Liebert XD™
Flexible, Energy-Saving Cooling Solutions For High Heat Density Applications

EMERSON™
Network Power
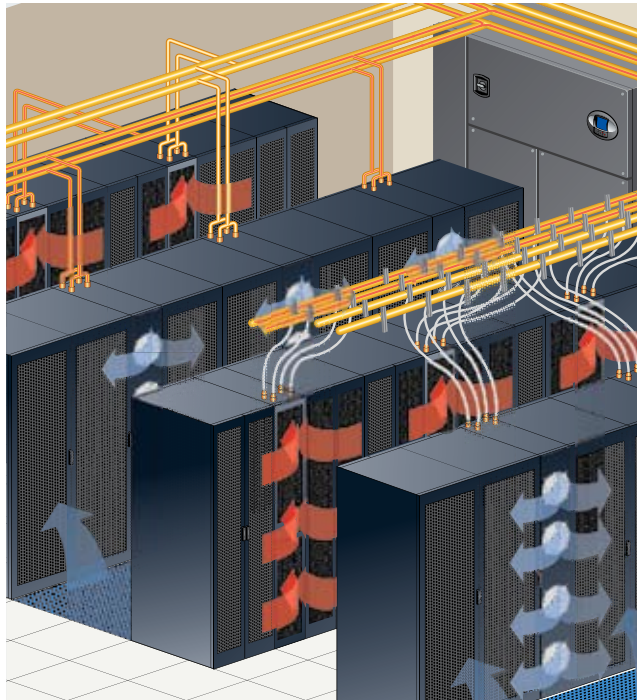
High Heat Density. High Temperatures.

Today, more than ever, environmental and economic issues are pushing business continuity professionals to lobby for energy efficient, environmentally friendly solutions in their data centers. The Liebert XD solution is the answer on both fronts. With a hybrid approach that requires 15% - 50% less chiller plant capacity, as well as less diesel generator and switchgear capacity required, the potential energy consumption for your centers is reduced up to 40%. The significant energy savings achieved by the Liebert XD solution are attributed to these factors:

- Locating cooling units closer to the load reduces the energy required to move the air and results in less mixing of hot and cold air.

- Micro channel coils provide minimal air pressure drop losses and improved thermal heat transfer.

- No need to over-chill data centers to eliminate hot spots.

However, flexibility is also an important attribute of your cooling systems. The Liebert XD solution — a combination of floormount mission-critical cooling units and supplemental cooling — allows your facility to adapt as heat loads increase. And by adding/reconfiguring solutions to react to changes in your environment, the flexible configuration of the Liebert XD system modules also allows scalability for future growth.

Today's data center technologies compound conventional cooling problems. Blade servers, communications switches and other electronics are being packed into tighter and tighter spaces. Computing capacity that once filled an entire room is now contained in a single rack — creating extreme power and heat densities.

Conventional Solutions Just Can't Keep Up

While the cornerstone of an effective cooling strategy, you can't rely solely on conventional mission-critical cooling systems to resolve such high heat densities. Hot spots or zones require targeted cooling solutions. And, for extremely high heat loads, conventional approaches may simply take up too much floor space to be practical.
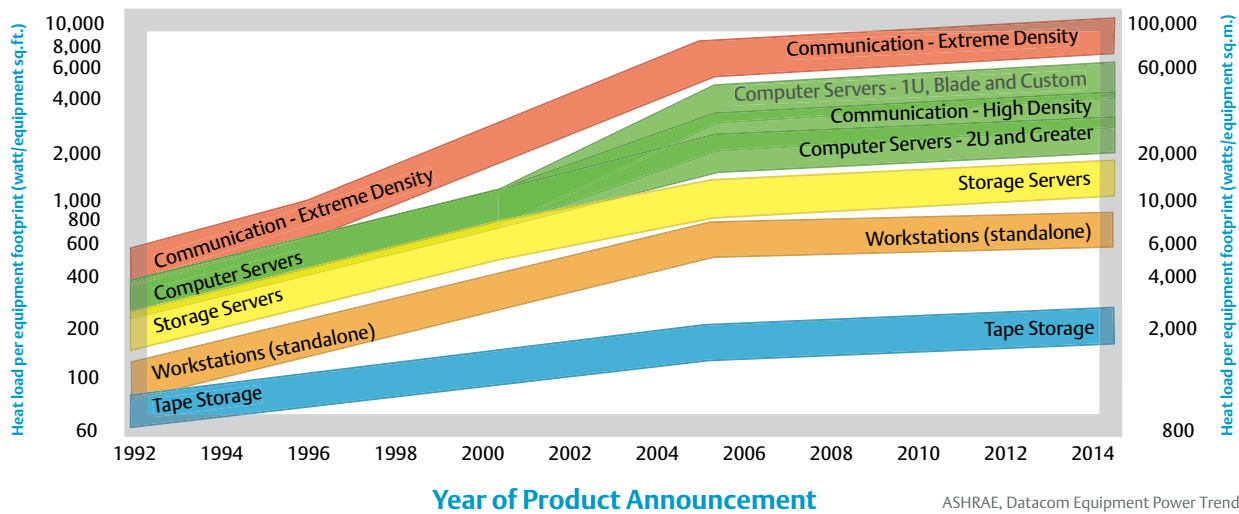
Business continuity professionals will rely on an integrated solution — one that solves both room-level and rack-level cooling challenges.

Higher Watt, Higher Heat Densities

This increased capacity is fueled by rapid growth in processing capacity. But, more compact capacity means higher heat densities. What was a 1 kW rack now may exceed 10 kW. This requires a shift in focus from a room-based view of cooling to a rack-based view. More literally, business continuity professionals must consider both "Watt per square foot" and "kW per rack" when evaluating cooling solutions.

No Relief In Sight: Heat Loads Rising

Year of Product Announcement

Heat load per equipment footprint (watt/equipment sq.ft.)

Heat load per equipment footprint (watts/equipment sq.m.)

- Communication - Extreme Density
- Computer Servers - 1U, Blade and Custom
- Communication - High Density
- Computer Servers - 2U and Greater
- Storage Servers
- Workstations (standalone)
- Tape Storage

ASHRAE, Datacom Equipment Power Trends and Cooling Applications, 2005. © American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., www.ashrae.org

And, They Attack Your Facility in Two Ways

Hotter Facilities
As processor capabilities increase, so do computer room power densities—from 50 Watt per square foot (540W/m²) to over 300 Watt per square foot (320W/m²). Your whole data center just keeps getting hotter.

