

Grid Synchronization and Connection

مؤسسة الإمارات للطاقة النووية
Emirates Nuclear Energy Corporation

شركة بركة الذوق شركة
Barakah One Company PJSC



شركة نوا للطاقة
Nowah Energy Company



The Barakah Nuclear Energy Plant is the first peaceful nuclear plant in the UAE and the Arab World. It consists of four nuclear units of the APR1400 design each one capable of producing up to 1,400 megawatts (MW) of electricity. Once fully operational, the Barakah plant will generate up to 25% of the UAE's electricity with zero emissions, preventing the release of 21 million tons of carbon dioxide into the atmosphere.

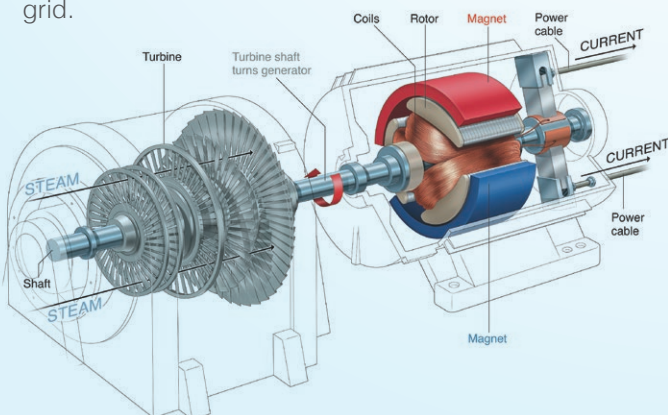
What is grid synchronization and connection?

Grid synchronization or grid connection, is a historic moment for any energy plant. This marks the first time that the electricity produced at the plant is delivered to the national grid. To do this, the plant's operators and engineers bring the electric generator to the same conditions* as the electric grid, allowing the two to connect safely.

How does grid connection happen in a nuclear plant?

In a nuclear energy plant, grid connection happens in the same way as in any gas, coal or oil-fired plant. The equipment and process for grid connection are all the same. The main difference with any fossil-fueled plant is that a nuclear plant uses uranium pellets as fuel to generate heat, which creates steam that spins a turbine, which in turn drives the electric generator to produce electricity. This process creates zero CO2 emissions.

To connect a nuclear plant to the electrical grid, the reactor operators slowly increase the heat generated by the reactor to generate enough steam to begin spinning the turbine and driving the generator. Once the reactor is at about 15% power, enough steam is created to have the turbine spinning at its optimal speed. This allows the electric generator to prepare to synchronize and connect to the national electricity grid.



* the conditions are: equal line voltage, frequency, phase sequence, phase angle, and waveform.

What is an electric generator?

The electric generator is a device that converts mechanical energy to electrical energy. Generators are the machines that provide all electric power around the world. The source of the mechanical energy is typically a turbine that spins to drive the generator.

Inside the generator, metal coils spin inside a set of magnets, generating electric current. This current is transmitted through a power cable connected to the electric grid.

At the Barakah Nuclear Energy Plant, we have one of the largest turbine-generator systems in the world, capable of producing 1,400 MW of electric power. In total, it is about 63 meters long and it is 9 meters in diameter at its widest section. It spins at 1,500 revolutions per minute (RPM). The electrical generator is produced by Toshiba, and is driven by one high-pressure and three low-pressure turbines made by a joint venture between Toshiba and Doosan, using a Toshiba design.



What happens next?

Following the successful startup of the reactor and then the grid synchronization and connection of the generator, the plant operators slowly increase reactor power and electrical output. This process is called Power Ascension Testing (PAT). We conduct numerous tests at different power levels, ensuring that all equipment is performing safely and as designed. This process takes several months to complete, until the Unit reaches 100% reactor power and is delivering 1,400 MW of clean and reliable electricity to the nation.