ELECTRICITY –

WHAT ARE THE OPTIONS FOR SOUTH AFRICAN COLD STORES?

By James Cunningham

The recent blackouts and loadshedding have forced South African cold stores to consider the purchasing of diesel generators. A recent trip to the IARW Back to Basics conference in Amsterdam would suggest that while the installation of generators may be important, there are other options that also require consideration. For European stores, the cost of electricity is the second largest expense after labour and is therefore a prime target for reduction. Variable rates per kWh and the absence or otherwise of maximum demand charges make it difficult to assess exactly how European electricity costs compare to those in South Africa. However, it would appear that the European cost per unit is approximately three times what South African stores can expect to pay. While the European grids are not entirely stable, blackouts are infrequent. Large users, such as cold stores, can purchase their requirements approximately 3 months in advance and pay a higher or a lower rate depending on the prevailing market conditions. In other parts of the UK, peak rates during the winter months (4 to 7 pm) can rise by a factor of 4 to approximately 38 pence per kWh. This rate applies to industrial users with a demand of over 500kVA.

The UK Government imposed a climate change levy in 2000 on industrial users. Under this scheme, a cold store which used 25 million kWh per year could expect to pay a levy of 110,000 GBP. Further encouragement in the form of climate change agreements, have also been introduced. In 2006 these agreements were made available to cold stores and since that time 150 sites have joined the scheme. A climate change agreement is concluded between the government and an industrial user. The user can save up to 80% of the climate change levy so long as certain intermediate reduction targets are reached, with the final objective being a 12% reduction by 2012. Consequently, while UK cold stores are not suffering from frequent blackouts and an unstable grid, they are still being encouraged to reduce consumption. Cold stores on mainland Europe are not subject to these levies at the moment, but this is expected to change in the medium term. In any case, intense competition and rate cutting in the European market make the efficient use of electricity essential.

Generators Back up Cold Chain

Not all UK cold stores possess generators. However, one of the largest I visited, Reed Boardall Cold Storage, had a total installed capacity of 5.5mVA. They are not being run on a regular basis, as the current contract prices from power suppliers make this uneconomical. The average cost per kWh is 25 pence using a generator. The cost per kWh from the grid supply is well below this, except where peak charges apply. However, they are there if required. As the manager Garry Tilburn said, he could not afford to have his 200 refrigerated trucks standing in the event of a blackout and the need for strict temperature control for products stored made generators an essential marketing tool.

One of the generators at Reed Boardall.

In South Africa, some sort of self generating capacity is essential, given the current situation and the probability of it continuing for at least the medium term. If the outages remain at one to two hours, generators can be sized to only run the essentials while the power is off. If the cold room doors are only opened to allow pallets in and out, the product temperatures should not rise significantly during such a period. This alternative can save on the capital cost of the generator as well as on the cost of the diesel. It is important here to realise that a 1000kVA generator will use over 200litres per hour. On the other hand, if the government decides to impose daylong load-shedding, or ESKOM is prepared to compensate self generators for running their sets during times of peak demand, then larger generators may well be financially justified.

High Installation Costs

Buying a generator is one thing, but it also has to be installed. Here the cost of cabling, especially on the larger sets, can be substantial. Even in the case of smaller sets, where these are running the essentials, the installation costs can be higher than one would expect.

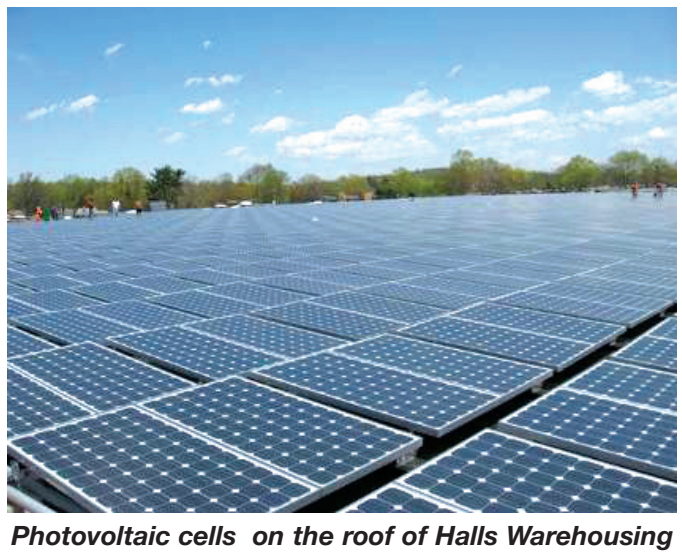
Generators need to be run under load and cold storage demand is variable, both on a daily and seasonal basis. It can make sense to buy 2 smaller sets which can be synchronised with each other. If the refrigeration plant's demand falls, one set can be turned off. In some instances too, the cost of 2 smaller sets can be less than one large one. If the objective is to supply the total demand, then synchronisation with the mains supply is essential to allow the supply to be switched seamlessly from mains to generator and back again without any interruption. Although synchronisation with the mains supply has not been formally approved by ESKOM, it is likely to happen shortly.

Wind Power: A Viable Option

In Europe the idea of self generation has gone far further than the installation of generator sets. Wind power is becoming a serious contender with cold stores in the process of identifying land on which to place wind generators, normally with a 2 to 2.5mVA capacity. The windmills are subcontracted to specialised companies who finance the purchase, installation and maintenance. The cold store owner contracts to buy his electricity at a fixed price for, say 5 years which is approximately 15% below current rates. The specialist subcontractor also guarantees to supply power at the agreed rate even if there is no wind. Castlecool Ltd, which operates cold stores in Ireland has already entered into such an arrangement and the MD, Paul Shortt, gave a presentation to the IARW conference on his reasons for doing so.