Hot Spots
Compounding the problem, this higher heat load is not evenly distributed throughout the room. Sometimes, power densities can grow into hundreds of Watt per square foot, creating localized "hot spots" of extreme heat.


50W TO 300W

600+W
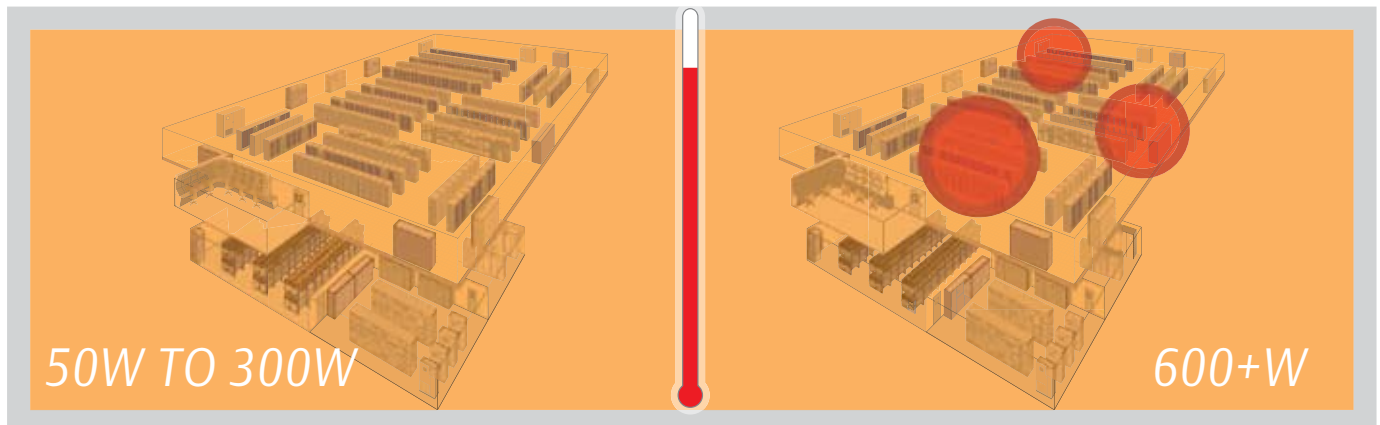
The Cold Aisle Is Feeling A Bit Hot

A common way to improve performance of existing raised floor cooling applications has been the "hot aisle/cold aisle" approach. In this configuration, rows of equipment racks are arranged in alternating "hot" and "cold" aisles. Only the cold aisles have perforated floor tiles that allow cool air to come up from under the raised floor.
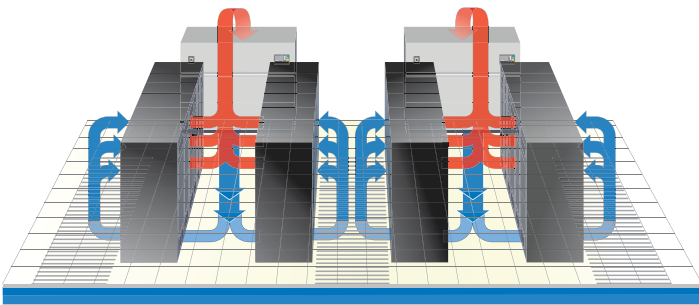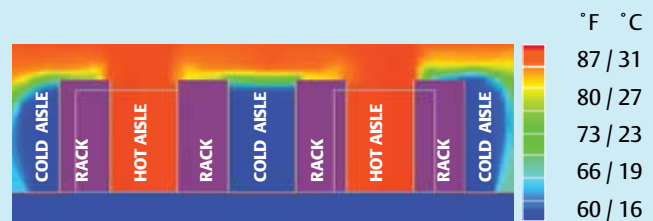
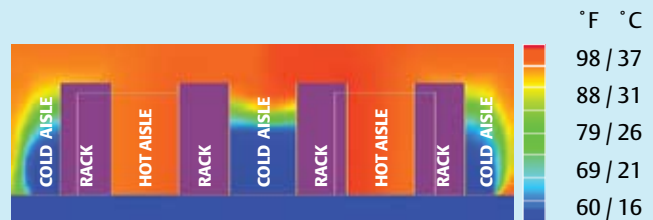**Hot Aisle /Cold Aisle Approach**

Unfortunately, even when using a hot aisle/cold aisle configuration, the limits of standard underfloor cooling are soon reached as rack heat loads increase.
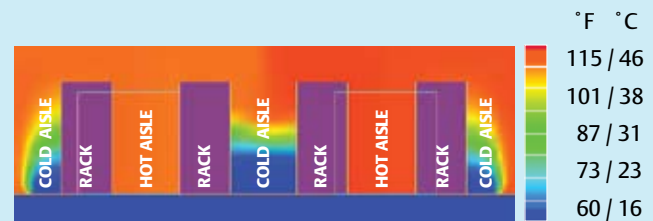
°F	°C
100	38
90	32
80	27
70	21
60	16
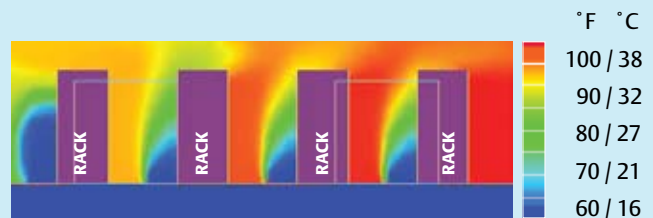
Heat Load = 3 kW Per Rack Without Hot Aisle /Cold Aisle Layout

°F	°C
87	31
80	27
73	23
66	19
60	16

Heat Load = 3 kW Per Rack With Hot Aisle /Cold Aisle Layout

°F	°C
98	37
88	31
79	26
69	21
60	16

Heat Load = 6 kW Per Rack With Hot Aisle /Cold Aisle Layout

°F	°C
115	46
101	38
87	31
73	23
60	16

Heat Load = 10 kW Per Rack With Hot Aisle /Cold Aisle Layout

Side views of Computational Fluid Dynamics (CFD) by Fluent showing limitations of hot aisle/cold aisle approach as heat load increases.

Liebert XD: The Flexible Solution

Business continuity professionals are demanding an integrated high heat density cooling solution — one that considers both room-level and rack-level needs.

Effective solutions need to be flexible.

The Liebert XD solution for high heat density cooling applications is a hybrid approach using a combination of floormount mission-critical cooling units and supplemental cooling from the Liebert XD Series.

