Chiller Systems for Combustion Inlet Air Cooling

Trevor Richter

Vice President, Stellar Energy Systems, Inc.

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Chiller Systems

Outline

- Drivers for Chiller Systems
- TIAC Chiller System Overview
- Predominant Chiller System Types
- Project Design Parameters
- System Design Considerations
- Summary

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Chiller Systems

Drivers

- Additional Output
- Dispatch Priority
- Predictable and Consistent Output
- Altitude Compensation
- Matching Output of Competitors GT
- Waste Heat Utilization

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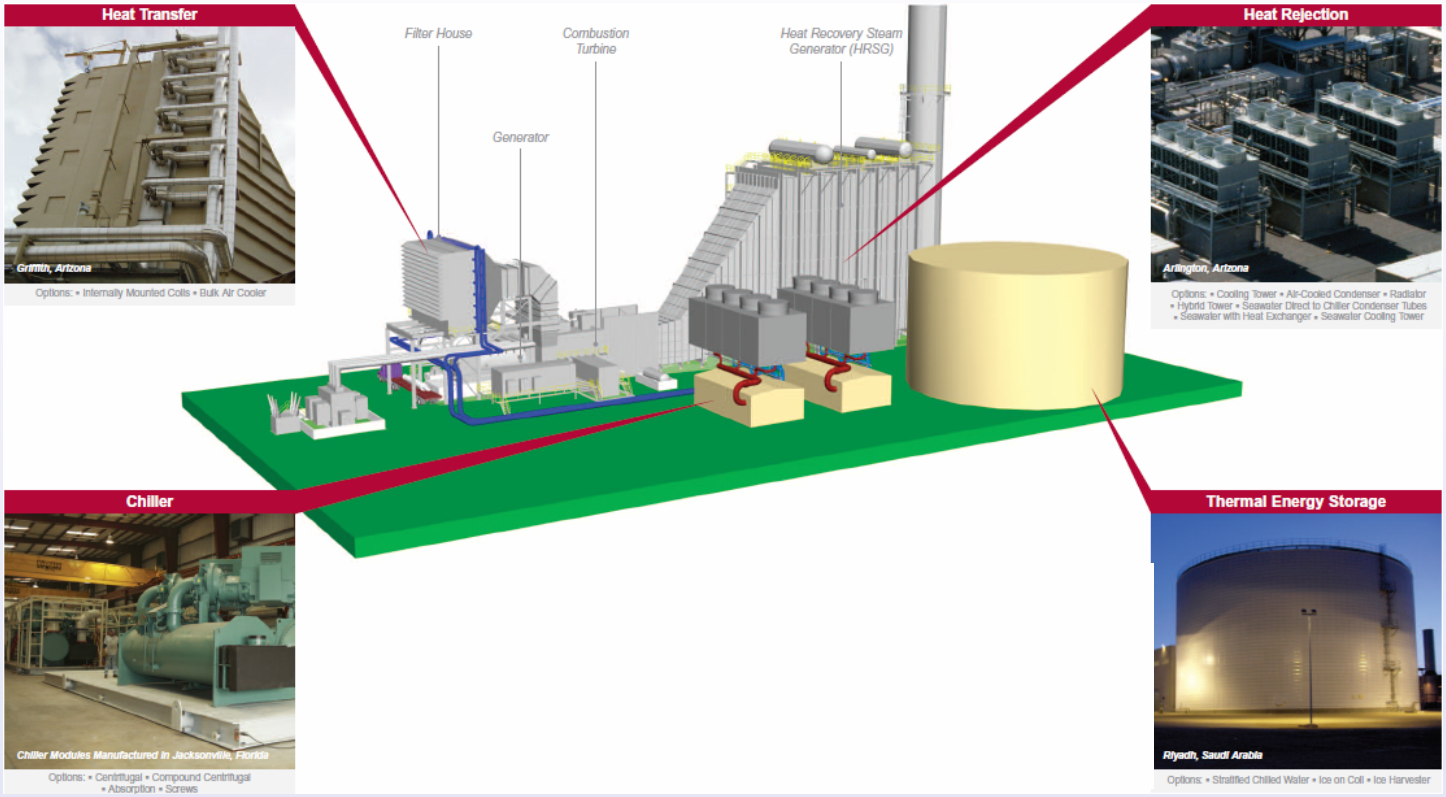
Chiller Systems

