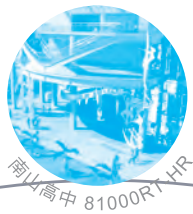
PES

GREEN TECHNOLOGY



南山高中 81000RT-HR

南科奇美電子 7000T-HR

中台禪寺 10000RT-HR

儲冰式空調系統

TOTAL FREEZE ICE TANK®

台中科博館 6370RT-HR

桃園機場 9000RT-HR

江陵矽谷 12000RT-HR

何謂儲冰式空調

當水結成冰時，其所儲存的能量稱為「潛熱」，此「潛熱」能量為79 Kcal / Kg。因一般中央空調系統所使用的冰水溫度最高約為15℃，也就是說：「當15℃的水，凍結成0℃的冰時，合計可應用之儲存能量共94 Kcal / Kg」。儲冰空調之原理即是：「選擇某段可利用之時間（離峰或半尖峰時間），使壓縮機運轉，冷卻冰水製冰，將壓縮機的冷卻能量，以冰的形態儲存起來，等到白天尖峰時段，需使用冰水（冷氣），而又不適宜運轉冰水機組的時間（尖峰時間），即可讓冰溶化，吸收高溫冰水的熱量，達到冰水冷卻的效果，如此即可將白天尖峰時段的冷氣用電，轉移至夜間離峰時段。

儲冰式空調系統的特點

● 轉移尖峰用電

利用夜間或非尖峰時段運轉主機儲冰，轉移白天或尖峰時段之用電量，具有平衡電力負載之功能。

● 節約基本電費及新設線路補助費

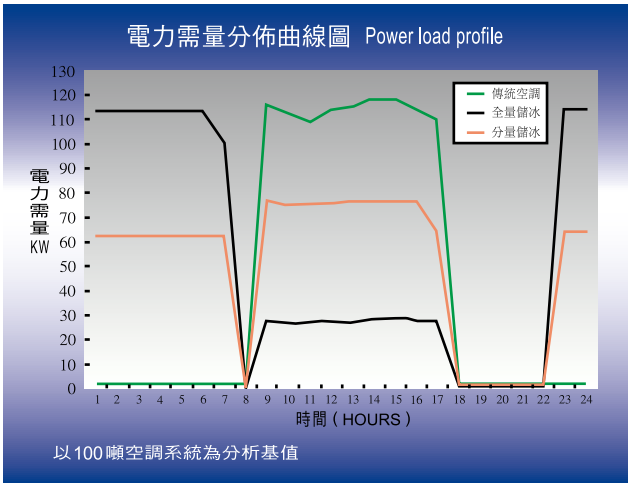
例如某工廠，生產設備用電100KW，空調尖峰用電100KW，若採傳統空調冰水機組，則其申請的電力契約容量為100KW+100KW=200KW。若使用儲冰空調，因運轉時間措開，故當生產設備用電停止使用後，其電力轉移供主機運轉儲冰，因此基本電費之契約容量仍然為100KW。

● 節約流動電費

利用二段式或三段式時間電價，享受電費差價措施。儲冰系統之離峰電價另打六折計收。

● 降低主機容量

傳統空調系統，冰水主機之容量選定都是以尖峰負荷為依據，但是實際上尖峰負荷全年不超過六十天，主機絕大部份時間是在部份負荷下運轉。在春秋季節時，負荷可能更低至50%以下，造成主機投資的浪費。採用儲冰系統可拉長主機運轉時數，大幅降低主機容量。例如：某空調負載每小時需求200噸，從早上8：00～17：00共9小時，全部空調負荷為200噸×9小時＝1800噸／時，若將主機運轉時間延長為15小時，則主機能力可降為120噸（1800噸／時÷15小時），因儲冰機效率較低，故需選擇150噸級。若同案例採行傳統空調，則主機必需配置200噸級。



● 高運轉效率

主機滿載運轉至儲冰完成，機組完全在100%容量狀況下運轉，避免卸載運轉時的效率損失（傳統機組當容量卸載至50%時，其耗電仍高達75%）。

● 具擴充功能

在機組能力不變的情況下，只要將運轉時數拉長，即可增加空調能力，彈性運用自如。

● 低溫冰水供應

可提供低溫冰水，供冷藏、低溫除濕及製程冷卻系統使用。同時在相同室溫條件下，可減少供風量及水量，降低風車馬力35%，並可減少水泵耗電25%，同時可減少工程費用。

傳統空調電價計費 Tradition

月份	契約電量 KW	尖鋒 KWH	半尖鋒 KWH	離鋒 KWH	月用電量 KWH	基本電費 NT	流動電費 NT（二段）	流動電費 NT（三段）	總電費 NT（二段）	總電費 NT（三段）
1	117	0	0	0	0	18603	0	0	18603	18603
2	117	0	0	0	0	18603	0	0	18603	18603
3	117	0	7774	0	7774	18603	14692	13837	33295	32440
4	117	0	19812	0	19812	18603	37444	35265	56047	53868
5	117	0	23712	0	73712	18603	44815	42207	63418	60810
6	117	17576	8814	0	26390	18603	49877	67537	68480	86140
7	117	17576	8814	0	26390	24921	49877	67537	74798	92458
8	117	17576	8814	0	26390	24921	49877	67537	74798	92458
9	117	15808	7904	0	23712	24921	44815	60702	69736	85623
10	117	0	15808	0	15808	24921	29877	28138	54798	53059
11	117	0	7774	0	7774	18603	14692	13837	33295	32440
12	117	0	0	0	0	18603	0	0	18603	18603
TOTAL	25	68536	109226	0	177762	248508	335966	396597	584474	645105

