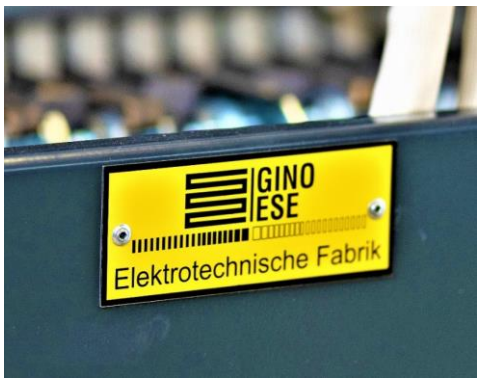
GINO AG

Elektrotechnische Fabrik



Special applications

Product data catalogue

GINO
ESE

1 High performance liquid resistance starter (LRS)

Some applications require tremendous power capabilities. One example is a reversible hydroelectric facility such as a pump-storage power plant.

The force of water stored in an elevated reservoir is used to produce electricity by passing it through a turbine and into a lower located basin. The pumped storage hydro power plant is an important source of grid power due to its fast availability and high efficiency between 70-80%. Especially during hours of peak energy demands the turbines can run on high capacity. As soon as there is lower demand and surplus energy available the turbines can be used as large water pumps and refill the higher located storage reservoir for the next duty cycle.

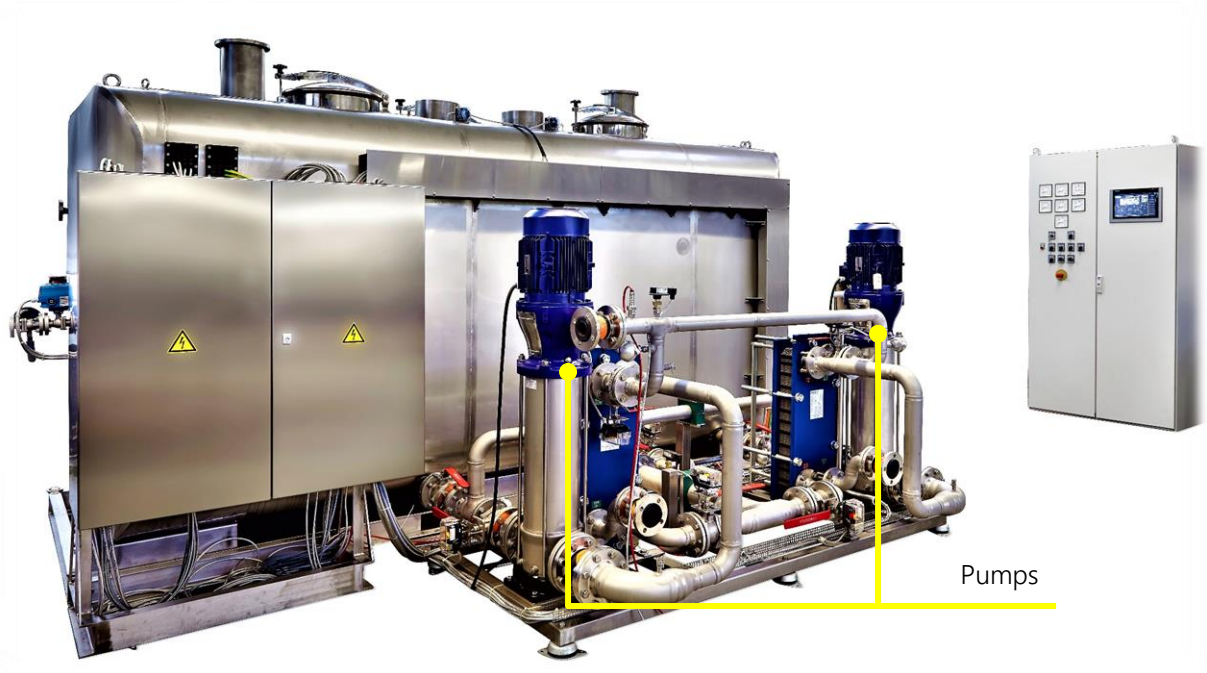
Due to the large size of the pump-turbine machine with the resulting high inertia of the pump rotor the startup of the pump function is accomplished by a proxy-motor. Often these proxy motors to rotate the pumps rotor exceed powers of 15MW. In order to control the starting currents and the proxy motors torque a high performance liquid starter is used.

