Best Practices for Chiller Systems for Performance Enhancement of Combustion Turbines During Hot Weather

By Trey Sims

Sponsored by:

Turbine Inlet Cooling Association (TICA)

October 8, 2014; 1 PM (U.S. Central Time)

https://members.meetingzone.com/presenter/default.aspx

Call-In Number: 1 877 406 7969
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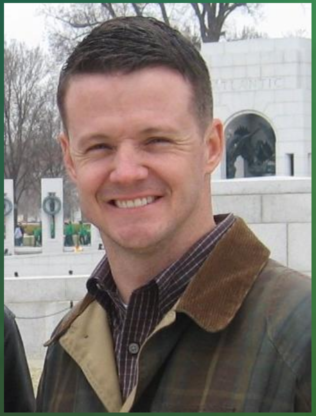
INTRODUCTIONS

Dharam Punwani

- President
  Avalon Consulting, Inc.
- Executive Director, TICA



Trey Sims

- Turnkey Sales Manager
- TAS Energy

Who is TICA?

- The Turbine Inlet Cooling Association (TICA) promotes the development and exchange of knowledge related to gas turbine inlet cooling
- The TICA website is one-stop source of TIC technical information, including Installation Database & Performance Calculator
- TICA is a non-profit organization.

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TICA Member Benefits

- Access to full/detailed version of TIC Installation Database
- Access to full/detailed version of the TIC Technology Performance Calculator
- GT Users get access to the TIC Forum
- Suppliers information is included in the Resource Guide on TICA Website, have access to advertisement space on that site, and have opportunity to display literature at the TICA booths at various electric power trade shows

Become a Member Today!!!

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Turbine Inlet Cooling Best Practices

Upcoming Webinar Schedule

- ***December 12, 2014: Thermal Energy Storage***
- ***February 11, 2015: Wet Compression***
- ***April 8, 2015: Hybrid Systems***

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All Webinars start at 1 PM (U.S. Central Time)

AGENDA

- TAS Introduction
- Technology Overview – Generation Storage & Inlet Chilling
- Project Examples
- Best Practices
- Questions

COMPANY INTRODUCTION

CORE COMPETENCIES

MANUFACTURING FACILITY

- Houston, TX HQ
- 275,000 sq ft
- 80 Ton Crane Capacity
- In-house pneumatic tes
  - Pressure & Leak Testing

Technology Overview

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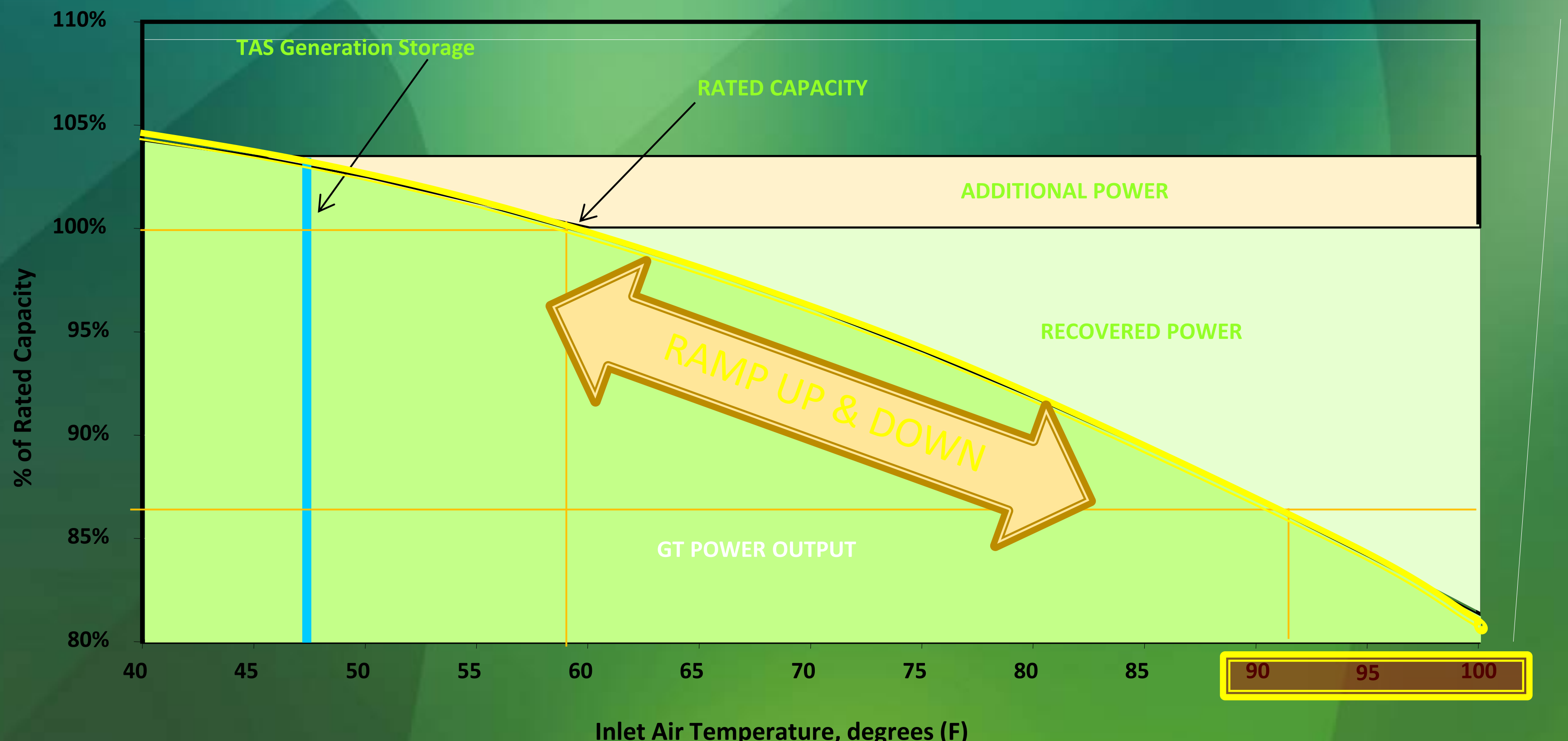
Turbine Inlet Chilling (TIC) & Generation Storage (GS)

- Gas turbines only operate at 100% of their rated capacity when the temperature outside is 59F.
- As temperatures climb into the 90's and beyond, greater than 10% of the capacity of the turbine disappears.
- By chilling below rated capacity and adding storage all lost power is recovered, and additional power is generated.
- Storage and ancillary services including ramping benefits are captured as well



