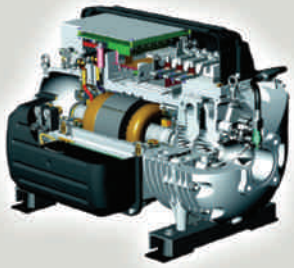
GUANGZHOU MELBOURNE MONTREAL PLATTSBURGH SINGAPORE STUTTGART

REVOLUTIONARY ENERGY SAVINGS FOR THE BUILT ENVIRONMENT

From the global leader in oil-free centrifugal chillers

SMARDT-POWERPAX

The Smardt Chiller Group now has over 3000 operating chiller installations across the world – all delivering high reliability, outstanding part-load efficiencies and the overall lowest cost of ownership to building owners. Achieving these goals as consistently and simply as possible remains Smardt-Powerpax's core purpose, and clearly differentiates it from competitors with conventional machines.



Smardt-Powerpax chillers optimise the benefits of the revolutionary Turbocor oil-free centrifugal technology. The TT300 compressor delivers 200 to 300 kW while the TT400 delivers 400 to 500 kW and the TT500 approximately 625 kW – more with fitted economizers.

Advanced electronics mean that mechanical forces can be managed with extraordinarily fine tolerances, achieving very high reliability. Not a surprise, when the shaft position is automatically measured and adjusted 120 times per revolution. At a maximum operating speed of 48,000 rpm, this means six million times a minute.

THE SMARDT CHILLER GROUP

WORLD LEADER IN OIL-FREE CHILLER EFFICIENCY

The Smardt Chiller Group was established to maximise the customer benefits of the Turbocor oil-free centrifugal compressor technology in chiller performance. Driving whole life costs of ownership way down, your Smardt-Powerpax chiller saves you money, year after long year, while reducing your carbon footprint and making a major contribution to the future of the planet.

DECADES OF DEVELOPMENT

The Smardt-Powerpax engineering team, many with long experience actually developing the Turbocor compressor technology, came together to bring a definitive high-performance range of water-cooled and air-cooled oil-free centrifugal chillers to the market, and to make sure each Smardt-Powerpax chiller saves its owners money – money in operating costs, money in maintenance costs, money because of high reliability and redundancy which practically removes mechanical risk altogether.

Algorithms used in all Smardt-Powerpax chiller controllers further enhance the intelligence built-in to the compressor – achieving further efficiencies across each compressor's operating map, and further, optimising each compressor's intrinsic part-load efficiencies in delivering integrated chiller efficiencies that are currently unmatched.

GLOBAL REACH, SINGLE FOCUS

PowerPax (founded in Melbourne, Australia in 2000 as a specialist heat-exchanger group) and Smardt (founded in Montreal, Canada in 2005 to focus on oil-free centrifugal chillers) joined forces during 2005 to form the Smardt Chiller Group. After several years of rapid growth, a new Smardt factory was opened in Plattsburgh, New York in 2010, and a sales and service operation opened in Singapore. In 2011, Smardt was joined by the well-known OPK Klimatechnik business in Stuttgart, Germany – an outstanding European pioneer in oil-free centrifugal technology. And in 2012, Smardt's China manufacturing operations will open in Guangzhou, Guangdong.

The heart of every Smardt-Powerpax chiller is its Turbocor oil-free centrifugal compressors, which integrate rugged magnetic bearings systems with variable-speed drive, high-efficiency centrifugal compression and on-board digital electronics to achieve a revolutionary leap, a quantum leap, in part-load energy efficiency.

