANTS

Our tailored solutions to keep alive your old plant.

Summary

RATING	Up to 850 MVAR
RATED VOLTAGE	Max. 27 kV
INERTIA	As required by grid
EXCITATION	Static
STARTING	SFC or as required

Worldwide references

Ansaldo Energia generators and synchronous condensers combine the proven design of a long tradition and know-how dating back to 1920. Thanks to its experience with more than 1,300 units installed worldwide, Ansaldo Energia can provide a wide portfolio of proven, reliable and trouble free-operation generators equally suitable for both power generation and synchronous condensing applications. Now grid owners looking for the most reliable and simple solution to stabilize their grids can take advantage of the accumulated know-how gained about our generators in the energy sector in terms of proven design, state-of-the-art technology and robustness. The high level of reliability combined with negligible maintenance downtime and costs result in an excellent record of availability. Fast track delivery, installation and commissioning capabilities add a key value to Customer profitability.

Case Histories: TERNA project



CODRONGIANOS - PROTECT DATA

2 x 250 MVAR
Speed: 3000 rpm
Voltage: 19 kV
Delivery Time: 20 months from NTP to PAC
(4 month in advance from contractual scheduled data)
Operation year (units connected to grid): 2014



MATERA, FOGGIA, GARIGLIANO, SUVERETO, CANDIA, VILLANOVA PROTECT DATA

8 x 250 MVAR with flywheel
Inertia: more than 1.75 GVAs each shaftline
Speed: 3000 rpm
Voltage: 19 kV
Operation year (units connected to grid): Since Dec. 2020

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