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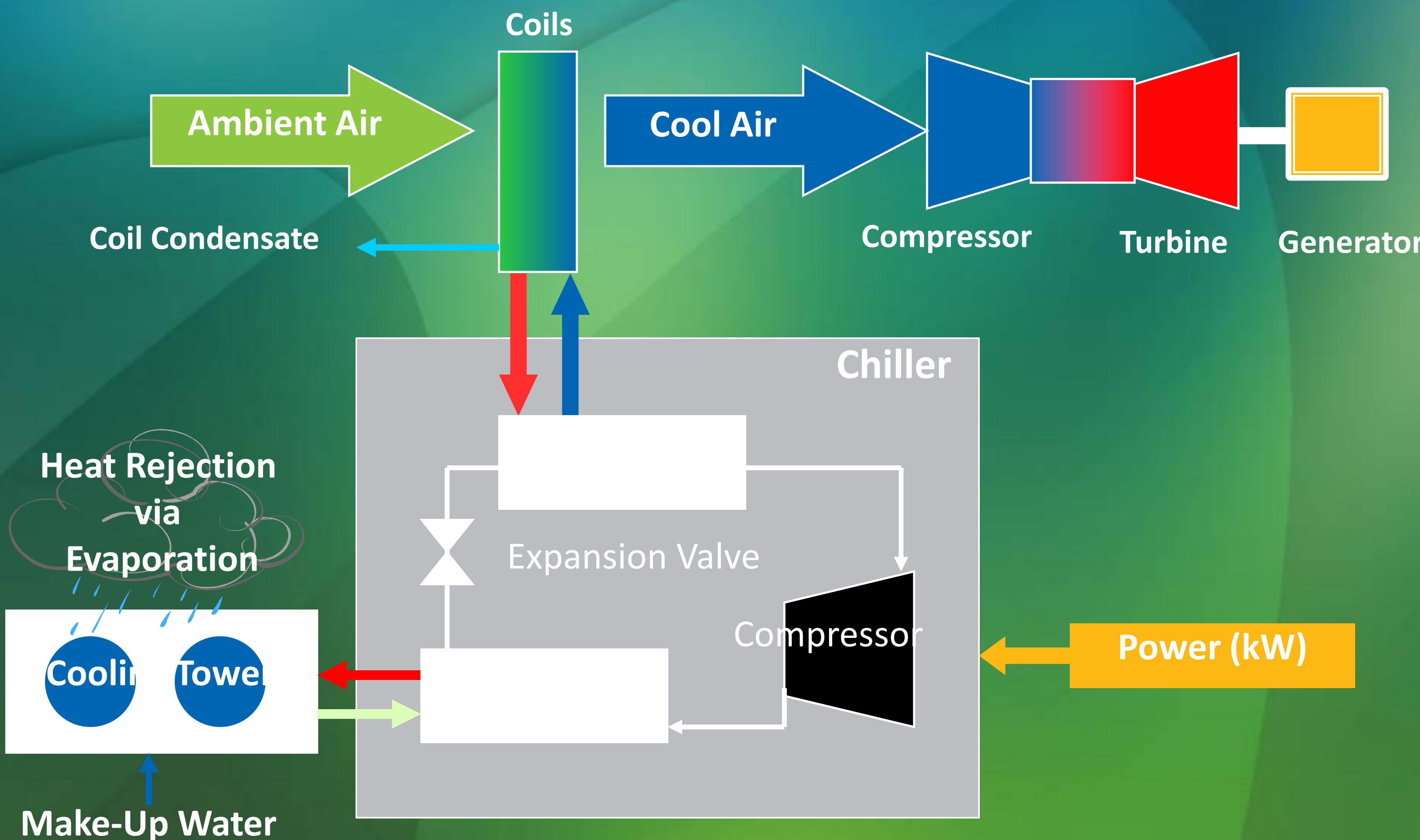
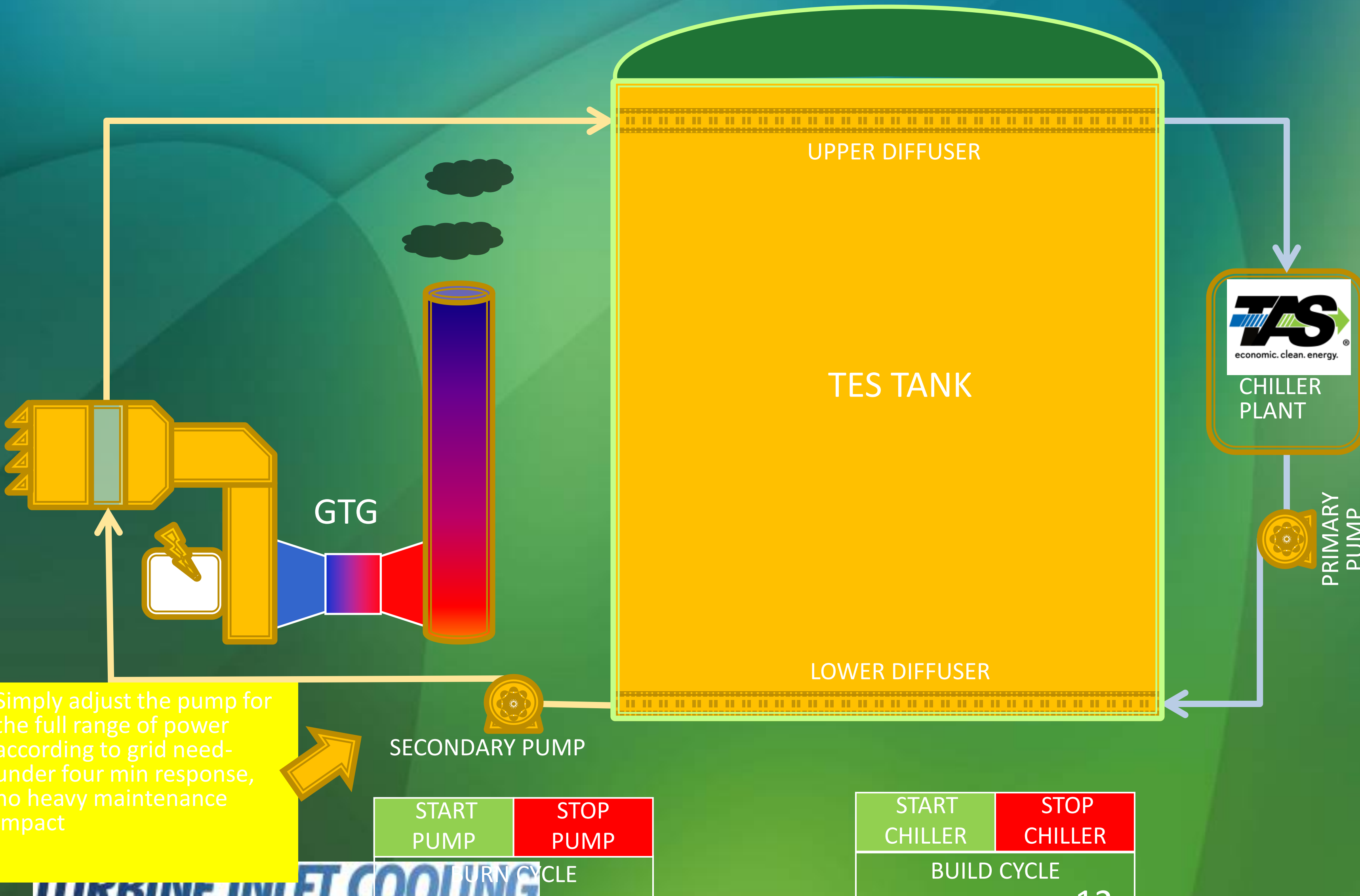
WATER-COOLED MECHANICAL