TIAC Chiller System Overview



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Chiller Systems

Predominant Types

- Electric Centrifugal Chillers
- Screw Compressor Refrigeration Systems
- Absorption Chillers

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Chiller Systems
Electric Centrifugal Chillers with Cooling Towers

Benefits

- High Efficiency
- Low Cost
- Small Footprint
- Operational Flexibility

Limitations

- Requires Makeup Water
- Open Loop Heat Rejection
- Water Discharge

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Chiller Systems
Electric Centrifugal Chillers with Cooling Towers

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Chiller Systems
Electric Centrifugal Chillers with Radiators

Benefits

- No Water Required
- Relatively Fast Startup
- Low Cost Air-Cooled System

Limitations

- Lower Efficiency than with Cooling Towers
- Larger Footprint
- Higher Sound Levels
- Higher Cost than with Cooling Towers

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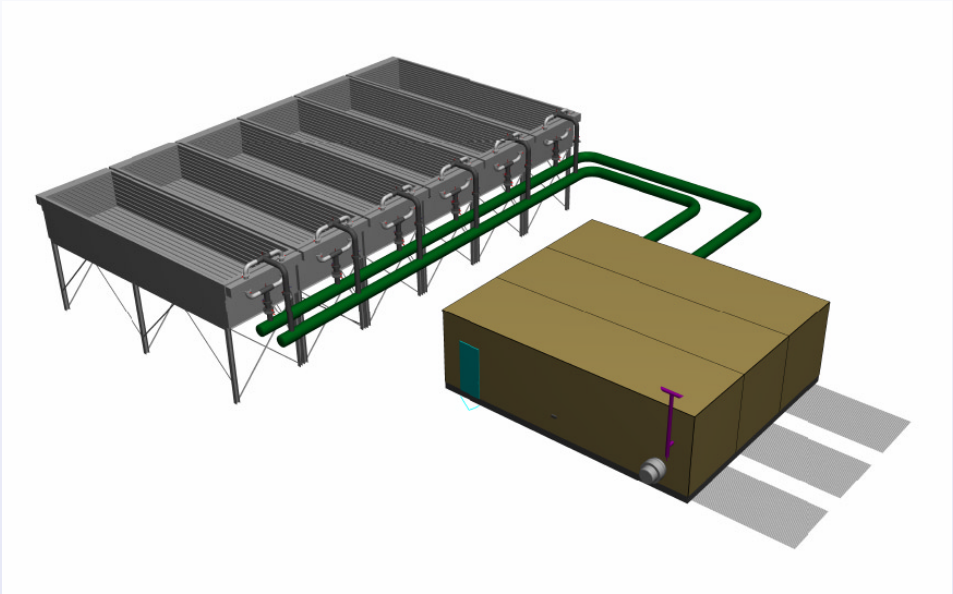
Chiller Systems
Electric Centrifugal Chillers with Radiators



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Chiller Systems
Screw Compressor Refrigeration System with Air-Cooled Condenser

Benefits

- No Water Required
- Relatively Fast Startup
- Can be Modular

Limitations

- Lower Efficiency
- Larger Footprint
- Higher Sound Levels
- Higher Cost

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Chiller Systems
Screw Compressor Refrigeration System with Air-Cooled Condenser

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Chiller Systems
Absorption Chiller with Cooling Towers

Benefits

- Fueled by Heat or Natural Gas

Limitations

- Supply Water Temps
- Makeup Water Req
- Higher Cost
- Lacks Flexibility
- Must use Heat when Available

