Packaged Central Plants

August 4, 2005

TRANE
Success Has Partners

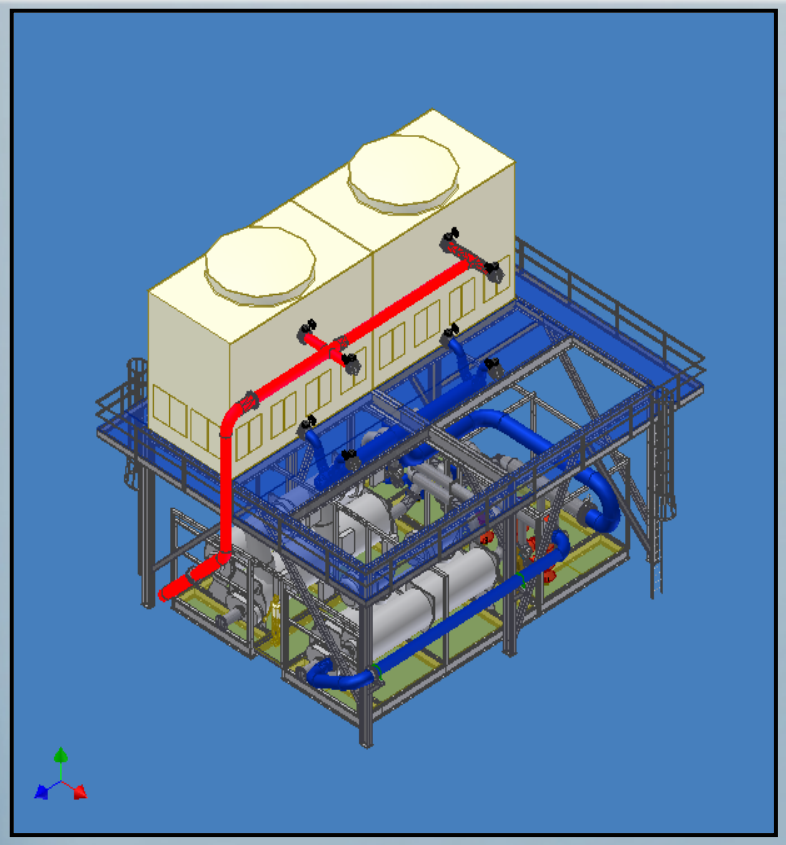
ISO 9001:2000

Agenda

- ✓ Packaged Central Plant Product
- ✓ Capabilities/Value Proposition
- ✓ Application
- ✓ Summary

Innovation → Efficiency → Savings = ^ Best Value Guaranteed

Packaged Plant Product



- ✓ Engineered Package:
  - **Single or Multiple Chillers**
  - **Boilers and/or Plate & Frame HX**
  - **Chilled water pumps (N+1)**
  - **Condenser water pumps (N+1)**
  - **Hot Water Pumps (N+1)**
  - **Motor Control Centers**
  - **Controls: DDC or PLC**
  - **Fully Air Conditioned Enclosure**
    - **Optional "Convertible" versions**
  - **Cooling Tower**
  - **Tower support structure and piping**
- ✓ Guarantees:
  - **Cost ($/ton)**
  - **System Efficiency (kW/ton)**
  - **Completion date (months)**

Benefit of Packaging: Contract to Require Performance Liquidated Damages (LD's) for Efficiency, Tons, etc.

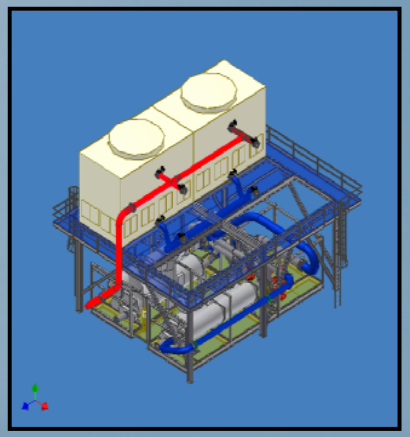
Guaranteed Innovation → Efficiency → Savings = ^ Best Value

Core Design Principles

- ✓ **Highest Energy Efficiency**
  - ✓ **Thermodynamic staging**
  - ✓ **Low condenser water flow**

    (1.5 gpm/ton = 20ºF ΔT)
  - ✓ **Low chilled water flow**

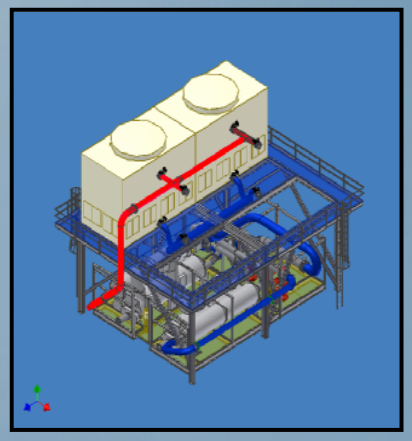
    (1.0 to 1.6 gpm/ton = 15ºF to 24ºF ΔT)
  - ✓ **Variable-primary-flow (ChW)**
- ✓ **Equipment serviceability**



Innovation → Efficiency → Savings = ^ Best Value Guaranteed

Design Principles – “Low-Flow” Design

- ✓ Reduces initial costs
  - **Smaller pumps**
  - **Smaller pipe sizes**
  - **Smaller switchgear and electrical equipment**
- ✓ Reduces operating costs
  - **Less pumping energy**
  - **Lower connected load**



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Quantitative Advantages

- ✓ Cost – Typical installed cost savings of $200-$300 per ton versus field-erected systems
  - ✓ Controlled construction environment
  - ✓ Repetitive processes
- ✓ Schedule - can save up to 50% (6 months) versus typical design/bid/construct
- ✓ Industrial Quality
  - ✓ ISO 9001:2000 Certified Manufacturing Processes
  - ✓ Standard product designs allow continuous improvement
  - ✓ B31.1 Piping
  - ✓ Seismic Zone IV – 115MPH – 40 lb/sq ft

