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| Methods | Advantages | Disadvantages | Considerations |
| **Evaporative cooling**  *(wetted media)*  Mixing of water with the GT inlet air stream cools the inlet air, as the water evaporates, and latent heat of evaporation is absorbed from surrounding air. | * Continuous inlet air-cooling operation. * High quality water is not a prerequisite. * No risk of over-spraying or supersaturation. * Low parasitic power consumption. * Short delivery and installation time. * Simplicity of design and operation. * Economically feasible for hot and dry climates. Low unit capital cost. | * Highly dependent on ambient conditions (temperature and relative humidity). * Limited potential in humid regions. * Large amounts of water are required. * Installation time is longer (~100%) compared to fogging systems. * Pressure drop is higher than fogging systems. * Capital and maintenance costs are usually higher (~20%) than fogging systems. | * **Site and climate**   Ambient temperature, relative humidity and altitude of the facility.   * **Water employment**   Water availability, consumption, treatment (demineralization) and costs.   * **Type of GT used**   Some GT technologies are more vulnerable to compressor erosion than others. This limits the amount of water that can be injected.   * **Power output**   Performance improvement after applying the GT inlet cooling method. In this matrix, the parasitic power consumption and inlet pressure drop must be considered.   * **Economic evaluation**   Capital costs and added value from the investment. This includes payback period and installation costs of the cooling system per incremental power increase. Also, one should take into account that gas and electricity prices vary in time. Moreover, the fuel costs must be considered. Operations and maintenance (O&M) costs are also included here. If TES is used to store energy, ‘Energy Arbitrage’ applies so that the overall economic outcome is not a conflicting factor with the thermodynamics of the system.   * **Environmental impact**   Inlet cooling can be beneficial for the NOX and CO2 emissions. Selection of the refrigerant fluid and sealing of the corresponding system must be performed carefully. |
| **Inlet fogging**  *(fogging/overspray techniques)*  Inlet fogging systems consist of very fine water droplets that are sprayed into the air through atomizing nozzles and evaporate prior to reaching the compressor. Overspraying (high pressure fogging or wet compression) allows excess fog. | * Continuous inlet air-cooling operation. * Efficiency of humidification is 90-100%. * Low parasitic power consumption. * Low annual maintenance time. * Simplicity of design and operation. * Short delivery and installation time. * Economically feasible for hot and dry climates. Low unit capital cost. * In over-spraying a compressor intercooling effect is created by allowing part of the evaporation take place inside the compressor, as the air is heated up. | * Efficiency is limited by the wet bulb on inlet air temperature. * Water requires special treatment for demineralization. * Duct surfaces are wetted with demineralized water which requires measures against duct corrosion. These include additional filters and drainage systems. * Risk of erosion of compressor blades. * Inlet fogging requires the modification of a large part of the air inlet which results in a required-additional investment. |
| **Mechanical refrigeration**  *(vapor compression cycle)*  Intake air is cooled as it flows through HEXs that utilize either the refrigerant fluid from the vapor compression cycle or chilled water from thermal energy storage systems. | * Continuous inlet air-cooling operation. * Allows for a wider range of inlet conditioning and hence, greater power augmentation as compared to water evaporation methods. * Better performance and independent of ambient-air wet-bulb temperature as compared to water evaporation methods. * Simplicity of design and operation. | * Running this cycle requires high electrical power to drive the compressor. This results in the largest parasitic losses on the net generated power of the plant, compared to all other methods. * High capital costs. * High O&M expertise and costs required. * Longer delivery and installation time compared to water evaporation methods. |
| **Absorption chilling**  *(absorption refrigeration cycle)*  The operation of such systems is to recover heat from the GT exhaust streams, employing the heat recovered to produce cooling. Two working fluids are used: the first one as the absorbent (LiBr or NH3) and the second one as the refrigerant (water). | * Continuous inlet air-cooling operation. * Parasitic losses are minimized as the energy required to run the compressor of the cooling cycle is extracted from GT exhaust gases. * Makes use of un-tapped energy. * Greater power augmentation and independent of ambient-air wet bulb temperature, as compared to water evaporation methods. * Lower O&M costs as compared to mechanical refrigeration. | * Corrosive nature if lithium-bromide is used in the absorption refrigeration system. This leads to a reduction of the overall life of the system. Ammonia-water technique is corrosive when used with copper. * Careful sealing of the refrigeration system must be performed to prevent leakages. * Higher heat rejection requires higher cooling tower and pump capacities. High capital costs. * High O&M expertise and costs required. * Longer delivery and installation time compared to water evaporation methods. |
| **Hybrid systems**  Combinations of two or more of the previously presented systems which may also incorporate thermal energy storage systems (TES). | * Less water can be used. * Provide operational flexibility to the cooling system to cover the demand. * Avoid high parasitic load in periods with high electricity tariffs. * May achieve inlet temperature reduction with less power and water consumption. | * Complex systems requiring operational and maintenance expertise. * Because of the above, if not designed properly, capital costs can become immoderate. * Literature of the hybrid system effects on GTs is limited. |
| **Other systems**  *(LNG vaporization / coolant pre-cooling / evaporative cooling of pre-compressed air)* | * Innovative methods. * Potential economic and power enhancement. * In LNG vaporization, LNG is initially cooled to be transferred and then re-heated to be transmitted to the users. As such, it has a significant cooling potential. | * Innovative methods. * Not yet proven technologies. * Not yet proven economic feasibility. * LNG vaporization only applicable in LNG storage sites and corresponding facilities. * Reliability and safety. |
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