Opportunities With Gas Engine-Driven Cooling Systems

DOE - Chiller System Optimization

TECOGEN Markets

Gas Cooling Market Is One of the Fastest Growing Segment in HVAC Industry

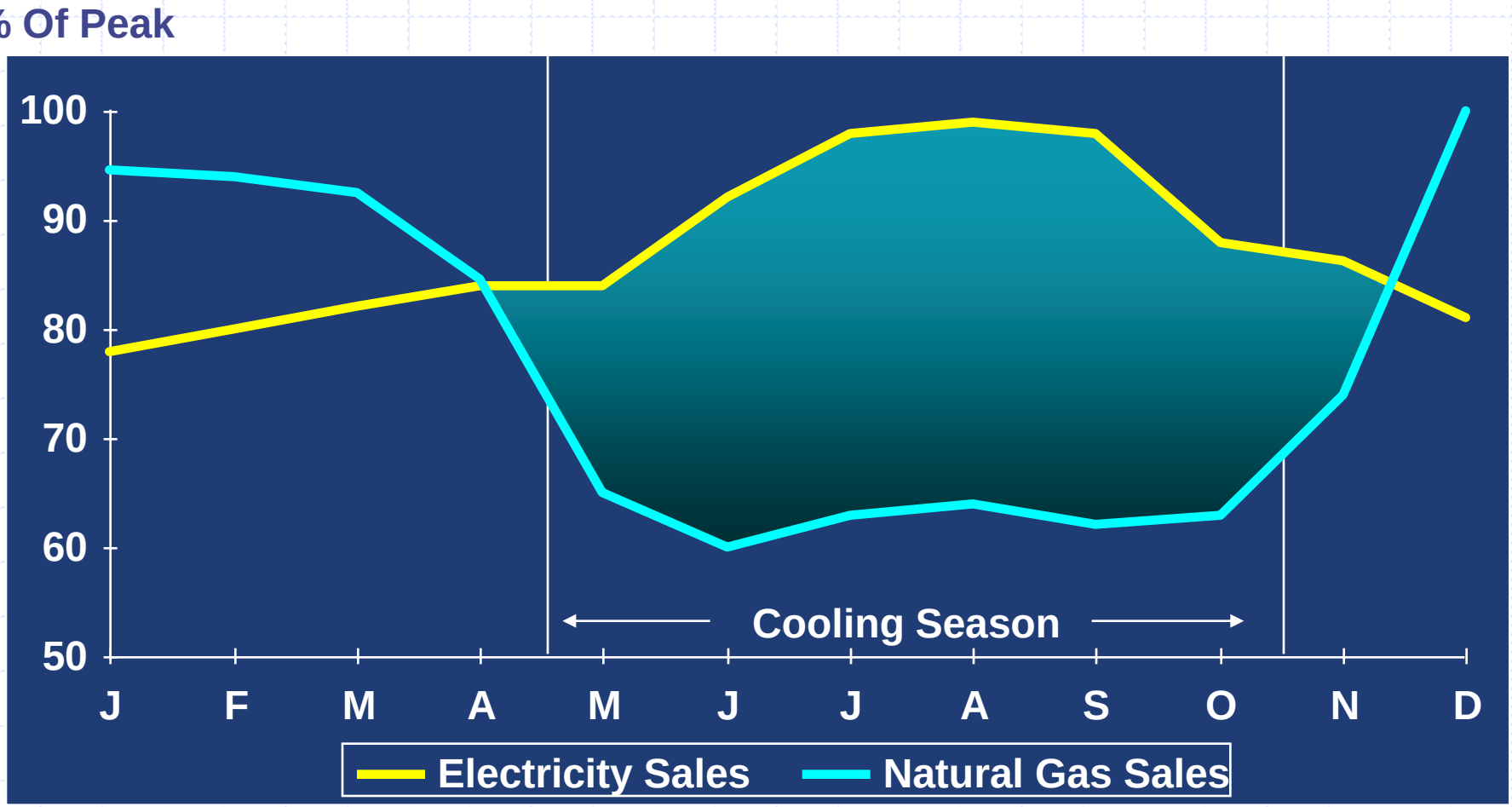
- Rising Cost of Electric Cooling
- Refrigerant Issues
- Available Incentives
- Increasing Acceptance of Gas Cooling

Chiller Decision Is No Longer an Automatic Choice for Electric

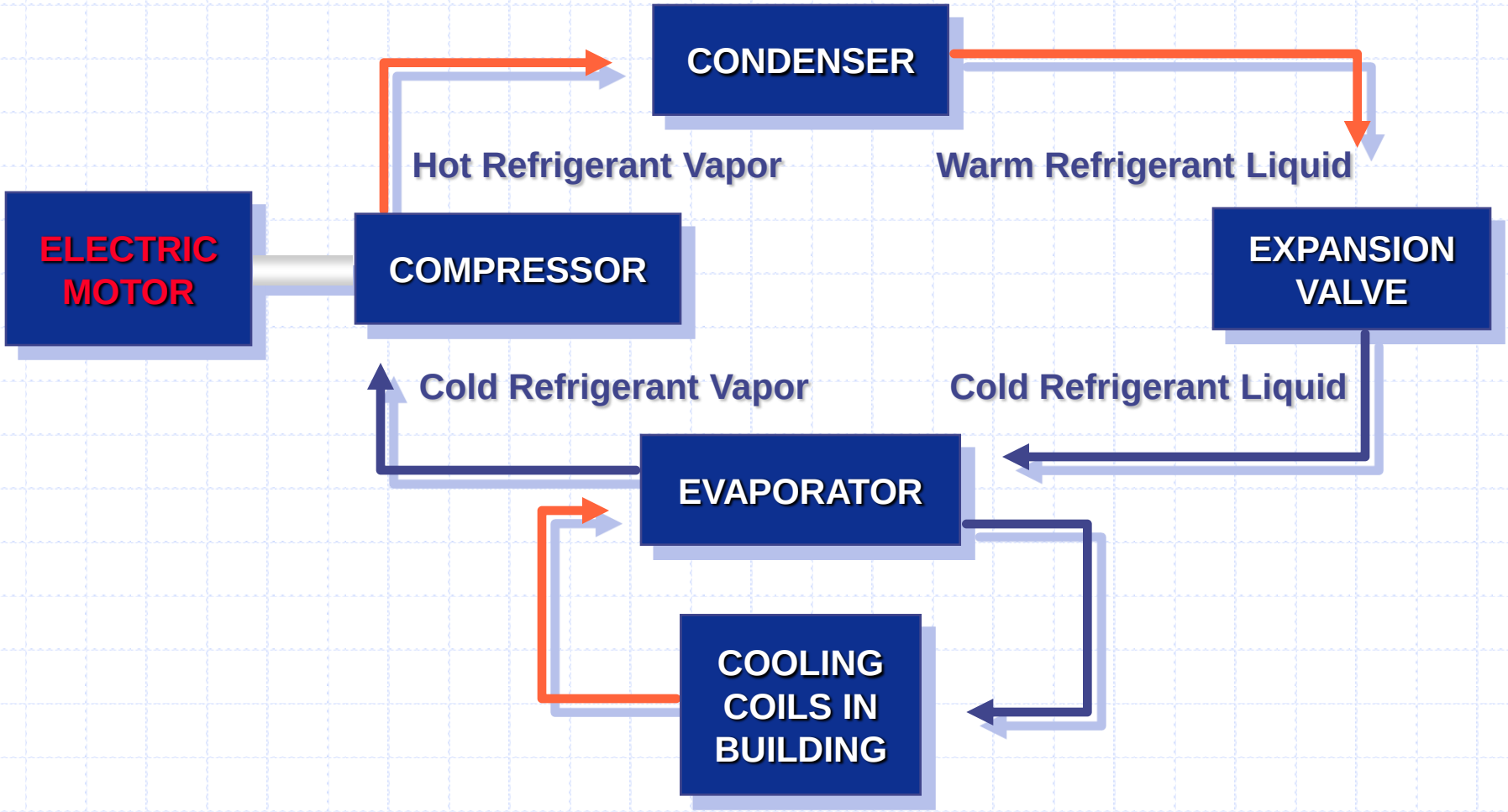
Market Drivers - Strongest in Company History