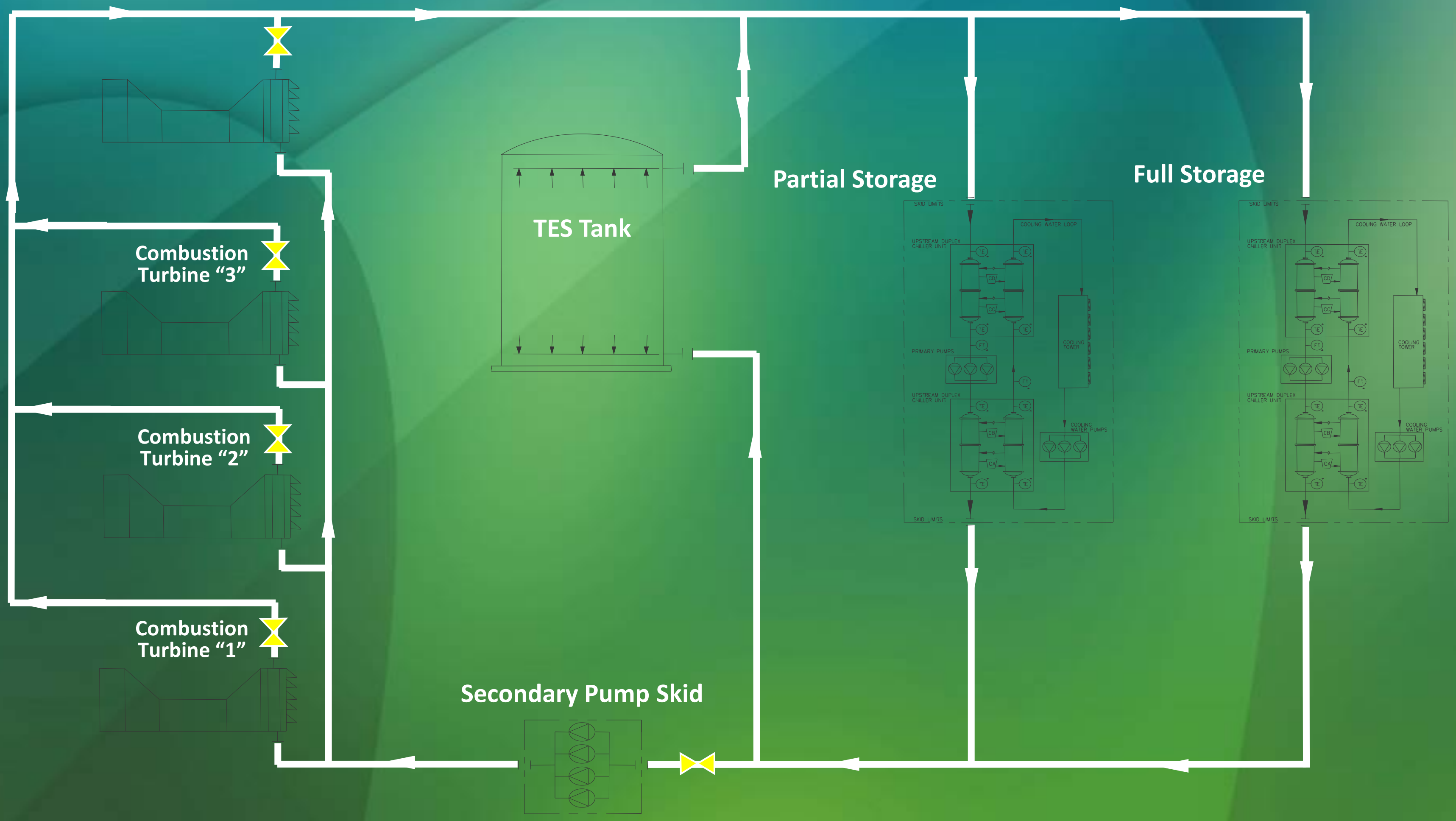


GS: More Than Just Capacity



Simply adjust the pump for the full range of power according to grid need- under four min response, no heavy maintenance impact

