RAHAVARD ENERGY

Gas Turbine Power Augmentation Systems

Our GTIAC History:

2001 — As an R&D project, a 30MW GT was equipped with TIAC system by our group for the first time in Iran

2003 — Fogging system of 6 * GE-F9 units implemented successfully by our group

2010 — Upstream Media cooling on 2*V94.2 units installed successfully by our group

2016 — Establishment of Rahavard Energy co.

2019 — Upstream Media cooler for Turbo-compressors of a natural Gas plant for the first time

2022 — Our first international TIAC project in Rumaila CCPP, Basra, Iraq

2024 — The biggest upstream Media coolers installed on 2*Class-F, 308MW turbines!

2025 — Media cooling system for 12*Air coolers of Rumaila CCPP, Basra, Iraq

2026 — And the journey continues…

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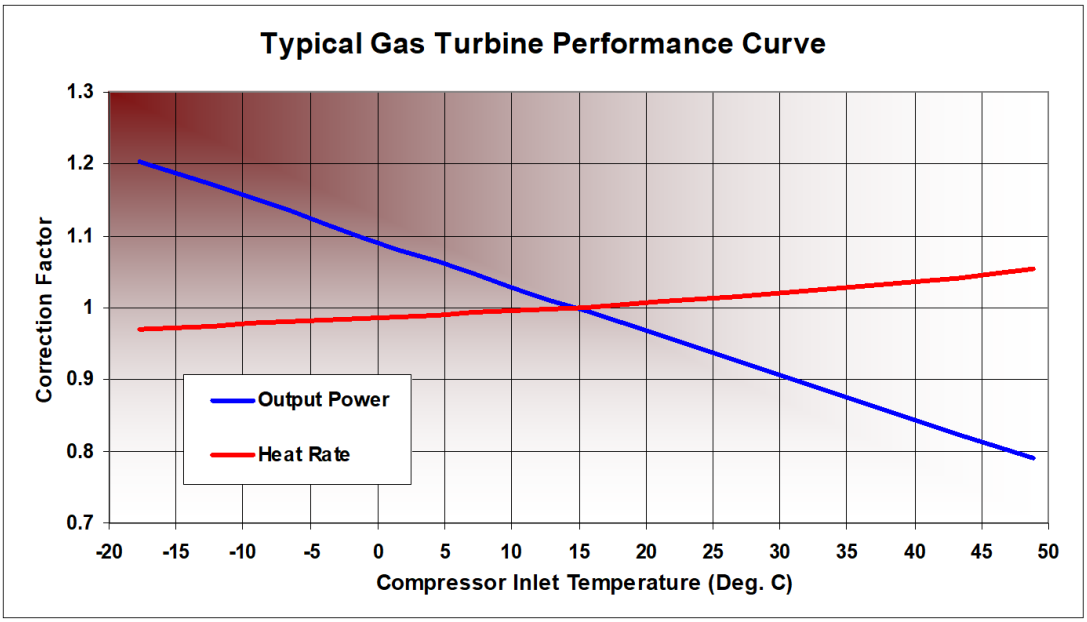
Ambient Air Temperature Effects on Gas Turbine Performance:

Gas turbine output power decreases with respect to ISO condition when ambient air temperature rises significantly. Approximately, each 1.5°C increase in ambient air temperature results in 1% decrease in output power!