Added as heat loads increase, supplemental Liebert XD cooling capacity allows your facility to adapt as heat loads rise — allowing cooling solutions to be added and reconfigured to react to the changes in your environment.

Benefits of the Liebert XD approach include:

Flexibility

- Floor-mount, rack-mount and ceiling-mount modules, plus a choice of cooling capacities, cover any application requirements.
- Plug and play for initial installation and future growth.
- Can cool more than 30 kW per rack.

Higher Availability

- The Liebert XD solution assures continuous operation of critical IT systems under extreme heat conditions.
- Designed to work with the hot aisle/cold aisle design of raised floor applications by efficiently drawing hot air out of equipment racks and moving cool air into the cold aisle.

Lowest Total Cost of Ownership

- The Liebert XD targeted cooling solution is more cost-effective than increasing the overall room air conditioning capacity using floor-mounted cooling units only.
- Total energy savings potential of up to 40% can be achieved with the Liebert XD solution.
- Minimal floor space requirements allow more room for IT equipment.

Flexible Approaches For High Heat Density Cooling

No one offers you more ways to meet the challenges of cooling high heat density installations than Liebert. We offer open and closed architectures, a choice of pumped refrigerant and water-based cooling, and the widest range of equipment configurations to meet every need—from small communications equipment closets to the largest data centers.

A Choice Of Cooling Methods

Adding targeted cooling is more cost-efficient than trying to lower the temperature of localized hot spots by increasing the overall room air conditioning capacity. Liebert X-treme Density mission-critical cooling systems are specifically designed to address the higher heat loads generated by tightly packed electronic rack enclosures. Individual systems can improve interior air flow, cool hot air ejected from the enclosure or cool hot spots near the racks.

Open and Closed Architecture Systems as defined by ASHRAE

- The **open architecture** systems utilize cooling coils near the heat load either inside or outside the open server rack and utilize the room air volume as a thermal storage to ride through short power outages.

- The **closed architecture** fully encloses the rack with the cooling coils inside. Other provisions are required for power loss ride through.
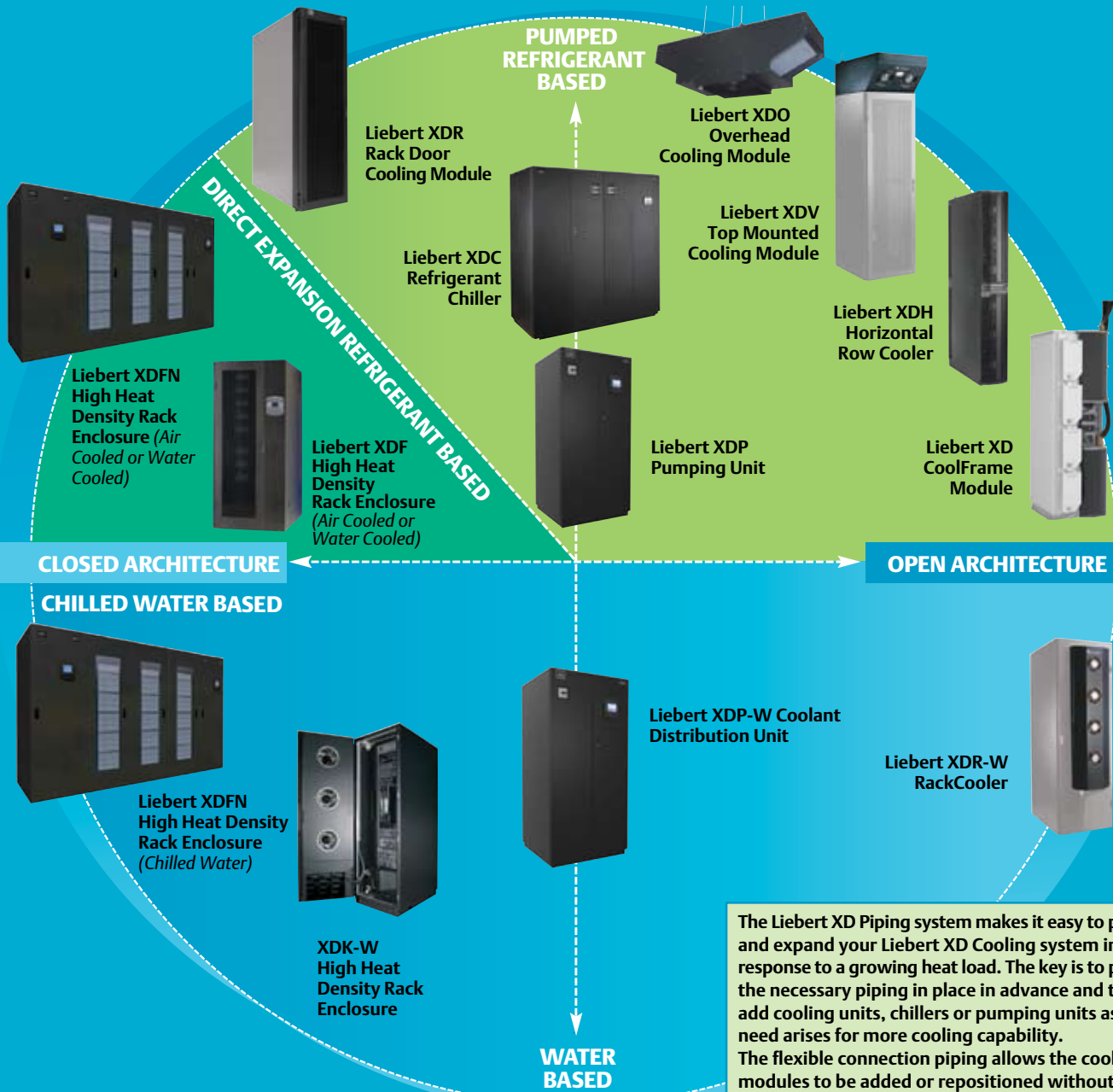
Liebert XD Pumped Refrigerant-Based Systems

Pumped refrigerant is ideal for use in data center environments. By eliminating the use of cooling water, it removes the chance of electrical hazards. It operates at low pressure and becomes a gas at room temperatures, making it ideal for use around electronic equipment.

It utilizes micro-channel coil efficiency and low pressure drop for lower operating costs. Use of pumped refrigerant also saves space with smaller piping requirements and the ability to utilize more compact heat exchangers. Pumped refrigerant is designed for medium to large computer rooms and data centers.