- Unprecedented Attention to Energy
  - Front Page National Press
  - National Priority
- Efficiency
  - No Longer About Being a Good Citizen...
  - Its About Staying in Business

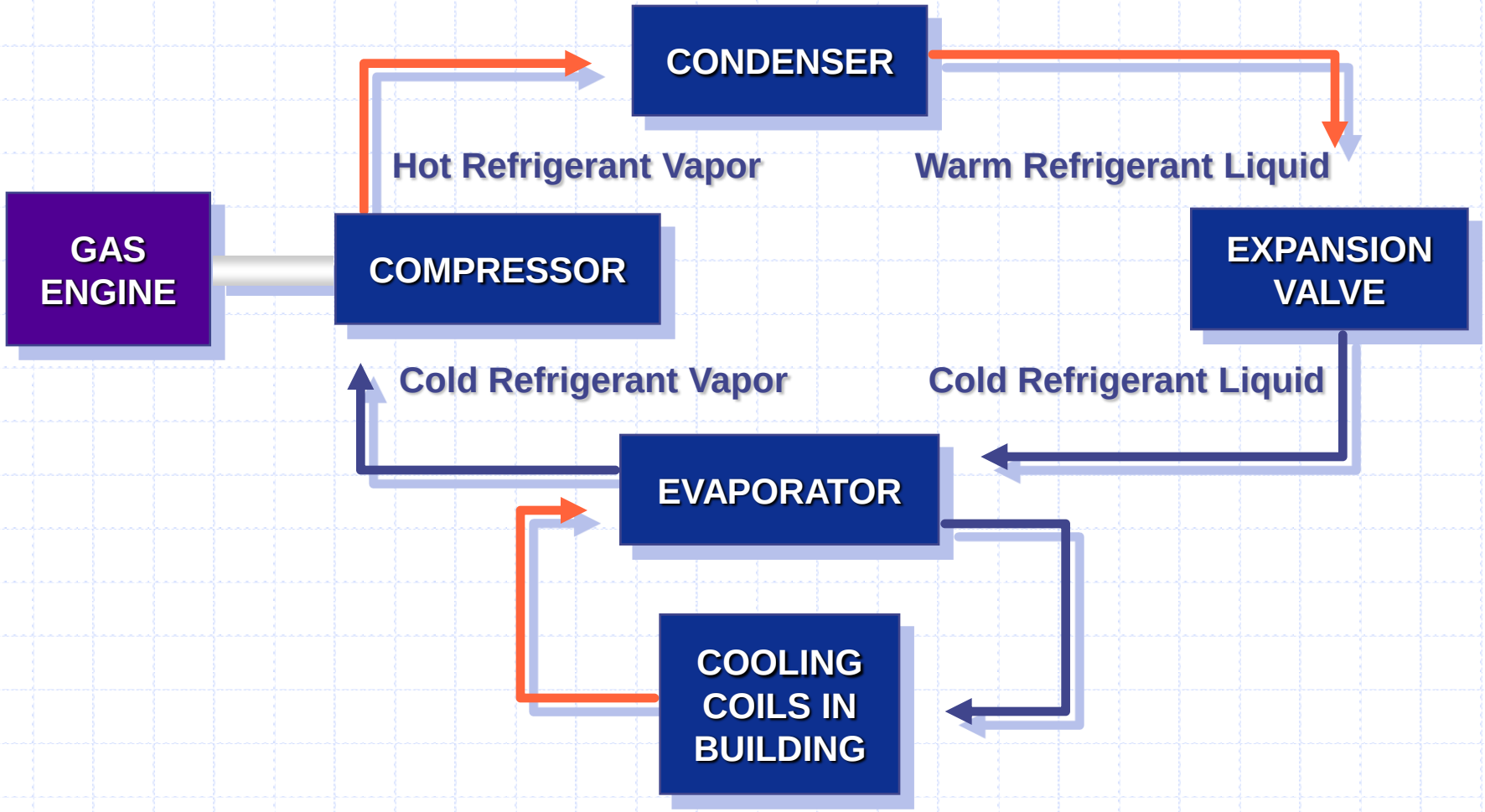
Peak Seasons for Gas and Electricity Sales