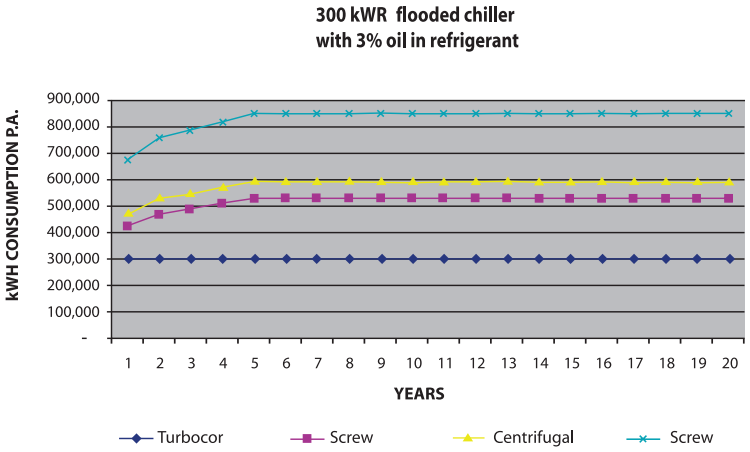
A QUANTUM LEAP

IN ENERGY EFFICIENCY

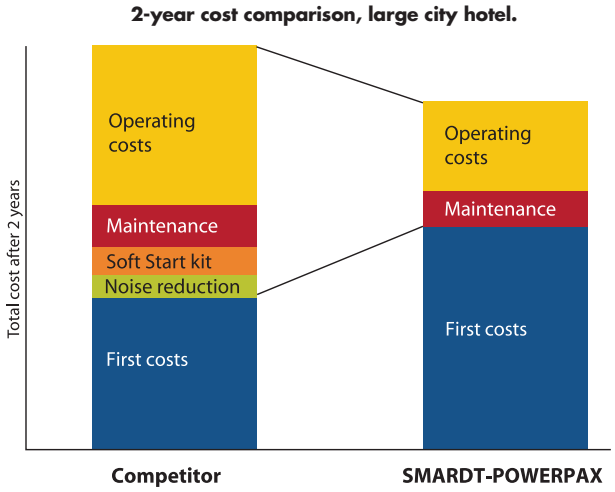
All Smardt-Powerpax chillers, whether water-cooled or air-cooled, are designed to optimise the performance of oil-free centrifugal compressors from Danfoss Turbocor Compressors Inc. These use oil-free magnetic bearings and variable-speed drives to deliver better IPLV efficiencies than conventional oil-lubricated centrifugal, reciprocating, scroll and screw compressors. They are also high-speed – up to 48,000 rpm, very compact, very quiet, rugged and reliable. Power factor is a high .92.

Proprietary *magnetic bearings* replace conventional oil-lubricated bearings, eliminating high friction losses, mechanical wear and high-maintenance oil management systems to deliver energy savings of 35 percent and more over conventional chillers while ensuring long-term reliability. Over 90,000 magnetic bearing machines are operating in the field, mainly in high-end vacuum pumps and CNC spindles – any innovation risk with this component technology has been long overcome.

Turbocor's one main moving part (rotor shaft and impellers) is levitated during rotation by a digitally controlled magnetic bearing system. Position sensors at each magnetic bearing provide real-time feedback to the bearing control system, 120 times each revolution, ensuring constantly centered rotation.



As this comparative ASHRAE study showed, over 20% of a lubricated chiller's operating efficiency is routinely lost in the early years as a result of oil clogging of heat transfer surfaces.



This decision between two different chillers has long term positive consequences for the hotel which made it. The left-hand option is a low-cost lubricated screw chiller. The right hand option is a 1 MW Smardt-Powerpax water cooled chiller

Oil-free design optimises heat transfer

The well-known ASHRAE study (Research Project 361) concluded that typical lubricated chiller circuits show reductions in design heat transfer efficiency of 15-25%, as lubricant accumulates on heat transfer surfaces, denatures and blocks normal thermodynamic transfer processes. Logically, no oil in your chiller means no oil contamination over time, so design efficiency is maintained effortlessly.

Extraordinary soft-start efficiency

The compressor's power electronics, further enhanced by Smardt-Powerpax's proprietary chiller controllers, require only 2 amps for start-up, compared with 500-600 amps in conventional machines. Further savings for owners, who can reduce maximum power loads and reduce backup generator size, cost and capacity.

Rugged and built-in defense against power failure

Each compressor has a bank of capacitors for energy storage and to filter DC voltage fluctuations. In case of a power failure, the capacitors provide continuity power to the bearings to keep the shaft levitated, allowing the motor to turn into a generator and to power itself down to a stop. Extended life testing confirms the system's remarkable durability.

HFC-134a refrigerant

R134a has no Ozone Depletion Potential and no phase-out schedule under the Montreal Protocol. It has an A1 rating under ASHRAE standard 34 (no flame propagation, lower toxicity). Positive pressure chiller designs (compared with negative pressure designs using R123, for example) enhance sustainable performance, as neither air nor moisture can leak into the chiller. No purge unit is required – a further saving. Liquid R134a refrigerant is used in Smardt-Powerpax chillers to cool critical electronic and electromechanical components to assure maximum efficiency and safe operation.

Very quiet

Very low sound and vibration levels, because there is no physical contact between moving metal parts, eliminate the need for expensive attenuation. Smardt-Powerpax chillers are typically so quiet, in fact, that a novice cannot tell whether they are actually operating. Testing of Smardt-Powerpax water cooled chillers with reference to ARI standard 575 yields readings as low as 77 dBA at 1 metre.