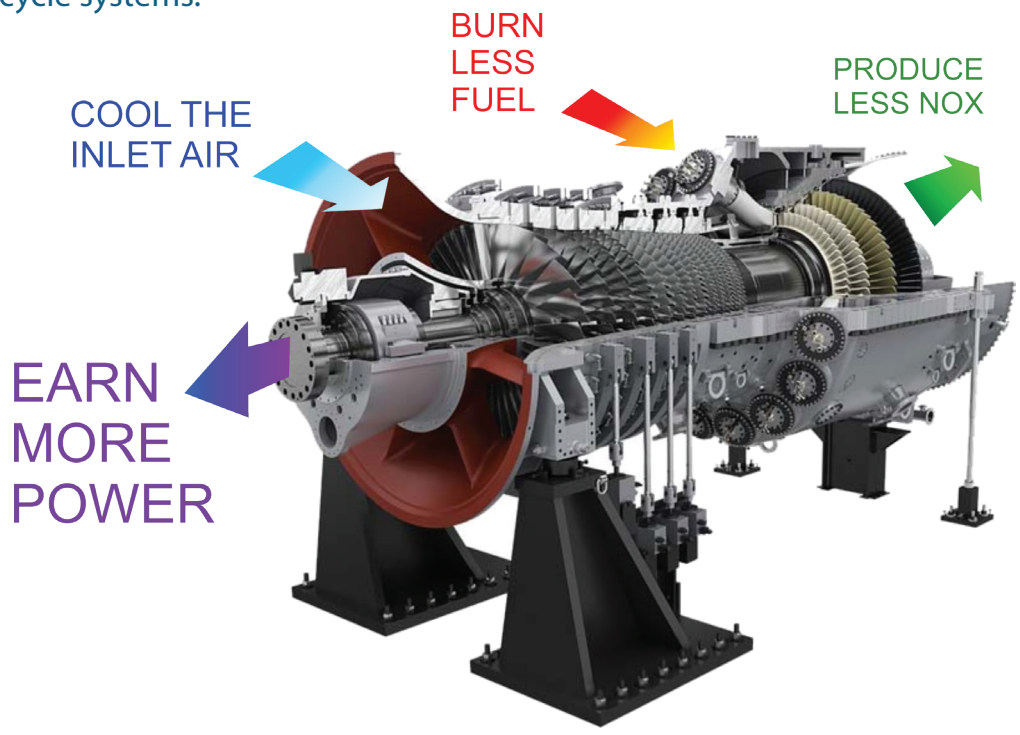
In other words, during hot season, when there is the highest demand for electricity, Gas turbines lose around 15~20% of their production capacity.



Gas Turbine Inlet Air Cooling Technologies (GTIAC):

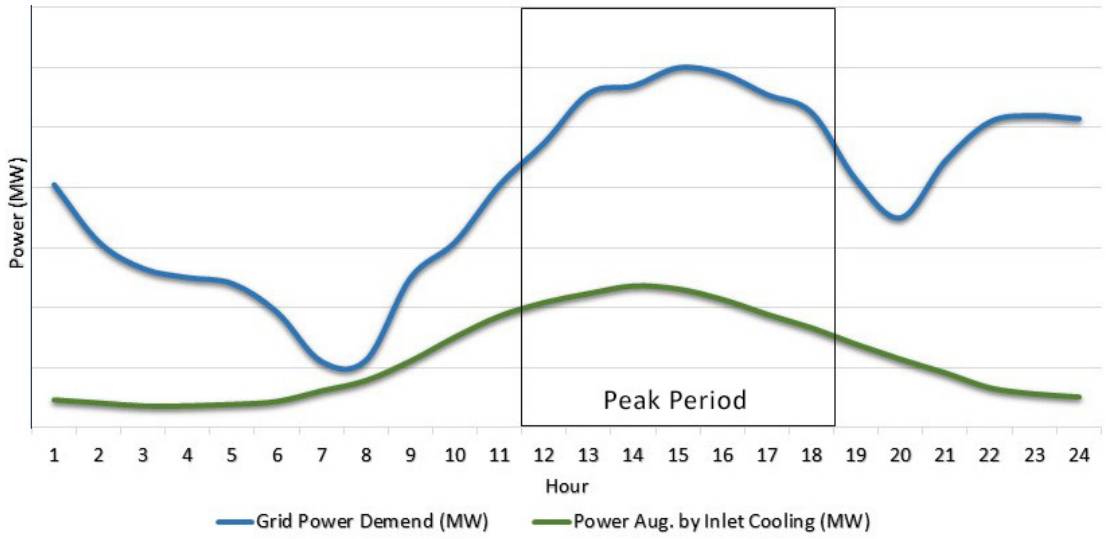
Gas turbine works on a constant-volume cycle, so the output power directly depends on air mass flow rate. Cooling the inlet air is a good solution to retrieve the Gas Turbine's lost power during summer time. It increases mass flow rate of the inlet air, so more work is done by the Gas turbine, resulting in increased output power!

GTIAC is applicable to all GTs installed in hot-dry climates, whether operating in simple-cycle or combined-cycle systems.