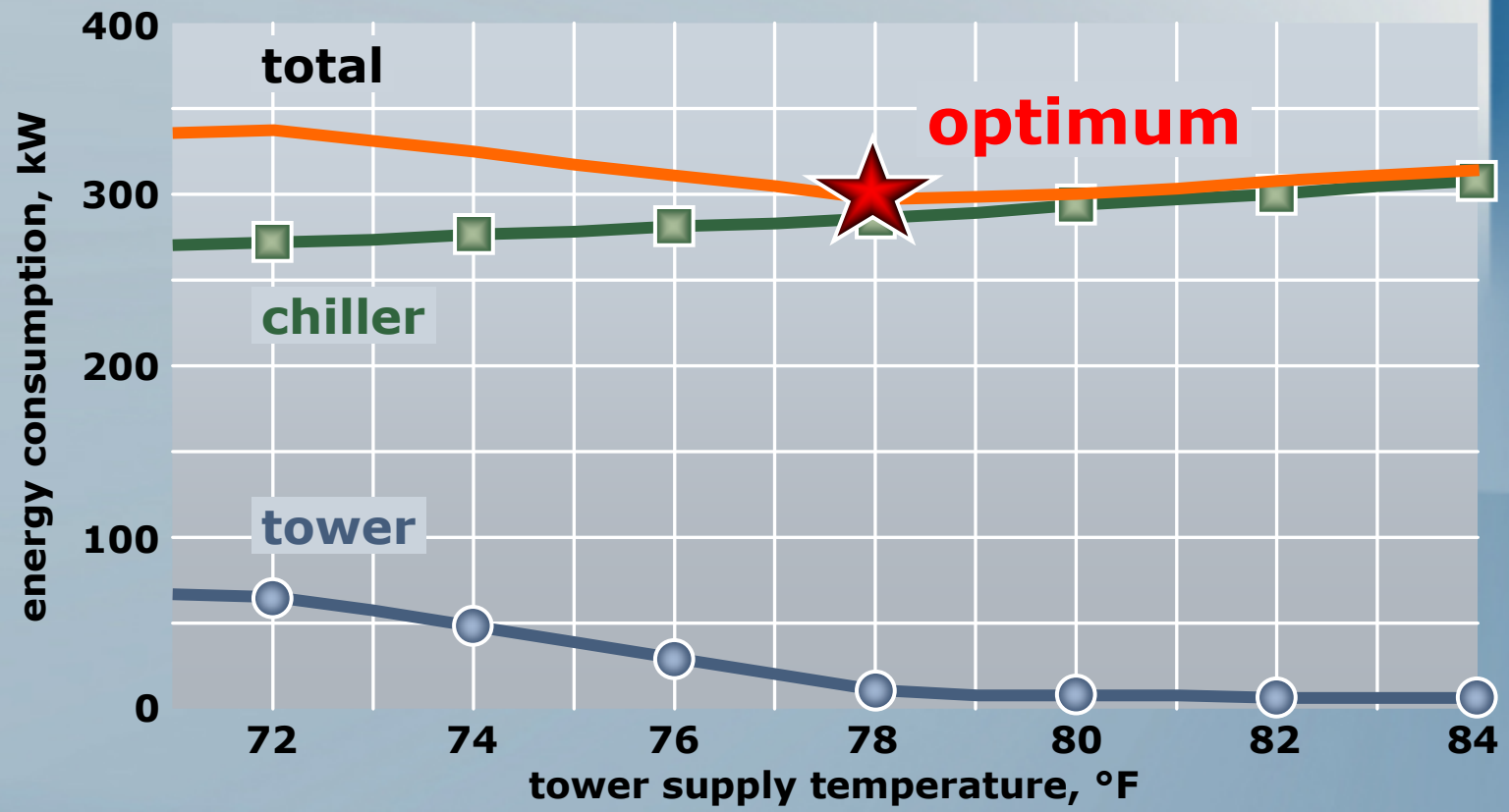
Guaranteed Innovation → Efficiency → Savings = ^ Best Value

Quantitative Advantages

- ✓ High System Efficiency
  - ✓ Chiller/Pump/Tower Optimization
- ✓ Equipment Enclosure
  - ✓ Realize use of building space once reserved for mechanical room(s)
- ✓ Compact Footprint
- ✓ Standardized O&M service and parts

Innovation → Efficiency → Savings = ^ Best Value Guaranteed

Chiller–Tower Optimization



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Trane was awarded the 2004 SBIC "Best Sustainable Practice" award, recognizing the Trane Chiller-Tower Optimization chiller plant operating system.

SBIC – Sustainable Buildings Industry Council

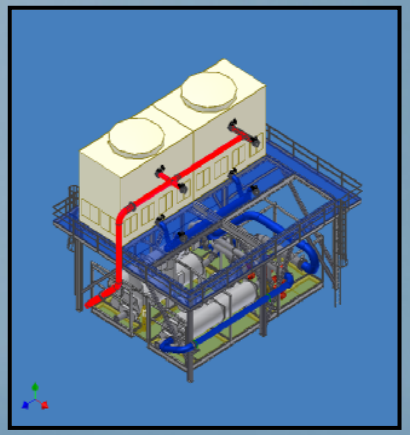
Qualitative Advantages

- ✓ Single-source responsibility
  - ✓ Integration
  - ✓ One set of submittal, P&ID, PFD documents
- ✓ Simplified project execution/management
- ✓ Commissioning
  - ✓ Controls certification
- ✓ Flexibility - customizable to fit specific site conditions
  - ✓ Various scope options: compatible with TES, BCHP, and Cogeneration
- ✓ Portable/Modular/Expandable
  - ✓ On-site as missions/needs change
  - ✓ Different sites
- ✓ Guaranteed and predictable performance

Innovation → Efficiency → Savings = ^ Best Value Guaranteed

Plant Maintenance and Serviceability

- ✓ Dry room for switchgear and controls
- ✓ Minimum 5 foot aisle between chillers
- ✓ Clearance for compressor removal
- ✓ Overhead monorail hoist (pumps)
- ✓ Removable end-walls or doors for tube access
- ✓ Internal catwalks and ladders
- ✓ Cooling tower catwalk & railing