Generation Storage - PFD



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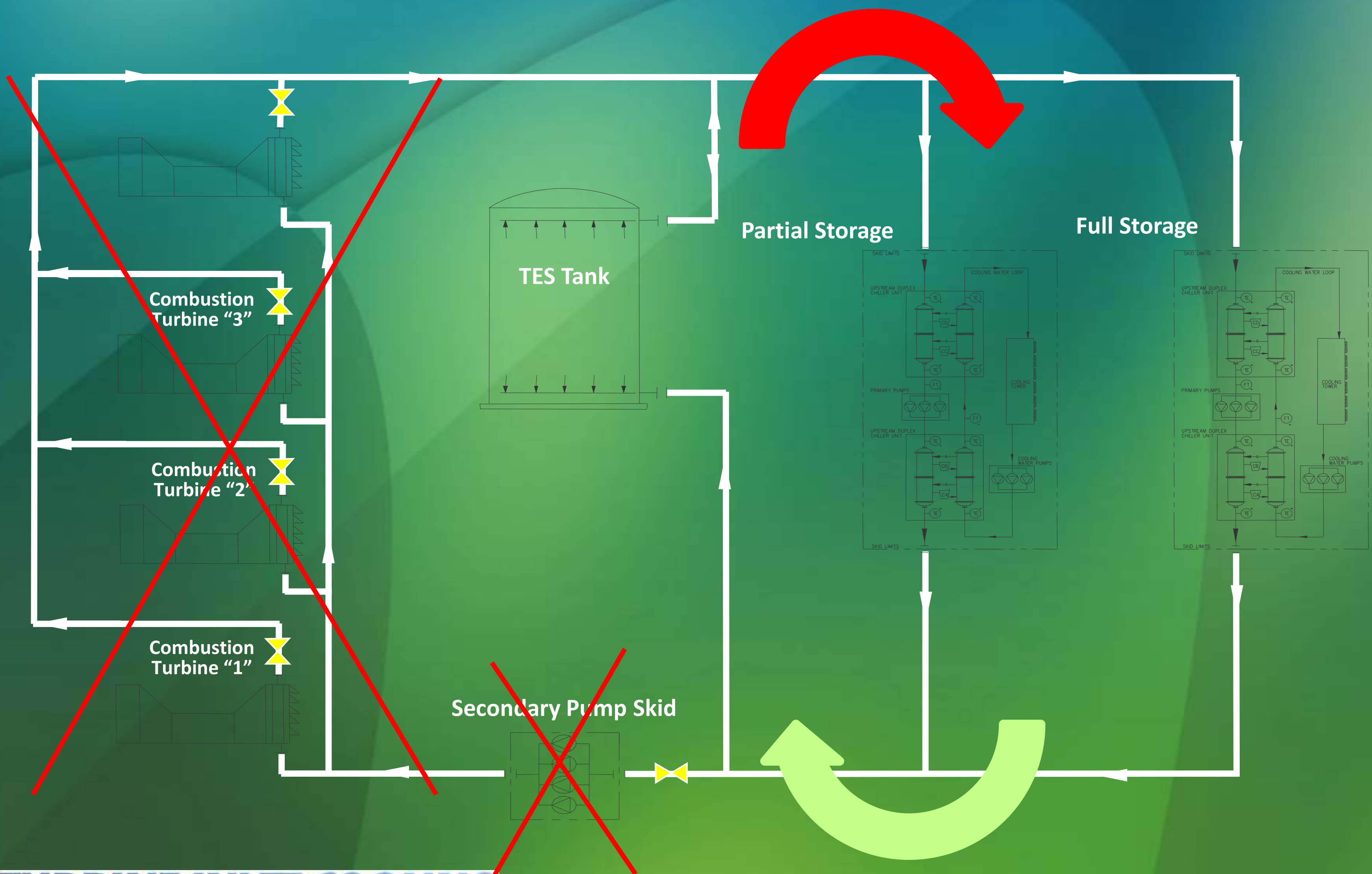
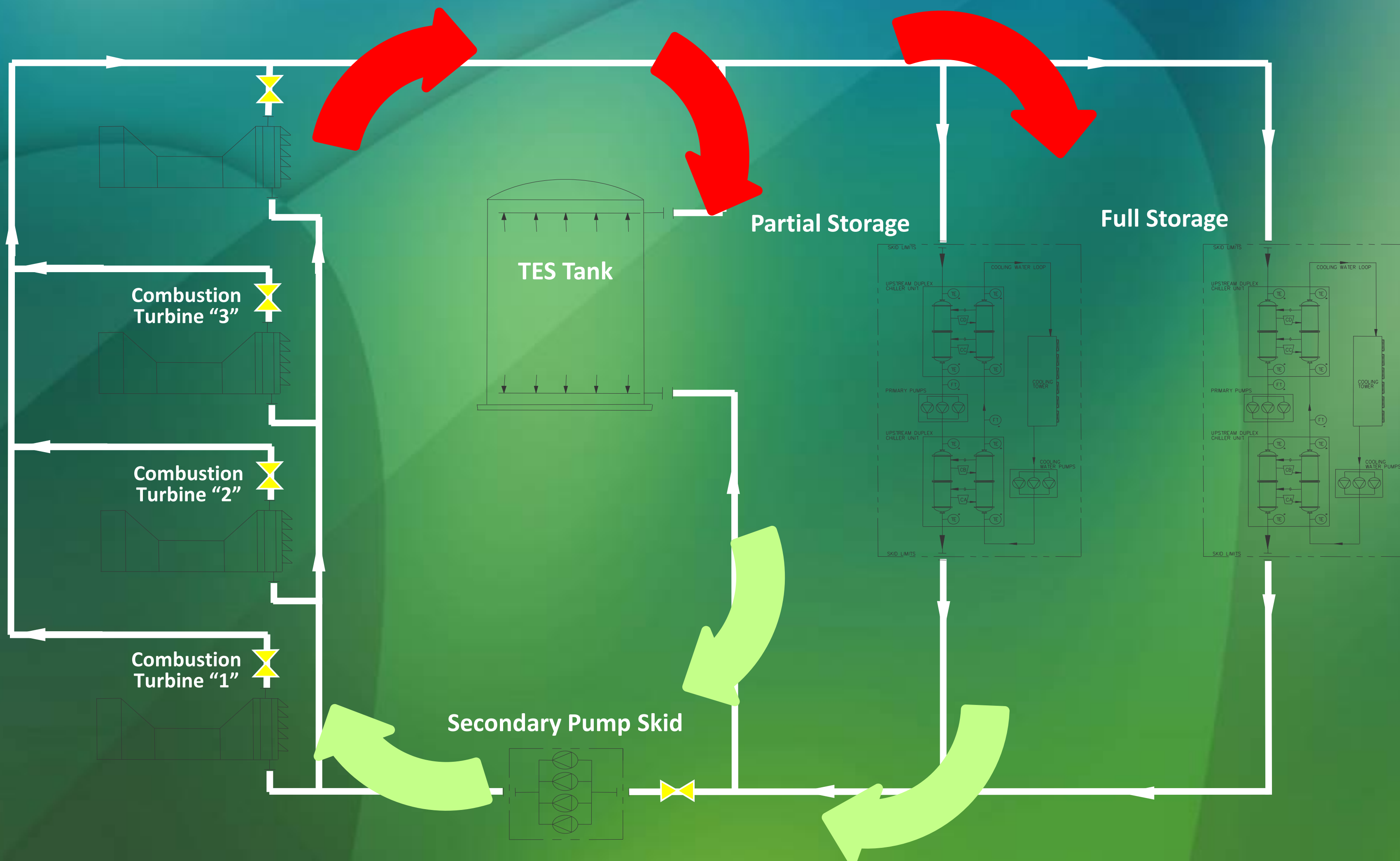
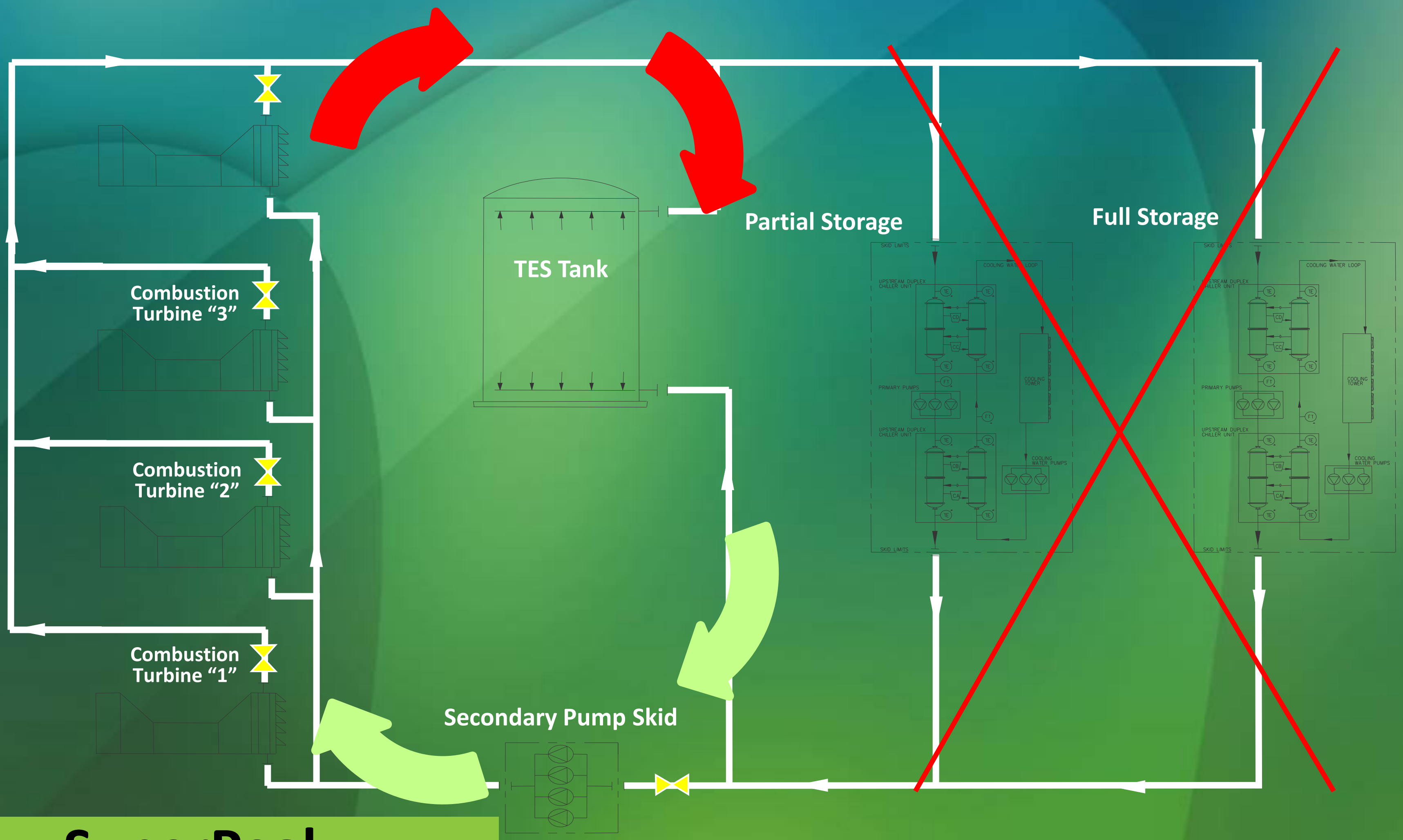
PFD – CHARGE 12/10/2