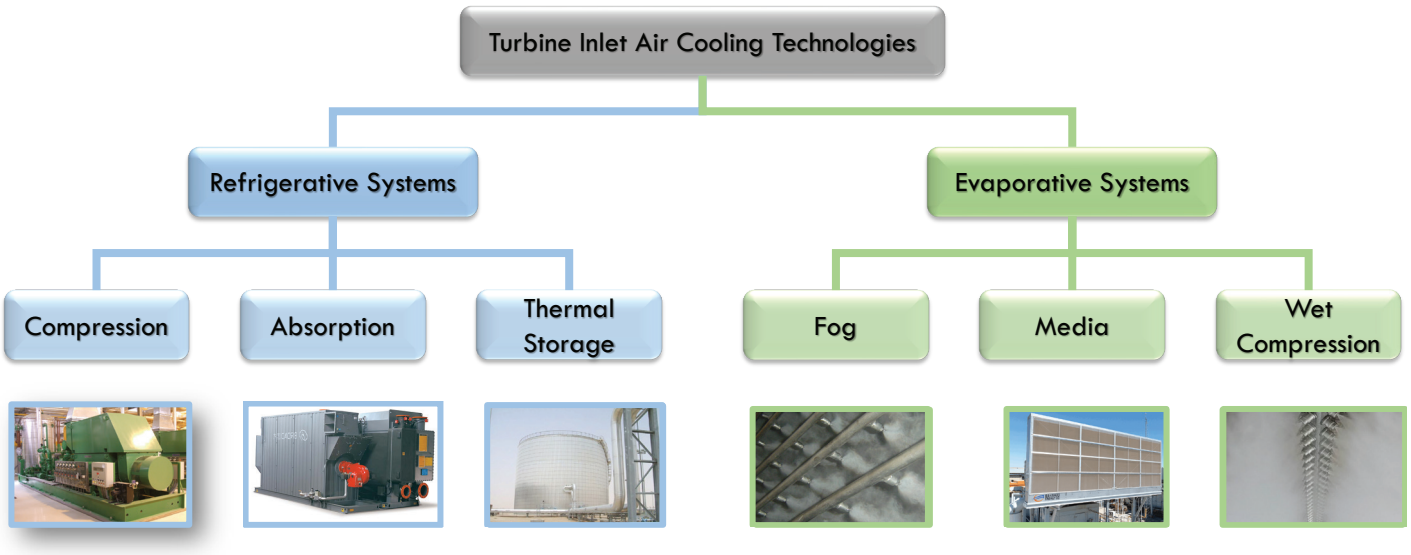


Power Augmentation at Peak Hours:

GTIAC assists the electric grid to compensate the gap between the power production and consumption during peak hours based on below diagram, the maximum power enhancement by inlet cooling systems occurs in the same time period in which the grid demand is the highest.



Inlet Air Cooling Technologies can be categorized as the following.



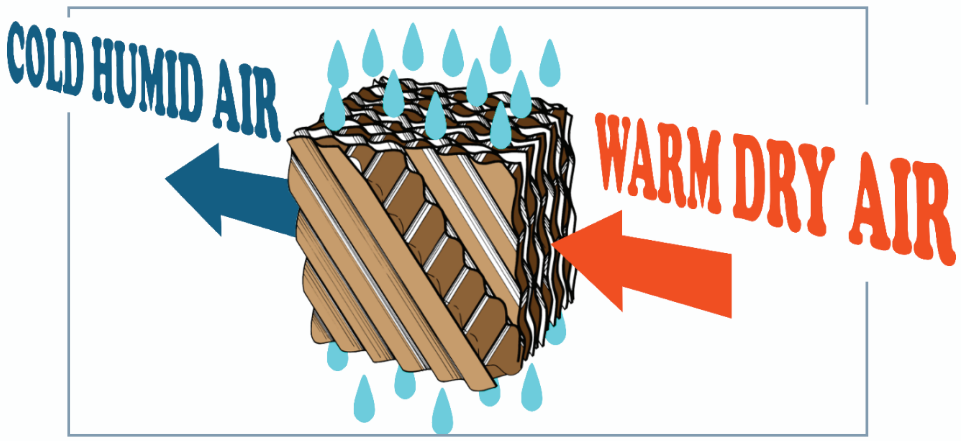
Evaporative cooling systems have received more attention so far due to their greater suitability to the climate of the Middle East, ease of operation & maintenance, and less investment cost.

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 are made of corrugated paper fibers or Glass fiber materials. Water is introduced through a header at the top of the pads and is deflected downward on the distribution pads and wets an enormous area of the pads contacted by the passing air.