分量儲冰空調電價計費 Partial storage

月份	契約電量 KW	尖鋒 KWH	半尖鋒 KWH	離鋒 KWH	月用電量 KWH	基本電費 NT	流動電費 NT（二段）	流動電費 NT（三段）	總電費 NT（二段）	總電費 NT（三段）
1	74	0	0	0	0	11766	0	0	11766	11766
2	74	0	0	0	0	11766	0	0	11766	11766
3	74	0	936	9854	10790	11766	7459	6389	19225	18605
4	74	0	9984	14274	24358	11766	27112	25264	38878	37030
5	74	0	14118	14274	28392	11766	34926	32623	46692	44389
6	74	11154	5746	14274	31174	11766	40183	50624	51949	62390
7	74	11154	5746	14274	31174	11766	40183	50624	55945	66386
8	74	11154	5746	14274	31174	11766	40183	50624	55945	66386
9	74	8502	5616	14274	28392	15762	34926	42596	50688	58311
10	74	0	5850	14274	20124	15762	19299	17905	35061	33667
11	74	0	936	9854	10790	11766	7459	6839	19225	18605
12	74	0	0	0	0	11766	0	0	11766	11766
TOTAL	74	41964	54678	119626	216268	157176	251703	283911	408906	441087

全量儲冰空調電價計費 Full storage

月份	契約電量 KW	尖鋒 KWH	半尖鋒 KWH	離鋒 KWH	月用電量 KWH	基本電費 NT	流動電費 NT（二段）	流動電費 NT（三段）	總電費 NT（二段）	總電費 NT（三段）
1	25	0	0	0	0	3975	0	0	3975	3975
2	25	0	0	0	0	3975	0	0	3975	3975
3	25	0	1638	7826	9464	3975	7641	7023	11589	10998
4	25	0	4134	19630	23764	3975	19149	17663	23124	21638
5	25	0	5018	23504	28522	3975	23057	21271	27032	25246
6	25	3744	1846	26104	31694	3975	25640	28033	29615	32008
7	25	3744	1846	26104	31694	5325	25640	28033	30965	33358
8	25	3744	1846	26104	31694	5325	25640	28033	30965	33358
9	25	3328	1690	23504	28522	5325	23057	25164	28382	30489
10	25	0	3328	15678	19006	5325	15343	14153	20668	19478
11	25	0	1638	7826	9464	3975	7614	7023	11589	10998
12	25	0	0	0	0	3975	0	0	3975	3975
TOTAL	25	14560	22984	176280	213824	53100	172754	176396	225854	229496

Fundamental Of Ice Storage System

When water is solidified into water, the heat stored is called “heat of solidification”. The solidification heat is 79 Kcal/Kg (1 Kg of 0℃ water to be solidified into 0℃ ice) . Usually, the required temperature of cooling water used for air conditioning is less than 15℃. It means that 94 Kcal/Kg of energy would be available when 1 Kg of 15℃ water is solidified into 0℃ ice.

The principle of ice storage system is to utilize the off-peak hours to operate the chiller to make ice. The cooling capacity stored in ice then can be applied for cooling instead of operating chiller during peak hour to avoid the higher energy cost.

Funcion Of Ice Storage System

● Shift peak-hour energy consumption

The ice making chiller is operated in the night time or off-peak hours so that the energy consumption in the day time or peak hours is shifted and reduced.

● Cost saving on the demand charge and the initial cost of power receiving system

For instance, for a factory, the energy consumption is 100KW each for production equipment and for peak load of air conditioning. If traditional chilled water system is used, the total demand charge of 200KW shall be applied. By application of ice storage system, the energy consumption of ice making chiller is shifted to night time while production equipment is not operating, and the demand charge can be minimized to 100KW.

● Save on running cost

Under the bi-zone or the tri-zone electrical rate, the running cost can be saved at the off-peak rate. The additional 25% discount of non-peak hour is applied for ice storage system (in Taiwan).

● Reduction of chiller capacity

For traditional air conditioning system, the cooling capacity is decided according to peak cooling load. However, the required period for peak load is limited to certain time period only, and the chiller is operating at less capacity in most time of the year. Especially in Spring and Fall seasons, the cooling load is reduced to less than 50% of capacity, which means the initial investment of chiller is partially wasted. By application of ice storage system, the chiller can be operated for the extended hours at the lower capacity.

For example, a cooling load of 200RT/hr is required for 9 hours, from 08:00 to 17:00, the total cooling capacity is 200RTx9HR. If the operation hours are extended to 15 hours, the chiller capacity will be reduced to 120RT (1800RT-HR÷15HR). As the efficiency of ice storage system is lower, the 150RT of cooling capacity shall be selected for the chiller, in comparison to 200RT chiller for traditional chiller system.

● Higher running efficiency

During ice making process, the chiller is running at full capacity so as to avoid the less efficiency of operation at lower capacity. (Generally, for traditional system, even under operation of 50% load, the energy consumption is still up to75% of full load consumption).

● Capability of extension

Additional cooling capacity can be achieved by simply extending the operation hours without investment of new equipment.

● Low temperature cooling water supply

The ice storage system supply chilled water for refrigeration, dehumidification and process cooling. Due to the lower temperature, the volume of supply air and supply water can be reduced, so that the capacity of fan and pump can be reduced accordingly. As a result, the energy consumption and the initial investment can be minimized as well. (the fan capacity can be reduced up to 35%, the water pump power consumption can be 25% less).

轉移空調尖峰電力．節約回收電費

Transfer the peak-hour air condition power consumption and save the electricity fee.

奇立 PES 以客觀的評量標準，製造國際性的產品

Chi-li applies the objective evaluation standard into manufacturing the international product.

Implement and enhanced with good quality

Technical research and development

Responsibility of global village

Self - affirmation and challenge

奇立針對台灣高溫高濕的環境，特別開發研製適用於台灣的產品

超低熱損值．斷熱佳不結露．全不鏽蝕材質 ． 室內放置（△T35℃）熱損值—0. 059%

Aiming at the high temperature and high humidity environment, Chi - Li develops P series products whose features are low heat loss value【△T35℃ heat loss is 0.059%.】,
excellent heat insulating character, condeusation prevention and corrosion-resisting material.

全凍結式儲冰槽的評量重點：

The key factors of evaluation for the total freeze ice storage tank performance are:

性能容量

- 全熱、潛熱值，以及顯熱計算溫度值。
- 溶冰速率曲線，儲冰凍結溫度曲線。
- 壓降與流量的平衡特性 。

構造特性

- 材質的耐鏽蝕效果。
- 保溫材的防潮、防濕、防露效果。
- 槽體熱損熱傳導數值。
- 槽體是否適宜放置戶外或筏基處。

其他項目

- 維修服務空間的高度需求。
- 保固責任年限。
- 經濟效益評估服務，與系統技術資料提供。
- 價格成本，提升競爭力。
- 儲冰系統附屬產品的提供。
- 業績。

Performance capacity：

- the calculation temperature values of total heat, latent heat and sensible heat,
- ice-melting speed curve and ice storage frozen temperature curve.
- the balance character of pressure drop and flow rate.