PFD – PARTIAL DISCHARGE 12/10/2



PFD – FULL DISCHARGE 12/10/2



SuperPeak™

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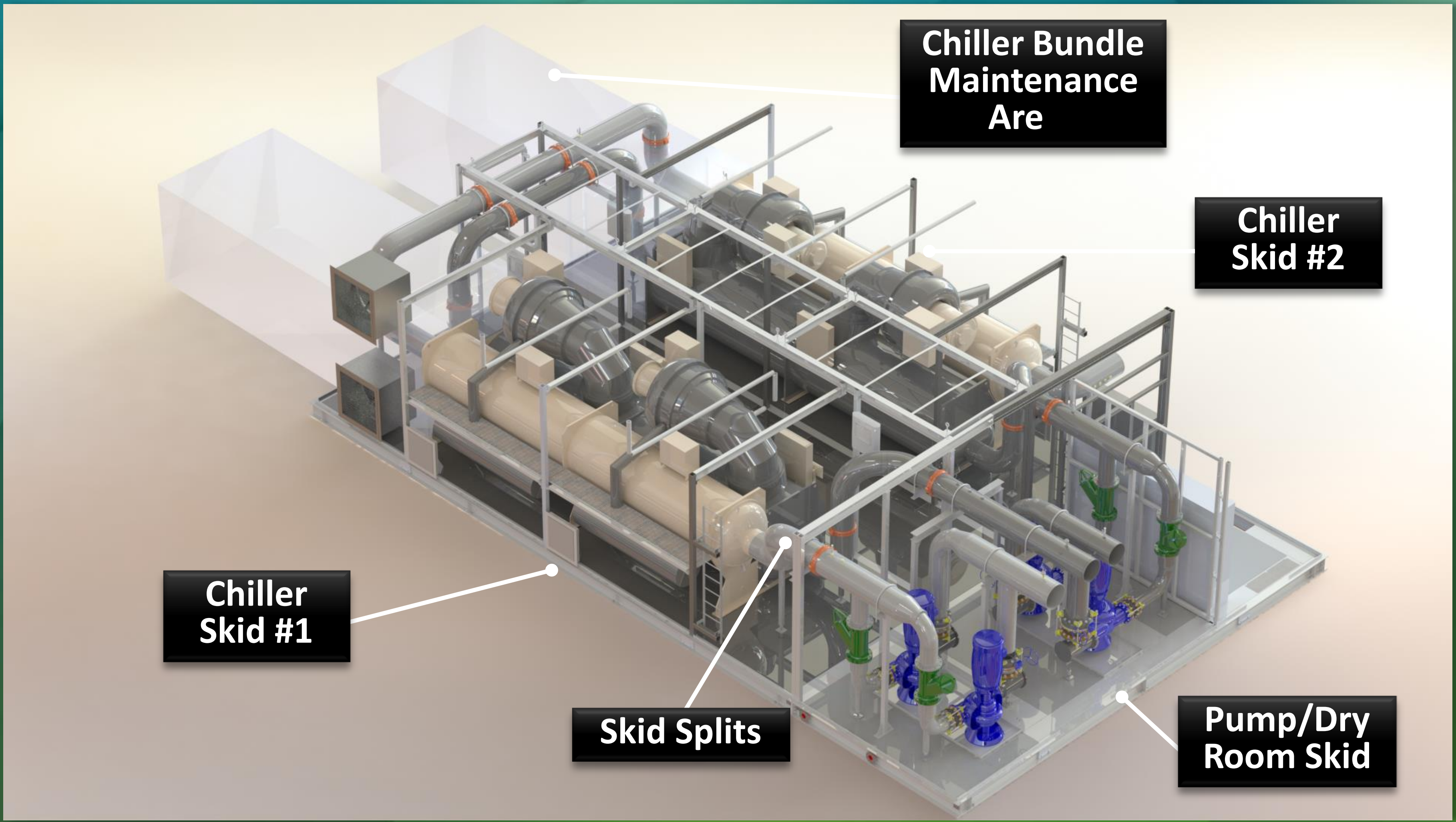
F-SKID FEATURES



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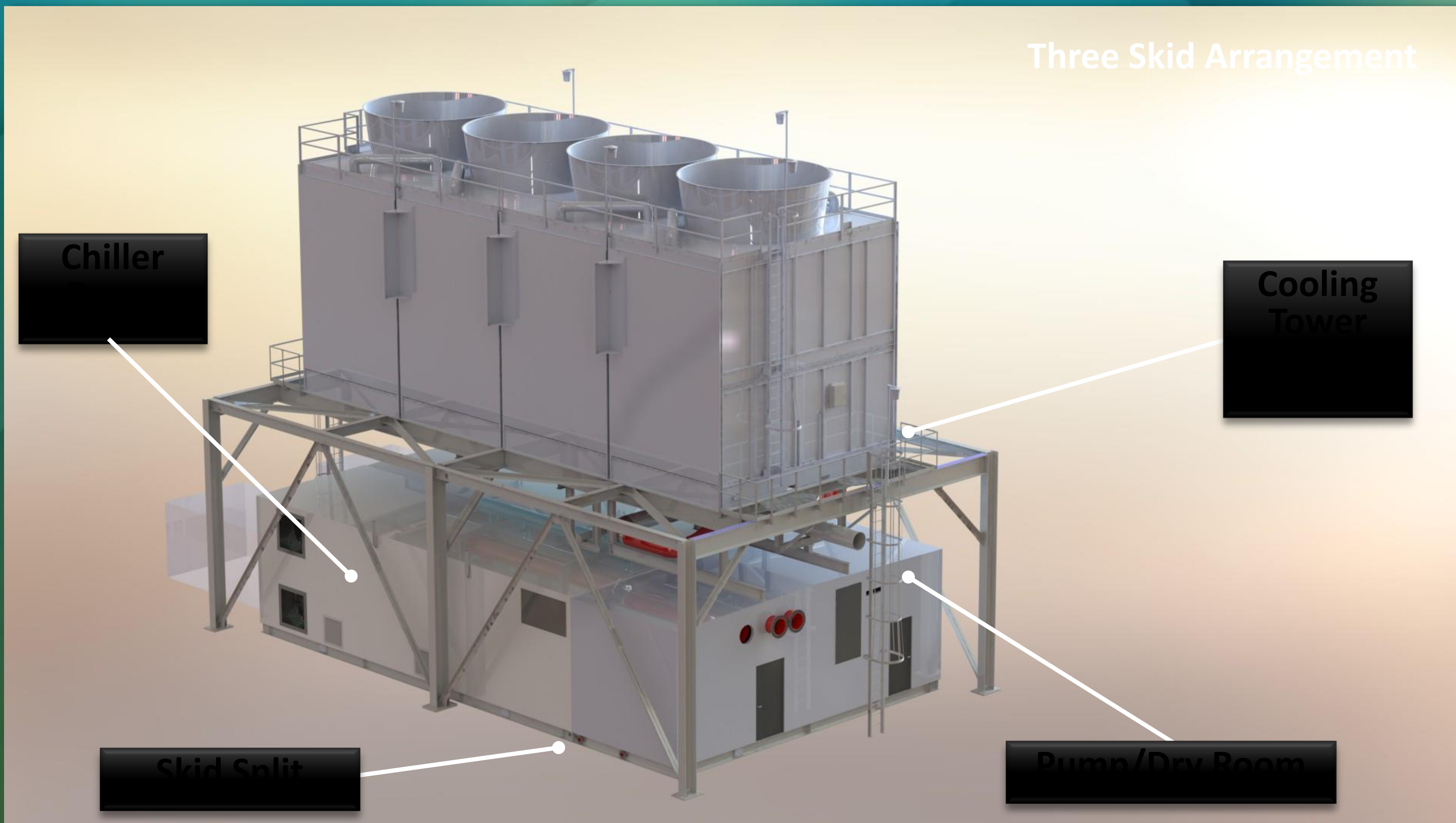
F-SKID FEATURES