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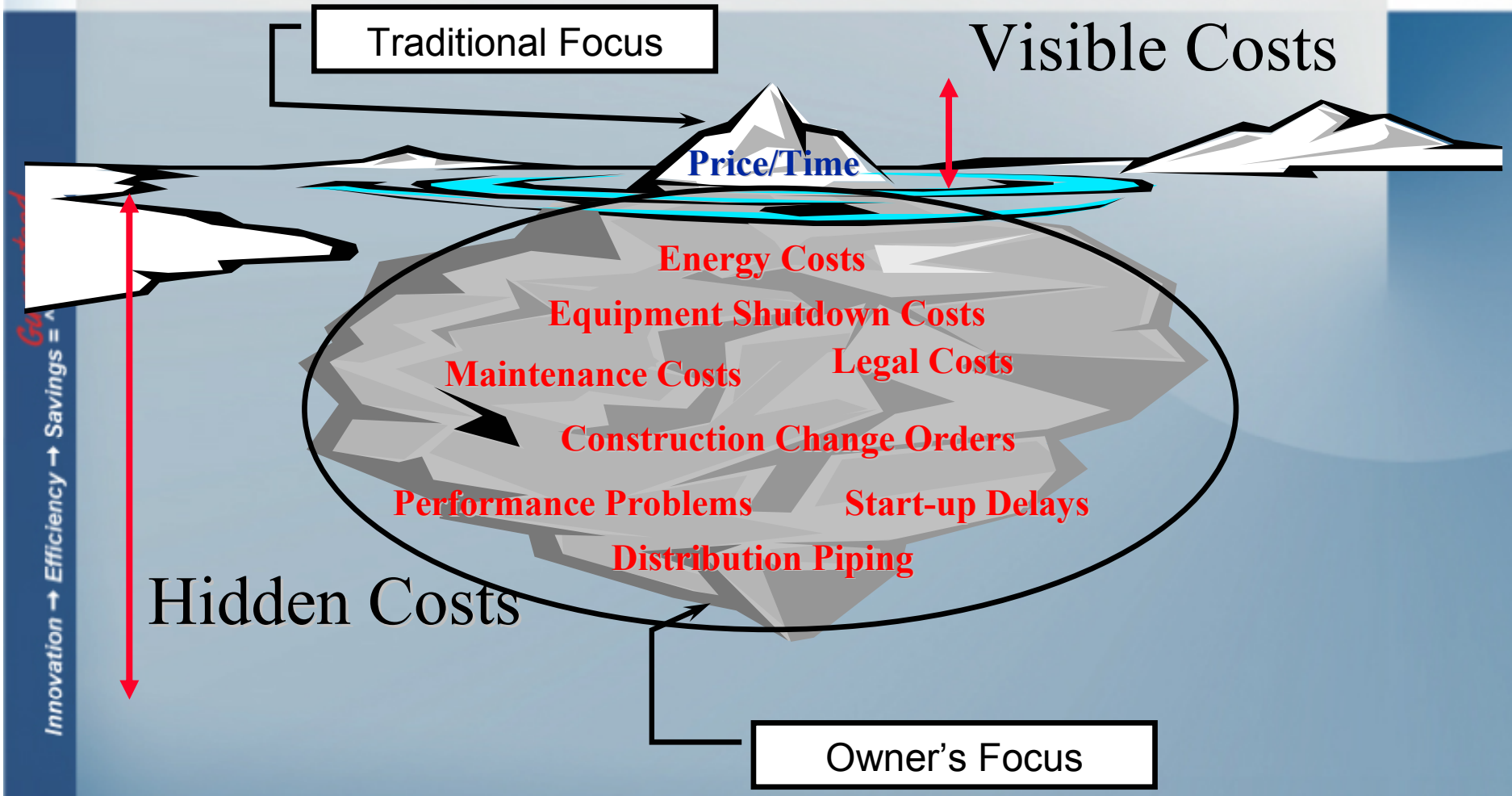
Total Cost of Ownership



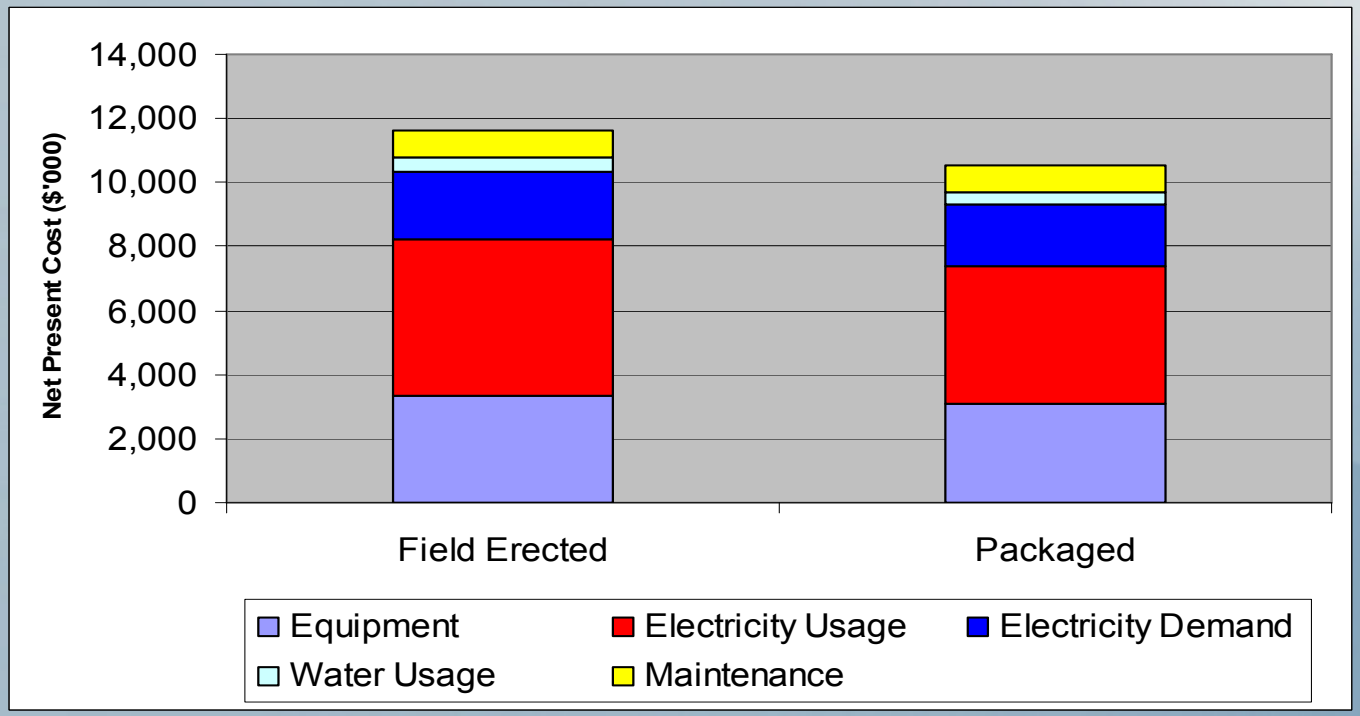
Innovation → Efficiency → Savings = A

PACKAGED CENTRAL PLANTS

Project:	2000 Ton Central Plant				
TAS Proposal Number:	2004-I				
Customer Name	Medical Building				
Option 1:	Field Erected 2000 ton plant				
Option 2:	TAS H-Series with 2 x Long barrel simplex chillers				
Input:					
Total Installed Tons:	2000				
Planned Full Load:	100%	*Use if redundancy exists*			
Running Full Load Tons:	2000				
	Option 1 (MC Estimate)			**Option 2 - TAS PCP (actual)**	
Concrete Slab:		0			26,250
Chillers:		400,000			2,350,000
Cooling Towers:		170,000			included
Cooling Tower Structure:		48,000			included
Pumps:		96,000			included
Piping/Valves/Instrumentation:		370,000			included
Insulation:		148,000			included
Controls:		88,000			included
Chiller Plant Building:		320,000			included
Startup:		37,200			included
Commissioning:		64,000			included
Electrical:		344,000			included
Shipping:		74,000			90,000
Rigging:		56,000			45,000
Water Treatment:		35,000			35,000
Building HVAC:		48,000			included
Refrigerant Monitoring System:		30,000			included
Field Labor:		170,000			130,000
Warranty:		70,000			included
Subcontractor Mark-up		337,230			31,500
General Contractor Mark-up		435,815			406,163
Construction First Cost:		**3,341,245**		Actual	**3,113,913**
($/ton)		*1,671*			*1,557*
Performance Input:		**(ESTIMATED)**			**(ACTUAL)**
kW/Ton:		0.85			0.75
Running Load kW:		1,700			1,500
Connect Load kW:		1,700			1,500
Full Load Hours/Year:		4,117			4,117