Electric Chiller



Natural Gas Engine Driven Chiller

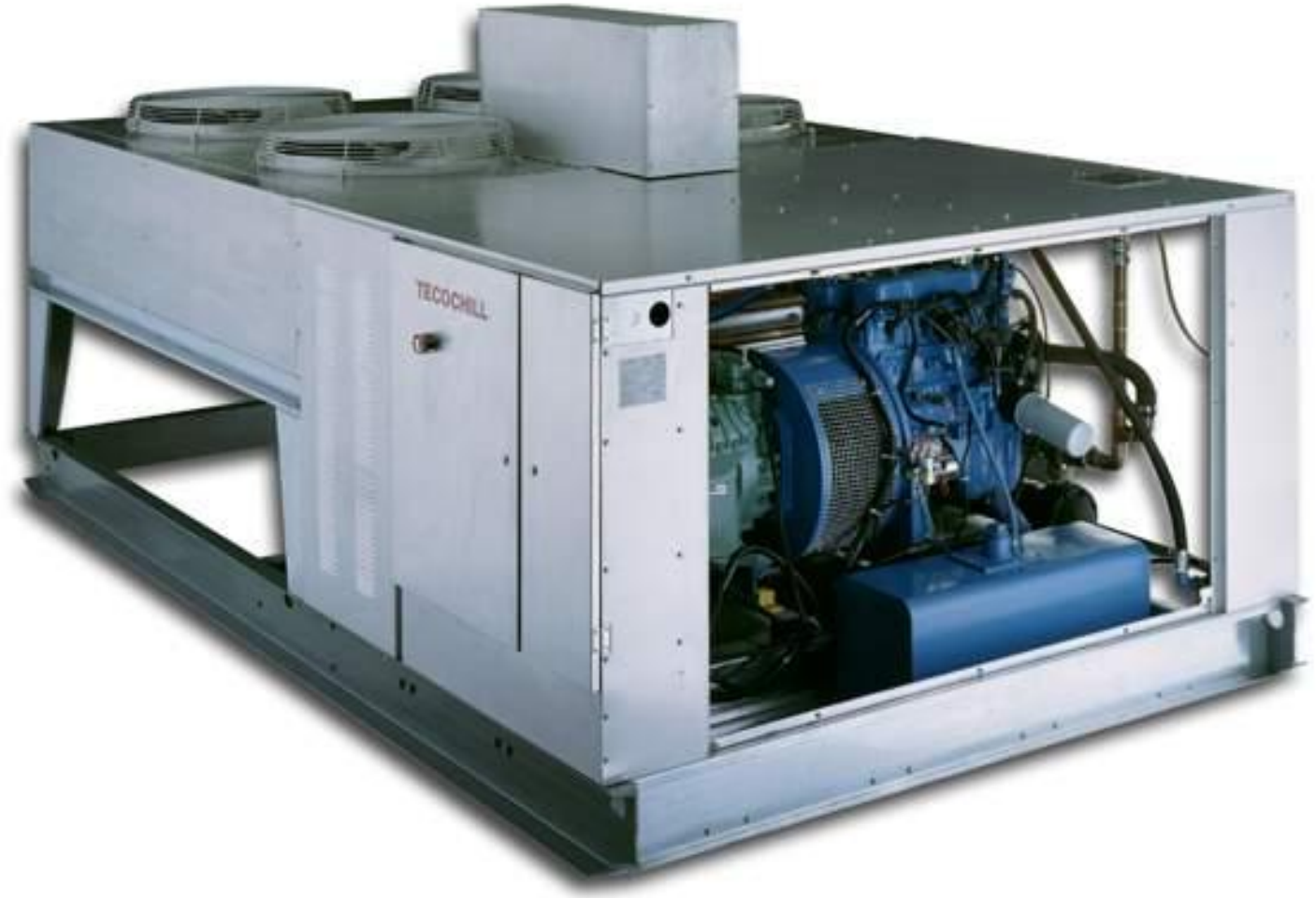


TECOCHILL RT Series

Air-Cooled Water Chiller or Condensing Unit

TECOCHILL RT Series

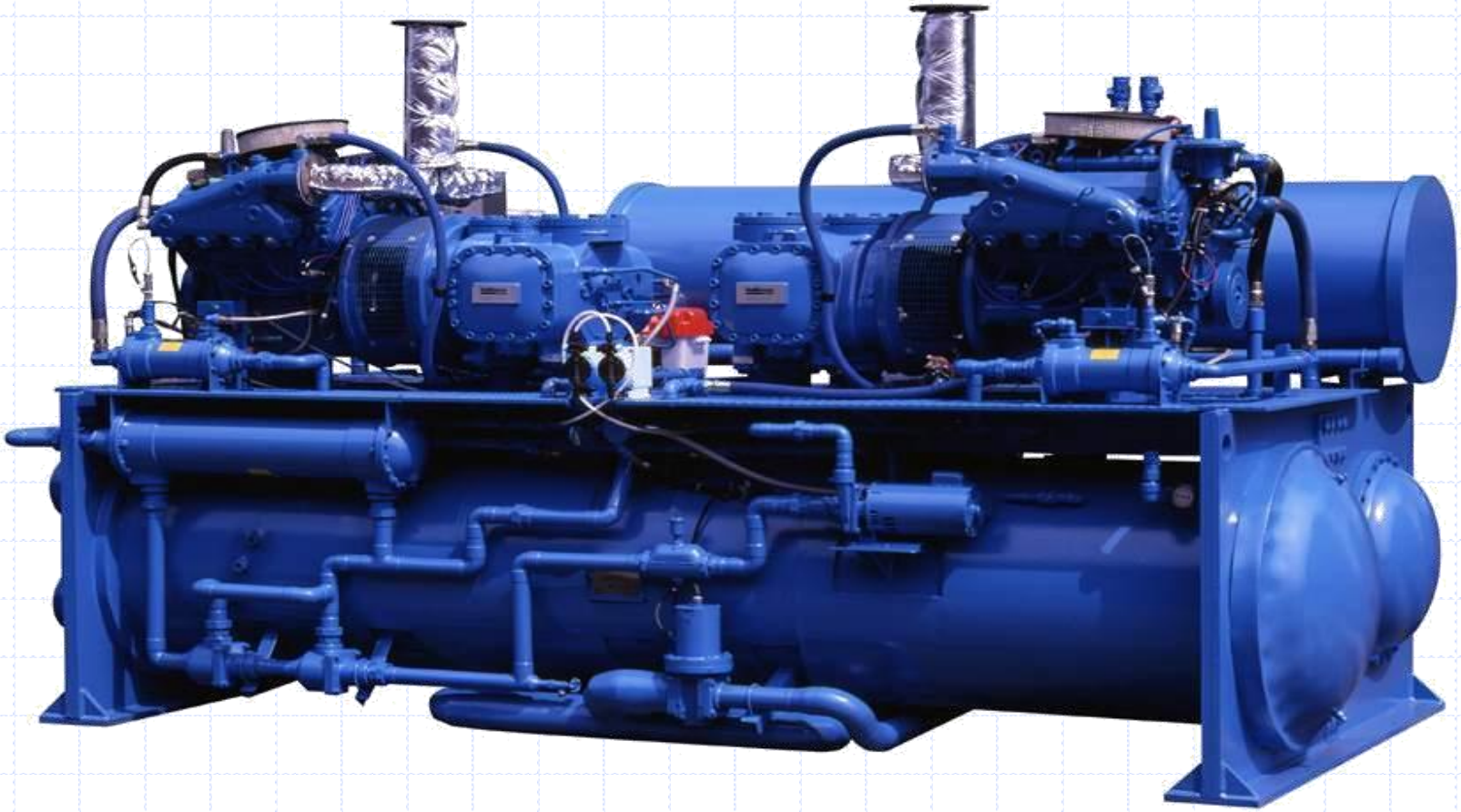
Air-Cooled Water Chiller or Condensing Unit



TECOCHILL DT Series

Water Chiller

TECOCHILL CH-400*x*



TECOCHILL Hybrid Installation

Engine Driven Chillers

- Benefits:
  - Lowest Operating Cost/Lowest Life Cycle Cost
  - Most Efficient Technology Available
    - High-Efficiency Screw Compressor
    - Variable Speed Engine Drive
    - Very High Part Load Efficiency
    - Continuous Load-Following Capability

