



Gas Turbine Power Augmentation Systems

We deliver different SOLUTIONs!

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Gas Turbine Inlet Air Cooling Technologies (GTIAC)

Gas turbines output power decreases with respect to ISO design condition when ambient temperature rises significantly. The results show reductions of power to be about 0.5-0.9%, due to each °C ambient air temperature growth.

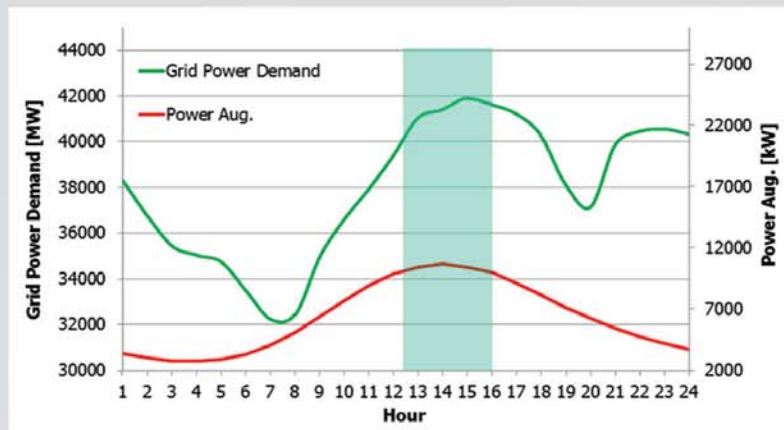
On the other hand, demand for electric power and the value of electricity are greatest at those times of high ambient air temperature, when Grid loads are maximized.

Cooling the inlet air is a common way to retrieve the turbine lost power. It increases mass flow rate of the inlet air, so more work is done by the gas turbine.

The cooling technologies can be categorized to major groups of Evaporative & Refrigerative cooling. Evaporative cooling is more common due to low cost and simplicity.

Power Augmentation at Peak Hours!

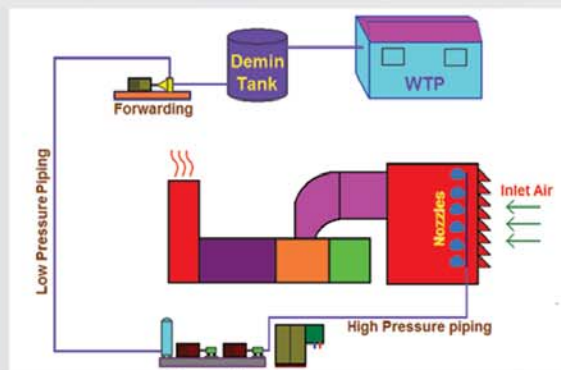
TIAC helps the Grid to compensate the gap between the electric power production & consumption, especially on peak hours. The below figure illustrates the issue.



Fog cooling system:

High pressure Fogging is a method of inlet cooling where demineralized water is converted into fine fog droplets by means of specially designed atomizing nozzles operating at pressures between 70-140 barg. As the fog evaporates in the intake duct, it cools the air.

Fogging nozzle is the heart of the inlet fogging system. Rahavard Energy offers its clients a type of Impaction pin nozzles, which is famous for its fine droplet size & effectiveness. More than 30 GT units have been equipped with Fog cooling system by Rahavard Energy (as Subsidiary of E-Man Serve), increasing more than 200MW of power during peak hours!



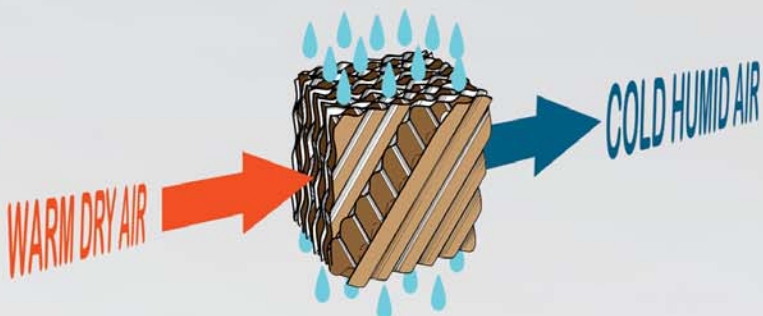
Media Evaporative Cooling System:

The simple operation of Media cooler as a kind of evaporative cooling system has made it an appropriate solution for gas turbine power augmentation. The evaporation surface consists of media pads which can be made of simple cellulose or fire-resistant Glass fiber material. Such system is used as a preferred method in dry-hot climates, which can be expected to boost Gas Turbine output power about 10-15%.