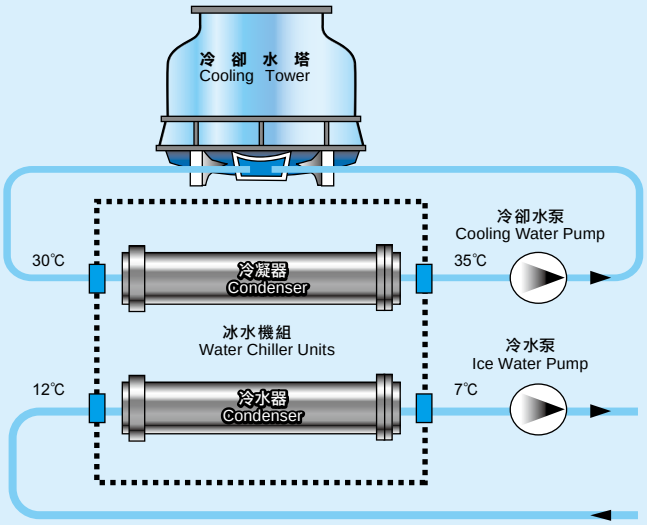
Construction Features are :

- the corrosion-resisting performance of material,
- the moisture proof, water proof and anti-condensation performance of insulation material.
- the heat loss and heat transfer coefficient of the tank body.
- the tank body suitable to be applied on the raft foundation or outdoors.

Others :

- space requirement of maintenance service.
- the period of warranty.
- capability of competition from lower cost.
- service for the economic evaluation and the capability of technical information of the system.
- supply the associated eguipmens of the ice storage system.
- job reference.

傳統中央冰水空調系統



傳統空調系統：

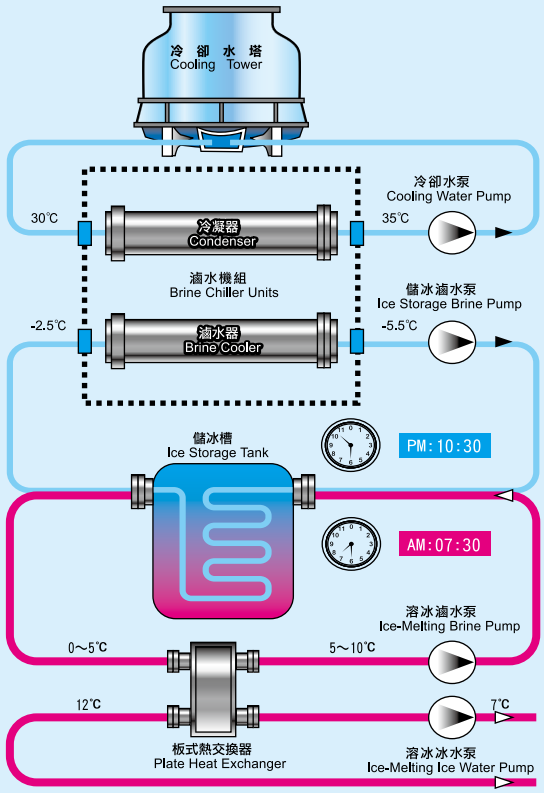
使用冷氣時段時，啟動冰水機組及所有附屬設備用電，空調電力最高載時，亦是電價最貴的尖峰用電時間。

Traditional Air Conditioner System:

When the conditioned air is applied, run the chiller water units and all accessories. The highest conditioned air demand period is the peak-hour electricity consuming period – the most expensive rate period .

儲冰式中央冰水空調系統

Ice Storage Cooling System



儲冰式空調系統：

電價最便宜之夜間離峰時段，啟動滷水機組及儲冰滷水泵製冰（藍線流程），節省流動電費。白天使用冷氣時段時，僅需啟動溶冰滷水泵（紅線流程）即可達到空調使用目的，兼具轉移白天契約電力，降低基本電費的功能。若將溶冰泵接續緊急發電機電源，白天即使停電，仍可供應冷源。

Ice Storage Cooling System:

Operate the brine units and ice storage brine water pump to for ice making (blue line processes) during the off-peak electricity consuming period-the cheapest electric price period to save running cost.

When air conditioning at day time , it is only need to operate the ice-melting brine (red line processes) for cooling the so as to transfer the day time electricity consumption to night time and save the demand chare

If the ice - melting pump is connected to emergency generator , the cooling function can be continuous even the power is in failure.

儲冰式空調使用案例

1.體育館、宗教團體大堂

＊空調負載特徵：
非常態性使用，短時間內聚集熱負荷，主要為人員及照明負荷，外氣負荷的影響程度相對較小。

＊案例分析：
尖峰負荷：620-RT/Hr
單日活動8-Hr空調負荷：4300 RT-Hr
雙日活動12-Hr空調負荷：6500 RT-Hr
連續單日活動4-Hr空調負荷：2300 RT-Hr

[傳統空調]
冰水機組能力：620 RT
冰水機組及附屬設備用電量：750 KW

[全量儲冰空調]
儲冰機組能力：120 RT（19.35%）
儲冰槽容量：4300 RT-Hr
儲冰機組及附屬設備用電量：160 KW（21.3%）

＊運轉模式說明：
1、120-RT儲冰機組，每日離峰時段運轉9Hr，儲存864 RT-Hr製冷能力，5日的總儲存量為4320 RT-Hr，如此即可滿足單日8 RT-Hr活動的空調負荷。
2、120-RT儲冰機組，儲冰運轉20Hr，儲存1920 RT-Hr製冷能力，另於活動時間直接輔助運轉4Hr，提供480 RT-Hr製冷能力，合計可提供1920+480=2400 RT-Hr，如此即可滿足連續單日活動4-Hr的空調負荷。
3、若為雙日活動12-Hr，則可以1+2項模式運轉儲存 4320 +2400=6720 RT-Hr製冷能力。