Engine Driven Chillers Benefits

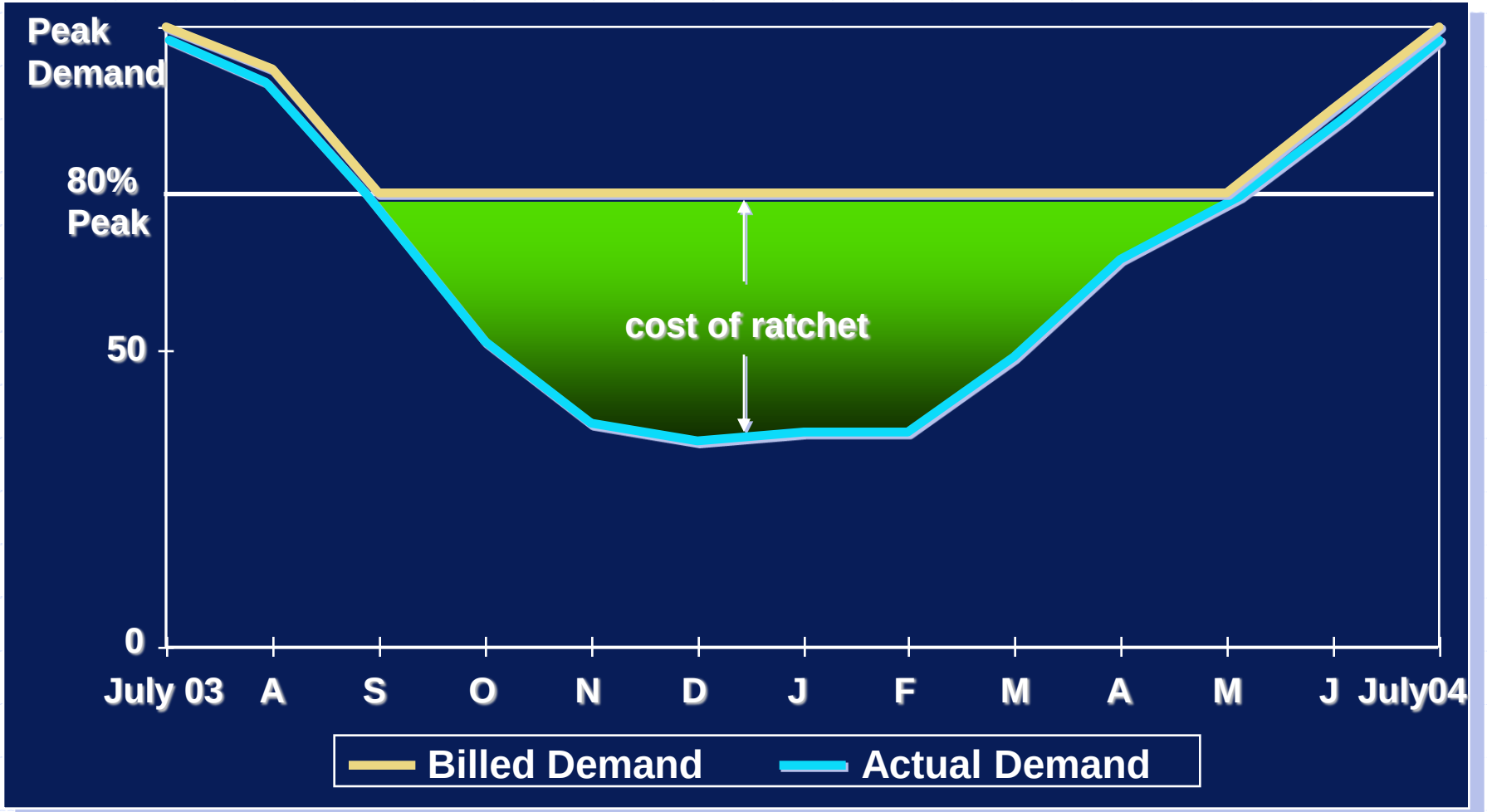
- Heat Recovery Capability
- Environmentally Friendly
  - Non-CFC Refrigerant
  - Reduced Global Warming
  - Reduced Fossil Fuel Use
  - Reduced CO_2 Emissions

Engine Driven Chillers

- Engine Driven vs. Electric
  - Significantly Lower Operating Costs
  - Peak Electric Demand Reduction
  - Heat Recovery Capability
  - Superior Part Load Efficiency
  - Stand-by Generator Size Reduction
  - Back-up Cooling During Power Outages
  - Avoid Electric Service Capacity Upgrades