This liquid starter needs to have a large tank volume to start up the high power motor, a redundant cooling system for high availability, advanced sensors for process control as well as a special control system for integration in the plant control and grid synchronization of the motor.

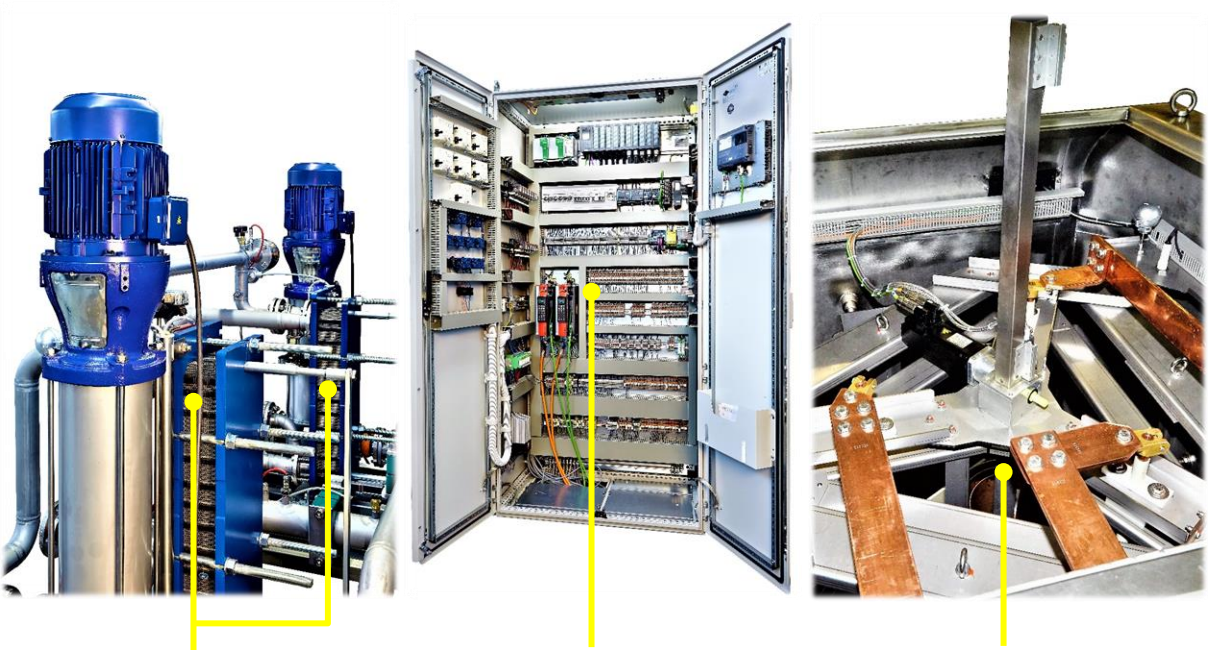
The on the next page presented high performance LRS is designed for TIWAGs KW Kühtai storage power plant with an overall installed power of 37.4 MW on two pump generator sets.

For liquid starters, the electrolyte solution of Na2CO3 acts as resistor, which resistivity in turn depends on the soda concentration. By changing the distance between upper and lower electrodes, the resistance is reduced smoothly. In addition, the fluid acts as an energy storage medium for the dissipated heat during start up procedures. Following the startup, the energy is then slowly dissipated to the atmosphere over the tank surface.

Design overview:



LRS for TIWAGs KW Kühtai storage power plant



2 Conveyor starters

The belt conveyor is a main component of mayor mining operations all over the world. Especially for the long distance overland conveyors, the high power wound rotor induction motors (WRIM) must be started up in a smooth way to avoid belt slip and power quality issues. For this application GINO AG delivers oil-cooled as well as air-cooled conveyor starters with customized (binary) step control.

The air-cooled conveyor starters are made of cast iron banks mounted in frames and controlled by an engineered step control system installed in a separate switch cabinet. The resistor systems are designed for full load start-up as it must be possible to restart the conveyer in fully loaded condition without removing tons of material first.