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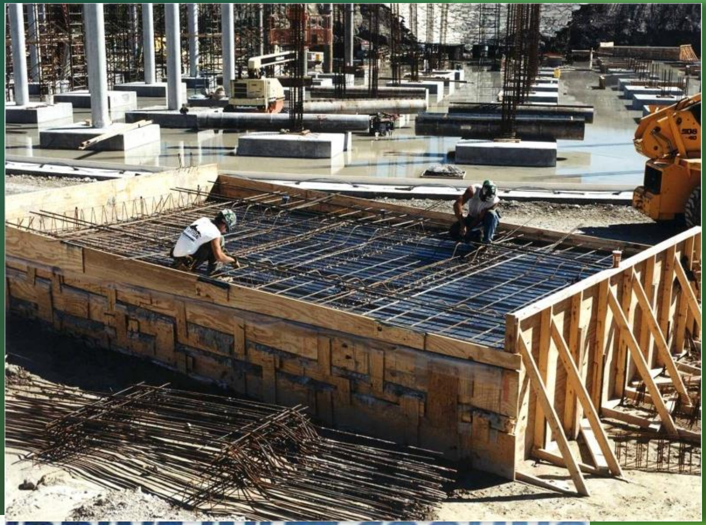
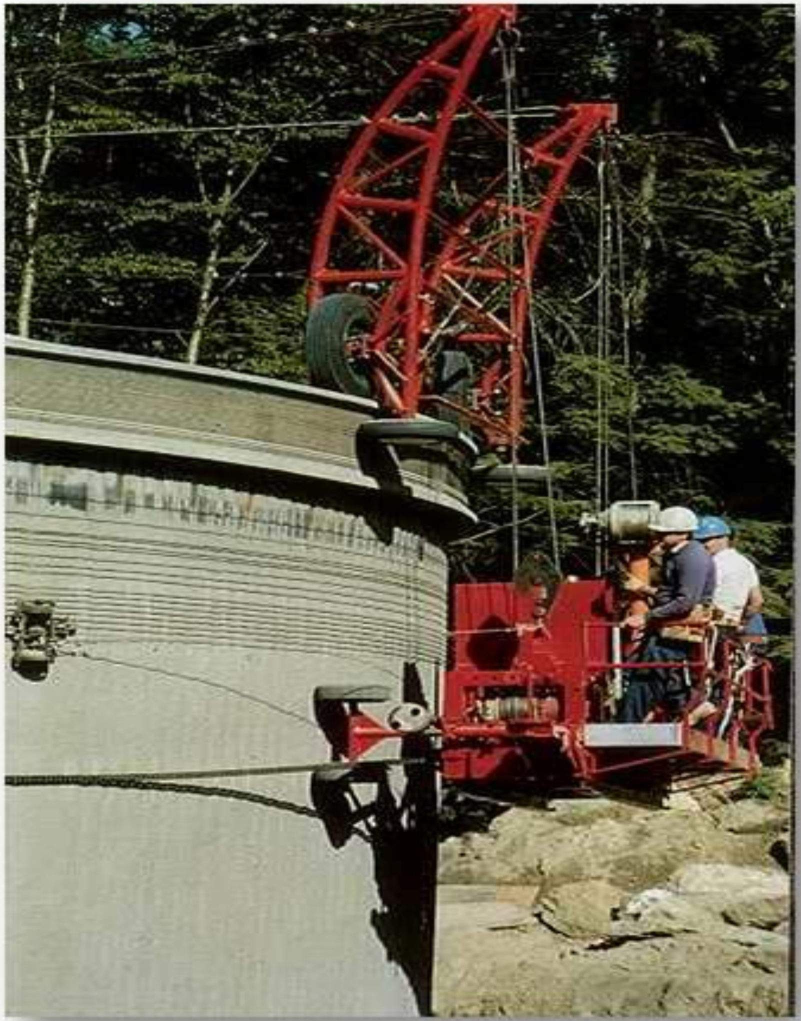
TES TANK CONSTRUCTION



TES TANK CONSTRUCTION



Pre-Stressing
Calibrated Wire Spacing

TES TANK INTERNALS

Diffuser Holes

Lower Diffuser Manifold

Upper Diffuser Manifold

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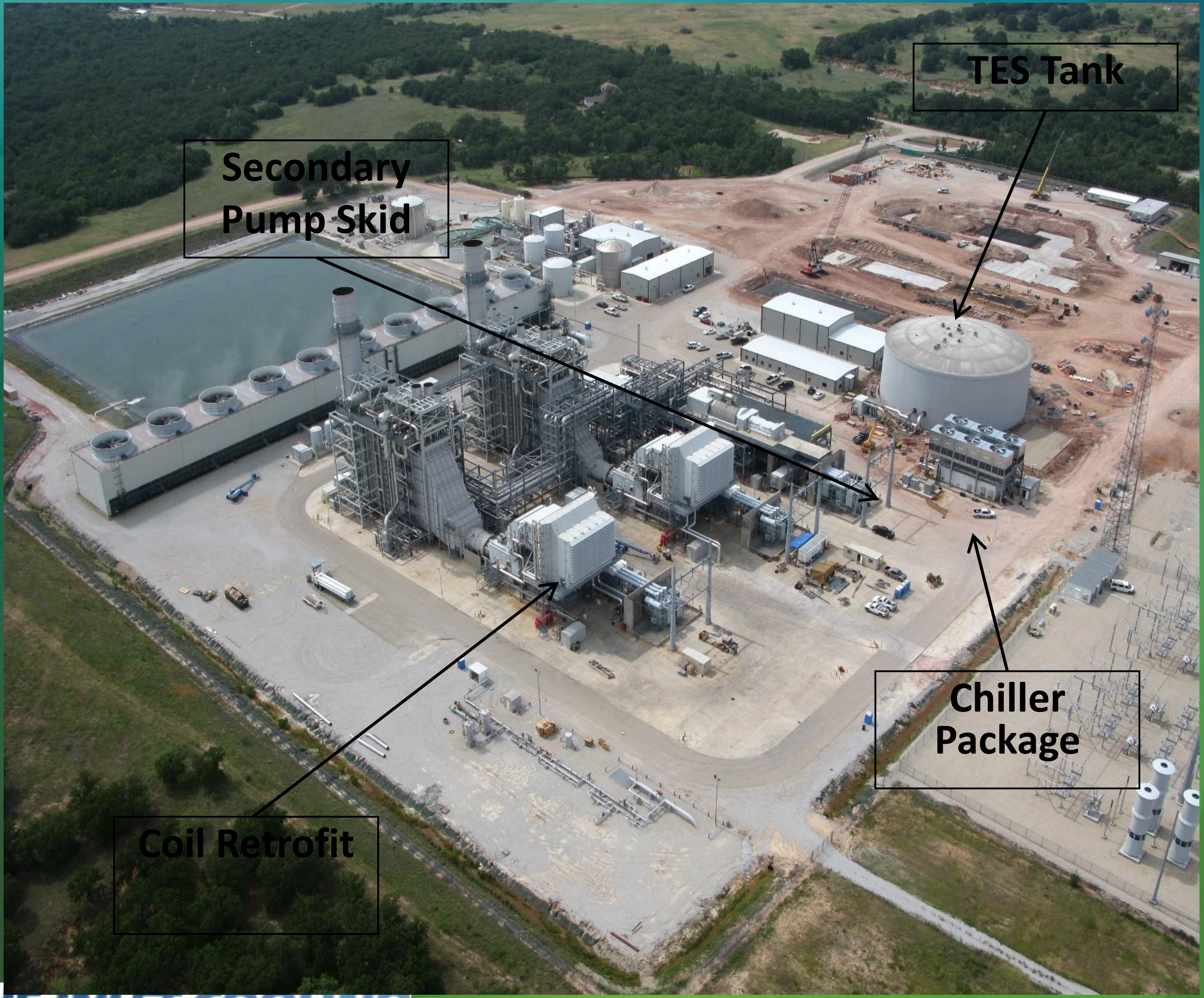
TYPICAL LAYOUT



