

100 MW **5th GENERATION** 5STGR POWER STATION FOR COGENERATION AND LOW COST ELECTRICITY AND DRINKING-WATER PRODUCTION



Proposal for the 5 x 20 MW Floating Modular 5STGR Power Station



5STGR with Freshwater MED – Multi Effect Distillation Water-plant – for 2 x 6000 tons of water per day

5STGR: Generation 5 (CDF=0) nuclear reactor

5S – Sustainable, Safe, Smart, Simple, Small

TEN|Energy, 2019-01-21

Introduction:

The 5STGR 100 MW Barge-mounted power station is the ideal solution to combine low cost electric power generation with the production of low cost, high quality water for drinking-water, beverages and for use in hospitals, food-industries and various other industries, such as e.g. the oil-industry. The power-plant can also be placed on land if needed. This because the 5STGR 100 MW barge is an inherently safe plant.

For high quality water production MSF, Multi Stage Flashing or MED –Multi Effect Distillation, are used. These systems use 10 to 40 times less electricity, when compared with RO-Reverse Osmosis; see www.pcswatertreatment.com and www.pca-gmbh.com.

The 100 MW Barge-mounted 5STGR plant consists of 5 modular 20 MW units and each unit has two (2) skid-mounted 10.000 kW turbine-generator sets. This makes the electric power supply extremely reliable and the skid mounted concept minimizes the down-time of each modular unit.

The 5STGR module consists of a 20 MWe co-generation power station and with about 20 MW heat, as low back-pressure steam, to produce 5.000.000 litres/day of high quality water through a MED or MSF unit.

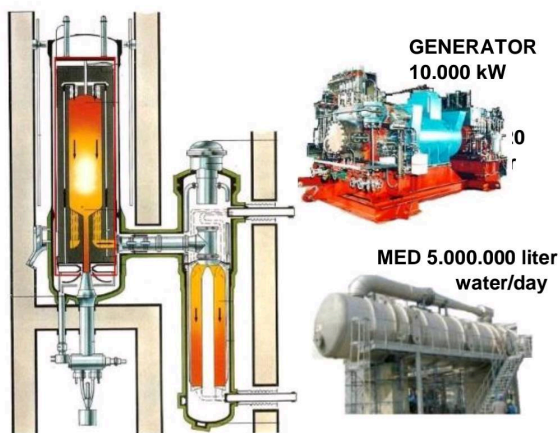


Figure 1: 5STGR –Reactor and Steam-generator, Generator and MED-Multi Effect Water Distillation Unit.

The process schematic through the steam-turbine and generator is shown in figure 2.

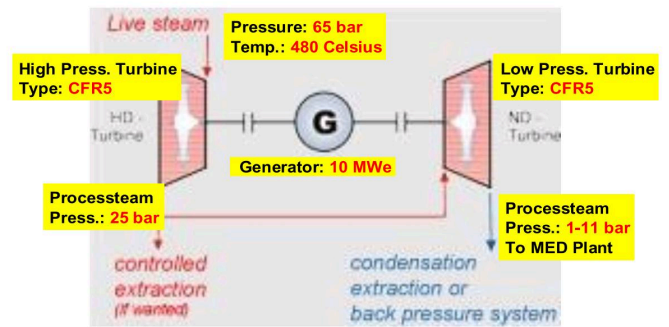


Figure 2: Generator with steam-turbines

By using the 5STGR as CHP plant high fuel-efficiency is obtained whereby the heat can be used to produce high quality water or for various other heat-processes.

5STGR Fuel Pebble:

The fuel of the 5STGR is the Graphite Fuel Pebble containing about 10.500 TRISO fuel kernels in each pebble.

INHERENTLY SAFE STGR FUEL

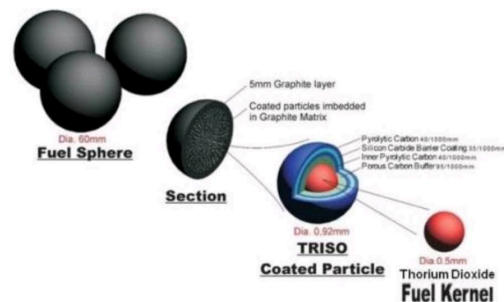


Figure 3: 5STGR Fuel Pebble

The Pebble is pneumatically loaded in the reactor and through a Multi-Pass system and during its’ life-time of 3 years will, on average, pass through the reactor 6 times. This means that that modular 5STGR does not need, like current reactors, to be shut down for refuelling. This increases the availability of the 5STGR significantly and reduces radiation exposure to personnel.