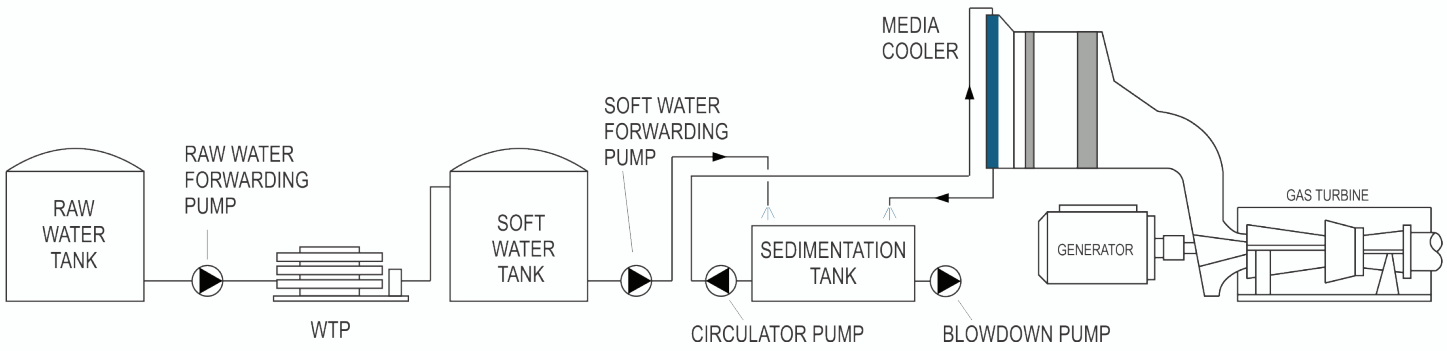
The basic idea behind this technology is the increase of the combustion air density (and mass flow rate) by reduction of the combustion air temperature, through adiabatic cooling.

Such system is used as a preferred method in dry-hot climates, which can be expected to boost gas turbine output power about 15~20%.



Media cooling pads can be placed both outside (UPSTREAM) or inside the air intake (DOWNSTREAM) of the Gas turbine. However, the Upstream Media has the advantage of washing the passing air and extending the life-time of the inlet air filters.

In addition, the duration of the turbine shutdown for the installation of Upstream Media is short (only few days) and there is no risk of water droplets and foreign objects entering the compressor.



Other important advantages of Media evaporative coolers include the followings:

- Simple operation & maintenance
- Low pressure drop in the air inlet path to the compressor (100~150 Pascal)
- Using soft (potable) water instead of Demin water
- Increased turbine efficiency by up to 2% along with increasing output power by up to 20%
- Pre-filtration of turbine inlet air and increased filter life (Upstream Media Type)
- Lower power consumption compared to other GTIAC methods
- Low investment and operational costs
- Quick delivery and installation time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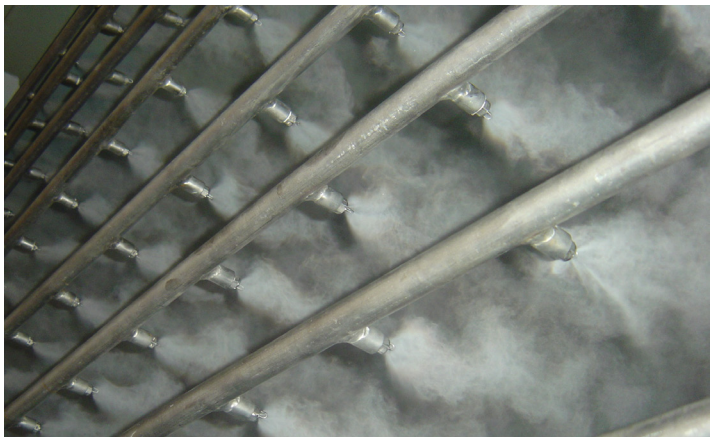
High Pressure Fogging System:

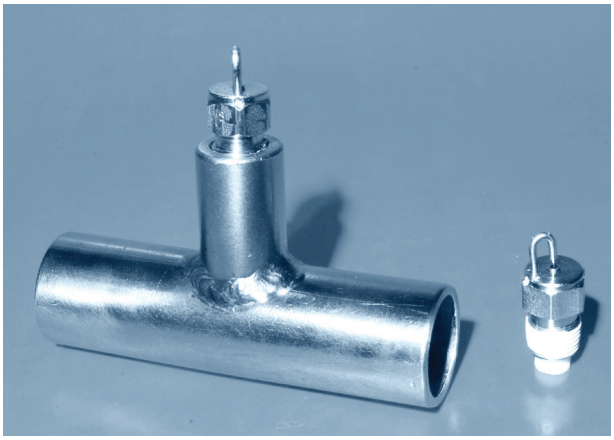
High pressure Fogging is a method of inlet cooling in which demineralized water is converted into fine fog droplets by means of specially designed atomizing nozzles operating at pressures around 150 barg. As the fog evaporates in the intake duct, it cools the inlet air. This technique can achieve close to 100% evaporative cooling effectiveness in terms of attaining the wet-bulb temperature at the compressor inlet.

