GAS TURBINE INLET CHILLING FOR PIPELINE OPERATORS

For sites where the wet bulb temperature is high and evaporative cooling is relatively ineffective, the use of mechanical chillers is attractive for inlet cooling. Water is needed for wet cooling towers, but dry cooling is an option. FERN ENGINEERING has recently completed a state-of-the-art study for the Electric Power Research Institute (EPRI) on the use of chillers for inlet cooling. As a result of this study, Fern has identified techniques to reduce costs and to reduce parasitic power. Fern has programmed design and economic evaluation methods for quickly evaluating the annual benefits of chilling and the cost-effectiveness of this approach. A typical pipeline compressor located at a humid site such as Lake Charles in Louisiana would benefit from chilling in accordance with the results in the following table:

Effect of Inlet Chilling on Annual Performance of a GE M3912R Gas Turbine

Tdb, ºF Bin	Twb, ºF	Hours	∑Hours	TR	TR-Hours	Hpo	Hpo-Hrs	ΔHp, %
90-95	77.8	177	177	877	155229	8625	1526625	26.5
85-90	77.2	518	695	863	447034	8850	4584300	23.3
80-85	74.4	982	1677	771	757122	9084	8920488	20.2
75-80	72.7	1569	3246	716	1123404	9304	14597976	17.3
70-75	68.6	1214	4460	596	723544	9525	11563350	14.5
65-70	63.7	832	5292	483	401856	9745	8107840	12
60-65	58.8	934	6226	381	355854	9963	9305442	9.5
55-60	53	648	6874	227	147096	10180	6596640	7.2
50-55	48.7	562	7436	146	82052	10400	5844800	5
Sums		7436			4193191		71047461	

where: TR = tons of refrigeration
Hpo = horsepower at site conditions
Hpo-Hrs = product of horsepower x annual number of hours at site conditions
ΔHp, % = percentage increase in power output due to chilling to 40°F

With chilling to 40°F, the power output is 10,900 shp, resulting in 81,178,000 hp-hrs for an increase of 10,131,000 hp-hrs, or an average increase of output 1362 hp. The capacity factor is the ratio of ton-hrs/max. ton-hrs or 64%, and the percentage of time in use is 84%. Cost effective systems must have a high capacity factor and a high percentage of time in use. The parasitic power can be minimized by cascading the inlet cooling coil and using several chillers with varying evaporator temperatures. Nevertheless, the total annual parasitic energy loss is estimated to be 15% - 20% of the annual output benefit.

For more information, please visit the Downloads page of our award-winning Web site (http://www.fernengineering.com/Downloads/whitepapers.shtml) to download a Fern-authored article which appeared in the November-December edition of CompressorTech^{Two} magazine or contact Fern's Philip Levine at plevine@fernengineering. Fern Engineering can perform site evaluations from preliminary conceptual estimates to complete specifications.

55 Portside Drive • P.O. Box 3380 • Pocasset, MA 02559 • (508) 563-7181 • Fax (508) 564-4851
WWW.FERNENGINEERING.COM