2.乳製品工廠

＊空調負載特徵：
對生乳進行低溫殺菌(4℃)，每日僅1-Hr的冷卻負荷，屬短期間、單一時限內產生的大冷卻負荷需求。

＊案例分析：
1-Hr的冷卻負荷：86-RT/Hr

[傳統空調]
滷水機組能力：86 RT
滷水機組及附屬設備用電量：105 KW

[全量儲冰空調]
儲冰機組能力：5 RT（5.8%）
儲冰槽容量：86 RT-Hr
儲冰機組及附屬設備用電量：7.5 KW（7.1%）

＊運轉模式說明：
5-RT儲冰機組，每日連續運轉22Hr，可儲存86 RT-Hr製冷能力，如此即可於每日早晨，提供1小時1℃的冰水，對生乳進行低溫殺菌的冷卻負荷。

3.化學工廠

＊空調負載特徵：
常態性為24小時運轉的系統，其特別在於化學反應發生時，在短期間、單一時限內，會產生的大冷卻負荷的需求，其餘時間則僅需提供尖峰負荷時，約20%的維持性冷卻負荷即可。

＊案例分析：
化學反應發生時的冷卻負荷：420-RT/Hr
常態期的維持性冷卻負荷：80-RT/Hr

[傳統空調]
冰水機組能力：420 RT
冰水機組及附屬設備用電量：470 KW

[分量儲冰空調]
冰水機組能力：80 RT（常態期的維持性冷卻用途）
儲冰機組能力：20 RT
儲冰槽容量：350 RT-Hr
機組及附屬設備用電量：127 KW（27%）

＊運轉模式說明：
常態時期由80 RT冰水機組提供製冷維持能力，另20-RT儲冰機組連續運轉22Hr，可儲存350 RT-Hr製冷能力，待化學反應發生時，由兩者聯合提供350+80=430 RT-Hr的冷卻負荷。

4.百貨公司、飛機場等商業空間

＊空調負載特徵：
於特定時限內，產生高於常態負荷30～40%的製冷需求。百貨公司的[突波負荷]發生於假日、週年慶及活動期間，此時期的製冷負荷需求，高於平日30%以上，另外、平日的負荷則集中於11:00～13:00及17:00～21:00時段，其餘時段的負荷，則僅為最高設計負荷的50～60%需求。

＊案例分析：
尖峰最大冷卻負荷：3200-RT/Hr
全日負荷需求:30220 RT-Hr

[傳統空調]
冰水機組能力：3200 RT
冰水機組及附屬設備用電量：3232 KW

[分量儲冰空調]
儲冰機組能力：1600 RT
儲冰槽容量：11520 RT-Hr
機組及附屬設備用電量：2100 KW（64.9%）

＊運轉模式說明：
1600-RT儲冰機組於夜間離峰時段運轉9Hr，可儲存11520 RT-Hr製冷能力，另於白天的空調使用時段，視負荷大小的狀況，1600-RT機組輔助運轉提供19200 RT-Hr(1600 RT×12Hr)製冷能力，兩者合計可提供11520+19200=30720 RT-Hr的冷卻負荷，如此即可滿足全日所需的負荷需求。

Case Study of Ice Storage System

1.Stadium, Church/Temple Hall

∗ Cooling load characteristics
Heat load generation in short period of time, mainly from lighting and personnel. The impact of outside air is relatively small.

∗ Case analysis
Peak load: 620-RT/HR
Cooling load for one day event of 8 hrs: 4300RT-HR
Cooling load for two day event of 12 hrs: 6500RT-HR
Cooling load for consecutive day event of 4 hrs:2300RT-HR

[Traditional system]
Chiller capacity: 620 RT
Power consumption: 750 KW

[Full load ice storage system]
Chiller capacity for ice storage: 120 RT (19.35%)
Ice storage tank: 4300 RT-HR
Power consumption: 160KW (21.3%)

∗ Operation Model:
1. 120 RT of chiller, 9 hrs of operation at off-peak hours, cooling capacity:864 RT-HR, total stored cooling capacity for 5 days:4320 RT-HR, enough for one day event of 8 hrs.
2. 120 RT of chiller, cooling capacity of 1920RT-HR at 20 hrs of operation in night time, by adding 4 hrs of operation in day time, the total cooling capacity is 1920+480=2400 RT-HR,which is sufficient for daily event of 4 hrs requirement.
3. For two days event of 12 hrs, by combination of above, 4320+2400=6720 RT=HR cooling capacity available.

2.Dairy product manufacturer

∗ Cooling load characteristics
Dairy product sterilization at low temperature(4℃), 1 hr of cooling requirement, surge cooling load requirement in short period of time.

∗ Case analysis
Peak load: 620-RT/HR
Cooling load for one hr: 86 RT/HR

[Traditional system]
Chiller capacity: 86 RT
Power consumption: 105 KW

[Full load ice storage system]
Chiller capacity for ice storage: 5 RT (5.8 %)
Ice storage tank: 86 RT-HR
Power consumption: 7.5KW (7.1%)

∗ Operation Model:
5 RT of chiller running for 22 hrs to store 86 RT-HR of cooling capacity, and release the cooling capacity in morning to supply 1 hr of chilled water for sterilization.

3.Chemical Plant

∗ Cooling load characteristics
24 hours of operation, but the surge cooling required for certain chemical reaction process for certain period of time, and only 20% of peak load required for the remaining operation hours.

∗ Case analysis
Cooling load for chemical reaction: 420 RT/HR
Cooling load for remaining hours: 80 RT/HR

[Traditional system]
Chiller capacity: 420 RT
Power consumption: 470 KW

[Partial load ice storage system]
Chilled water chiller capacity for ice storage: 80 RT
(for normal requirement)
Ice storage chiller capacity: 20 RT
Ice storage tank: 350 RT-HR
Power consumption: 127 KW (27%)

∗ Operation Model:
80 RT of chiller running for normal cooling capacity, and 20RT of chiller running 22 hrs to store 350 RT-HR of cooling capacity, then by combining above, 350+80=430 RT-HR of cooling capacity for cooling requirement of chemical reaction.