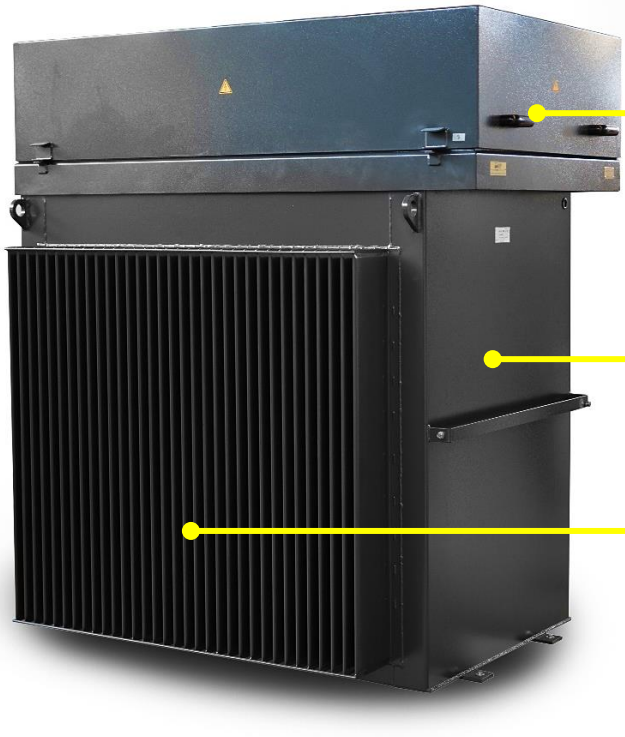
An alternative solution is based on oil-cooled starters with external slip resistors made of cast iron banks under the same control philosophy. The design combines the advantages of a resistor starter with those of a more economical heat carrier (oil) and a high protection class for applications in harsh environments. Robust power contactors guarantee high operational reliability and a long service life combined with low maintenance requirements.

We own a successful track record in the mining market for over 30 years which gives us the experience to specifically engineer and calculate an advanced starting system customized to our customers' demands.

The list of large mines using GINO AG starters:

- MaeMoh mine
- Hongsa mine
- Chuquicamata mine
- Radomiro Tomic mine
- Peñasquito mine
- Maritsa Iztok mine
- RWE Power coal mines

Design overview:



Oil-cooled conveyor starter

Air-cooled conveyor starter

3 Oil- / water cooled resistors

The oil/water cooled resistors are customized resistor systems that are designed for applications with special demands. It combines the advantages of fully enclosed oil cooled resistors with an external cooling circuit and can therefore be used for high voltage applications with high duty cycles. The introduced solution is customizable in order to be adjusted to different applications as well as various ambient conditions.

Oil-cooled resistors are used as braking resistor for frequency convertors, slip resistors for large motors or neutral grounding resistors in hazardous environments. They are designed for continuous or short time power and can absorb considerable more loads than models with air-cooled resistors. The heat exchanger cools down the resistor unit permanently on an operation temperature of approx. 80°C. Main advantages of oil-/water-cooled resistors at a glance:

- High voltage insulation up to 36kV;
- High protection degree of IP54;
- Capable of continuous load duty;
- High dynamic loads possible (current peaks);
- Low heat dissipation to the installation place;
- Small footprint.