Innovation → Efficiency → Savings = ^ Best Value Guaranteed

Net Present Cost Comparison



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Packaged Plant Product Benefits

Benefit	Packaged	Conventional
Energy Efficiency (kW/ton)	.70-.80	.85-1.0+
Eliminates Need for Building	Yes	No
Installed Capital Cost ($/ton)	950-1500	1600-2200+
Deployment Schedule (mos.)	6-9	18-24
Compactness	Yes	No
Portability	Yes	No
Modular Concept	Yes	No
Constructability	Simple	Complex

Guaranteed
Innovation → Efficiency → Savings = ^ Best Value

Packaged Central Plant Exterior

Innovation → Efficiency → Savings = ^ Best Value Guaranteed

Packaged Central Plant Interior

Innovation → Efficiency → Savings = ^ Best Value Guaranteed

Integrated Switchgear

Electrical/Control Dry Room separate from Chillers and Pumps

Innovation → Efficiency → Savings = ^ Best Value Guaranteed

Pumps and Headers

Innovation → Efficiency → Savings = ^ Best Value Guaranteed

Accessibility

Innovation → Efficiency → Savings = ^ Best Value Guaranteed

Typical Package Installation

Installation Statistics:

- 7-Man Crew
- 4 x 10 hour Days
- 4 Days per week

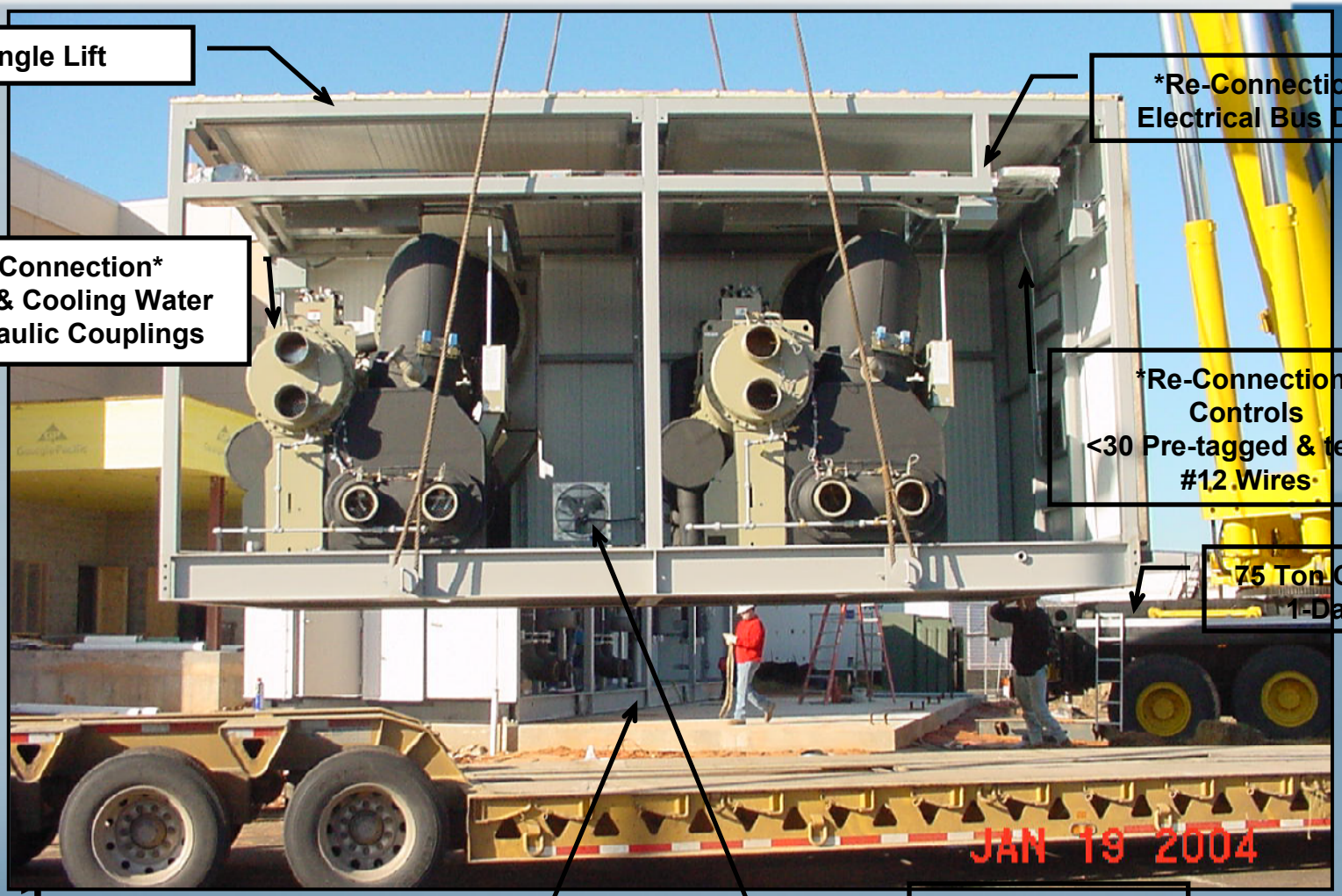
Plant Installed in 16 Working Days

Project Information:

- 1,200 tons Installed Now (2 x 600TR Centrifugal Chillers)
- Additional Expansion Planned (2 x Centrifugal Chillers)
- Expansion to be inside shown package and will require less than 10 days to install and require zero plant outage