4.Commercial space in department store or airport

∗ Cooling load characteristics
For certain period of time, additional cooling load of 30-40% is required. For department store, the increased cooling capacity required in holidays and sales event, and the required hours are 11:00-13:00 and 17:00-21:00, otherwise the cooling load for remaining hours is 50-60% of maximum load.

∗ Case analysis
Cooling load for peak-hour: 3200 RT/HR
Cooling load for whole day: 30220 RT-HR

[Traditional system]
Chiller capacity: 3200RT
Power consumption:3232KW

[Partial load ice storage system]
Ice storage chiller capacity: 1600RT
Ice storage tank: 11520 RT-HR
Power consumption: 2100 KW (64.9%)

∗ Operation Model:
1600 RT of ice storage chiller running for 9hrs in night time to store 11520 RT-HR of cooling capacity, In day time, the chiller is again operated for 12 hours to supply 19200 RT-HR of cooling capacity (1600 RT x 12 Hr), then by combining of two, 11520+19200=30720 RT-HR of cooling capacity is auailable for whole day cooling requirement.

5.高科技潔淨室電子廠房

＊空調負載特徵：

一般高科技電子廠房均為24小時運作，具有穩定的製程設備、燈光等室內負荷需求，而為了補充製程設備的排氣量，以維持無塵室的正壓條件，其所引進[外氣風量]負荷，以及[外牆的熱滲透]負荷，成為主要的變化考量因素（季節、早午晚、雨天）。另則一般[非24小時運作的辦公室]負荷，亦可併入屬[變動性負荷]考量。

＊案例分析：

尖峰最大冷卻負荷：16000 RT/Hr

[傳統空調]

冰水機組能力：16000 RT

冰水機組及附屬設備用電量：14400 KW

[分量儲冰空調]

常態冰水機組能力：13000 RT

儲冰機組能力：2400 RT

儲冰槽容量：17280 RT-Hr（分量儲冰）

尖峰時段-機組及附屬設備用電量：12300 KW（85.4%）

＊運轉模式說明：

2400 RT儲冰機組於夜間離峰時段運轉9Hr，儲存17280 RT-Hr製冷能力，白天空調使用時段時，前述的[變動性負荷]，由儲冰槽的蓄冷能力來調節供應，如此即可將契約容量（基本電費）、受電設施大幅降低。

6.醫院、電力公司

＊空調負載特徵：

一般的公共營運單位均為24小時運作，其均具有常態穩定性的室內負荷，而[外牆的熱滲透]負荷（季節、早午晚、雨天），成為主要的變化影響因素。另則一般[非24小時運作的區域]，例如：醫院及電力公司的門診區、行政辦公空、電力調度中心等，則可併入屬[變動性負荷]考量。

＊案例分析：

尖峰最大冷卻負荷：2400-RT/Hr

[傳統空調]

冰水機組能力：2400 RT

冰水機組及附屬設備用電量：2900 KW

[分量儲冰空調]

常態冰水機組能力：1800 RT

儲冰機組能力：800 RT

儲冰槽容量：5760 RT-Hr（分量儲冰）

尖峰時段-機組及附屬設備用電量：2130 KW（85.4%）

＊運轉模式說明：

800 RT儲冰機組於夜間離峰時段運轉9Hr，儲存5760 RT-Hr製冷能力，白天空調使用時段時，前述的[變動性負荷]，由儲冰槽的蓄冷能力來調節供應，如此即可將契約容量（基本電費）、受電設施大幅降低。

7.高科技經濟技術園區-超高壓電纜地下管溝的冷卻

＊空調負載特徵：

夜間因電流負載降低，電纜本體的發熱量減少，加以夜間的外氣溫度較白天低，因此夜間可直接引入外氣，來冷卻地下管溝內的電纜。反之白天時，因電流負載及外氣溫度均昇高，因此需使用製冷空調的方式，來冷卻地下管溝內的電纜，因此其空調負荷的大小，受外氣溫度及季節氣候因素的影響極大。

＊案例分析：

尖峰最大冷卻負荷：1000-RT/Hr

07:30～22:30時段的總計製冷負荷：11250 RT-Hr

22:30～07:30時段採外氣冷卻負荷

[傳統空調]

冰水機組能力：1000 RT

冰水機組及附屬設備用電量：1200 KW

[分量儲冰空調]

儲冰機組能力：600 RT

儲冰槽容量：4320 RT-Hr（分量儲冰）

尖峰時段-機組及附屬設備用電量：720 KW（60%）

離峰時段-機組及附屬設備用電量：600 KW

＊運轉模式說明：

600 RT儲冰機組於夜間離峰時段運轉9Hr，儲存4320 RT-Hr製冷能力。白天空調使用時段時，此600 RT機組輔助運轉14小時(08:00～22:00)，提供8400 RT-Hr的製冷能力，與儲冰槽的4320 RT-Hr蓄冷能力，合計可提供12720 RT-Hr(8400+4320)的製冷能力，如此即可滿足白天的負荷需求，並可將契約容量（基本電費）及受電設施大幅降低。

5.Cleanroom of hi-tech electronic manufacturer

∗ Cooling load characteristics

The hi-tech electronic manufacturer is always 24 operation and the cooling load from production and lighting is stable. The variation of cooling load is contributed form the outside air loading and the heat transfered from the building wall due to weather, climate or season, another variation is the loading for office could be considered as well.

∗ Case analysis

Cooling load for peak-hour: 16000 RT/HR

[Traditional system]

Chiller capacity: 16000 RT

Power consumption:14400 KW

[Partial load ice storage system]

Chilled water chiller capacity: 13000 RT

Ice storage chiller capacity: 2400 RT

Ice storage tank: 17280 RT-HR

Power consumption: 12300 KW (85.4%)

∗ Operation Model:

2400 RT of ice storage chiller running for 9hrs in night time to store 17280 RT-HR of cooling capacity, In day time, beside of the cooling load from chilled water chiller, the ice storage cooling capacity is used to meet the cooling variation requirement as above mentioned.

6.Hospital. Power Company

∗ Cooling load characteristics

For public unit, it is normally in 24 hours operation and the cooling load is often remained stable, except certain area like reception lobby, administration office and other areas which are not 24 hours operation and could be considered as variable cooling load.