Understanding Your Electric Bill

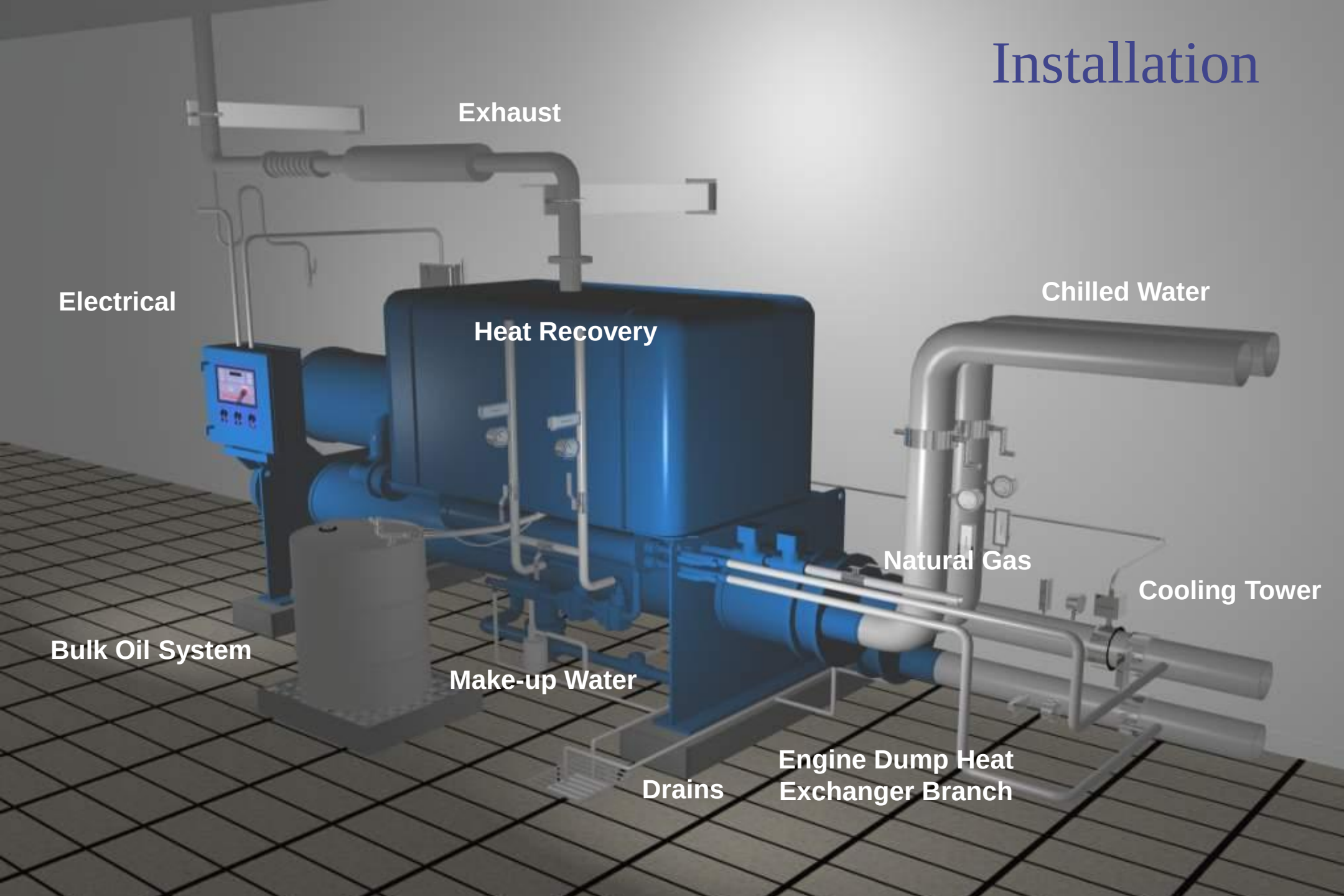
80% Demand Ratchet



Engine Driven Chillers

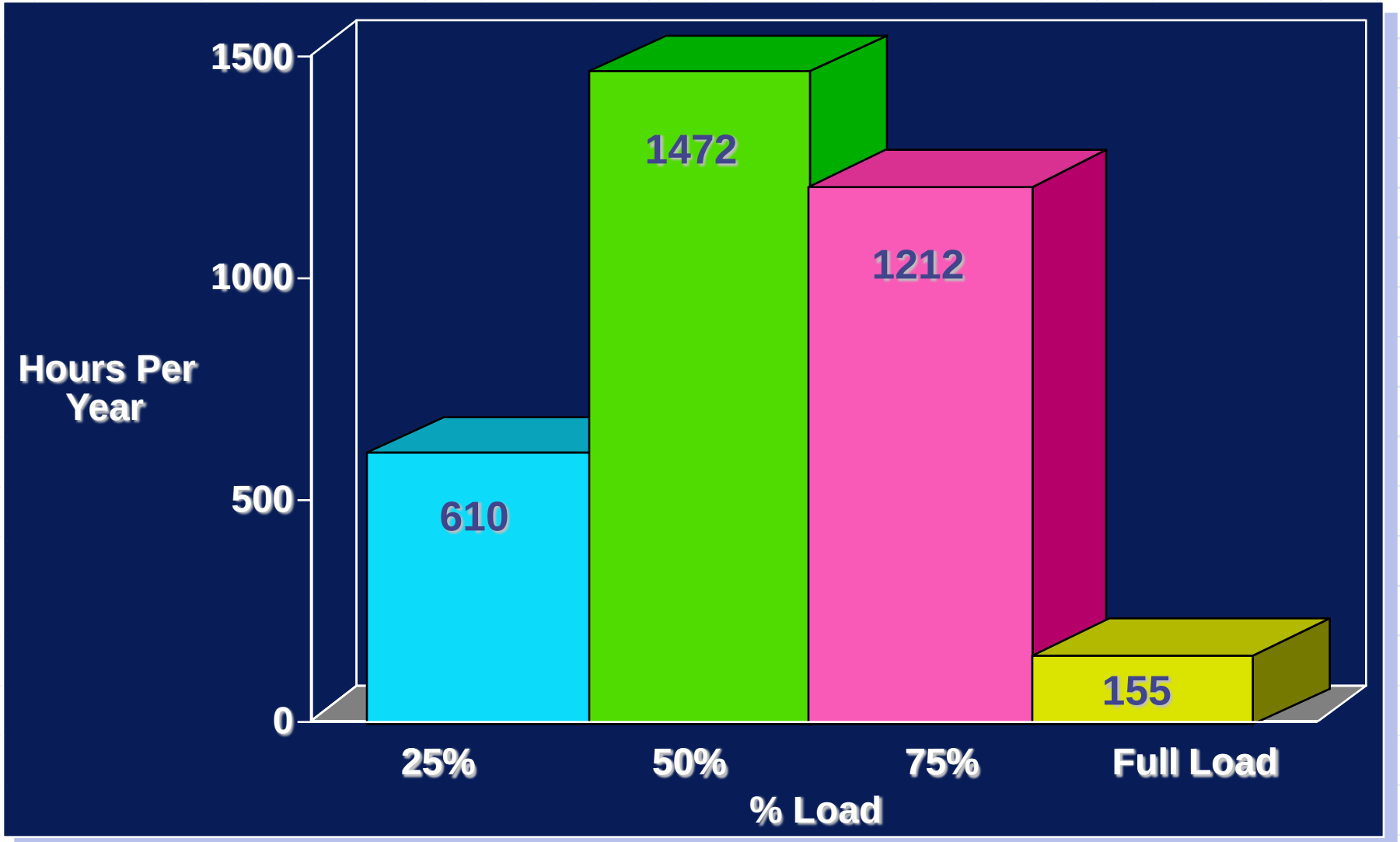
- Engine Driven vs. Absorption
  - Lower Operating Costs
    - High COP; Much Higher at Part Load
    - Low Parasitics
  - Easy Retrofits
    - Smaller Footprint
    - Can Use Existing Tower, Pumps, Piping
  - Familiar Vapor Compression Technology
  - Low Temperature Capability