Liebert XD Water-Cooled Systems

Liebert XD water-cooled systems offer a cost-efficient cooling alternative where electrical hazards are minimal. They are also designed to work in any size space from a small computer room to a large data center.

A Cooling Solution For Every High Heat Density Application

PUMPED REFRIGERANT BASED

DIRECT EXPANSION REFRIGERANT BASED

Liebert XDR Rack Door Cooling Module

Liebert XDO Overhead Cooling Module

Liebert XDV Top Mounted Cooling Module

Liebert XDC Refrigerant Chiller

Liebert XDH Horizontal Row Cooler

Liebert XDFN High Heat Density Rack Enclosure (Air Cooled or Water Cooled)

Liebert XDF High Heat Density Rack Enclosure (Air Cooled or Water Cooled)

Liebert XDP Pumping Unit

Liebert XD CoolFrame Module

CLOSED ARCHITECTURE

OPEN ARCHITECTURE

CHILLED WATER BASED

Liebert XDFN High Heat Density Rack Enclosure (Chilled Water)

XDK-W High Heat Density Rack Enclosure

Liebert XDP-W Coolant Distribution Unit

Liebert XDR-W RackCooler

WATER BASED

The Liebert XD Piping system makes it easy to plan and expand your Liebert XD Cooling system in response to a growing heat load. The key is to put the necessary piping in place in advance and then add cooling units, chillers or pumping units as the need arises for more cooling capability.

The flexible connection piping allows the cooling modules to be added or repositioned without interruption in operation as needs change.

Liebert XD™ Cooling Solutions

The Liebert iCOM control system on the Liebert XDP pumping unit features maintenance history, spare parts list, Liebert IntelliSlot® for up to two cards (web compatibility and BMS), and comprehensive monitoring.

Pumped Refrigerant-Based Approach

Liebert XD™ zone and spot cooling units are available in several configurations using open or closed architecture and pumped refrigerant. Heat removal is provided by either the Liebert XDC Refrigerant Chiller or a Liebert XDP Pumping Unit used in conjunction with an existing building chilled water circuit.

The XD Solution Starts With An Innovative Pumped Refrigerant Application

This unique application of an off-the-shelf product makes the Liebert XD solution very energy efficient. Pumping refrigerant as a liquid and allowing it to expand to a gas as it absorbs heat is over seven times as efficient as a single phase fluid (water). The pumped refrigerant operates at low pressure and becomes a gas at room temperatures, making it ideal for use around electronic equipment.

A Chiller Designed For Direct System Configurations

The **Liebert XDC Chiller** is a specially designed indoor unit that connects directly to the Liebert XD Cooling Modules and provides chilled pumped refrigerant circulation and control. It ensures that the refrigerant is constantly above the actual dew point in the room, eliminating concern about condensation. Available with several heat rejection options.

Liebert XDC

Pumping Unit Designed For Indirect Configuration Applications

When a building chilled water system is available, the **Liebert XDP Pumping Unit** serves as an isolating interface between the building chilled water system and the pumped refrigerant circuit. It circulates refrigerant to the XD Cooling Modules at a temperature always above the actual dew point to prevent condensation. Liebert XDP features Liebert iCOM controls, enhancing system reliability and flexibility.
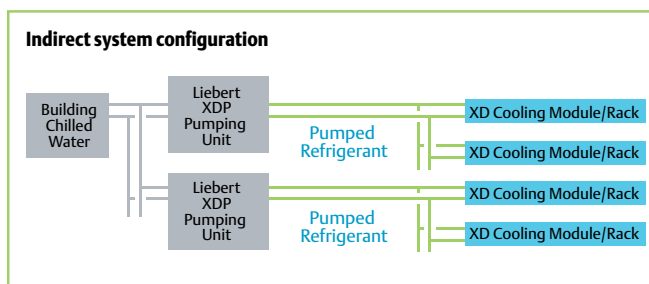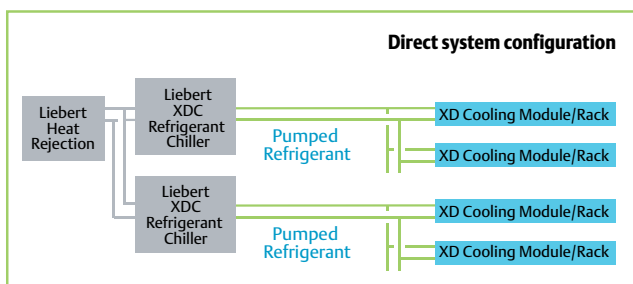
Liebert XDP

Open Architecture

The Overhead Cooling Solution

The ceiling-mounted Liebert **XDO Overhead Cooling Module** mounts directly above the cold aisle. It draws in hot air from the hot aisle and then discharges cool air into the cold aisle where the equipment air inlets are located. This energy-efficient unit takes up no floor space. Available with Smart Module integrated control board, for increased module control and monitoring.
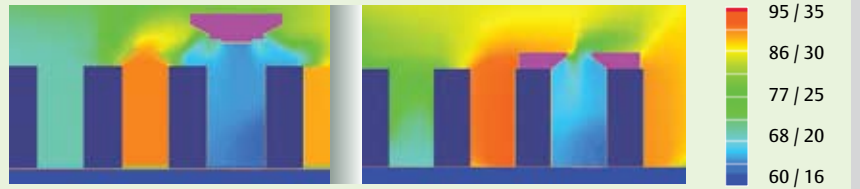
Liebert XDO

Direct system configuration

Liebert Heat Rejection	Liebert XDC Refrigerant Chiller	Pumped Refrigerant	XD Cooling Module/Rack
			XD Cooling Module/Rack
	Liebert XDC Refrigerant Chiller	Pumped Refrigerant	XD Cooling Module/Rack
			XD Cooling Module/Rack

Indirect system configuration

| Building Chilled Water | Liebert XDP Pumping Unit | Pumped Refrigerant | XD Cooling Module/Rack |
			XD Cooling Module/Rack
	Liebert XDP Pumping Unit	Pumped Refrigerant	XD Cooling Module/Rack
			XD Cooling Module/Rack

The Liebert XD Units Enhance The Hot Aisle/Cold Aisle Approach

The XDO and XDV fill the cold aisle with air at the temperature required for proper operation of the electronic equipment.

Temperature Profile of XDO System   **Temperature Profile of XDV System**

Temperature °F °C
95 / 35
86 / 30
77 / 25
68 / 20
60 / 16

Side views of Computational Fluid Dynamics (CFD) by Fluent.