∗ Case analysis

Cooling load for peak-hour: 2400 RT/HR

[Traditional system]

Chiller capacity: 2400 RT

Power consumption:2900 KW

[Partial load ice storage system]

Chilled water chiller capacity: 1800 RT

Ice storage chiller capacity: 800 RT

Ice storage tank: 5760 RT-HR

Power consumption: 2130 KW (85.4%)

∗ Operation Model:

800 RT of ice storage chiller running for 9hrs in night time to store 5760 RT-HR of cooling capacity, In day time, beside of the cooling load from chilled water chiller, the ice storage cooling capacity is used to meet the cooling variation requirement as above mentioned.

7.Cooling for high voltage cable in underground trench-Hi-tech Economic Technoloy Park

∗ Cooling load characteristics

In night time, the cable heat generation is less as the electricity demand is reduced, so the outside air can be introduced to satisfy the cooling requirement. However, in day time, air conditioned air shall be required as the increased heat load and outside temperature affected by the weather.

∗ Case analysis

Cooling load for peak-hour: 1000 RT/HR

07:30-22:30: 11250 RT-HR

22:30-07:30: outside air cooling

[Traditional system]

Chiller capacity: 1000 RT

Power consumption:1200 KW

[Partial load ice storage system]

Ice storage chiller capacity: 600 RT

Ice storage tank: 4320 RT-HR

Power consumption (peak hours): 720 KW (60%)

Power consumption (off-peak hours):600 KW

∗ Operation Model:

600 RT of ice storage chiller running for 9hrs in night time to store 4320 RT-HR of cooling capacity, In day time, the chiller is again operated for 14 hours to supply 8400 RT-HR of cooling capacity (600 RT x 14Hr), then by combining of two, 8400+43200=12720 RT-HR of cooling capacity for whole day cooling requirement.

8.博物館

＊空調負載特徵：

屬24小時運轉的系統，其特性在於假日及特定活動期間，將產生較常態性負荷高30～40%的製冷需求，其餘閉館時段的維持性負荷，則僅為最高設計負荷的40%。另則因保存文物的需求，大部份的室內空間，均需維持較低的恆溫恆濕條件。

＊案例分析：

最高尖峰冷卻負荷：1500 RT/Hr

開館期的常態性冷卻負荷：1100 RT/Hr

閉館時段的維持性冷卻負荷:600 RT/Hr

尖峰期(08:00~17:00)的冷卻負荷：12000 RT-Hr

[傳統空調]

冰水機組能力：1500 RT

冰水機組及附屬設備契約用電量：1875 KW

[分量儲冰空調]

冰水機組能力：600 RT（常態期的維持性冷卻用途）

儲冰機組能力：1000 RT

儲冰槽容量：6750 RT-Hr

機組及附屬設備契約用電量：975 KW（52%）

＊運轉模式說明：

夜間離峰電價時期由600 RT冰水機組提供製冷維持能力，另1000 RT儲冰機組於離峰時段運轉9Hr，可儲存6750 RT-Hr製冷能力。假日及特定活動開館期間，採[冰水機優先運轉模式]，儲冰容量視負荷高低輔助運轉，兩者聯合提供12150 RT-Hr的冷卻負荷(600RT×9hr+6750RT-Hr)。低負荷平常時期採[儲冰優先運轉模式]，儲冰槽每小時平均輸出750 RT的製冷負荷，分擔冰水機組所需提供的製冷維持能力(僅運轉50%能力300 RT)，如此可降低尖峰時間的運轉電費。

9.辦公商業大樓

＊空調負載特徵：

外氣負荷的變化為主要的考量因素（季節、早午晚、雨天），具有穩定的室內負荷（人員、燈光等），全年間處於最高設計負荷的天數不超過65日，60%以上的空調時間，僅具有最高設計負荷的50～60%需求。

＊案例分析：

尖峰最大冷卻負荷：1200-RT/Hr

全日負荷需求:9720 RT-Hr

[傳統空調]

冰水機組能力：1200 RT

冰水機組及附屬設備用電量：1380 KW

[全量儲冰空調]

儲冰機組能力：1350 RT

儲冰槽容量：9720 RT-Hr（全量儲冰）

離峰時段-機組及附屬設備用電量：1282 KW

尖峰時段-機組及附屬設備用電量：256 KW（18.5%）

＊運轉模式說明：

1350-RT儲冰機組於夜間離峰時段運轉9Hr，儲存9720 RT-Hr製冷能力，白天空調使用時段時，製冷機組完全不運轉，僅由儲冰槽提供所需的製冷能力，如此即可將大樓的契約容量（基本電費）、受電設施大幅降低。

10.傳統中央冰水空調系統改設為儲冰空調系統–學校

＊空調負載特徵：

該校空調使用時間為5～10月份，每日的10:00～21:00時段，另有體育館大禮堂負荷，不定時的於活動期間發生。外氣負荷的變化為主要的考量因素（季節、早午晚、雨天），具有穩定的室內負荷（人員、燈光等），另則假日時期，及夜間補校的負荷變化較大。

＊案例分析：

尖峰時期的冷卻負荷：1200 RT/Hr

常態期的維持性冷卻負荷：800 RT/Hr

尖峰期全日的冷卻負荷：8000 RT-Hr

[傳統空調]

冰水機組能力：1200 RT

冰水機組及附屬設備用電量：1440 KW

全校電力契約容量：2300 Kw

[全量儲冰空調]

儲冰機組能力：1200 RT（原舊機組改設為儲冰機組）

儲冰槽容量：8000 RT-Hr（全量儲冰）

全校電力契約容量：1200 KW（52.1%）

＊運轉模式說明：

夜間離峰電價時期，儲冰機組(320×2+80×3+160×2=1200 RT，共有7台機組)運轉9Hr，可儲存8100 RT-Hr製冷能力。白天空調使用時段時，製冷機組完全不運轉，僅由儲冰槽提供所需的製冷能力，如此即可將契約容量（基本電費）大幅降低。

備註:

原機組的冷卻水泵、冰水泵、冷卻水塔、配電盤均保留使用，僅增設儲冰槽、板式熱交換器、鹵水泵。

8.Museum

∗ Cooling load characteristics

24 hours of operation, especially in holiday and event activity, the cooling requirement is 30-40% higher then usual, and the closed hours require only 40% of maximum load. However, the lower temperature/humidity is required for most of the indoor area.

