



TITLE: THE USE OF VARIABLE SPEED DRIVES AND THERMAL STORAGE SYSTEMS TO ACHIEVE ENERGY AND COST SAVINGS OF AN UNDERGROUND RAILWAY STATION

可变速驱动系统及蓄热(蓄冰)系统应用于地下铁车站的节能及省费设计

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摘要

地下铁路是现代化都市的重要集体运输交通工具之一。地下铁车站每天都要应付大量的乘客。一般来说都设有空调系统,以维持适当的温度及鲜风量。在热带或亚热带的地区,空调系统的能量消耗可占车站设备的总耗电量之 50% 至 70%。

空调系统的设计一般都会采用尖峰时段的数据,而又同时采用设计容量饱和的年份。机电设备的效率通常选择在尖峰时段最佳,这做法可以确保有足够的机电容量,但亦可能忽略了大部份的作业时间都是离峰的,而离峰时段的机电设备亦并非运作在最佳效率的状态。因此,可变速驱动设计在此情况下可调整系统运作效率,使机电设备保持最佳运作效率,从而达至节省能源的目标。

除了可变速系统外,蓄热系统(一般指蓄冰系统)能够把尖峰时段的制冷需求分布到离峰时段,利用较便宜的离峰时段电费,达至省费目标。而且因为尖峰时段制冷需求降低,制冷机的冷吨亦相应地降低,额外制冷可从蓄冰池补给。

ABSTRACT

Railway stations are designed to handle large amount of passengers. In tropical or sub-tropic climate, air conditioning is usually provided to underground railway stations to maintain acceptable thermal comfort conditions and providing adequate fresh air. The air conditioning load represents about 50% to 70% of the total building services energy consumption.

Conventionally, engineer tends to design the system to meet the peak hour cooling load at optimum

efficiency. However, the cooling load will vary during the time of the day and also from season to season. At part load operation, the air conditioning equipment will not operate at its full capacity and hence the efficiency of air conditioning equipment may not be at its optimum. Variable speed drives can save energy by tuning down the system characteristics to meet loading requirements whilst keeping the optimum equipment efficiency. Apart from the daily or seasonal variation of cooling load, the system design and selected equipment are usually based on peak load at the Design Year, which may be some years after the Opening Year.

Thermal storage system could achieve cost savings by shifting the peak refrigeration plant energy consumption to off peak period thereby using cheaper off peak tariff rates. The refrigeration plant would operate continuously during off peak period to re-charge the thermal storage. The refrigeration plant could thus be less than that designed to meet the peak cooling load.