Liebert XDO
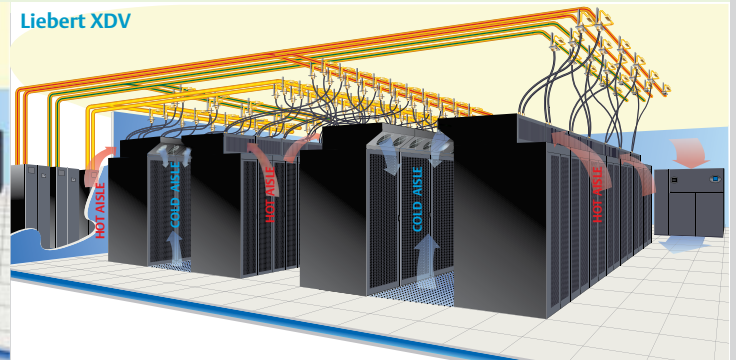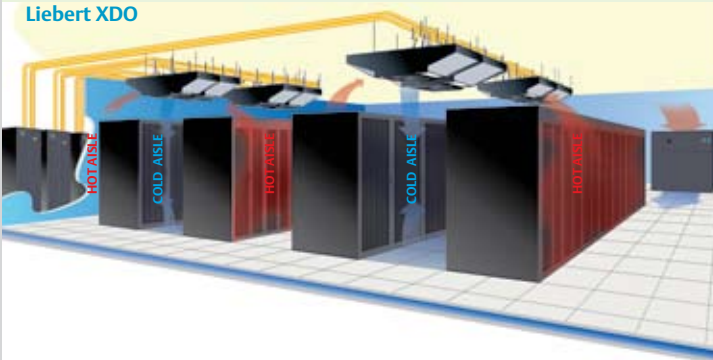
Liebert XDV

Space-Saving Solution That Cools From The Top	**In-Row Cooling That's Right In Line With Your Needs**	**The Most Energy Efficient Cooling Available**	**A Specialized Rack Cooling Solution**
The **Liebert XDV Cooling Module** mounts vertically above or on the IT rack enclosure, drawing hot air from inside the cabinet or from the hot aisle. It then cools the air and discharges it down to the cold aisle. This space- saving solution requires zero floor space. Available with Smart Module integrated control board, for increased module control and monitoring.	The modular **Liebert XDH Horizontal Row Cooler** is placed directly in line with rack enclosures. Air from the hot aisle is drawn in through the rear of the unit, cooled, and then discharged through the front of the unit into the cold aisle. The modular and adaptive design of the Liebert XDH allows it to be easily added as the demand for cooling increases. Available with Smart Module integrated control board, for increased module control and monitoring.	**Liebert XDR Rack Door Cooling Module** replaces the back door of a server enclosure, providing cooling without increasing the rack footprint. The module uses the server fans within the protected rack to provide airflow, providing the most energy efficient design.	**Liebert XD CoolFrame™** module is specially designed to attach directly to the rear of the Egenera BladeFrame EX system. The Liebert XD CoolFrame allows these racks to be placed in a data center environment around other heat-generating equipment without adding to the heat load in the room. Use of the Liebert XD CoolFrame solution can promote efficient expansion of data center capacity with a minimal impact on your critical infrastructure.
Liebert XDV	Liebert XDH	Liebert XDR	Liebert XD CoolFrame

What is a Smart Module?

Smart Modules are a technology option that increases the control and management capabilities of Liebert XD modules. Available on Liebert XDO, Liebert XDV and Liebert XDH. Smart Modules provide the following capabilities:

- Monitor fan status with the red/green LED positioned on the face of the module
- Alert to the presence of condensation
- Remotely shutdown the module via dry contact closures
- Save energy by adjusting the number of fans operating in multi-fan modules
- Compatible with Liebert XDC, Liebert XDP or Liebert XDP with iCOM

# Liebert XD Piping: *The Key To Adaptability*

The Liebert XD Piping system makes it easy to plan and expand your Liebert XD Cooling system in response to a growing heat load.

The key is to put the necessary piping in place in advance and then add cooling units and pump unts/chillers as the need arises for more cooling capability.

This unique system allows the room cooling capacity to increase to more than 500 Watt per square foot ($5400W/m^2$) with no additional disruptive piping installation. The flexible connection piping also allows the cooling modules to be re-positioned without interruption in operation.
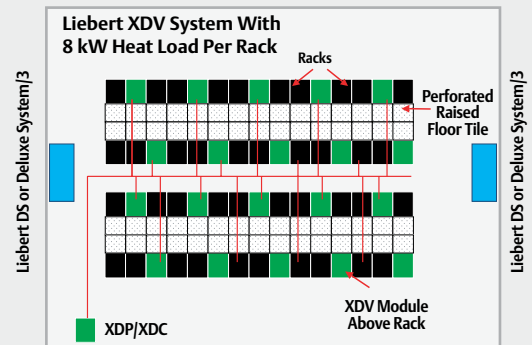
Invest Now, Save In The Future

Liebert XD Piping provides for future expansion and simplifies both the installation of additional units and the reconfiguration of components as needs change.
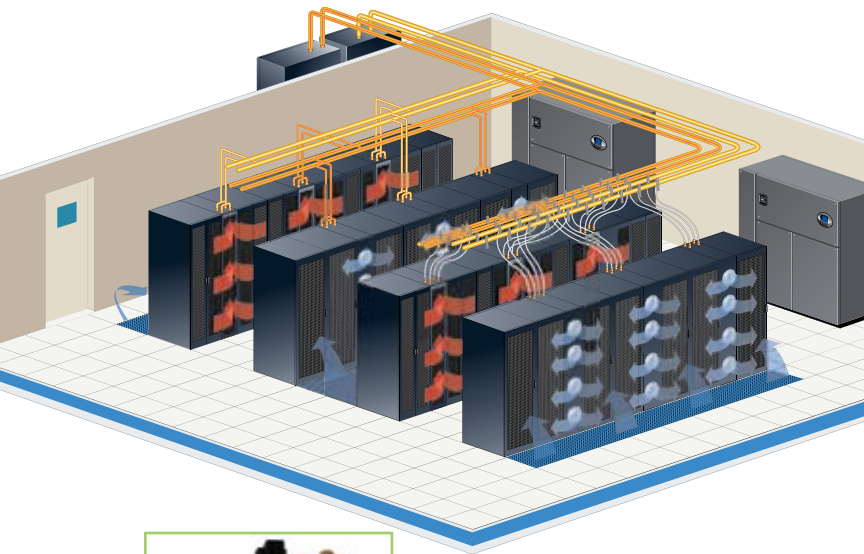
Liebert XD Piping is pre-fabricated distribution piping that is installed in anticipation of a growing system, then Liebert XD Cooling modules are added, disconnected, or repositioned as required and are quickly made operational with flexible connection piping with quick-connect fittings.