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PROJECT PROFILE

Texas Cooperative

- GE 7FA in CC (2 Blocks of 2x1)
- Two (2) F Packaged Chiller Systems
- One Thermal Energy Storage Tank
- Start-Up in 2010 (retrofit) & 2012 (new plant)

Retrofit + New EPC

Project Timing: 2008-2009 Outage Duration: ~15-30 Days Construction Man-Hours: ~50,000
Construction Duration: ~9 Months Project Timing: 2008-2009

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PROJECT PROFILE

Texas Cooperative

- Siemens 501FC in CC (1x1)
- One (1) Packaged Chiller Systems
- One Thermal Energy Storage Tank – 1.74 M gallons
- Start-Up in 2012

Retrofit

PROJECT PROFILE

Duke Power – Buck CC Plant

- GE 7FA in CC (2x1)
- Two (2) F Packaged Chiller Systems
- COD in 2011

TES Tank

Chiller Package

PROJECT PROFILE

Duke Power – Dan River CC Plant

- GE 7FA in CC (2x1)
- Two (2) F Packaged Chiller Systems
- COD in 2012

PROJECT PROFILE

Dominion – Fairless Energy

- GE 7FA in CC (2 blocks of 2x1)
- 2 TAS Packaged Chiller Systems
- 1 Thermal Energy Storage Tank
- Completed in 2008
- Filter House Retrofit for Inlet Coils

Retrofit
(installation by others)

TANK SIZE: 7.6 MG POWER INCREASE: 115 MW

Near Trenton, NJ

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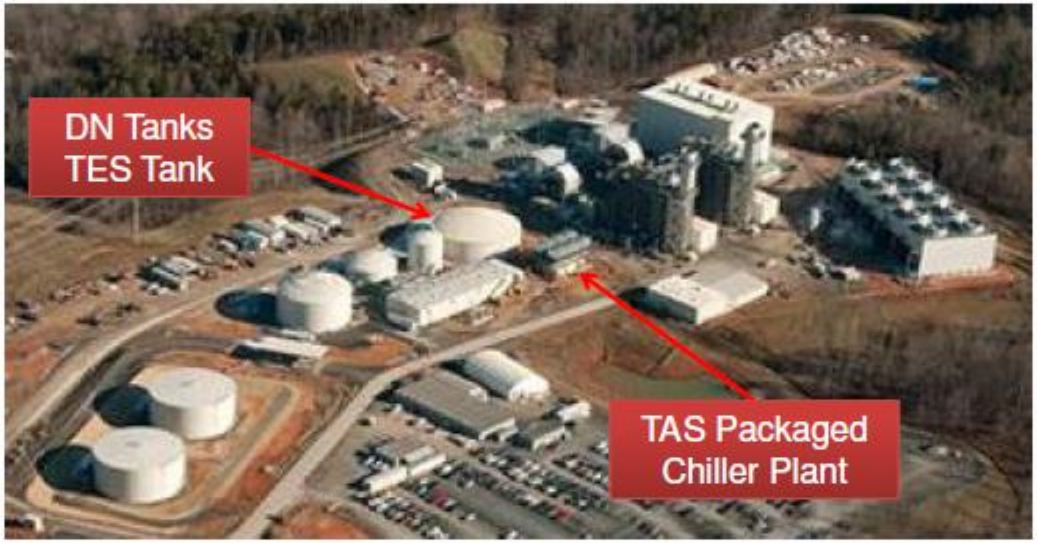
PROJECT PROFILE

Dominion – Bear Garden

- GE 7FA Combined Cycle Plant (2x1)
- 1 TAS Packaged Chiller Systems
- 1 Thermal Energy Storage Tank
- Completed in 2011



TANK SIZE: 3.9 MG POWER INCREASE: 60 MW

PROJECT PROFILE

Dominion – Warren County

- MHI 501G Combined Cycle Plant (3x1)
- 3 TAS Packaged Chiller Systems
- 1 Thermal Energy Storage Tank
- Start-Up in 2014

TANK SIZE: 8.9 MG POWER INCREASE: 107 MW EPC: Zachry/Burns & McDonnell

PROJECT PROFILE

Dominion – Brunswick County

- MHI 501G Combined Cycle Plant (3x1)
- 4 TAS Packaged Chiller Systems
- 1 Thermal Energy Storage Tank
- Start-Up in 2016

<u>TANK SIZE: </u> 10.7 MG <u>POWER INCREASE:</u> 123 MW <u>EPC:</u> Fluor

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Turbine Inlet Chilling (TIC) Generation Storage

Best Practices

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DESIGNING THE SYSTEM

WHAT IS THE DRIVER FOR ADDITIONAL CAPACITY?

- Do you need the added capacity 24 hours per day
- How many hours do you want highest output
- What are revenue considerations
  - How valuable is another 5-7 MW on top of system addition
- Will there be an expansion effort onsite in future
- Availability of water

AF COIL MODULE DESIGN

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CONCENTRIC VS. ECCENTRIC

BEFORE

- Eccentric Inlet Duct
- Extended Inlet Duct for Fogging

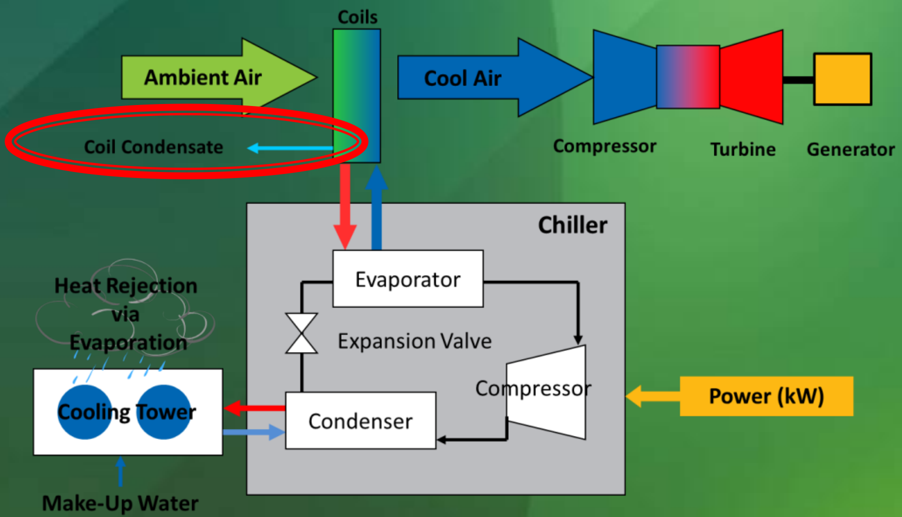
AFTER

- Concentric Inlet Duct
- New Spacer Elevates Inlet Duct
- Existing Filter House Utilized