The design of the fuel is such that in addition to the Thorium many other fuel types can be used in the TRISO Fuel kernel.

The 5STGR is an inherently safe reactor; this means that a core damage accident is not possible in the 5STGR. The Pebble

temperature can not, by the design of the reactor, exceed 1100° Celsius while the graphite integrity of the fuel pebbles and reactor components remains stable till over 2500° Celsius.

Production of High Quality Water

The barge-mounted 100 MW 5STGR in combination with the floating MED/MSF water-plant is the ideal solution to produce large quantities of drinking water and solve the water scarcity problem in the world.



Figure 4: Water-scarcity by 2025

The schematic in figure 5 shows how the 5STGR is combined with a MED/MSF installation unit and how the high quality water is made. The nuclear part from the 5STGR is never in contact with the drinking-water part in the MED or MSF unit. The pressure in the steam-cycle of the reactor is higher than the pressure of the Helium coolant in the reactor. Helium is a noble gas that can not become radioactive.

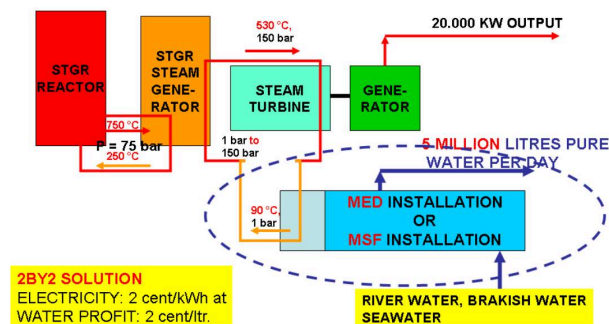


Figure 5: 5STGR with MED/MSF

In this way we can make the best quality water even with seawater or brackish water. The environmental organizations have expressed their concern towards big

water companies to stop drilling water-wells for drinking-water and in this way destroy fertile agriculture land and create very dry land. The situation in California has become so serious out that most likely the only solution for the state is sea-water desalination.



Figure 6: Pure water with 5STGR

For the future of California the 5STGR is one of the best solutions.

Transportation of the Barge-mounted power-station and drinking-water plant.

The Barge-mounted 5STGR has one great advantage; stand-by plants can quickly be commissioned at any location where electricity or drinking-water is needed.



Figure 7: Haiti struck by IRMA (2017)

These barges, can be located at strategic locations and could bring quick relief in places where disasters, such as flooding, earthquakes, hurricanes have taken out most of the needed infrastructures.

The hurricanes will come every year and it appears that their force is getting stronger; we will have to cool down our planet.



Figure 8: Orient Bay – Saint Martin struck by IRMA (2017)

The barges-mounted 100 MW 5STGR plants and the drinking-water plants can easily be transported by special carriers to the disaster affected places and be in operation in the shortest time.

Each 100 MW 5STGR plant can also produce 25.000 cubic meter of high quality drinking-water per day.



Figure 9 : Water for Florida – struck by IRMA (2017);
<https://www.bustle.com/p/can-you-send-water-to-florida-for-hurricane-irma-81405>

In this way the 5STGR solves two problems in any disaster; Power supply and Drinking-water needs.

Safety of the 5STGR:

The international nuclear industry has prepared criteria for Generation IV nuclear reactors to be on the market in 2030. These criteria, 1-Enhanced Safety, 2- Minimal Waste, 3-More Economical, 4-Proliferation Resistant, applied to the 5STGR show that the 5STGR is a Generation V power station because its performance, on each criterion, is far better then Generation IV.