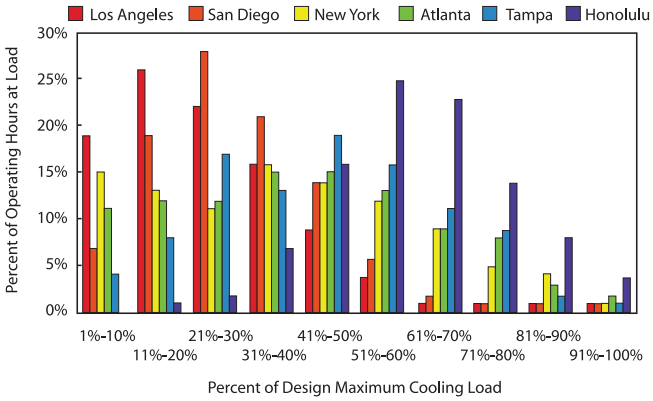
Energy cost savings can be spectacular

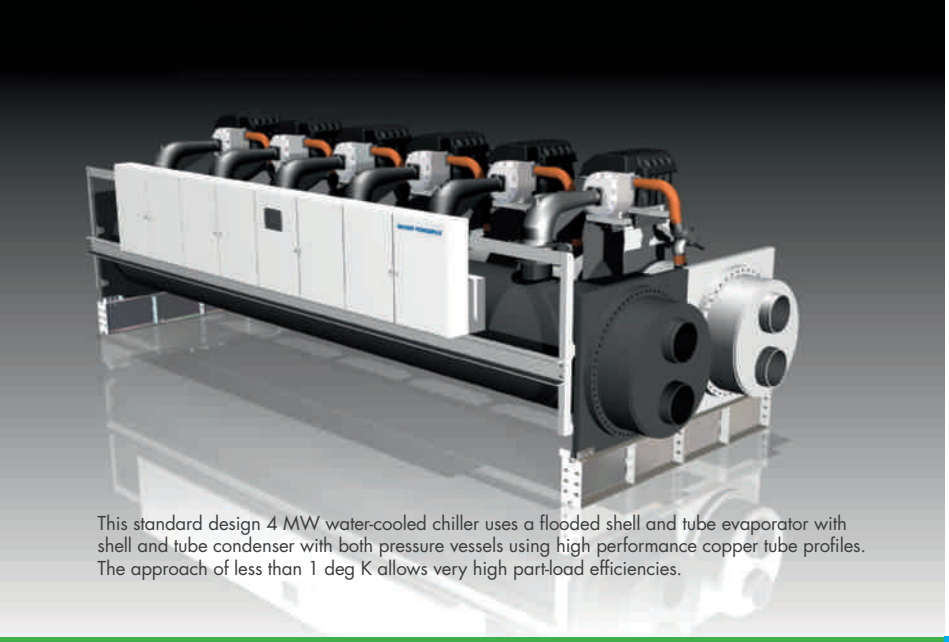
Compared with a new screw chiller, Smardt-Powerpax IPLV energy efficiency is routinely more than 32% better. Compared with older lubricated reciprocating, screw, scroll or centrifugal chillers, year round savings with a Smardt-Powerpax can be spectacular, with well over 50% savings.

Under ARI conditions, Smardt-Powerpax IPLV performance can be as low as .33 kW/TR while part-load efficiency can be well under .30 kW/TR.

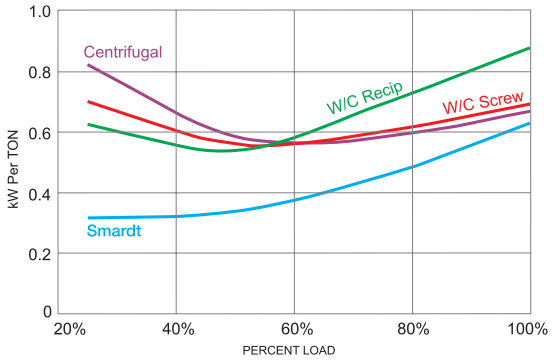
Why part loads are critical

The graph below (data source: AHRI, 2005) shows very simply that a wide range of large US cities all demand the vast bulk of their chiller operations at part load – enabling much lower operating costs from a Smardt-Powerpax chiller than from a lubricated alternative. Australian cities are very similar.





This standard design 4 MW water-cooled chiller uses a flooded shell and tube evaporator with shell and tube condenser with both pressure vessels using high performance copper tube profiles. The approach of less than 1 deg K allows very high part-load efficiencies.



This simple comparison uses generic industry performance data for 250 TR water-cooled chillers (data source: AHRI) to plot the relative efficiencies of different compressor modalities as they unload.

WATER-COOLED CHILLER RANGE
200 kW through 4000kW

Lowest lifetime operating costs
Smardt-Powerpax works hard to minimise complexity in chiller design and operation – Smardt-Powerpax simplicity is reflected in low Smardt-Powerpax operating costs. The thinking makes simple sense – with no oil, flooded shell-and-tube evaporation, soft start, low power consumption, low maintenance costs and high reliability with only one main moving part.

Smardt-Powerpax field reliability has been outstanding – not surprising when you consider that some 80% of all chiller problems in the field are due to failures in compressor oil return. And Smardt-Powerpax chillers use no oil.

The worldwide fraternity of Smardt-trained engineers and technicians often suggests that total maintenance costs for Smardt-Powerpax oil-free chillers run at well under half the costs of traditional lubricated chillers. This may be very conservative.

Serviceability
Always important in minimising operating costs, service access is swift and simple, as is access to operating history through remote monitoring. Operating history, compressor and chiller set points are all accessible remotely by trained and authorised service personnel.

Simple BAS integration
Integration with Modbus, Bacnet and LONworks building management systems is standard, as is connectivity with most industry-standard protocols.

Custom design and problem solving
The group's design engineers are happy to resolve special equipment design challenges for you, but please allow some extra time and, possibly, some extra cost for these.

For example, high-efficiency heat recovery and free cooling applications can all be supplied competitively. Marine water boxes, corrosion protection and other options are available and can be explored on request.