∗ Case analysis

Cooling load for peak-hour: 1500 RT/HR
Open hours cooling load: 1100 RT/HR
Closed hours cooling load: 600 RT/HR
Peak hour cooling capacity:12000 RT-HR

[Traditional system]

Chiller capacity: 1500 RT
Power consumption:1875 KW

[Partial load ice storage system]

Chilled water chiller capacity: 600 RT
(for normal cooling load)
Ice storage chiller capacity: 1000 RT
Ice storage tank: 6750 RT-HR
Power consumption: 975 KW (52%)

∗ Operation Model:

In night time, 600 RT of chilled water chiller is operated for cooling and1000 RT of ice storage chiller running for 9hrs to store 675 RT-HR of cooling capacity. For high cooling load requirement in holiday or event, the chiller is operated in priority and the ice storage is as back up system. The total of 12150 RT-HR cooling capacity is available (600 RTx9HR + 6750 RT-HR). For low cooling load requirement, the ice storage system is operated in priority. As the ice tank is able to share 750 RT of cooling capacity so that the chilled water chiller can operate at 50% load, 300 RT, to reduce the energy consumption.

9.Office building

∗ Cooling load characteristics

Main consideration is the variation of cooling load for outside air (day or night, weather, season), however, the indoor cooling load (person, lighting etc.) is steady. The maximum cooling load required period is less than 65 days and over 60% of air conditioning period only requires 50-60% of maximum design load.

∗ Case analysis

Cooling load for peak-hour: 1200 RT/HR
Whole day cooling load: 9720 RT-HR

[Traditional system]

Chiller capacity: 1200 RT
Power consumption: 1380 KW

[Full load ice storage system]

Ice storage chiller capacity: 1350 RT
Ice storage tank: 9720 RT-HR
Power consumption (peak hours): 256 KW (18.5%)
Power consumption (off-peak hours): 1282 KW

∗ Operation Model:

In night time, 1350 RT of ice storage chiller running for 9hrs to store 9720 RT-HR of cooling capacity which allows to satisfy the cooling requirement for day time without the operation of chiller so that the demand charge and the power receiving device can be drastically reduced.

10.Modification of traditional chiller system to ice storage system - school

∗ Cooling load characteristics

The air conditioning period is 10:00 to 21:00 daily from May to October. In addition, the cooling load is required for the activities in the stadium. The consideration of the variation of cooling load for outside air (day or night, weather, season) is incorporated, and the indoor cooling load (person, lighting etc.) is steady. However, the requirement of loading in holiday and nighttime class session shall be considered as well.

∗ Case analysis

Cooling load for peak-hour: 1200 RT/HR
Normal cooling load: 800 RT-HR
Whole day cooling load of peak hour: 8000 RT-HR

[Traditional system]

Chiller capacity: 1200 RT
Power consumption:1440 KW
Demand charge: 2300 KW

[Full load ice storage system]

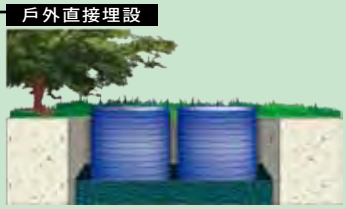
Ice storage chiller capacity: 1200 RT
(existing chiller modified to ice storage chiller)
Ice storage tank: 8000 RT-HR
Demand charge: 1200KW (52.1%)

∗ Operation Model:

1200 RT of ice storage chiller(320x2+80x3+160x2) running for 9hrs in night time to store 8100 RT-HR of cooling capacity, which allows to satisfy the cooling requirement for day time without the operation of chiller so that the demand charge and the power receiving device can be drastically reduced.
Remarks:
The original cooling water pump, cooling tower, chilled water pump and power panel are kept and the new installed equipments include ice storage tank, plate heat exchanger and brine water pump.

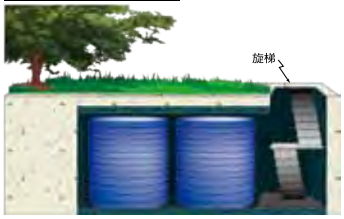
安裝範例

戶外直接埋設



戶外直接埋設示意圖(A)

戶外地下室按裝



戶外地下室按裝示意圖(B)

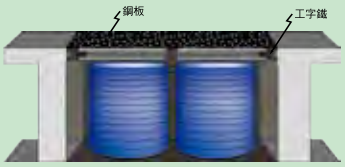
建築筏基槽按裝1

建築筏基槽按裝示意圖(C)

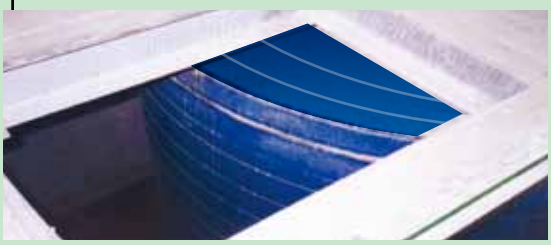
戶外直接按裝1

戶外直接按裝示意圖(E)

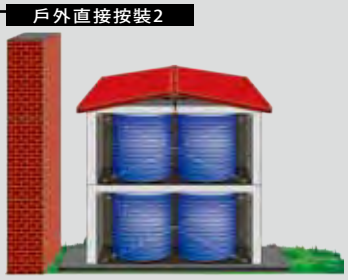
建築筏基槽按裝2



建築筏基槽按裝示意圖(D)



戶外直接按裝2



戶外雙層架抬按裝示意圖(F)

設備規格

槽　　體

＊聚乙烯共聚合體為主體原料，應用特殊開發的專利模具，一體加工成型，創造出獨特的雙層式槽體（ DOUBLE SKIN ）結構，內外槽夾層處充填 PU 發泡保溫材，保證保溫材可防水、防潮、抗日照，最適宜置於戶外及筏基層處。