Innovation → Efficiency → Savings = ^ Best Value Guaranteed

Receipt, Unloading, and Setting of Modules



Single Lift

Re-Connection
Electrical Bus Duct

Re-Connection
Chilled & Cooling Water
(8)-Victaulic Couplings

Re-Connection
Controls
<30 Pre-tagged & tested
#12 Wires

75 Ton Crane
1-Day

Pump Module

ASHRAE Ventilation
Lighting & Utility
Receptacles Built In

Guaranteed
Innovation → Efficiency → Savings = ^ Best Value

Day 1

TAS™

Innovation → Efficiency → Savings = ^ Best Value

Guaranteed

TAS™

Innovation → Efficiency → Savings = ^ Best Value Guaranteed

Cooling Tower Structure & Piping Arrive

Innovation → Efficiency → Savings = ^ Best Value

Guaranteed

Internal Package & Cooling Tower Structure Major Assembly Complete

Innovation → Efficiency → Savings = ^ Best Value Guaranteed

Cooling Tower scheduled for Just-in-Time Delivery and Placement

Innovation → Efficiency → Savings = ^ Best Value Guaranteed

Cooling Tower Motors & Instruments Wired, Piping Near Completion

Innovation → Efficiency → Savings = ^ Best Value Guaranteed

1200 Ton Facility Installed

Bossier City, Louisiana

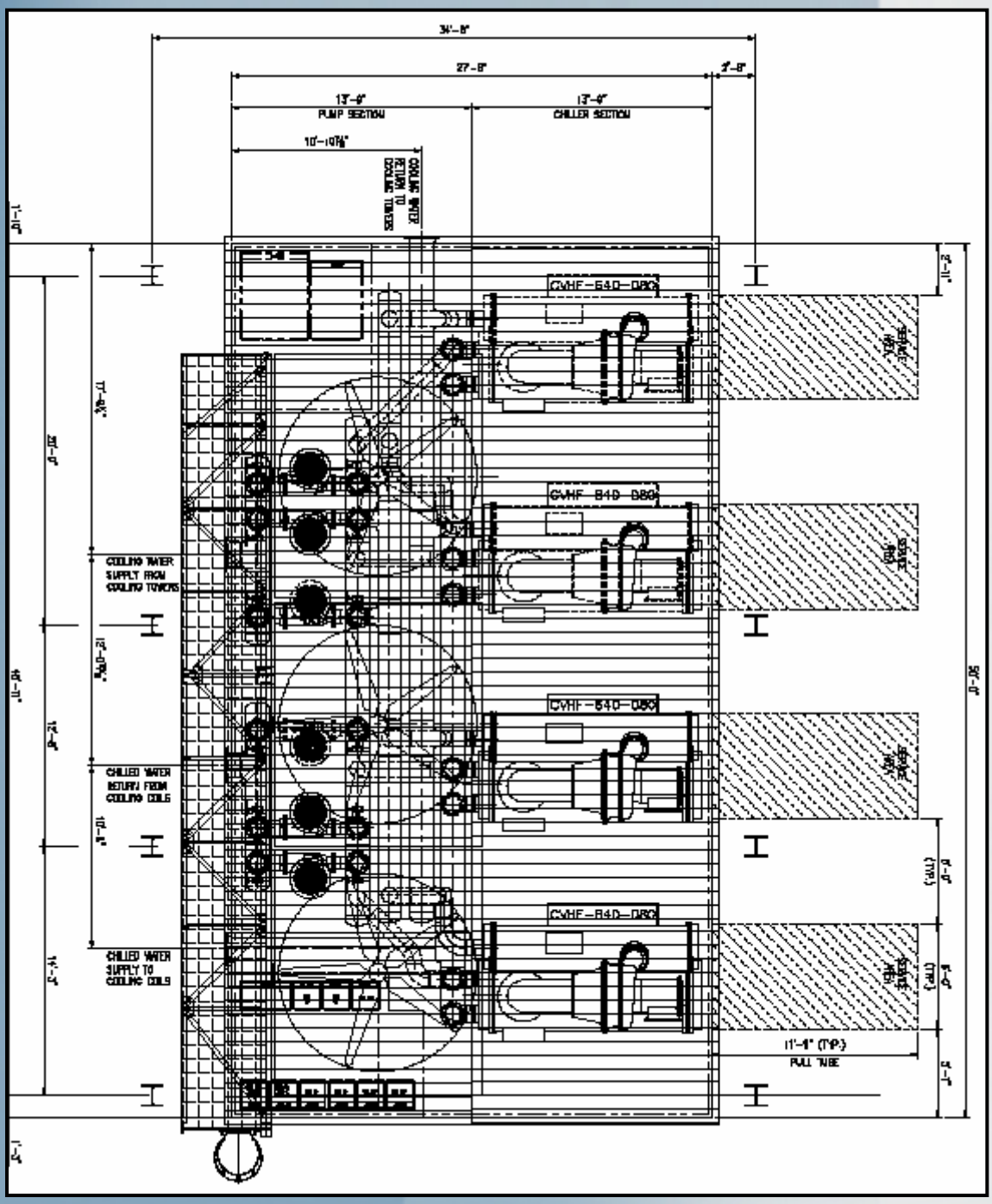
29 calendar days to install

24 weeks from order to chilled water

Innovation → Efficiency → Savings = ^ Best Value Guaranteed

1200 Tons – Rincon, California

Innovation → Efficiency → Savings = ^ Best Value Guaranteed



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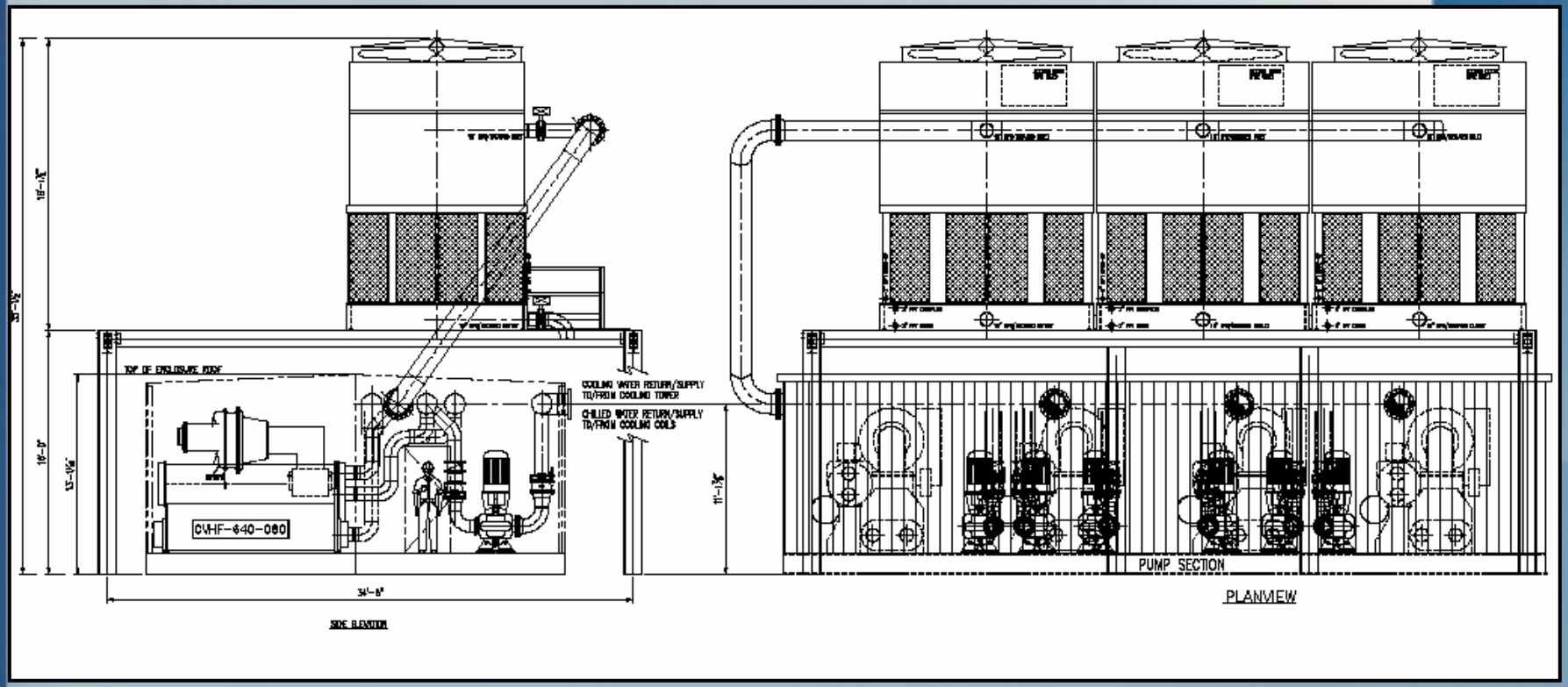
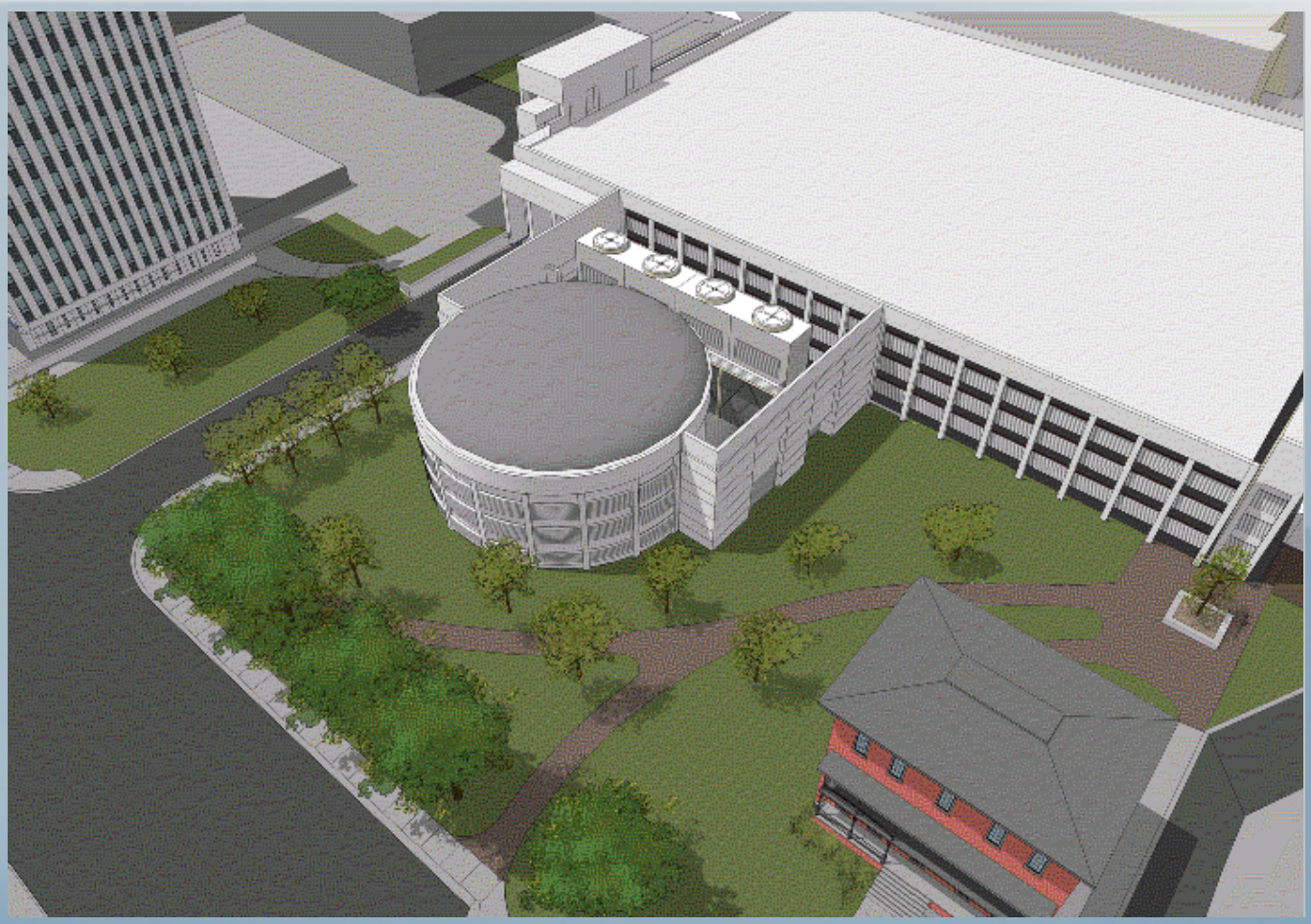


Screening Options

Innovation → Efficiency → Savings = ^ Best Value Guaranteed

Screening Options



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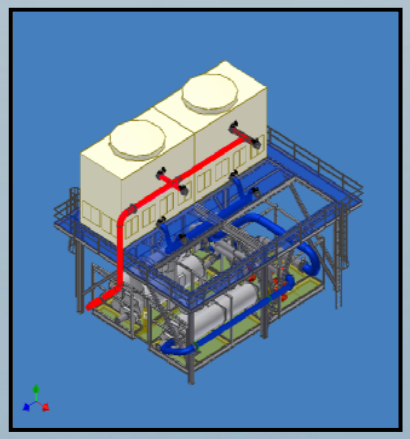
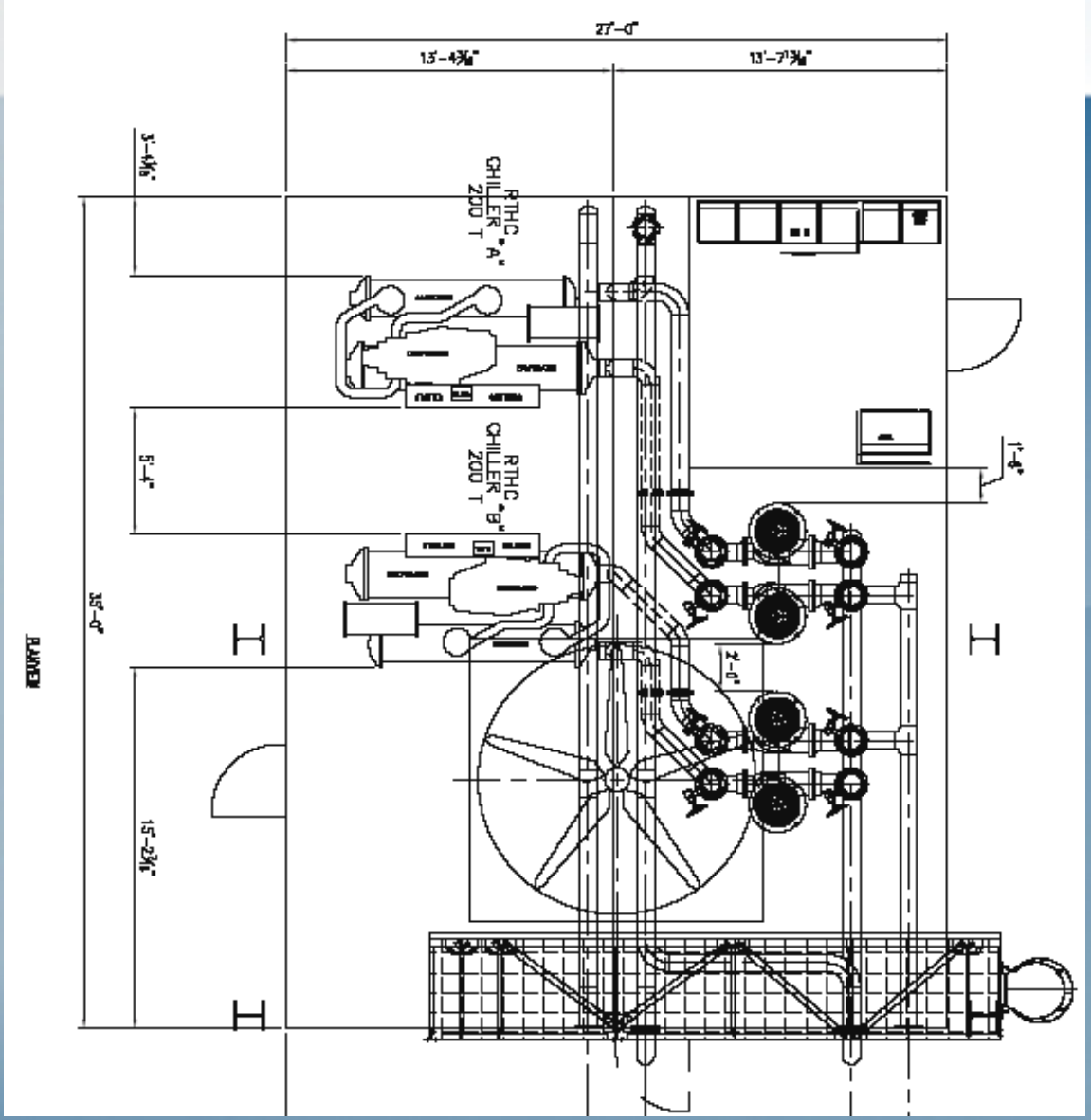