Redundancy
Use of multiple compressors allows unusual redundancy safeguards; and if multiple circuits are indicated, these can be designed in and supplied. Smardt-Powerpax's redundancy potential can offer system designers unique opportunities to eliminate multiple chillers, multiple controls and multiple pumps. More savings for owners.

Multiple compressors also allows system designers to save on low-load or pony chillers, because with a VFD integrated into each compressor control, a chiller which uses multiple compressors can be efficiently driven right down below 10% or even 5% load.

Over only 5 days, 400 TR of high-efficiency cooling was installed, commissioned and running at a fully tenanted CBD complex, using access only through standard doorways, stairs and elevators. Access savings – demolition, carnage and the costs of closing a busy downtown street – were enormous.

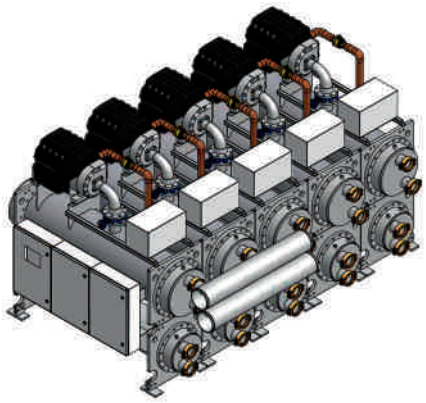
YOUR PLANT ROOM ACCESS PROBLEMS SOLVED – ONLY SMARDT-POWERPAX OFFERS TWO EASY OPTIONS

Compact Modular and Split chiller ranges; 200 kW through 2,600 kW

Smardt-Powerpax's Compact Modular and split-vessel chillers elevate the modular chiller into the high-efficiency, low-operating-cost world. No longer does modularity have to be compromised by efficiency sacrifices.

Now you can use the modularity concept to upgrade plant operating efficiency while minimising plant room access costs – saving high costs of demolition, rigging and cranage. Savings can be enormous, because the Smardt-Powerpax Compact Modular range is designed to move through a standard elevator and a standard door, through to a footprint smaller than any other high-efficiency chiller.

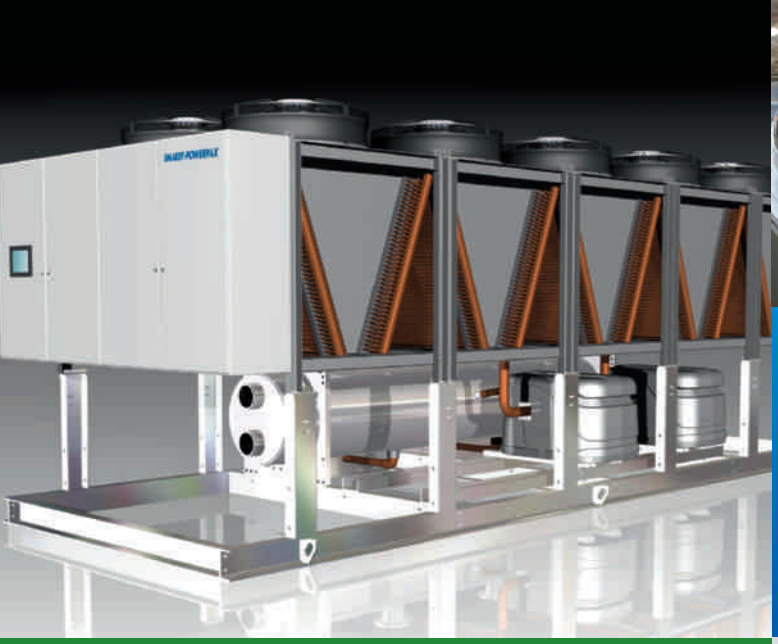
This standard 300 kW Compact Modular chiller can be doubled up with the same footprint, then expanded by up to 5 further modular steps, allowing a wide range of high-efficiency modular options.



The Compact Modular range delivers high IPLV efficiencies in capacities up to 2,600 kW while minimising access, rigging and other site costs.

Split designs: one step up from modular in first-cost efficiency

Smardt-Powerpax's Split chiller range (patent pending) minimises chiller first cost as well as operating cost as well as access cost. Each Split chiller, once factory-tested as a complete chiller, becomes a special disassembled kit so you need only use standard doors, standard elevators (and standard people instead of demolition crews and cranes) and optimising standard capex budgets.



AIR-COOLED PACKAGED CHILLER RANGE

200 kW to 1200 kW

The Smardt-Powerpax air-cooled range offers the smallest footprint, the quietest operation and the highest air-cooled operating efficiencies on the market.

Condenser coils use either a V or a W configuration to optimise heat rejection and footprint. Coils are baked and double-coated as standard with sealed edges as standard, to extend the coil's physical protection from environmental corrosion.

REMOTE AIR-COOLED CONDENSING

Remote location of the condenser can be a preferred option in some applications. Smardt-Powerpax can supply a full package if desired, or on a condenser-less basis.