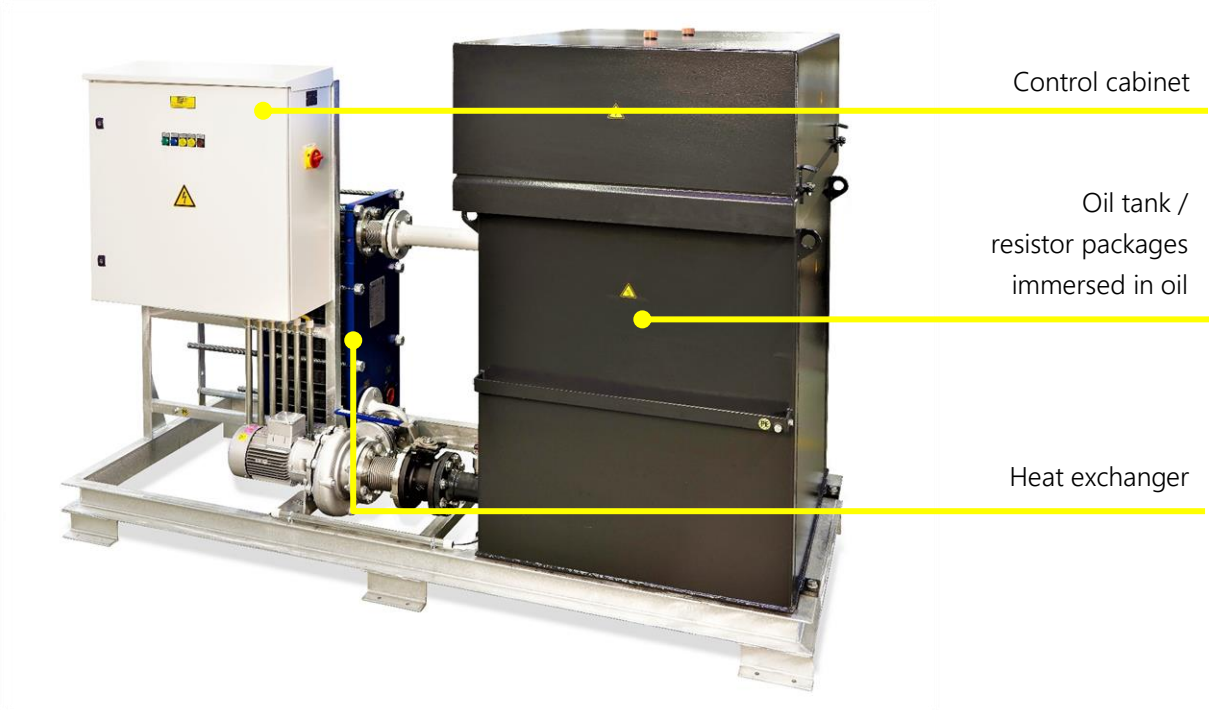
The sheet steel housing consists of the oil tank, a top plate fitted with resistors, and a cover. The resistor unit in the oil tank is assembled by cast iron elements.

The bushings are installed for connecting the wiring of the resistors, as well of the external cables.

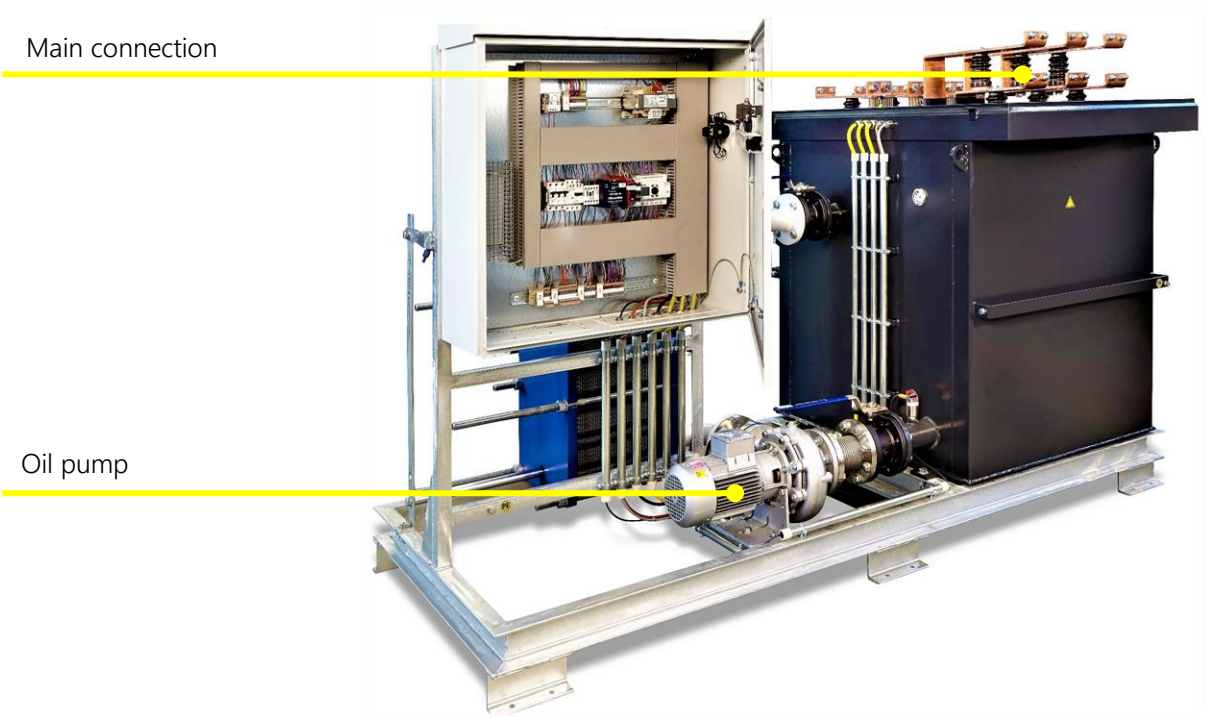
The oil/water cooled resistors are commonly used as:

- Continuous slip resistors (e.g. for sugar mills)
- Water cooled oil starters (e.g. for applications with 36 starts per hour)
- Braking resistors (e.g. in machine rooms on ships and offshore vessels)
- R-couplings for filter systems
- Hazardous location installation (ATEX, Hazloc))

Design overview:



Oil- / water cooled slip resistor



4 Liquid-cooled load banks

The station operators must be assured the generators work properly to full power capacity. Therefore, there is a need for load banks to test the generators output or to serve as a dummy load when the grid cannot accommodate the energy and a shutdown of the plant is either not possible or not economical. For very high powers a fixed resistor system as a load container is too expensive and too large. As an alternative option, the surplus energy can be dissipated by controlled heating of water within a hydro load bank. For the cooling of the hydro-load banks a large amount of cooling water is required. Therefore, it is mostly used in hydro power plants where the load banks can be cooled directly with river water.

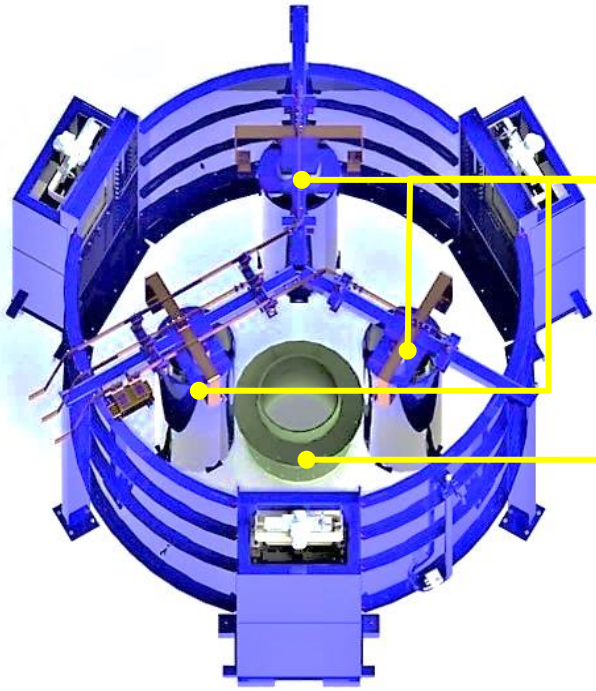
The three phase power supply on a hydro load bank is connected to three cylindrical electrodes via high current bus bars. The star point of the system is created by the current flow between the cylindrical electrodes. As the electrodes are isolated the only possibility of current flow is in the water column between the electrodes. The supply of untreated river water is at the bottom of the tank with the amount of cooling supply water depending on the power consumption of the load bank.

With the hydro load bank acting as a variable electrical load there must be a variation in system resistance to simulate different load situations. This load variation is done by manipulating the water level and therefore the percentage of electrode surface witch is surrounded by the water. The level of the water in the tank is controlled by spillways with sluice gates that can be lowered and lifted by a geared motor.

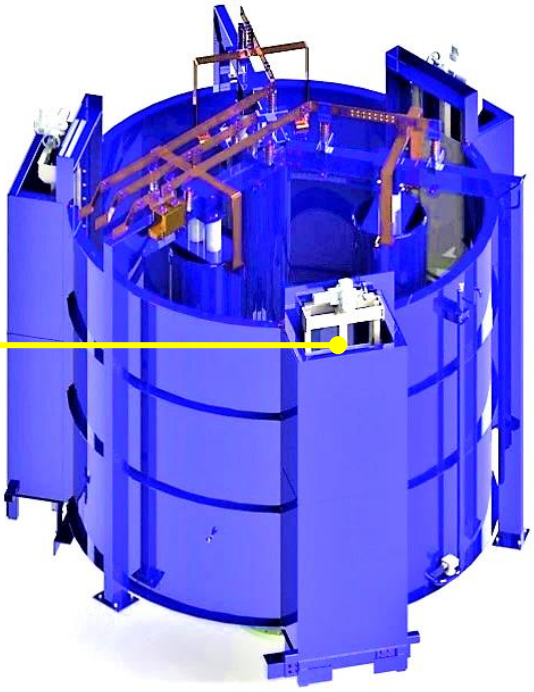
The main advantages of hydro load banks:

- economical pricing due to available resistance medium (water)
- very small footprint
- low maintenance cycles

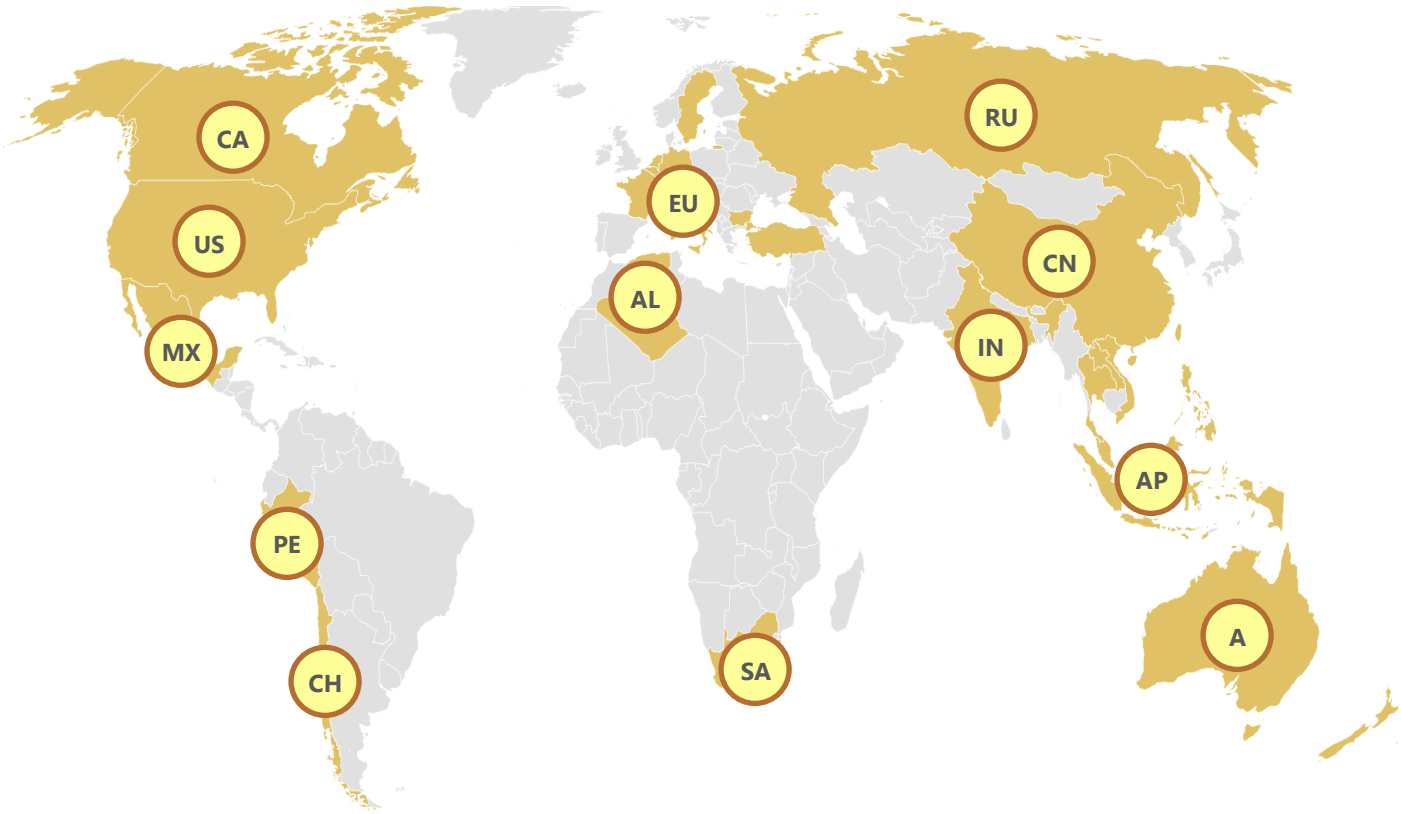
Design overview:



Liquid-cooled load banks for Isola Serafini power plant



GINO Representatives



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