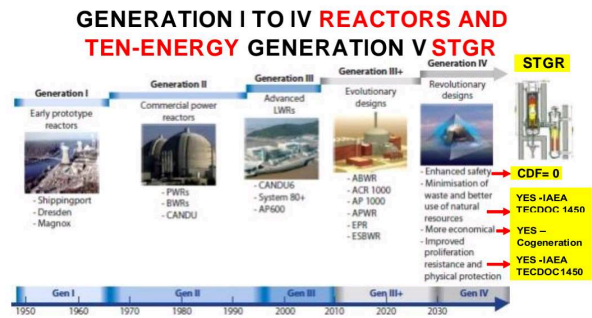


Figure 10: Generation I to IV and 5STGR

Deregulation and the Digital Society:

It has to be mentioned that the 5STGR is the better solution for the Digital Society and the Deregulated energy market; this has been described in an excellent way in the The Dawn of Micropower, The Economist, August 5, 2000.

The inherently safe 5STGR modular plant can also be introduced, on land, in our local Distributed Generation Networks where high quality power is needed.

This is a great advantage and reduces T&D costs.

The attractive applications 5STGR:

Aside of Disaster Relief the 5STGR is one of the best solutions to decrease CO₂ emissions and push back Global warming. Some very attractive solutions, that come with the 5STGR are mentioned below.

-Co-Generation

The co-generation, combined heat and power CHP, 5STGR plant offers many interesting applications aside of the high availability and quality electric power supply; these are:

-Replace Fossil Fuel plants at heavy industries at coastal and river sides: The greatest danger for our planet is the heating up by CO₂-emissions in the industrialized countries. As a result of UN initiatives to reduce CO₂ emissions an attractive solutions for industrial plants in coastal area or along rivers could also be served by

barge-mounted 5STGR's, which can be commissioned instantly when available.

-Replace coal-fired boilers powerplants:

Another huge market is to remove the coal storage area, the stacks and replace coal fired boiler, on land, with the 5STGR reactor and steam-generator. In this way most of the assets and investment is rescued at such a coal fired plant.

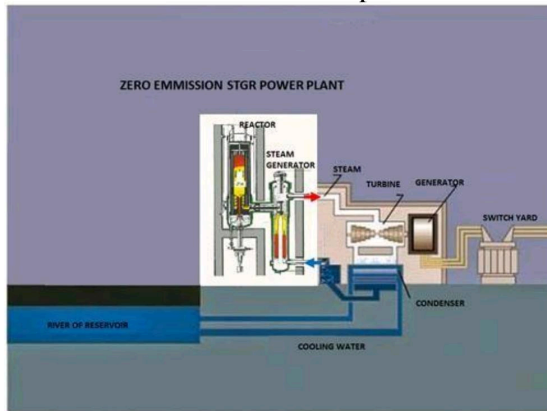


Figure 11: Replace Coal Fired Boiler by 5STGR reactor and steam-generator.

-The Hydrogen Economy

It is known in the scientific world that the Hydrogen economy can only come with cheap, and inherently safe, nuclear power.

The hydrogen technology, combined with the Fuel-Cell cars and buses are an excellent solution to solve the air-pollution problems in all densely populated cities.

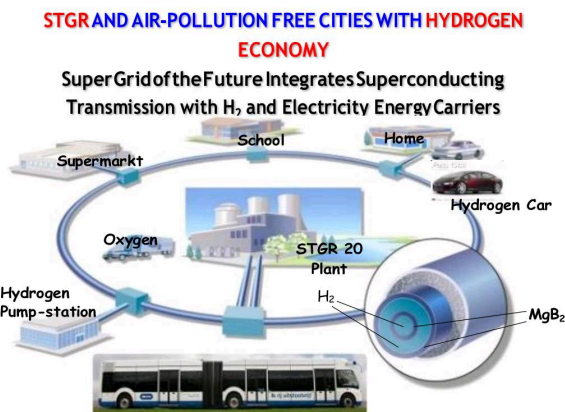


Figure 12: Hydrogen Economy
(Source: EPRI)

By combining the hydrogen- and fuel cell technology with the 5STGR technology, we also solve the greenhouse gas emission problems and reduce climate changes.

In this brochure the 5STGR is described as solution for high quality electricity in local networks and for high quality drinking-water, food and air. These are the important needs for our life.

Furthermore we have to push back Global Warming and give all the low level islands can be saved from high sea water rise.

The 5STGR is one of the best solutions to save our Planet.