INTEGRATED EVAPORATIVE PRE-COOLING FURTHER DROPS POWER CONSUMPTION

Integrating evaporative pre-cooling to lower the incident air temperature on the coil can dramatically reduce energy consumption, effectively shifting heat rejection from ambient dry bulb (95 deg F or 35 deg C) towards ambient wet bulb (say 75 deg F or 24 deg C). In warmer, dryer climates, Smardt-Powerpax reference sites show further savings of over 30% compared with normal Smardt-Powerpax air-cooled operation.

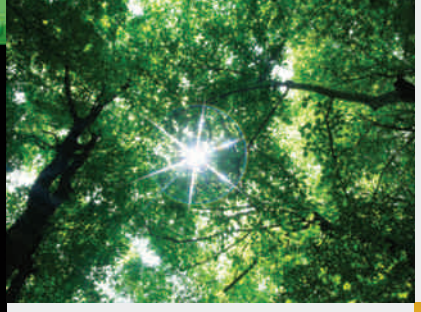
Service access is outstandingly simple.

Smardt-Powerpax air-cooled performance at this Florida university delivered the expected 40% energy savings.

SMARDT-POWERPAX FREE-COOLING CAN DRIVE EFFICIENCIES OFF THE PLANET

Adding a Smardt-Powerpax Free Cooling package (special bypass circuitry, controls and safeguards) can drive air cooled chiller efficiencies to spectacular levels with appropriately low ambient temperatures. Payback periods can be very short.

Use of evaporative pre-cooling to minimise air-cooled power consumption can be very efficient from an operating cost perspective.



Smardt-Powerpax chiller controllers have been developed from the ground up using primary compressor performance maps, maximizing the performance potential within these, then optimising the whole chiller's operation to minimise energy consumption.

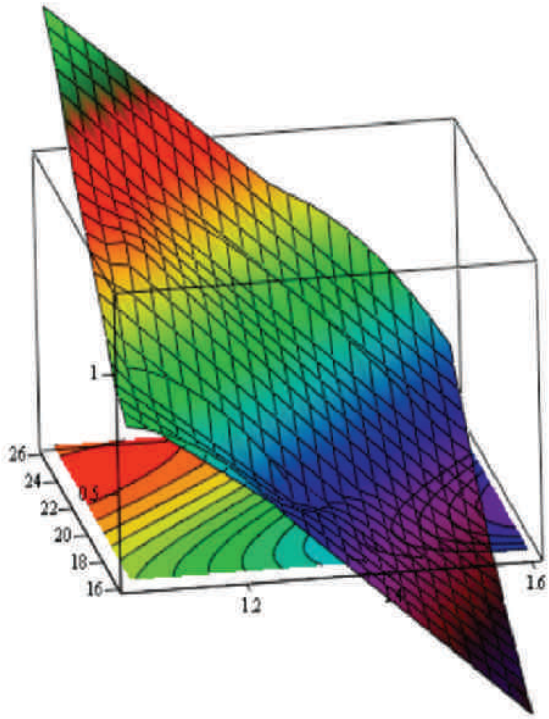
USER-FRIENDLY CONTROLS

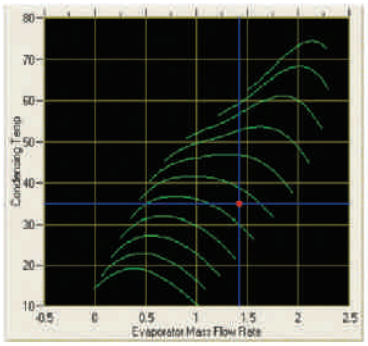
Smardt-Powerpax's Kiltech controller is very user-friendly, highly intuitive and allows optimisation of both single compressor operation and multiple compressor operation while enabling a rich array of communication options.

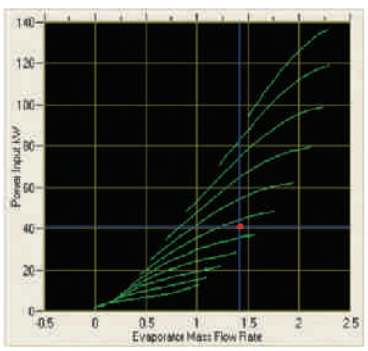
The compressor's onboard digital controller proactively manages compressor operation while allowing external control and web-enabled monitoring of performance and reliability information.

The PowerPax PLC-based microprocessor system has been used on well over 1500 chiller sites, and that installation experience has been used to generate the state-of-the-art controls software that is used to maximise operating efficiencies and minimise maintenance and operating costs. Two tiers of control options are available.

This system provides several access levels for plant operators and commissioning, and offers a wide variety of options for flexible operation and optimisation of power consumption, maximizing time spent operating at compressor sweet spots.







Especially when using multiple chillers in a chilled water plant, very large energy savings can be reliably achieved when the whole system is optimised by a Kiltech CPECS installation using all-variable-speed drives.

