Gateway Generating Station

Air-cooled Inlet Chilling

Gateway Plant History

- Formerly Mirant's Contra Costa Unit 8 plant
- PG&E's first new power plant in 20 years
  - Created **GATEWAY** project name
    - Approved by CPUC in June 2006
    - Reflects future of power generation using latest fuel efficient & environmentally friendly technologies
- Operating efficiency is key project driver
  - Changed design to chillers to achieve target efficiencies
    - 35,000 lb charged system uses ammonia inlet chilling

Project History

- PG&E acquired “in-construction” plant
  - Implemented design changes:
    - Project initiated with evaporative cooling
      - Wet cooling used for condensing steam
      - Risk of efficiency loss with steam parasitics
  - Design changed to air-cooled
    - Air-cooled inlet chilling increased efficiency performance
  - Water conservation, GHG emissions and efficiency performance were drivers for design change

PG&E's Challenge

Maximizing peak generation capacity while balancing the state's increasingly rigorous environmental requirements

California RPS

Renewable Portfolio Standards

- One of the most ambitious renewable energy standards “goals” in the country
  - 20% procurement of renewable energy sources (in support of retail sales)
- Established in ‘02 (Senate Bill 1078)
  - Original target of 2017
- Accelerated in ’06 (Senate Bill 107)
  - Accelerated target of 2010

Emerging Concept

Contingency Power

- Gateway plant smoothes out the windmills:
  - It's contingency power
  - Necessary to ramp other plants up or down depending on whether the wind is blowing
  - Contingency power generation increases the utility of wind power to the grid

Market Convergence of Generation Technologies

- Wind
  - Can not schedule; nor store
  - Best “environmental” solution
- Combined Cycle Technology
  - Can schedule and store
  - Best “reliability” solution
- Inlet Chilling Technology
  - Increases peak generation capability
  - Ramp up / down (load follow)
  - Boosts efficiency
  - Minimizes use of water

PG&E Inlet Chilling Decision Process

- Need to minimize use of fresh water
  - Looked at using reclaimed water vs. ACC
- Decision to go to air cooled condensers based on economics and water availability
  - Used chiller for cooling inlet air in lieu of evaporative cooling
    - Reduced water consumption by 97 percent
- Net power increased by 10 MW on 100 degree day

Gateway Plant Profile

- Combined Cycle (2x7FA)
  - Reduce regional reliance on an aging fleet of fossil fueled power plants
  - Combined cycle technology reduces GHG emissions by 35% (approximately)
- 580 MWs
- Scheduled to come on line Spring 2009
  - Serve load for 400,000 customers in northern and central California
  - Critical to supporting peak energy requirements

TAS'Project Partners

- TP Sales Inc. (Manufacturer's Rep)
- Black & Veatch (EPC)
- Worley Parsons
- Donaldson
- IHT
- GEA FES
- GEA Rainey

Effective project management of multiple suppliers and project schedule is critical to project success

Air-cooled Technology Highlights

- 97% less water; 96% less discharge
  - Compared to conventional water-cooled system
- Gateway @ 8,300 tons
  - TAS' largest ammonia project to date

TAS Profile

- Established in 1999:
  - 82 TIC installations
  - Prior to ’99 (founding team)
    - 23 projects; 76,000+ tons
  - Since ’99 (TAS formed; introduced modular construction)
    - 59 projects; 344,000+ tons
  - Over 735,000+ tons installed / on order (all markets)

TAS Scope

- For PG&E project:
  - Equipment Sale & Modular Construction
  - Commissioning
  - Start-up
  - Training
  - Technical direction
- Additional capabilities:
  - Full turnkey
  - Service