These computer room layouts illustrate how growth can be accommodated within the same space by installing additional Liebert XD Cooling capacity.

Liebert XDV System With 8 kW Heat Load Per Rack

Liebert DS or Deluxe System/3

Racks

Perforated Raised Floor Tile

XDP/XDC

XDV Module Above Rack

Liebert XDV System With 14 kW Heat Load Per Rack

Liebert DS or Deluxe System/3

XDP/XDC Units

XDV Modules Above Rack

Liebert XDV & XD0 System With 24 kW Heat Load Per Rack

Liebert DS or Deluxe System/3

XDP/XDC Units

Ceiling-Mounted XDO Modules

XDV Modules Above Rack

Liebert XD™ Cooling Solutions

Water-Cooled Based Approach

The Heart of the Water-based System

The **Liebert XDP-W Coolant Pumping Unit** is the key to the performance, efficiency and space saving of the Liebert XDR-W RackCooler and Liebert XDK-W water- cooled rack enclosure. The unit houses the isolating heat exchanger between the Liebert XDR-W/XDK-W circuit fluid and building chilled water, the control valve, the dual redundant pumps and the system controls. It controls the fluid temperature above the actual room dewpoint. The Liebert XDP-W can be used with other brands of rack cooling equipment.
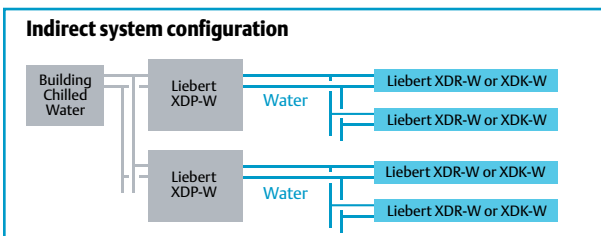
Open Architecture
Liebert RackCooler

The **Liebert XDR-W Rack Cooler** utilizes a cooling unit that is attached to the back door of the enclosure. Fans in the module move air from the equipment in the rack, through a cooling coil and expel it from the back of the unit, chilled to the point where the impact on the room is close to neutral. This makes the Liebert XDR-W an ideal solution in applications where the hot aisle/cold aisle arrangement is not practical. The Liebert XDR-W can be configured to eliminate hot spots or uneven heat loads within the room.

Closed Architecture
Liebert XDK-W

Utilizing closed air circulation, the racks are completely sealed from room air. The server heat load is dissipated into the process chilled water system through an air-to-water heat exchanger in the bottom of the rack. Redundant high-performance fans drive closed loop air circulation in the rack's interior, while servers are supplied with cold air at the front of the rack.

Liebert XDP-W

Liebert XDR-W

XDK-W

Indirect system configuration

Hydraulic Schematic

BUILDING CHILLED WATER LOOP

DUAL PUMPS

HEAT EXCHANGER

2-WAY VALVE CONTROLS SECONDARY FLUID ABOVE ROOM DEWPOINT

Up to 12 Liebert XDR-W units can be piped to each coolant distribution unit.
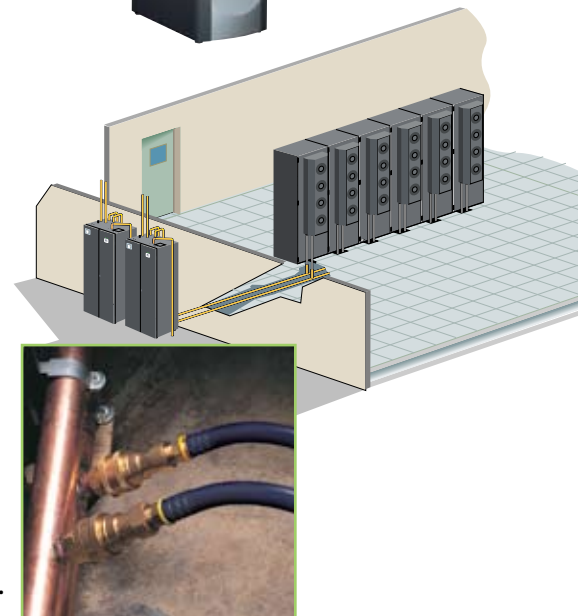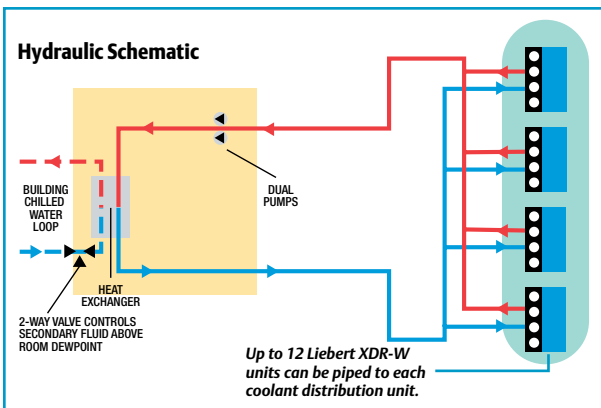
Liebert XDR-W modules are connected via quick-connect ports to a Liebert XDP-W that controls coolant flow and acts as an interface with your building's chilled water system through a heat exchanger.

Liebert XD™ Cooling Solutions

Direct Expansion Refrigerant Based Approach

Extreme density electronic equipment is turning up in many non-conventional spaces — spaces without the benefit of computer room air conditioning to provide cooling for the generated heat loads. This rack-based equipment must be protected with the same level of air, power and physical security support as a conventional computer room, but with the economies of scale and price in mind.

Cooling For High Heat Density Racks In 60hZ Applications

The Liebert XDF includes integrated high capacity cooling that provides the benefits of big room support in a cost-effective package to create an integrated, mission-critical protection system for sensitive electronics. Advantages include:

- Digital scroll compressor for continual and precise adjustments in cooling, resulting in lower energy costs.
- Optimized horizontal air circulation cools protected equipment, both in standard mode and in the unique backup ventilation mode.
- Automatic back-up ventilation feature ensures room air circulation through the rack in case of a failure.
- Control and monitoring provided through a cabinet-mounted Liebert iCOM control system, providing local and remote access to monitoring of conditions within the enclosure.
- The air-cooled Liebert XDF is a fully self-contained plug-and-play rack-enclosure system that requires only an AC power connection to protect up to 36U of equipment.
- Water or glycol-cooled units use remote heat rejection to support the in-rack cooling system and protect up to 42U of equipment.
- Business-critical power protection provided through optional Liebert GXT rack-mounted UPS.
- Liebert MP Advanced Power Strips available to provide power control at the receptacle level.

