



# How TTS helped a power plant add 79MW of gas turbine capacity and increased revenue



## Overview

TTS, in collaboration with GT Analysis, recently completed a controls modification and performance upgrade package that added 79 MW of gas turbine capacity to a power plant comprised of four 7EA DLN-1 gas turbines in two, 2-on-1 combined cycle blocks.

## The Situation

A customer located in the ERCOT region, which during the 2019 summer season, saw peak demand electricity prices hit the price cap of \$9000 MW-HR multiple times. To take advantage of peak demand pricing for the 2020 summer season, the customer purchased four wet compression systems from a non-OEM supplier which augment the gas turbine output by injecting 80 GPM of water into the compressor inlet. The wet compression system added 11-12 MW in output per gas turbine, which prior to the upgrade, generated nominally 74 MW at base load on an 80°F day.

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ERCOT Region

## The Solution

Wet compression skids are often installed as stand-alone systems with their own PLC controller. TTS provided controls integration between the PLC and gas turbine controller, enabling the operators to control the wet compression skid from the gas turbine HMI. To further increase the output capacity of the units TTS added four additional output enhancements:

### Base load firing temperature optimization to the 2055°F rated value of the hot section hardware

The gas turbines had combustor and turbine components installed that were designed for 2055°F firing temperature; however, the as-found control curves were under-firing the units with actual firing temperatures determined to be at different points between 2020°F and 2040°F. Setting the base load control curves to the rated 2055°F values gained approximately 5 MW total on the four units. This is a permanent gain in output whenever the unit operates at base load, as opposed to the remaining three options discussed, which are operator selected options.

### Wet firing bias to maintain 2055°F rating when wet compression is in operation

When wet compression is in operation, the injected water acts to suppress the firing temperature of the gas turbine below its rated value. The wet firing bias increases the firing temperature of the unit proportional to the amount of water injected in order to maintain the 2055°F rating. This option would not be possible without the controls integration between the wet compression PLC and the gas turbine controller because of the requirement for the gas turbine controller to have the water flow as an input. The wet firing bias resulted in an output gain of 9 MW on the four units.

### Low and high peak load firing

Low level and high level peak firing were implemented with the firing temperature calculated based on achieving hot section maintenance factors of 2 and 3, respectively. Peak firing can be utilized both with and without wet compression in operation. When tested with wet compression enabled, each level of peak firing resulted in an output gain of 9 MW on the four units or a total of 18 MW on the high peak setting.

# GAS TURBINE CAPACITY WAS INCREASED

# 79 MW



## The Results

Overall, the plant gas turbine capacity was increased 79 MW: 47 MW from the wet compression systems and 32 MW from the four capacity upgrades implemented by TTS and GT Analysis ([www.gtanalysis.com](http://www.gtanalysis.com)). Although measuring the total increase in combined-cycle capacity was not within the scope of the project, it is estimated that at least an additional 30 MW in steam turbine capacity was obtained from the upgrades described above.

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Being able to help our clients achieve additional MW's from their installed equipment is a huge plus, especially in the highly competitive ERCOT market.

- Mitch Cohen,  
Sr. Combustion Engineer, TTS ”