TAS Installations

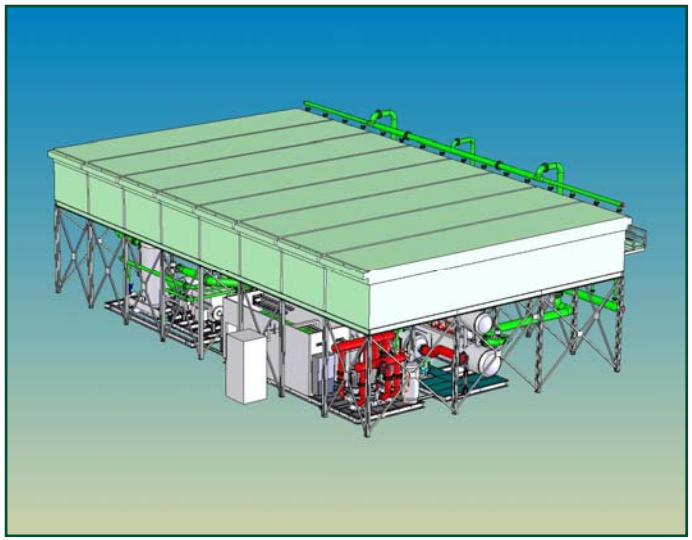
Gateway Project
System Performance

- Guarantee T2 @ 50°F
- Parasitics @ 9862 kW (1.19kW/ton)
- Pressure drop 1.1 inches wg on design day of 104°F with coincident wet bulb of 67.3°F.

Modular Design

Chiller system skid module:

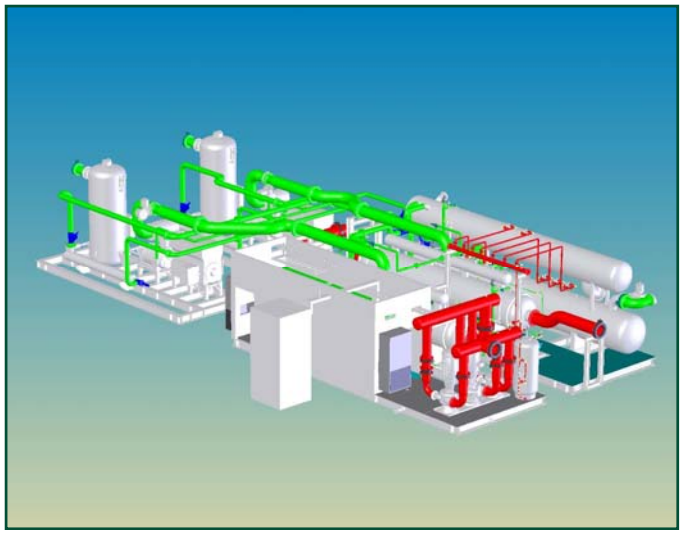
- Heavy structural steel base
- Frame with R-22 receiver
- Evaporator
- Compressor
- Oil separator
- Packaged piping
- Valves
- Pump skids (with 3 chilled water pumps)
- Switchgear and control
- Factory installed and pre-wired



Air Cooled Condenser • Chiller • Pump • Control Room

Modular Design

The system is designed to operate at base load conditions of the gas turbines…..at specified design ambient conditions



Chiller • Pump • Control Room

Air-Cooled Technology

- More complex than water cooled
- Larger footprint for heat rejection
- Less efficient (1.35 kW/ton vs. .75 kW/ton)
- More site installation work: increased interconnecting piping

TAS Inlet Air Chilling Solutions

- Ideal solution for:
  - Peak, intermediate and even base load energy
  - Capacity MWs
  - Ancillary Service MWs
  - Correcting gas turbine degradation:
    - Every 4 degrees is worth 1% of power

In Assembly

Turbine Inlet Chilling System Modular Construction

- Merits of Factory Construction:
  - Pre-engineered designs
  - Single point of control from design to commissioning
  - Guaranteed delivery schedule
  - Guaranteed operating efficiency

ISO 9001:2000
Registered

TAS Modular Inlet Chilling System

- A25A Chiller System
  - 8300 tons of chiller output at specified design conditions
- Three TAS skid modules

Field Installation

- Field installation consists of setting chiller skids and power distribution center on prepared foundations;
  - erecting air cooled condenser support structure;
  - setting the air cooled condenser modules & piping;
  - connecting utility services;
  - control interfaces;
  - connection to the plant chilled water supply / return headers

Getting Smart in California

Progressive Energy Supply

#3. High Efficiency Power Augmentation

#2. Renewable Power

#1. Energy Efficiency / Demand Side Management