INTEGRATED VARIABLE SPEED CHILLED WATER PLANTS

Kiltech CPECS optimises total integrated energy efficiency

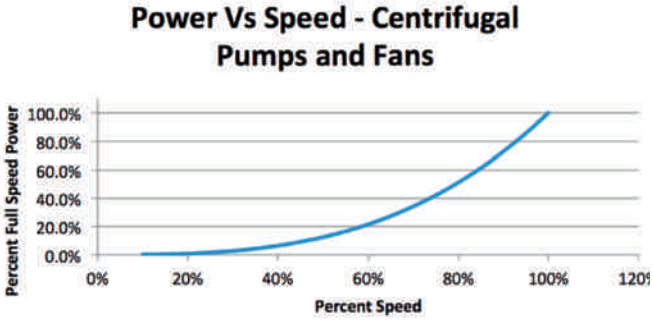
After many years' observing and testing variable primary flow systems in chilled water cooling plants across a wide range of environments and applications, Smardt Chiller Group's associate Kiltech infotech group developed a proprietary suite of functional algorithms which constantly minimise the total energy consumption of the chilled water cooling system. Not just the chillers, or the cooling towers, or the pumps, but the whole system. Perhaps surprisingly, optimising the whole system can mean running an individual component machine away from its own optimum.

There are two simple but absolutely key concepts involved:

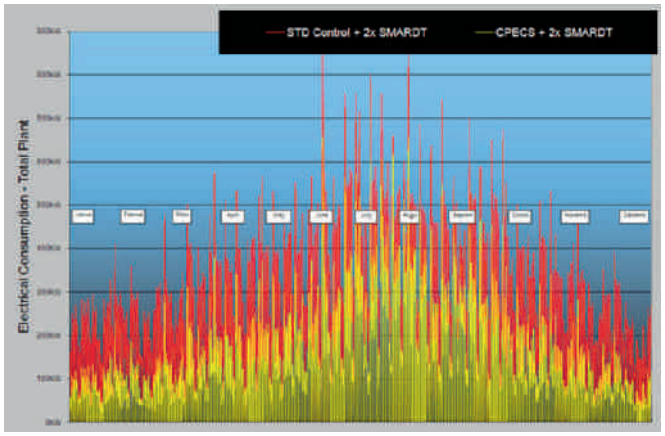
Reducing Operating Speed by X Reduces Operating Energy Consumption by X^3

When each item of your variable speed equipment (e.g. your Smardt-Powerpax chiller) is operating at part load, you save the cube of the differential of the load.

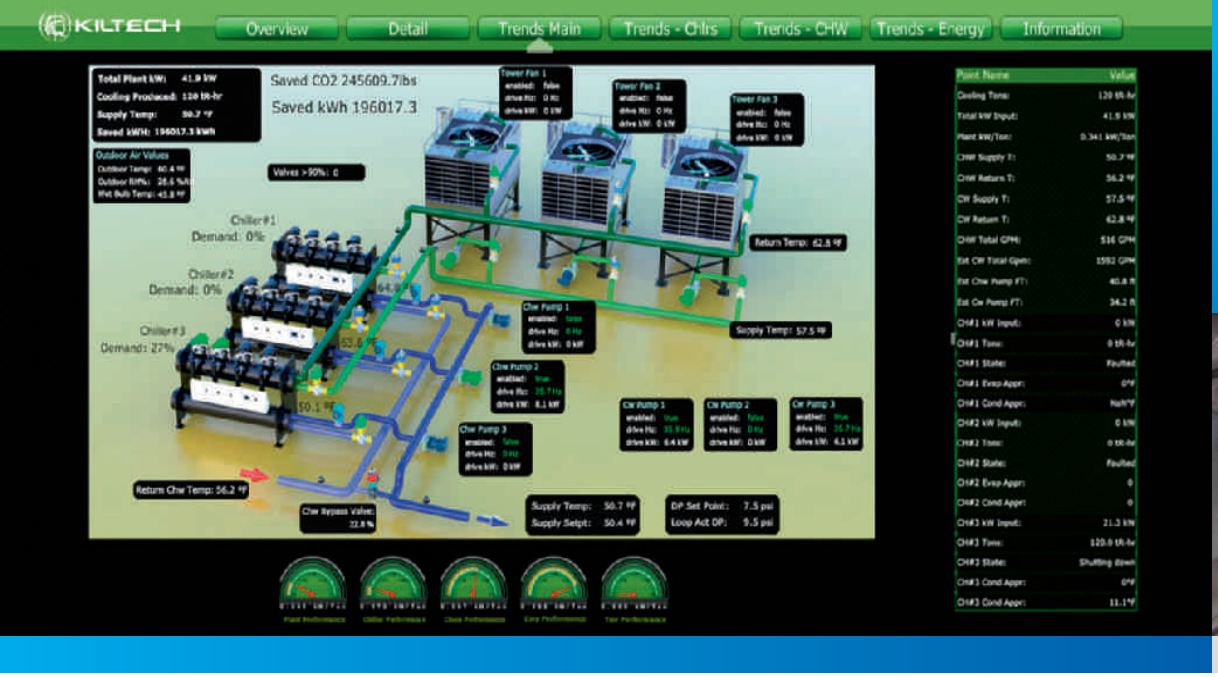
Obviously, it pays you to minimise the load on your variable speed equipment at all times.