＊不漏、不生青苔、不生鏽，抗紫外線特強，耐震、耐衝擊、不變形、抗藥品、不怕侵蝕，屬永久 產品。

槽　　蓋

＊聚乙烯共聚合體原料，一體加工成型，雙層式結構(DOUBLE SKIN)，夾層 處充填PU發泡保溫材。

＊同槽體特 ，人員可踩踏，附觀測井，可觀察結冰溶冰狀況。

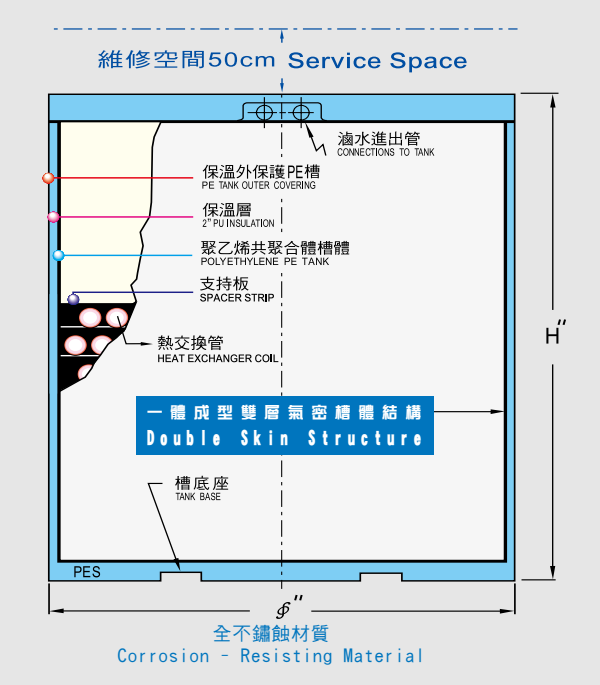
熱交換管

＊16mmΦ聚乙烯管盤繞而成，測試壓力達 10Kg/cm.g，並經消除彎曲應力之特殊處理，永保不破裂、不洩漏。

＊採用專利的三角錯列排置方式，三圓管夾角處的低效率凍結面積最小。另因管路的排列間距縮小，結冰厚度薄，熱傳面積大，使得結冰及溶冰的效率，能更有效的提昇。

保 溫 材

＊採用聚亞氨脂（PU）發泡保溫材，斷熱效果優於保麗龍及 PE 發泡材，保溫斷熱效果超強，全槽各處最低保溫厚度達50mm～100mm。



Tank body

＊Polyethylene is the main material and use special patented mold to make the double skin structure. The thickness of outer-shell is 4.5mm and inner skin can be 10.5mm or more. Fill PU expanded insulation in the chamber between outer and inner skin. The insulation can resist water, moisture and sunshine and it is the most suitable to place outdoors and on the raft foundation.

＊No leakage, no moss, no rust, UV light resist, vibration resist, impact resist, deformation resist, chemicals resist, erosion resist. It is a permanent product.

Tank cover:

＊Material is polyethylene molded and double skin structure, chamber between inner and outer skin is filled with PU insulation.

＊The characteristic is the same as tank body and can be stepped by personnel. The observing well is attached, and the ice-making and ice-melting condition can be observed through the well.

Heat exchanger coil

＊16mmφ polyethylene coil, test pressure is 10Kg／cm.g. Special treatment, leakage proof. Patent delta arrangement. The low efficiency frozen area of piping intersection angle is minimized.
Besides, the efficiency of ice-making and ice-melting can be increased, owing to the reduced gap between pipes,ice thickness decreased and heat transferring area increased.

＊Tank base and tank body is one-body formation and designed with lifter hauling guidance. It is easy to move and install.

Insulation

＊PU expanded insulation is adopted and insulation effect is better than the effect of expanded polystyrene and expanded PE. The thinnest insulation layer of the tank is 50mm~100mm.

Pipe adapter

＊Patent PE pipe copper adapter is adopted. It is guaranteed that leakage would not happen as adapter is welded with connecting pipe (copper pipe) by silver-brazen.

性能規格

全凍結式儲冰槽 TOTAL FREEZE ICE SYSTEM		P-130B	P-170B	P-200B	P-220B
儲冰溶量 ICE CAPACITY	總熱 TOTAL CAPACITY	130 RT-HR	170 RT-HR	200 RT-HR	220 RT-HR
	潛熱 LATENT CAPACITY	108 RT-HR	142 RT-HR	170 RT-HR	184 RT-HR
	顯熱 SENSIBLE CAPACITY	22 RT-HR	28 RT-HR	30 RT-HR	36 RT-HR
熱交換管 TUBES	管徑 LINE SIZE(mm)	16 mm			
	材質 INGREDIENT	高密度聚乙烯 POLYETHYLENE			
保温材 INSULATION	槽蓋 TANK COVER	PU發泡材75mm厚 75mm PU POLYURETHANE			
	槽體 TANK INNER	PU發泡材75mm厚 75mm PU POLYURETHANE			
	槽座 TANK BASE	PU發泡材75mm厚 75mm PU POLYURETHANE			
一體成型無縫複合夾層體 DOUBLE SKIN STRUCTURE	槽蓋材質 TANK COVER INGREDIENT	高密度聚乙烯 POLYETHYLENE			
	外槽體材質 TANK OUTER COVERING	高密度聚乙烯（SUS304不銹鋼） POLYETHYLENE（SUS304）			
	槽底座材質 TANK BASE INGREDIENT	高密度聚乙烯（SUS304不銹鋼） POLYETHYLENE（SUS304）			
	內槽體材質 TANK INNER INGREDIENT	高密度聚乙烯（SUS304不銹鋼） POLYETHYLENE（SUS304）			
乙二醇 ETHYLENE GLYCOL	填充量 EG CHARGE(Kg)	338	454	518	570
	循環量 EG FLOW RATE(lpm)	220	290	330	365
	重量百分比 % E.G BY WGT.	25%～27%			
外形尺寸 DIMENSION(mm)	直徑(mm)	2450	2450	2330	2450
	高度(mm)	1700	2300	2560	2700
滷水進出管徑 CONNECTIONS TO TANK(mm)		50A(2" B)×10K 法蘭（FLANGE）		65A(2 1/2" B)×10K 法蘭（FLANGE）	
搬運重量 UNFILLED WEIGHT(Kg)		530	720	800	900
運轉重量 FILLED WEIGHT(Kg)		5964	8228	9010	9835

★ 經濟效益評估分析，歡迎來電洽詢。
The complete design information and cost evaluation analysis are provided upon request

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