

## Heat Recovery Steam Generator

The power generation market has enjoyed sustained growth over the past few years and this growth is expected to continue for the foreseeable future. A recent study indicates that energy demand in 2020 will be 32% above 2000 levels. In the United States alone, more than 300,000 MW of additional capacity will be added in the next two decades. Among the different choices of fuel available, natural gas is currently the most widely used.

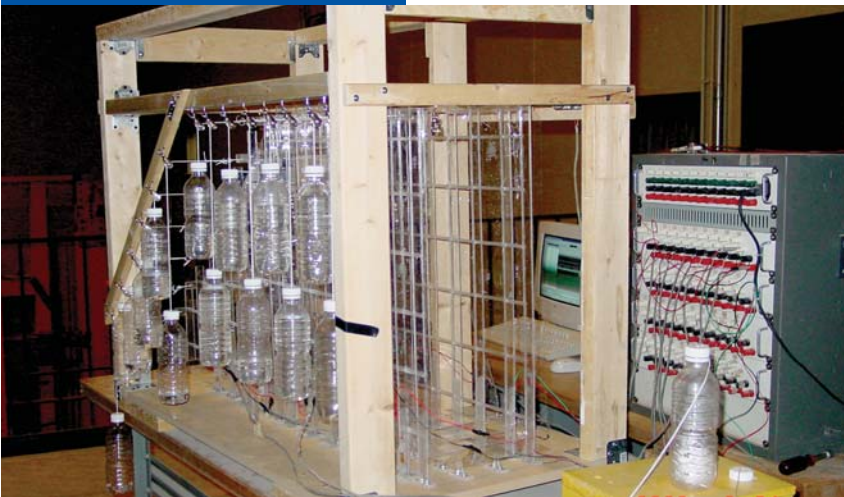
A typical natural gas power plant consists of a gas turbine generator, often supplemented by a heat recovery steam generator (HRSG) to produce steam. It is either sold to the industrial market or fed into a steam generator to produce additional power.

For many years, JNE Consulting has been active in the power generation market, providing engineering and construction to various original equipment manufacturers and plant owners. The analysis and design of an HRSG to be built in Mountain View (Seismic Zone 4), California, proved to be a particularly unique and challenging project.

JNE's structural design of the boiler, based on a two-dimensional static force method, provided foundation loads for the General Contractor (GC). After foundation design, and halfway through the fabrication of the steel, the GC stated that four similar boilers had calculated loads 30% higher than loads provided by JNE. The GC informed building officials in California that he believed the loads were low. JNE checked the design and found it sufficient. However, this did not satisfy the GC or the building officials.

A two-dimensional response spectrum dynamic analysis again showed that the design was adequate. Such an analysis gave some comfort to the building officials but not to the GC. The GC then requested a complete 3D response spectrum dynamic analysis. The result of this analysis also showed that the design was adequate with some re-distribution of the loads. JNE then met with the building officials in California and described the design approach used and its adequacy. The building officials approved the design and erection of the steel proceeded.

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## *Boiler Design cont*

After the design had been approved and the steel was erected, JNE constructed a scale model of the boiler to further study how the forces are re-distributed at column supports. The model was built using Plexiglas sheets, based on the similitude between the model and prototype HRSG structure in dimensional analysis.

In this study, lateral loads were applied to the model by hung dead weights and strains were measured at the base of several columns by electrical resistance strain gauges which were connected to a data acquisition system. The measured strains were then converted to support reactions at these columns for comparison purpose. In general, good agreement was obtained between theoretical and experimental results. This modeling study will result in more efficient and satisfactory designs of future HRSG's with similar structures.