Installation

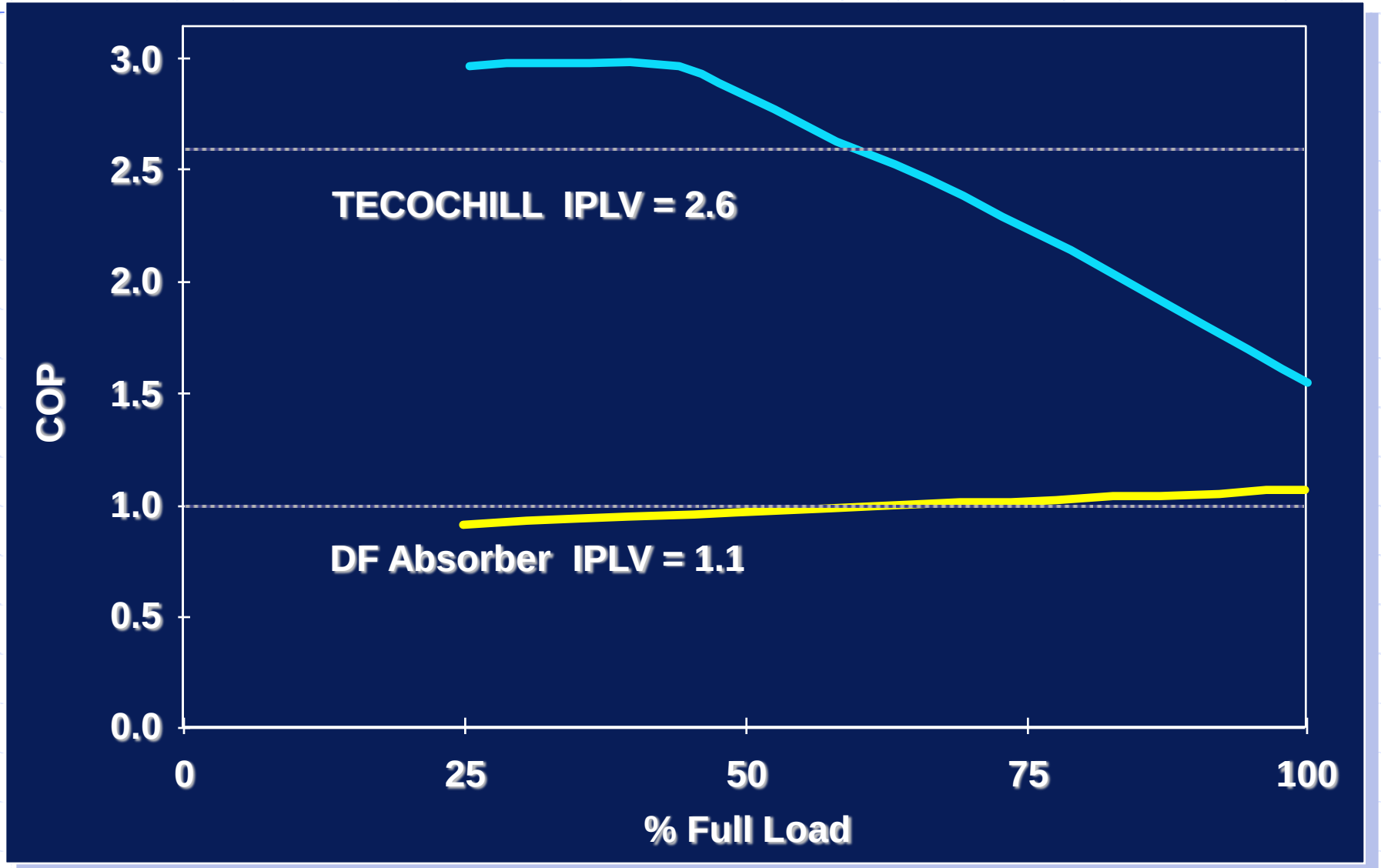


Economic Analysis Is Critical In Chiller Decision-Making

Typical Building Load Profile



Importance of Part Load Efficiency



Factors Affecting Chiller Economics

- Equipment Operating Efficiency (IPLV)
- Gas and Electric Rates (Including Demand)
- Use of Heat Recovery
- Utility Rebates
- Equipment and Installation Costs
- Electric Power Requirements (Transformer, Switchgear)
- Standby Generator Requirements

TECOCHILL Gas Cooling Energy Cost Analysis Boston Area Project

Savings Example: (1) TECOCHILL CH-400x

Operating Information

- Peak Load: 400 tons
- Annual Hours of Operation: 3,000 hours/yr
- Equivalent Full Load Hours (EFLH): 1,500 hours/yr
- Cooling Season Length: 6 months/yr

TECOCHILL Gas Cooling Energy Cost Analysis - Boston Area Project

Electric Utility Rates

Summer Demand:	**$22.52/kW**
Winter Demand	**$11.25/kW**
Energy Rate:	**$.068/kWh**

Natural Gas Utility Rates

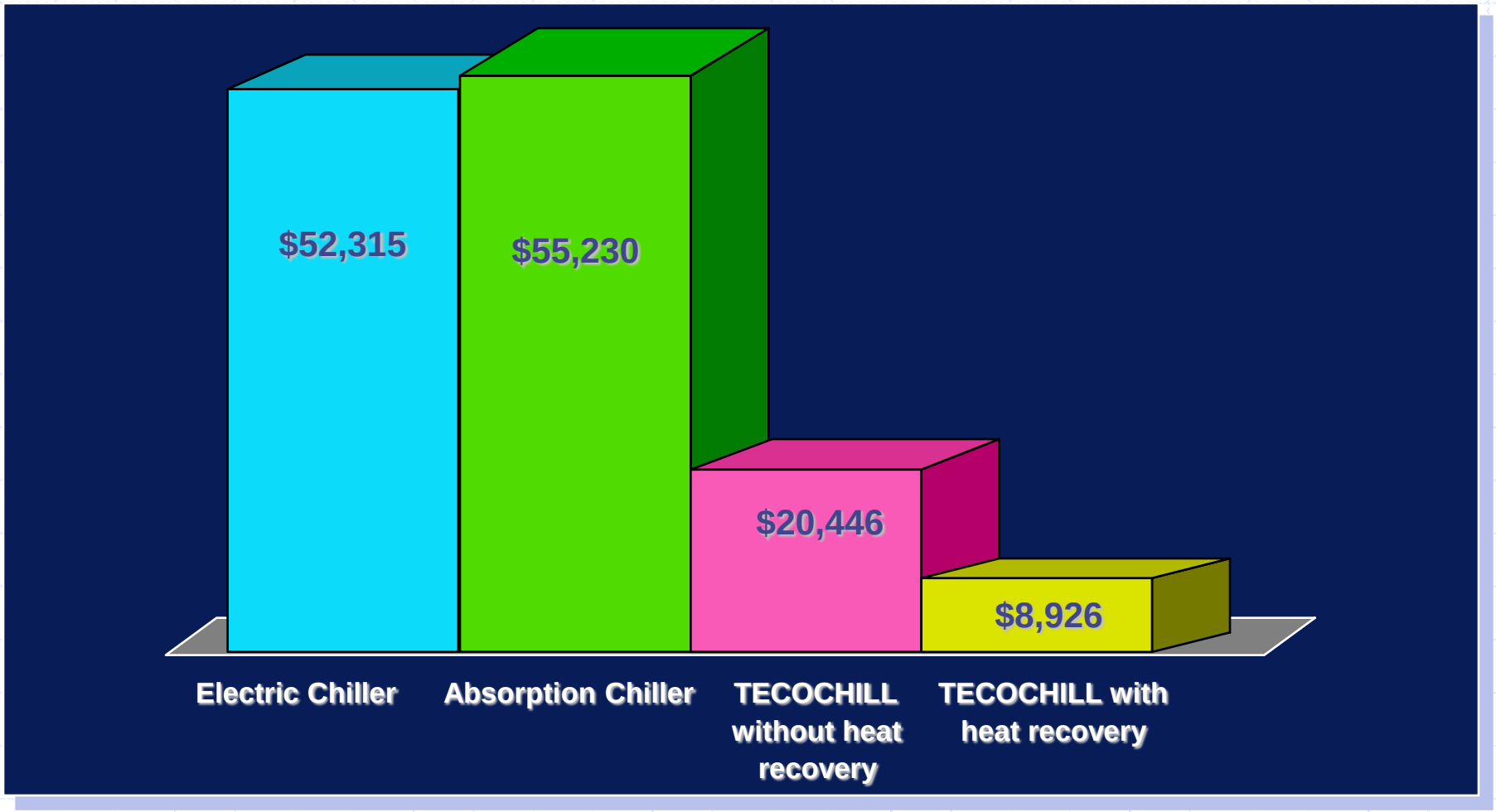
Cooling Rate:	**$0.60/therm**
Boiler Rate:	**$0.60/therm**