**Liebert XDF
High Heat Density
Rack Enclosure**
(Air Cooled or Water Cooled)

Closed Loop Cooling For High Heat Density Racks In 50hZ Applications

The Liebert XDFN is an integrated equipment cabinet with built in cooling, power distribution, monitoring and fire extinguishing system offering full redundancy and back-up ventilation. The Liebert XDFN features a 42U rack that provides these advantages:

- Self-contained cooling module is a modular direct expansion unit with remote air cooled condenser or water cooled condenser.
- Digital scroll compressor for continual and precise adjustments in cooling, resulting in lower energy costs.
- The modular design of Liebert XDFN allows for racks and cooling modules to be combined, in order to provide cooling to multiple racks.
- Back-up ventilation system ensures circulation through the rack of the air coming from the room in case of cooling module or power failure
- N+1 redundancy configuration utilizes one redundant cooling module ready to be activated in case of failure or maintenance of one of the running units.
- Control and monitoring provided through a cabinet-mounted Liebert iCOM control system, providing local and remote access to monitoring of conditions within the enclosure.
- Business-critical power protection provided through optional Liebert GXT rack-mounted UPS.
- Liebert MP Advanced Power Strips available to provide power control at the receptacle level.

**Liebert XDFN
High Heat Density
Rack Enclosure**
*(Air Cooled, Water Cooled
or Chilled Water)*

Only Liebert Offers A Real Choice In Protection Solutions

The wide variety of system architecture and cooling methods offered by the Liebert XD Series means you can find a perfect fit for any high heat density application within your data center, computer room or network closet.

Open vs. Closed Cooling Architecture System Comparisons

Open Architecture System

Advantages
- Ride-through/redundancy on room level
- Lower first cost and lower operating cost
- No limits on rack selection
- Plug and Play modules allow easy capacity increases if needed later

Other Considerations
- Mainly a room or zone solution

Closed Architecture System

Advantages
- Low audible noise
- Deployable as a single rack
- Does not require Data Center to be in a hot aisle/ cold aisle configuration

Other Considerations
- Shorter ride-through time on cooling system loss
- Fixed capacity, can not increase capacity later

Pumped Refrigerant Based vs. Water-Based System Comparisons

Pumped Refrigerant Based System

Advantages
- No water in data center — No risk if a leak occurs
- Higher energy efficiency
- Smaller piping requirements

Other Considerations
- Possible compatibility issues with small rooms
- Higher fluid cost
- Piping must be overhead

Water-Based System

Advantages
- Lower fluid cost
- No limitation to room size

Other Considerations
- May require fluid treatment to prevent fouling

Investing in a facility that utilizes a higher rack density design — along with a cooling system designed especially for this type of installation — offers a significant cost savings advantage in terms of building size and energy usage. The flexible configuration of the Liebert XD system modules also allows scalability for future growth, as well as the ability to efficiently add redundant units for maximum reliability in the most mission-critical applications. The Liebert XD approach significantly improves floor space utilization compared to an installation using only — floor-mounted cooling units. Because of the variety of cooling module sizes and placement, installing more XD capacity uses little or no additional floor area.

Data Center Cost (New Construction)
Fixed Load of 4,000 kW
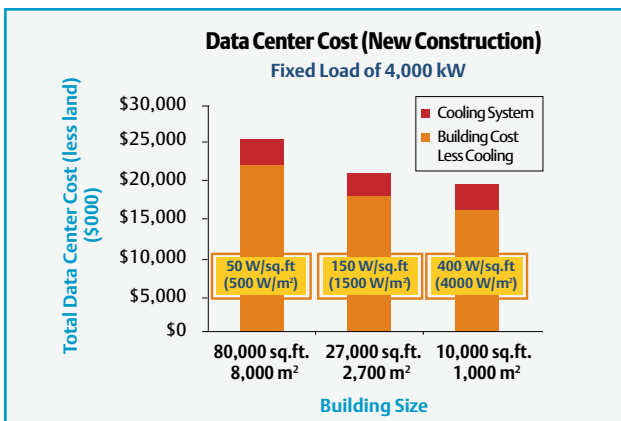
The capital costs of a data center are significantly reduced as higher densities of IT equipment are housed in smaller sized areas.

Study — Data Center Cost (New Construction) 400 racks with an average heat load of 10 kW each. Cost for building, power, cooling, lighting, fire protection, security, etc. included. Cost of land not included.

Building 1: 80,000 sq.ft. (8000m²), 18" (450mm) Raised Floor, Designed for 50 W/sq.ft (500W/m²), Raised-floor Precision Air Conditioning units for cooling.

Building 2: 27,000 sq.ft. (2700m²), 36" (900mm) Raised Floor. Designed for 150 W/sq.ft (1500W/m²), Raised-floor Precision Air Conditioning units for cooling.

Building 3: 10,000 sq.ft. (1000m²), 18" (450mm) Raised Floor. Designed for 400 W/sq.ft (4000W/m²), Raised-floor Precision Air Conditioning units (for basic cooling and humidity control) and Liebert XD.

Liebert XD - Supplemental Cooling Requires less Chiller Capacity
Chiller Capacity
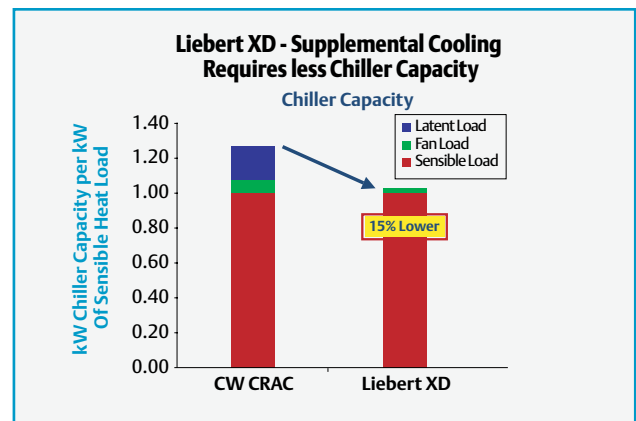
One of the major areas of savings identified with the use of Liebert XD equipment is the fact that the chiller plant size can be reduced. This is because the chiller typically is sized for the total gross capacity of the raised-floor cooling units. The 65% lower fan load of the Liebert XD System modules and the fact they are 100% sensible easily results in a capital chiller size savings of 15% or more.