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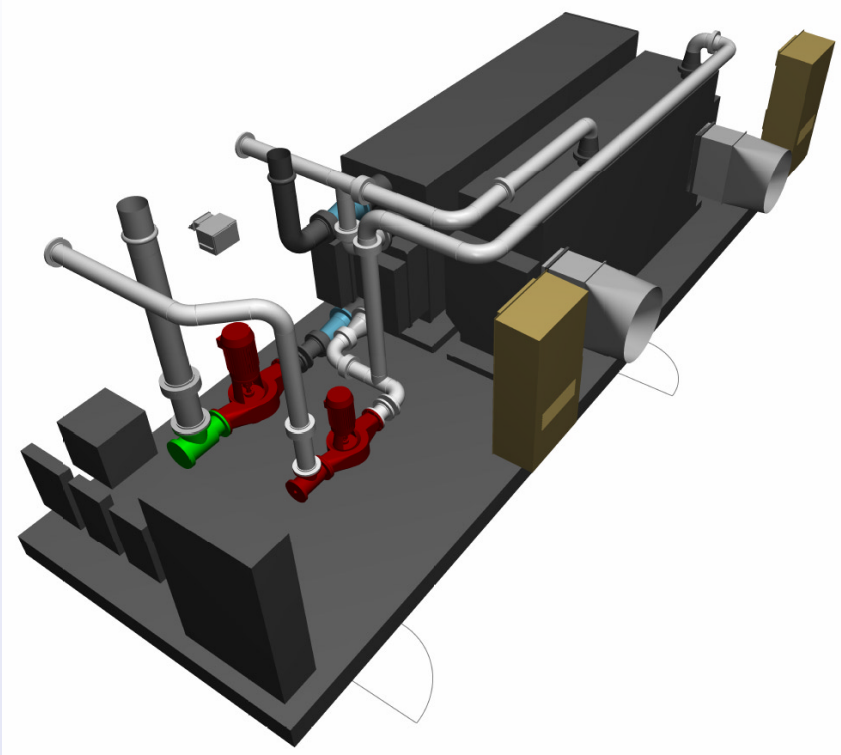
Chiller Systems
Absorption Chiller with Cooling Towers



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Chiller Systems

Project Design Parameters - Sizing

- **Ambient Design Conditions**
- **Elevation (Inlet Pressure)**
- **Mass Flow (Inlet Temperature)**
- **Parasitic Losses**
  - Pipe Heat Leak
  - Pump Heat Load
  - Chiller Plant Cooling
  - Auxiliary Loads

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Chiller Systems

Project Design Parameters - IAT

- **Maximum Output**
- **Optimal Capital**
- **Optimum Heat Rate**
- **Minimum Augmentation**
  - Satisfy Capacity Contract
  - Satisfy Competitive Specification
  - Site Utility Limitation

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Chiller Systems

Project Design Parameters - Site

- Equipment
- Space
- Chiller Plant Energy Source
- Heat Rejection
- Permitting

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Chiller Systems

System Design Considerations

Heat Transfer for Inlet Air

- Face Velocity (400 to 500 fpm)
- Pressure Drop
- Size Limitations
- Supply Temperature (Direct vs TES)
- Freeze Protection
- Macro-Environments

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Chiller Systems

System Design Considerations

Chiller

- Type
- Refrigerant
- Configuration
- Tube Material
- Manufacturer

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Chiller Systems

System Design Considerations

Pump

- Redundancy
- Configuration
- Motors

Chiller Systems

System Design Considerations

Heat Rejection

- **Cooling Towers**
  - Materials
  - Sound
- **Natural**
- **Radiators**
- **Condensers (wet surface or air-cooled)**

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Chiller Systems

System Design Considerations

Electrical

- Feeds
- Standards (NEMA,IEC, etc.)
- Gear (Arc Flash Resistant)
- Motors
- Controls

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Chiller Systems

Summary

- Output Independent of Ambient Conditions
- Water Consumption and Discharge
- Design Parameter Determination is Key

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