Chiller Efficiencies

	IPLV	**Full Load**
Electric:	**0.62 kW/ton**	**0.6 kW/ton**
Absorption:	**1.00 COP**	**1.00 COP**
TECOCHILL:	**2.50 COP**	**1.60 COP**

Annual Energy Costs - Boston Area

TECOCHILL vs. Other Chillers

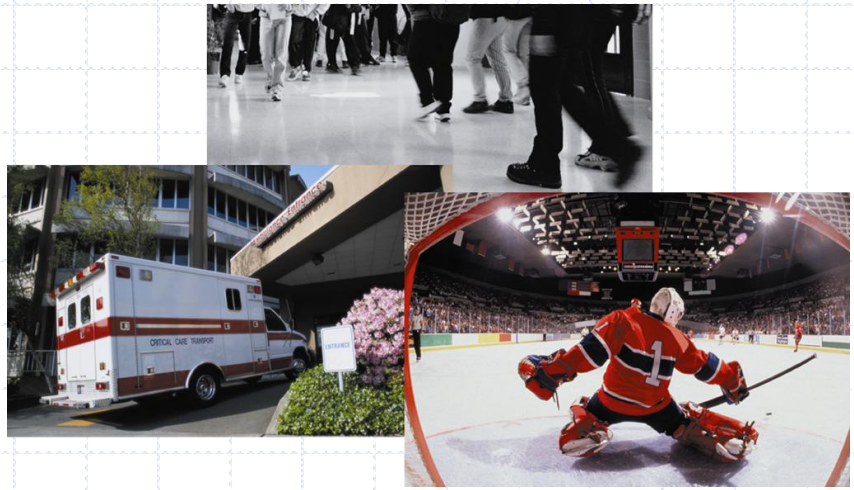


Characteristics of Good Gas Engine Chiller Applications

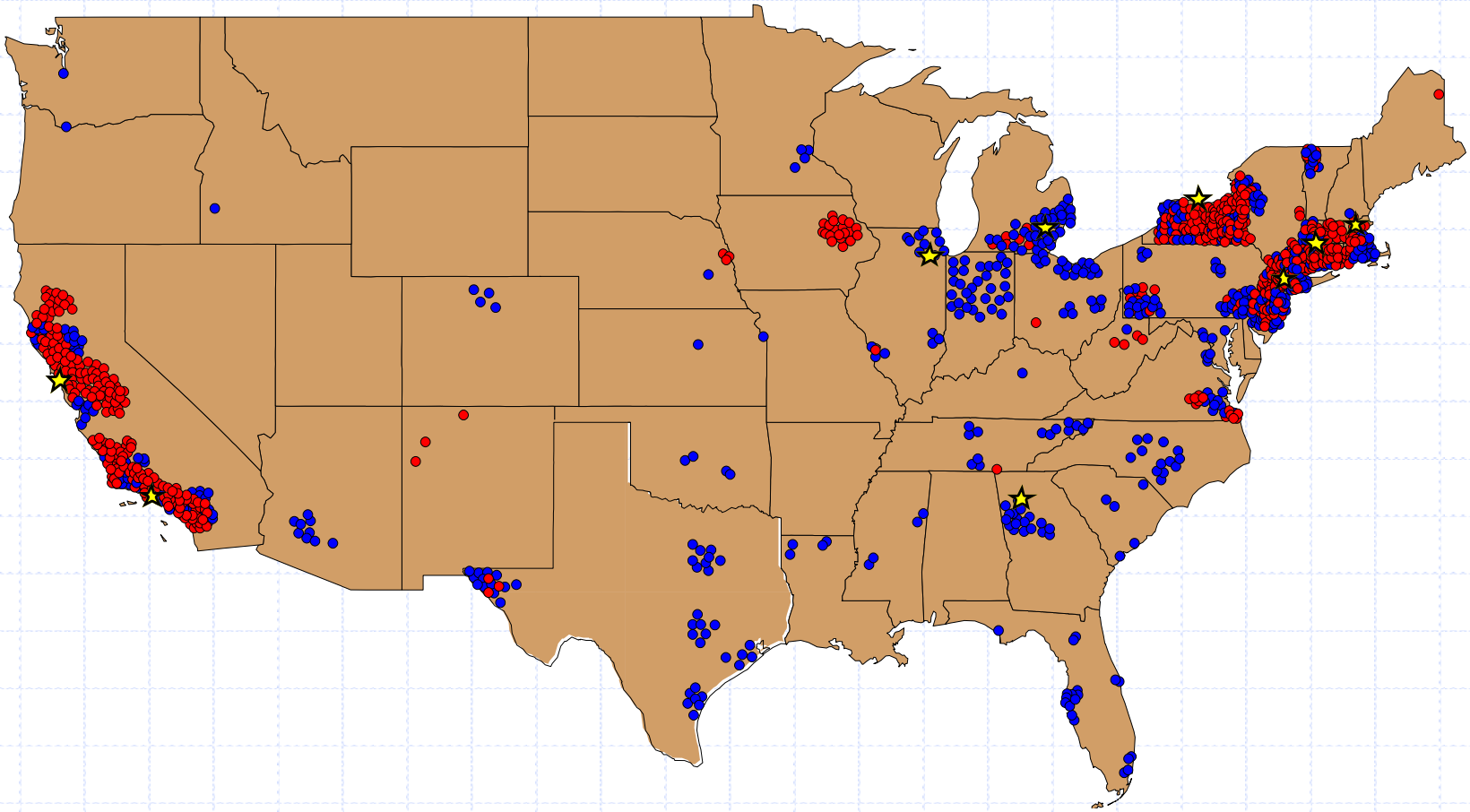
- Owner-Occupied
- High Electric Demand Rates
- Insufficient Electric Power
- Cooling Necessary During Power Outages
- Hot Water Needed
- Process Applications
- Eligible for Utility Rebates

Typical Gas Engine Driven Chiller Applications

- Hospitals
- Nursing Homes
- Colleges/Schools
- Hotels
- Industrial/Process
- Multi-Family Residential
- Department Stores
- Ice Rinks