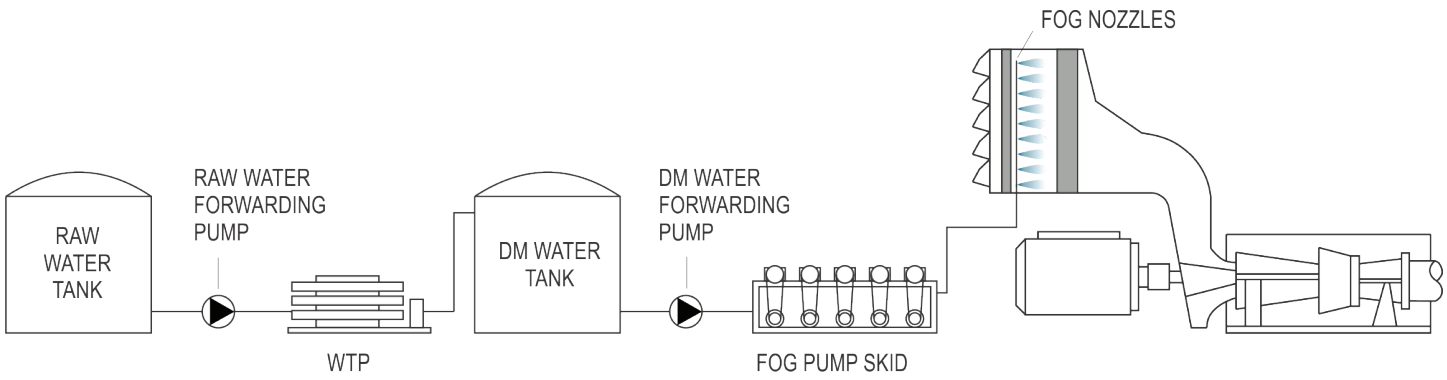
The fog nozzles is the heart of the inlet fogging system and great care should be taken when selecting the nozzle. Rahavard Energy offers a type of Impaction pin nozzle, which is famous for its fine droplet size & effectiveness.

Our fogging system operates through a predictive control loop which calculates the quantity of water to be sprayed in the inlet air to reach maximum water saturation.

By now, more than 30 GTs with different capacities from 25 to 123MW have been equipped with Fog cooling system by Rahavard Energy, resulting in 200MW power augmentation during peak hours of hot seasons.







Water Treatment for Evaporative Cooling Systems

To provide suitable water for the Evaporative inlet air cooling systems (Fog or Media), water treatment plant is offered by Rahavard Energy.
Containerized RO package is the best solution to produce treated water for GTIAC projects, as it is compact, cheap & fast commissioned.

Water Storage Tanks:

Water storage tanks for GTIAC are offered by Rahavard. This include Cylindrical or Modular type which will be erected according to the project requirements.

We Bring

Spring in Summer

The Most Cost-Effective Power Boosting Method of Gas Turbine

Our Reference List:

Year Commissioned	Site	Country	Turbine Type	Turbine Capacity (MW)	No. of Units
2026 (Planned)	Rumaila CCPP	Iraq	MGT - 70 (3) - Aux Cooling	183	12
2025	Zanjan PP	Iran	V94 . 2	183	4
2025	Sanandaj CCPP	Iran	V94 . 2	183	4
2025	Mobarakeh CCPP	Iran	MGT 80	308	2
2024	KhorramAbad CCPP	Iran	V94 . 2	183	2
2024	Semnan CCPP	Iran	MAP2B	183	2
2021 - 2024	Serajeh Gas Station	Iran	ZORYA DU80L	25	3
2022	Rumaila CCPP	Iraq	MGT - 70 (3)	183	2
2020	Zagros PP	Iran	V94 . 2	162	2
2018	IslamAbad Gharb PP	Iran	Hitachi H25	25	4
2016	Jahrom CCPP	Iran	V94 . 2	162	6
2015	Yazd CCPP	Iran	V94 . 2	162	2
2014	Ghaen PP	Iran	V94 . 2	162	4
				Total	**49**

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