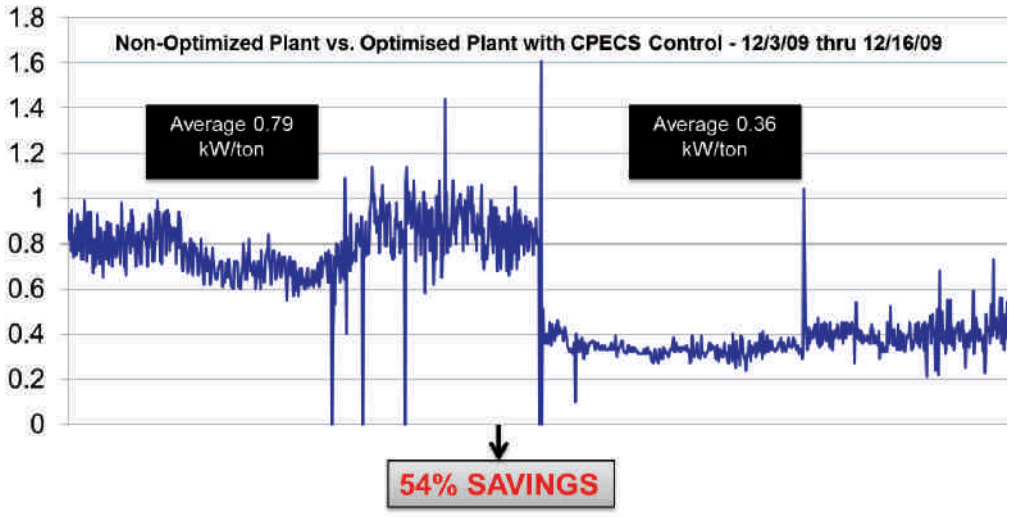
Optimising Operating Speed of a Total Variable Primary Flow System Aggregates Multiple Savings



A quick comparison between red and yellow bands above shows the consistent savings across a whole year achieved by a CPECS optimisation system compared with a standard plant control.



Switching on the CPECS Optimisation Control Drives Major System-Management Savings. Instantly.



Each member piece of equipment in this chilled water plant either has an in-built variable speed drive function (like the Smardt-Powerpax chillers) or has had a VSD added to it. That is, the system's primary flow is inherently variable.

However, it is not until you actually engage the system's controller that you can see the very large and year-round impact on system savings.

The data above comes from the Westwood High School in Phoenix, AZ during 2010.

SETS NEW BENCHMARK IN WHOLE-PLANT ENERGY SAVINGS

The Kiltech CPECS uses complex algorithms generated by over ten years of experimentation and research across the globe.

When the CPECS is switched on, and your chilled water cooling system optimised for energy efficiency, the dashboard looks like this:

SMARDT-POWERPAX OIL-FREE CENTRIFUGAL TECHNOLOGY DRIVES CHILLER SYSTEM COST SAVINGS ACROSS THE WORLD

IN HOTELS

Very quiet operation with unmatched part-load efficiencies across the Smardt-Powerpax chiller range enables leading hotel groups across the world to maintain optimum indoor environmental comfort year round while also optimising financial efficiency. Managing energy costs can be an ongoing challenge as seasons vary and occupancy levels fluctuate, but Smardt-Powerpax's flexibility and reliability provides hotel owners and operators with lowest total lifetime costs for their chillers.

IN HOSPITALS

Healthcare administrations across the globe find that their Smardt-Powerpax chillers make a critical contribution to the physical environment required for optimum patient comfort and quality care across all facilities including operating and data rooms. Unmatched redundancy from multiple compressors provides peace of mind while outstanding part-load efficiencies mean better operational performance and financial results. Some hospitals put special value on Smardt-Powerpax's **seismic certification** while others derive special benefits from Smardt-Powerpax's acoustic performance or the outstanding savings which can be delivered by heat recovery chillers.

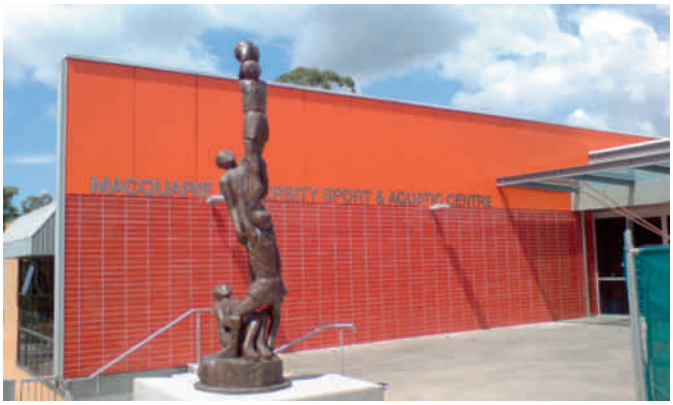
IN OFFICE BUILDINGS

Energy savings throughout the year are a feature of all Smardt-Powerpax chiller installations, while reductions of maintenance costs of over 50% are routine, compared with lubricated standard chillers. Smardt-Powerpax's quiet operation and built-in redundancy are also valuable, but for most owners and managers of Smardt-Powerpax-cooled office buildings it is the chillers' overall lowest lifetime cost that means most.