U. S. Installations: TECOCHILL/TECOGEN/TecoFROST

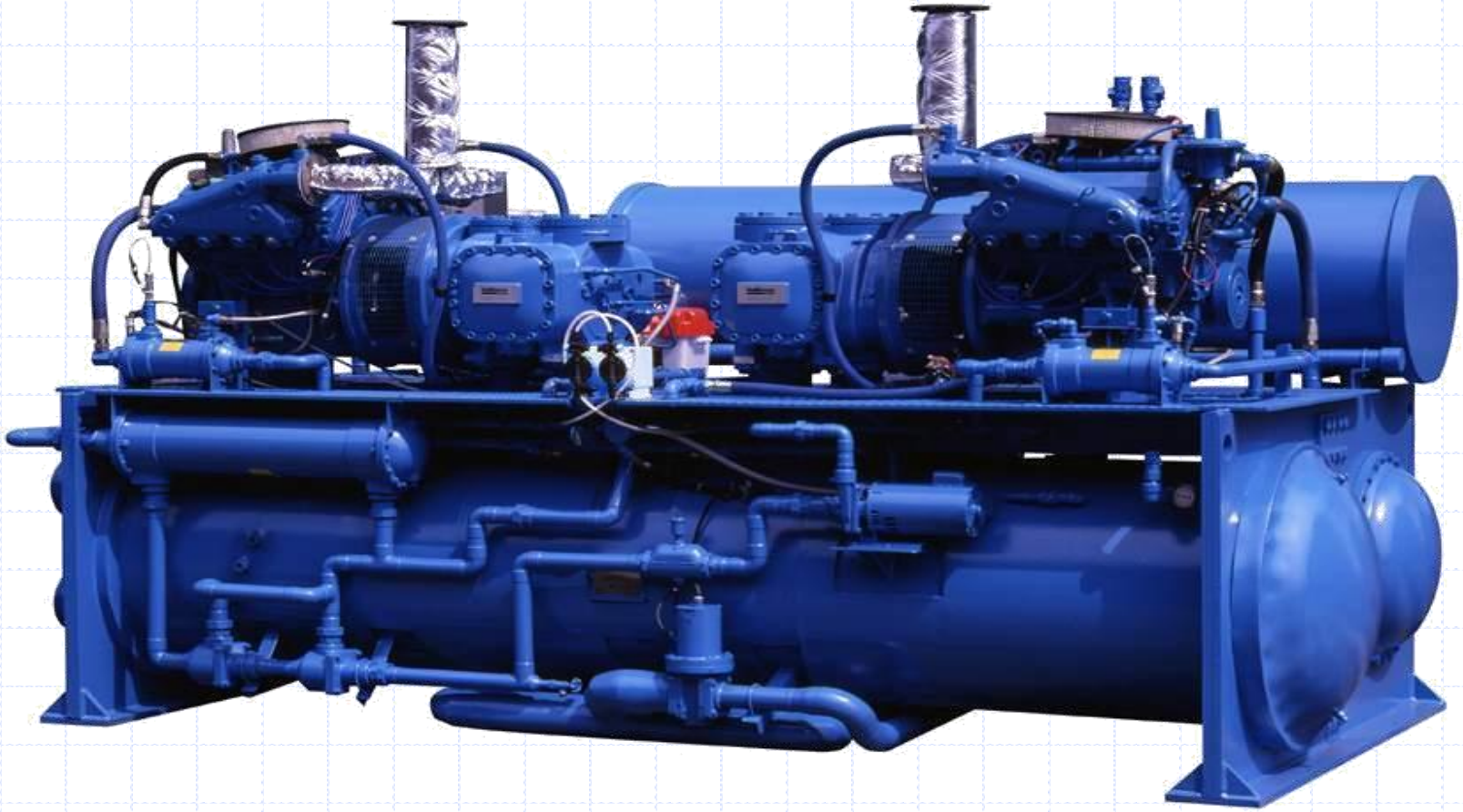


TECOCHILL CH-50ACP

TECOCHILL CH-50ACP

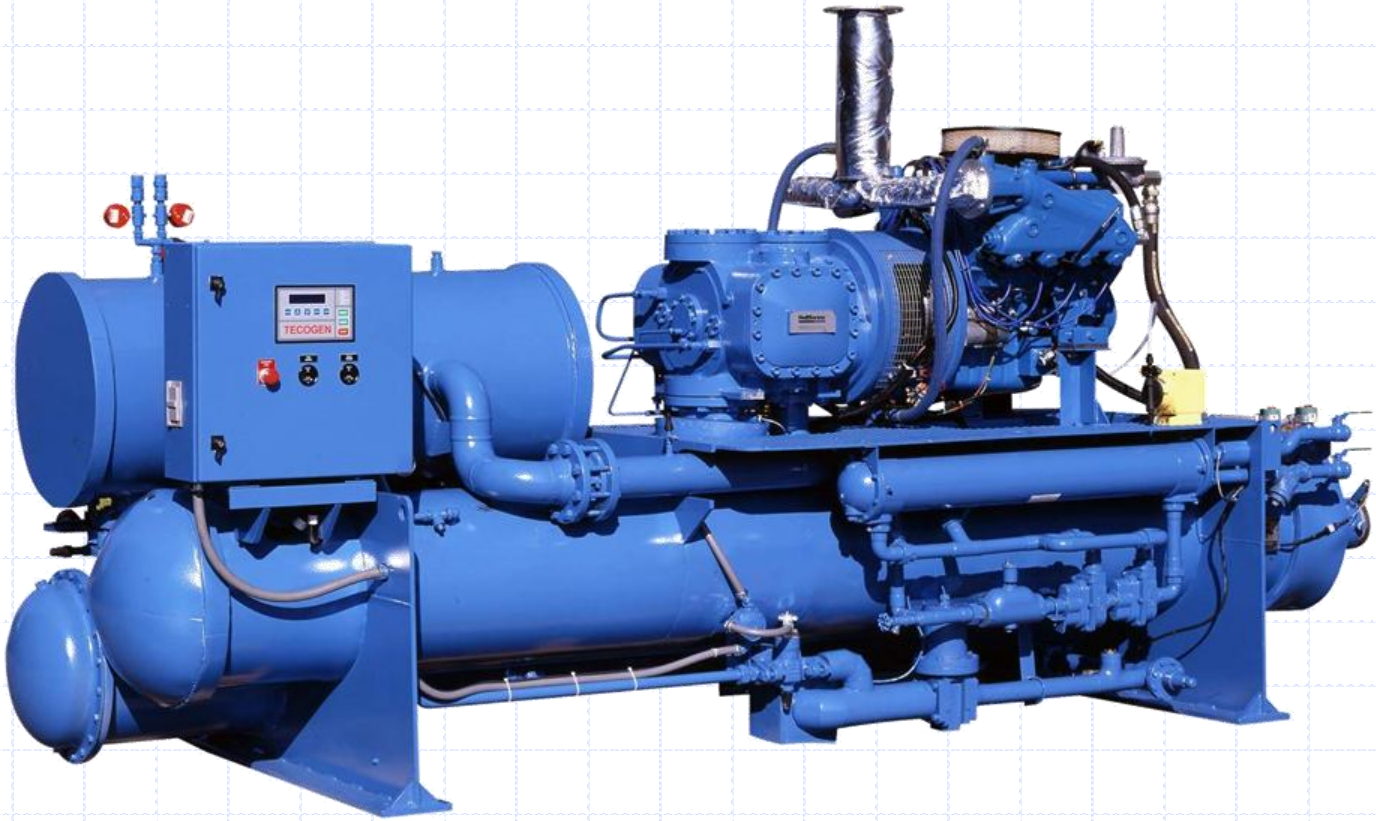
TECOCHILL CH-50ACP

TECOCHILL CH-400*x*



TECOCHILL CH-400*x*

TECOCHILL CH-200x



TECOGEN
Natural Gas Engine-Driven Products

TECOCHILL®
TECOFROST™
COGENERATION

The Future of Gas Engine-Driven Cooling is NOW!!!

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