Liebert XD - Supplemental Cooling with Lower Operating Costs
Power Usage
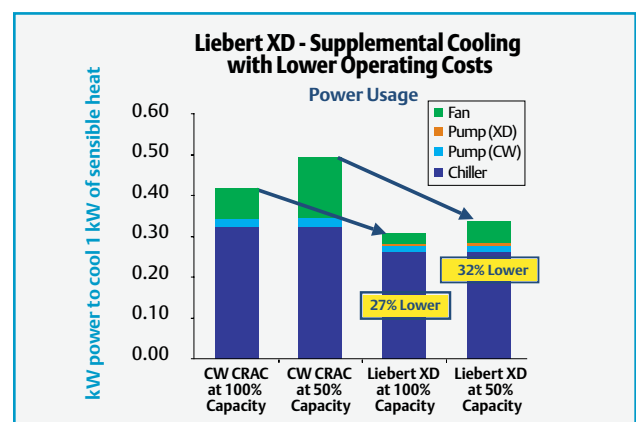
The smaller chiller plant and lower fan load result in significant energy savings as well. A 27% energy savings is very conservative.

The Liebert XD Cooling Solution Saves Floor Space

Here's a typical example of how implementation of the Liebert XD solution can impact life cycle costs. The example compares two data center layouts housing a total of 40 server racks with a capacity of 16 kW each.
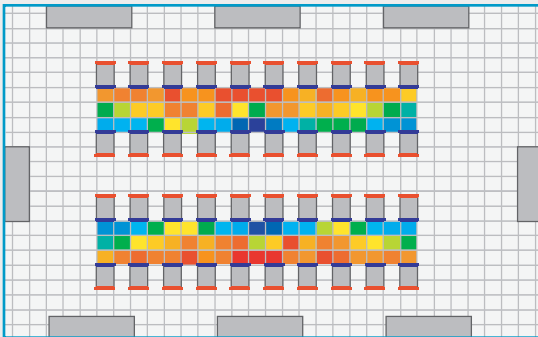
Raised-Floor Cooling Only
Eight 30-Ton (105 kW) Precision Air Conditioners
N+2 redundancy
284 Tons (998 kW) chiller plant
3000 sq. ft. (300m²)
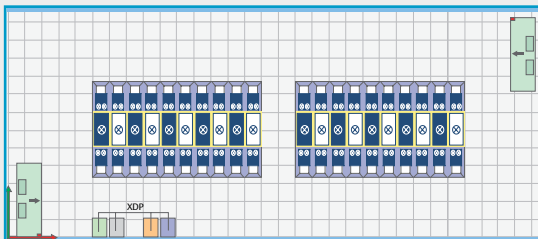
Raised-Floor And Liebert XD Cooling
Two 20-Ton (70 kW) Precision Air Conditioners
and 60 zero-footprint high heat density cooling
modules 33% redundancy
182 Tons (640 kW)Chiller Plant
1500 sq. ft.(150m²)

Here are two solution possibilities to be considered:

The raised-floor only approach of System 1 requires eight 30 Ton (105 kW) floor-mount units (6 primary, two redundant), 3000 sq. ft. (300 m²) of raised floor space due to the need for 6 foot (1.8m) cold aisles to handle the air flow requirements and a 284 Ton (998 kW) chiller plant.

With the raised-floor and Liebert XD cooling solution of System 2, the facility requires only two 20-Ton (70 kW) floor-mount units (one primary, one redundant) in half the floor space. Even with more redundancy, the chiller plant size is cut by 30% and energy consumption reduced by 40% per year. Here are the specifics on these numbers:

Capital Cost Comparison

	System 1	System 2	Savings
Net Sensible Load	2,184,320	2,184,320	
Total Gross Load	3,405,600	2,208,500	
Chiller Tons Required	284	184	**100 (351 kW)**

Capital Savings

Chiller at $400 / Ton	= $40,000
Diesel Generator / Switchgear capacity reduction 360 kW / 450 KVA	=$20,000
Total Savings	=$60,000

The sensible load is based on 40 racks times 16 kW each. But the chiller plant is sized to handle the gross total capacity of the raised-floor units. Only six raised-floor units are used for this calculation, but the cooling units at the rating conditions of 72˚ (22˚C)/50% humidity have a relatively high latent capacity requirement and the fan load needs to be added back to the chiller load. The Liebert XD System hybrid approach requires 1/3 less chiller plant capacity, also less diesel generator and switchgear capacity required. A conservative estimate is a savings of over $60,000 in capital costs.

Energy		System 1	System 2	
	kW ea	**Qty / kW**	**Qty / kW**	**Savings**
Chiller per Ton	0.9	284 / 256	184 / 166	
30 Ton CRAC	7.5	8 / 60		2 / 4
15 Ton CRAC	2.2	8 / 60		2 / 4
Liebert XDO	0.37		20 / 7	
Liebert XDV	0.2		40 / 8	
Liebert XDP	1.7		4 / 7	
Total kW		**316**	**192**	**124**
Cost / year @ $0.10 /kWhr		**$276,816**	**$168,192**	**$108,624**
Operational Costs				
Maintenance		$6,400	$1,600	$4,800
Humidifier		$5,400	$1,350	$4,050
Total Annual Savings				**$117,474**

Total First Year Savings $184,624 10 month payback

The significant energy savings achieved by the Liebert XD solution are, in great part, due to several factors.
- The cooling units are located closer to the load, which results in less mixing of hot and cold air.
- The fans can be optimized for a very low total system static pressure thanks to the micro channel coils and no pressure drop losses in ducts.

Customers are also finding they do not need to over chill their data centers to eliminate the hot spots as they have had to do with the raised-floor cooling only approach. They no longer need the cold aisle to be 62°F (17°C) in some places to maintain the desired 70°F (21°C) in other areas experiencing the hot bypass air.

Ensuring The High Availability Of Mission-Critical Data And Applications.

Emerson Network Power, the global leader in enabling business-critical continuity, ensures network resiliency and adaptability through a family of technologies — including Liebert power and cooling technologies — that protect and support business-critical systems. Liebert solutions employ an adaptive architecture that responds to changes in criticality, density and capacity. Enterprises benefit from greater IT system availability, operational flexibility, and reduced capital equipment and operating costs.

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