Rahavard Energy, as a subsidiary of E-Man Serve, is proud for implementing Media cooling system on 24 No. of Gas Turbines, ranging from 25 to 162MW!



Media Evaporative coolers at Kaveh CCPP, Iran (2015)



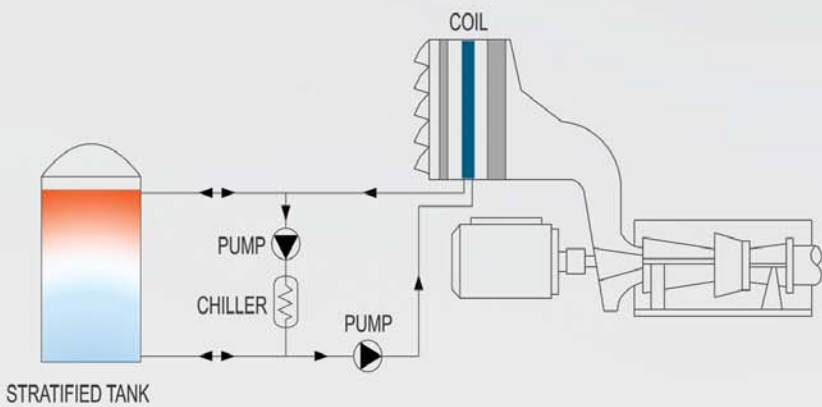
Main advantages:

- Upstream installation of Media cooler, makes easy the maintenance and minimizes the water carry-over
- Uses soft water instead of Demin water
- Inlet air pre-filtration effect which result to air filters life cycle extension
- Simple & fast installation/maintenance



Refregirative Cooling System:

Evaporative cooling systems (Media & Fog) effectiveness is limited in humid regions. To solve this problem, inlet cooling systems based on chiller technology (refrigeration) could be used. Rahavard Energy offers TESTIAC technology on behalf of its European partner, APINA Spain. TESTIAC system (Thermal Energy Storage for Turbine Inlet Air Cooling) can be implemented with both compression and absorption chillers and is particularly useful to increase the power output of a gas turbine power plant during peak hours. With TESTIAC, cold is produced and stored in special tanks, during 24 hours of a day, and is used to cool the turbine inlet air during the required hours (hot hours).





Turbine Inlet Air Cooling Systems Inauguration Ceremony
at Yazd, Kaveh & Kerman Power Plants



E-Man Serve co., as the pioneer company in the filed of Gas Turbine power augmentation, had an important role in utilizing this technology in Iran.

More than 50 GTs in different power plants have been equipped with different types of cooling systems in the past 18 years, increasing around 600MW of power.

Since 2017, **Rahavard Energy co.** (as a subsidiary of E-Man Serve) is responsible for the new GTIAC projects.

GT Type	NO.	Plant Name	MW Increase	Type of GTIAC	Year
Ansaldo V94.2	2	Yazd	2 x 15=30	Media	2017
Ansaldo V94.2	6	Jahrom	6 x 16=96	Media	2017
Ansaldo V94.2	2	Kerman	2 x 15=30	Media	2016
Ansaldo V94.2	4	Ghaen	4 x 15=60	Media	2016
Ansaldo V94.2	4	Kerman	4 x 15=60	Media	2015
Mitsubishi MW701	2	Qom	2 x 11=22	Fog	2015
Ansaldo V94.2	2	Zavareh	2 x 17.5=35	Media	2014
GE-9171E	2	Rajaei	2 x 10.5=21	Fog	2014
Hitachi-5361	1	Zahedan	1 x 2.5=2.5	Fog	2013
GE-9161E	2	Montazer.Gh	2 x 8.5=17	Fog	2013
AnsaldoV94.2	2	Damavand	2 x 15=30	Media	2012
AnsaldoV94.2	2	Kerman	2 x 15=30	Media	2011
Hitachi-5361	3	Zahedan	3 x 3.3=10	Fog	2010
AE G 5341	1	Zahedan	1 x 3=3	Fog	2007
Hitachi-5361	3	Zahedan	3 x 3.3=10	Fog	2005
GE-9161E	2	Montazer.Gh	2 x 10=20	Fog	2004
GE-9171E	2	Rajaei	2 x 10.5=21	Fog	2004
Mitsubishi MW701	2	Qom	2 x 11=22	Fog	2004
ABB-13D	1	Bandar Imam	1 x 8=8	Fog	2002
FIAT – Avio	6	Rey	6 x 4=24	Fog	2001
FIAT – Avio	1	Rey	1 x 4=4	Air Washer	1999
TOTAL	52		578 MW		1999-2017

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