BEST PRACTICTES

WINTERIZATION

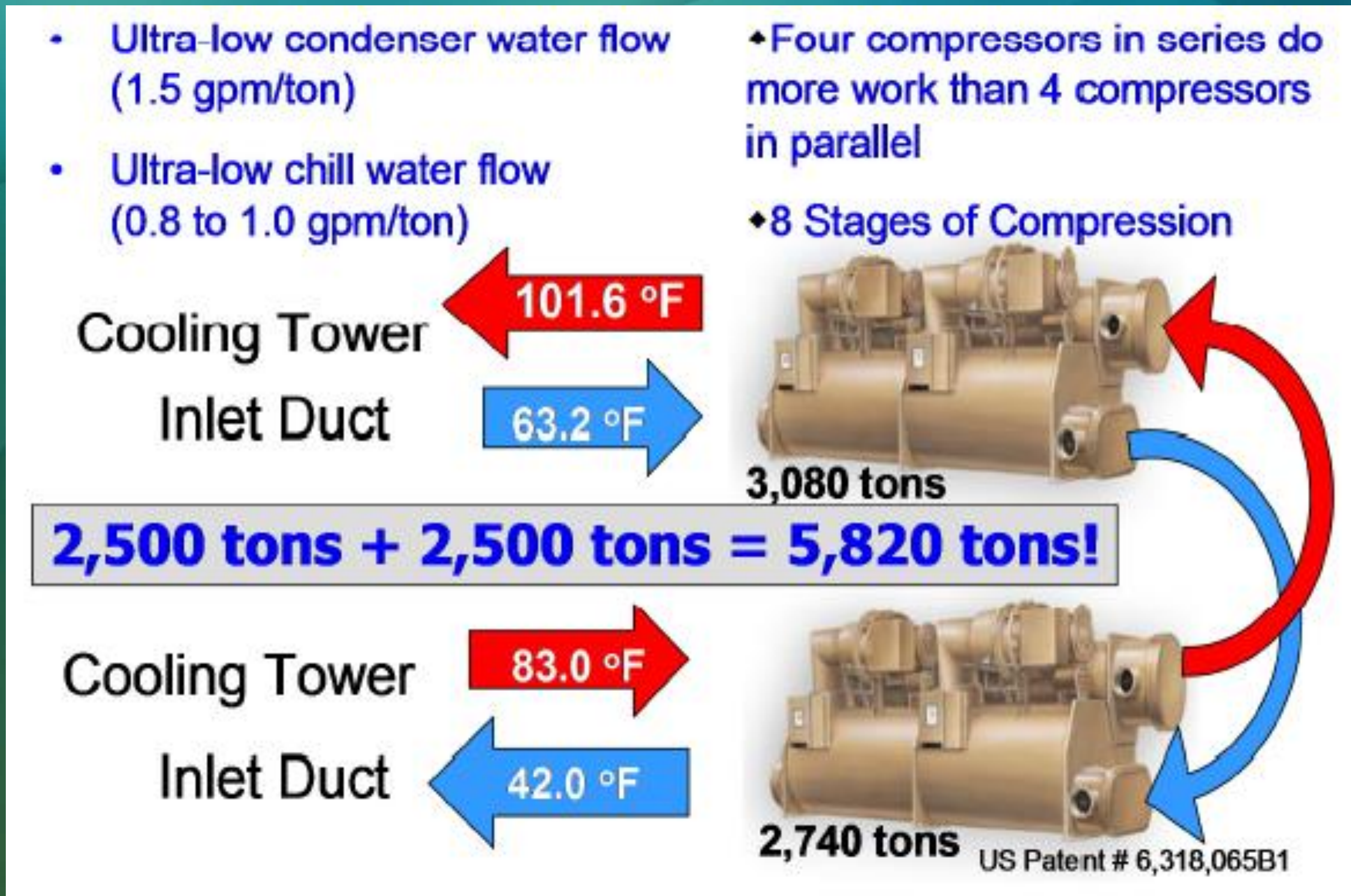
- No Glycol
- Drainable coils
- Not required on the TES T



COIL CONDENSATE

- Good quality
- Water makeup flexibility

SERIES COUNTERFLOW: EFFICIENCY



Lower Parasitic Loads

Higher CHW delta T = smaller TES tank, Pumps

BEST PRACTICTES

SUPER PEAK – 12/10/2 (charge, partial discharge, SuperPeak)

- Max benefit, lowest parasitics
- Larger Secondary Pump Skid, TES Tank flow rate

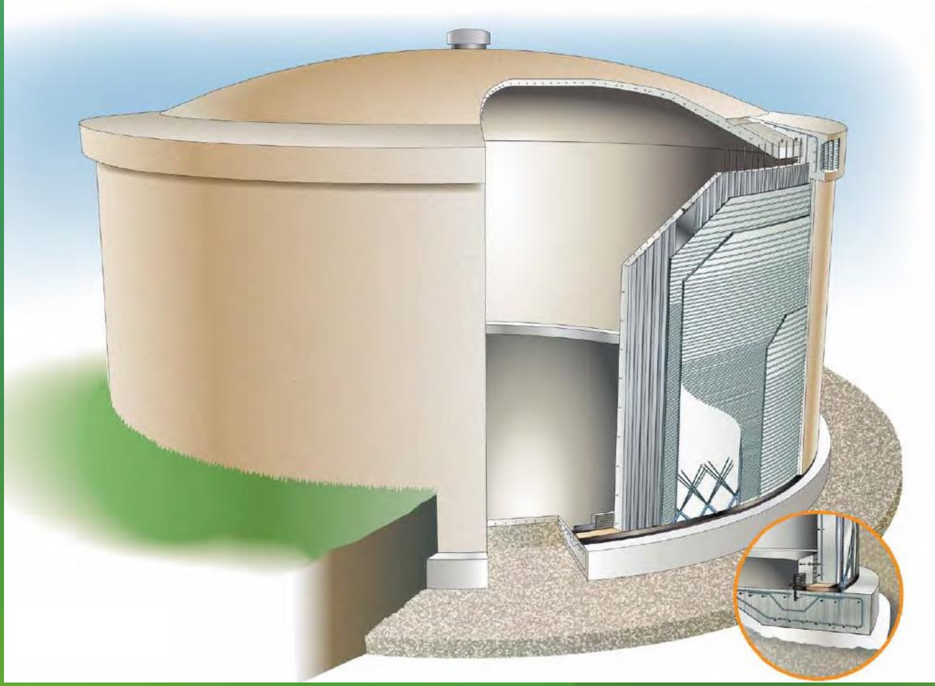
DESIGN CONDITION

- Design condition (95°F drybulb, 75°F wetbulb)
- 24 hour design DAY

BEST PRACTICTES

TES TANK

- AWWA Standard D-110, Type III
- Water Tight
- Thermal performance
- Concrete – lower life cycle cost, no painting



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Thank You!

Trey Sims
tsims@tas.com
281.229.4469

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