IN SCHOOLS AND UNIVERSITIES

Comfortable classroom environments are essential pre-requisites for optimum learning performance, according to the array of modern academic studies available across the world. Minimising lifetime chiller costs is an essential goal of K12 school administrations, where energy cost is usually the next largest variable after staff.

In universities, commitment not only to energy efficiency but also to minimising greenhouse gases is important to students and faculty alike. Administrators specify Smardt-Powerpax because of unmatched reliability and redundancy as well.



IN MANUFACTURING

Smardt-Powerpax chillers provide mission-critical cooling to leading companies in a wide range of industries – including pharmaceutical manufacturing and research, food and beverage, automotive, chemical, petrochemical and aerospace. In additional to extraordinary reliability (no oil, so no oil system to need maintenance), extraordinary savings in both operational energy efficiency and lower maintenance costs are routinely delivered.

IN DATA CENTRES

Smardt-Powerpax's share of new data centre chiller applications is reportedly increasing across the world, as owners and operators better understand their mission-critical need not only for uninterrupted uptime throughout the year but also for optimum energy efficiency throughout the year. Depending on specific applications, Smardt-Powerpax has deployed a large number of different configurations in data centres – water cooled, air cooled and condenserless chillers partnered with evaporative condensers.

CERTIFICATION

All Smardt-Powerpax chillers are ETL-listed. Electrical safety for the life of the chiller is a fundamental requirement throughout the company. Smardt-Powerpax evaporators and condensers naturally conform to the ASME pressure vessel codes.

AHRI CERTIFIED™ www.ahridirectory.org Air-Cooled Chillers AHRI Standard 550/590 C

AHRI CERTIFIED™ www.ahridirectory.org Water-Cooled Chillers AHRI Standard 550/590 C

Their energy efficiency performance is certified according to AHRI standard 500/590, as is confirmed by AHRI on its website www.ahrinet.org. The IPLV performance of its chillers always exceeds minimum levels set out by ASHRAE standard 90.1, CSA 743, Eurovent, Australia's MEPS, China's CRAA and others, usually by a very considerable margin. Smardt-Powerpax, in company with the majority of the HVACR industry's leading engineers, considers the use of full-load energy efficiencies to predict any chiller's actual year-round energy-efficiency under comfort-cooling conditions to be totally misleading, and therefore discourages the use of them.

Witness tests can be arranged on appropriate notice and for an appropriate fee on Smardt-Powerpax's AHRI-certified test stands.

STRONG LEED CONTRIBUTION

Smardt-Powerpax technology can be very useful in achieving LEED certification for your building, whether in existing buildings, core and shell or new construction, because it can help win critical points in the Energy & Atmosphere category. Market research by the US Green Building Council finds that the streamlined LEED process is second only to rising energy costs as a driver for stronger adoption of green building practices and the transformation of the built environment to sustainability. Smardt-Powerpax is a member of the USGBC.

GUANGZHOU MELBOURNE MONTREAL PLATTSBURGH SINGAPORE STUTTGART

STRONG SUPPORT FOR THE EPA'S RESPONSIBLE USE VISION

The EPA's Responsible Use vision encourages manufacturers, system designers and owners to invest in products and technologies which document sustainability of the highest efficiencies in tandem with lowest emissions. Smardt-Powerpax is a strong supporter of the vision, and the EPA.

For further information please contact:

SMARDT-POWERPAX

Smardt Chillers Pty Ltd
144 Colchester Road, Bayswater North
Victoria 3153, Australia

Tel: +61 3 9761 7905
Fax: +61 3 9761 6707

Email: sales@powerpax.com.au
www.powerpax.com.au

SMARDT

Smardt Chiller Group Inc.
1840 TransCanada Highway
Dorval, Quebec, Canada, H9P 1H7

Tel: +1 514 426 8989
Fax: +1 514 426 5757

Email: sales@smardt.com
www.smardt.com

SMARDT-OPK

Smardt-OPK Klimatechnik AG
Im Kalten Brunnen 29,
72666 Neckartailfingen, Germany

Tel: +49 7127 9202 20
Fax: +49 7127 9202 720

Email: sales@opk.de
www.opk.de

SMARDT

Guangzhou Smardt Chiller Manufacturing Co., Ltd
Mei Xing Industrial Park, No. 30 Dong Zhong Road,
ETDD Guangzhou, Guangdong

Tel: +86 20- 8205 7161
Fax: +86 20- 8200 1302

Email: sales.china@smardt.com
www.smardt.com

SMARDT

Smardt Chillers, Inc.
22 Colorado Avenue
Plattsburgh, New York 12903, USA

Tel: +1 514 426 8989
Fax: +1 514 426 5757

Email: sales@smardt.com
www.smardt.com

SMARDT

Smardt Chillers (Asia-Pacific) Pte Ltd
108 Pasir Panjang Road, #04-10,
Golden Agri Plaza, Singapore 118535

Tel: +65 6273 1120
Fax: +65 6273 1129

Email: sales.asia@smardt.com
www.smardt.com

1/12