Innovation → Efficiency → Savings = ^ Best Value Guaranteed

400 Tons - Stafford, Texas

- Water-Cooled Screw Compressor Chillers
- Replaced Air-Cooled Chiller system
- Delivery to Startup: 9 Days



Innovation → Efficiency → Savings = ^ Best Value Guaranteed

400 Ton Packaged Plant

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400 Ton Packaged Plant

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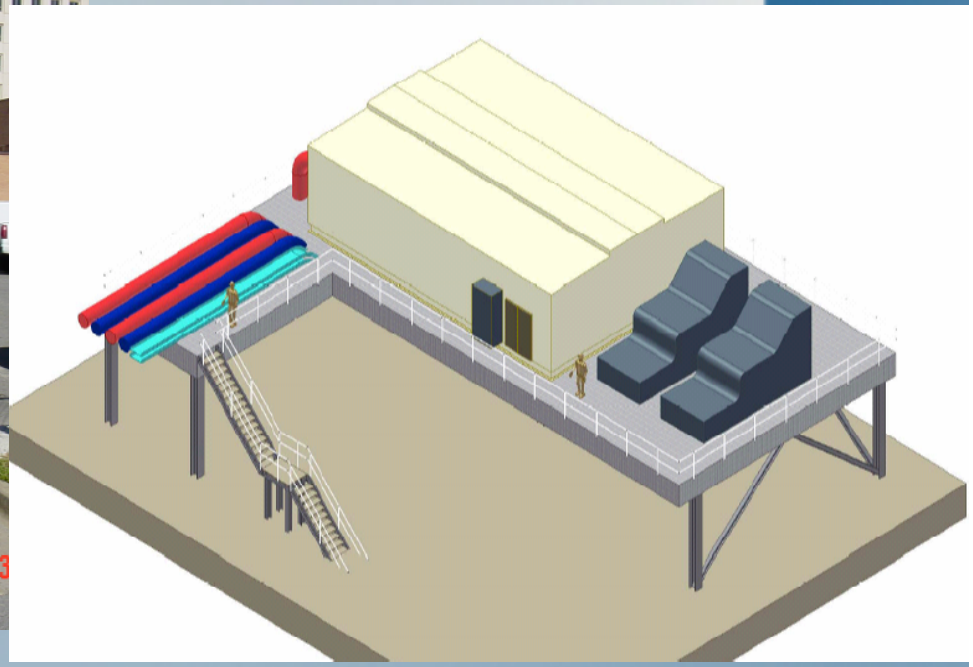
5000 Tons – Houston, Texas



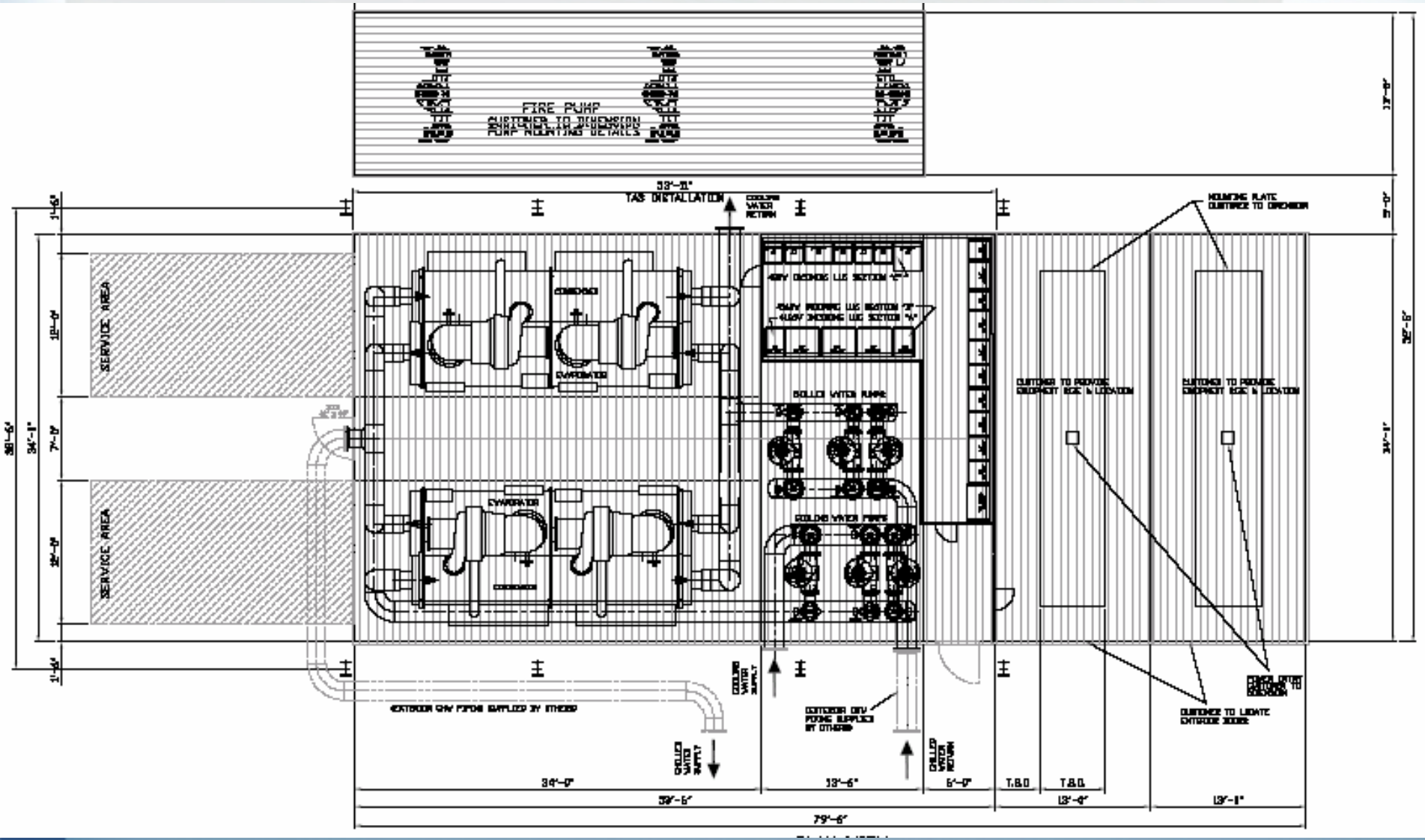
Innovation → Efficiency → Savings = ^ Best Value Guaranteed

- ✓5,000 Ton Plant
- ✓Located over an operating Loading Dock
- ✓0.73 kW/ton Guarantee
- ✓2 x 2.5 MW Emergency Generators

5000 Tons – Houston, Texas

Innovation → Efficiency → Savings = ^ Best Value Guaranteed

5000 Ton Packaged Plant – Pompano, Florida



5000 Ton Packaged Plant – Pompano, Florida

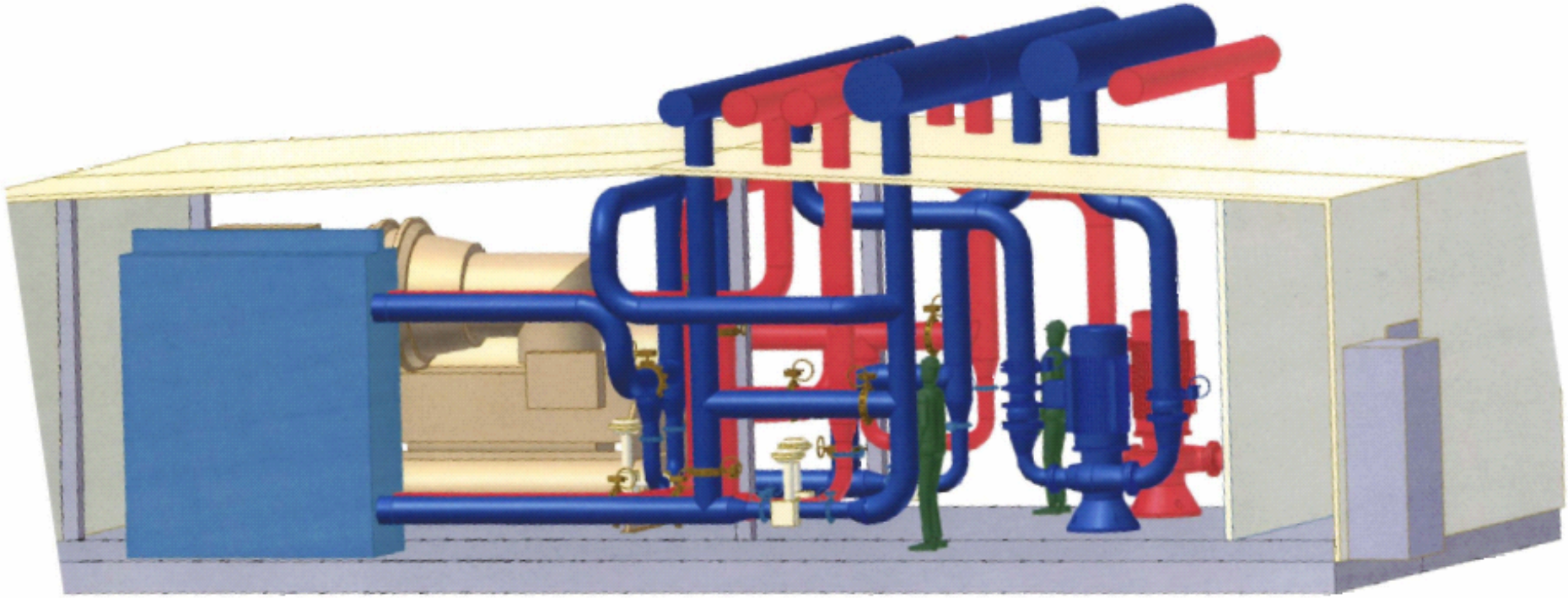
Innovation → Efficiency → Savings = ^ Best Value Guaranteed

5000 Ton Packaged Plant – Pompano, Florida

Innovation → Efficiency → Savings = ^ Best Value Guaranteed

Data Center Application

- 3 ea. Centrifugal Chillers (3000 Tons) – (55/71 ChW)
- 2 ea. Helical-Rotary Chillers (500 Tons) – (40/58 ChW)



Packaged Plant – Mission Critical

Innovation → Efficiency → Savings = ^ Best Value Guaranteed

Packaged Plant – Mission Critical

Guaranteed
Innovation → Efficiency → Savings = ^ Best Value

TAS™

Packaged Plant – Mission Critical

Jumeirah Beach Residence
(www.jbr.ae)

- 60,000 Tons (12 ea. 5,000 Ton Plants)
- 22 million square feet
- 36 Residential Towers
- 4 Hotel Towers

Innovation → Effi

Jumeirah Beach Residence
(www.jbr.ae)

Innovation → Efficien

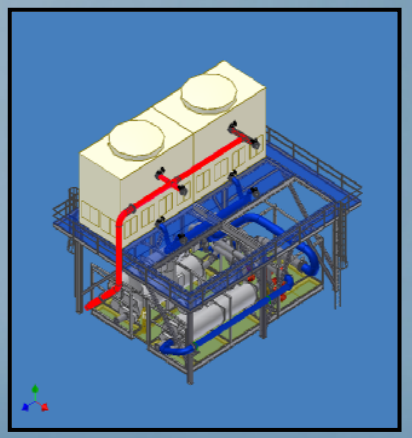
Ammonia Packages

Innovation → Efficiency → Savings = ^ Best Value Guaranteed

Summary

- ✓ Reduced first cost
- ✓ High-efficiency plant
  - ✓ Lowest Life-cycle cost
- ✓ Reliability
- ✓ Quality
- ✓ Reduced footprint
- ✓ Minimal site interference = Maximum Safety
- ✓ Shortened construction cycle
- ✓ Guaranteed performance

Guaranteed
Innovation → Efficiency → Savings = ^ Best Value



Additional Information

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