Environmentally Friendly

The installation of wind turbines not only cuts the cost of the electricity but also allows the cold store to market it's green credentials. This has become important as large retailers are already considering this aspect before awarding storage contracts. Tesco's, for example, is already installing smaller wind generators at some retail outlets. In Holland, work is being done on "night wind". This refers to electricity that is generated via thousands of wind turbines when the demand for electricity is low at night. Power can therefore be purchased from this source at a cheaper rate and software is being written to allow cold stores to run their plants as far as possible at these times. Hall's Warehouse Corporation in the US has installed photovoltaic cells which produce around 30% of its maximum power requirement. While South African



Photovoltaic cells on the roof of Halls Warehousing in the US.

Continued on page 10

Continued from page 8

cold stores need to be aware of these developments, they are only possible with the help of government grants and assistance. The higher price per Kwh in Europe also makes such developments far more

Glycol underfloor heating installation showing the main supply and return pipes and the plastic pipes that go under the cold room floor.

attractive. However, the price of electricity in South Africa will only increase and with the level of spending proposed by ESKOM it may not be long before the local price approaches that of Europe and the US.
European cold stores are designed to be as energy efficient as possible, which means that higher priced materials are used if they provide sufficient payback over the life of the store. I visited the new Reed Boardall chamber which was under construction and was told that while the walls and ceiling of this store were 200mms thick, the material being used was fire retarded polyurethane. The walls of all the other stores were 300mms of polystyrene, the insulation of these two materials being approximately the same. The change in materials used had come about due to insurance requirements.

Glycol is used for underfloor heating. The temperature of the glycol is increased by using waste heat from the refrigeration process. It is then circulated under the floors in pressure tested plastic pipes. When I mentioned that electrical heater mats were standard in South Africa.

Doubt As To Need for Airlocks

I was regarded with disbelief. There appears to be an ongoing discussion as to whether airlocks are necessary. In some stores, the trucks are loaded directly from the cold store into the truck via a special docking arrangement. This saves on air lock space. The opposing argument is that the lack of an airlock will allow warm moist air to enter a cold room as it is never possible to create an airtight seal around the truck. There are companies supplying dock levelling equipment who would disagree with this assertion. No airlock also means that a portion of the cold room itself must be used for making up loads. This reduces storage space. On one point however, there was agreement. In either alternative some form of air drying was absolutely necessary.

I talked to Garry Tilburn, operational director at Reed Boardall, about the difficulty that South African operators have in keeping the cold room doors closed. He pointed out that his entrances had no obvious door at all. They were wide enough to take “stand on” pallet trucks going in either direction, but not high enough for reach trucks which had their own special entrance. Strip curtains were hung at either side of an entrance tunnel which was long enough to allow the curtains to settle at one end before the stand on pallet jack hit the strips at the other. I assume that the entrance was under a slight positive pressure. Crucially a correctly sized Munters air drier had been installed which made sure that any air entering the cold room was completely dry. As the store operated on a 24 hour basis, the night door had never been closed and was only there in case of emergency.

High Load From Door Openings

In South Africa, it is common practice to size refrigeration plants to cope with the additional load created by leaving the cold room doors open. This is unnecessarily adding to energy usage. In South Africa ambient temperatures tend to be higher than those in the UK. Humidity levels also vary tremendously. Perhaps we should look at designing cold rooms so that direct sunlight is unable to hit the insulated panels, at least during the hottest part of the day. Cold store roofs could be painted with either reflective or insulating paint. While such measures might have been uneconomic in the past, the projected increase in electricity costs may well alter the situation.

Less Power Per Pallet

Another point Garry raised is that the bigger the cold store the less energy per pallet is required, with the annual electricity cost of for a 50,000 pallet store being only marginally more than that for a 27,000 pallet store. This would suggest that bigger stores can be far more effective in terms of energy cost per pallet stored. The argument should also apply if the capacity of an existing store is increased. The UK Cold Store and Distribution Federation has begun a debate as to how cold a store should be. The current norm of Minus 18Degrees (product temperature) appears to have little scientific basis apart from the fact that it is the same as 0 degrees Fahrenheit. The CSDF is currently lobbying for an increase to minus 16 degrees C. This would represent a saving of approximately 10%. As South African stores generally run at somewhere between Minus 25 and minus 30 Degrees, (Air temperature) there could be scope for considerable savings, so long as product was not left on the airlock floor.

An increase in product storage temperature to -16º C would reduce power consumption by 10%.

Defrost Only When Required

Another noticeable trend was that cold store managers were starting to look closely at their plant operations from an energy saving perspective. Reed Boardall had found that 2 defrosts per evaporator per day as set when the store was commissioned was completely unnecessary. Managers now inspected their evaporators on a daily basis and only defrosted them when required. As a result some evaporators were only being defrosted once a month. The realised savings had been substantial. Condenser fan motors had been changed to those that required less energy. Cold room lights use sodium bulbs. While these don’t come on as fast as tungsten halogen bulbs, they use a quarter of the power. There was agreement that major savings could be made to energy costs without major capital expenditure. All that was needed was the correct mind set and an approach that asked questions about every aspect of plant operation from the perspective of energy efficiency.

New chamber under construction at Reed Boardall.

Hands On Management Will Save Power

In South Africa, to take advantage of these saving opportunities, all cold store managers will need to know, in a practical sense, how their refrigeration systems work and how their actions can impact on it’s efficiency. One of their Key Performance Indicators should be KWH used per cubic metre or some other ratio that encourages energy saving.

How Much Energy Can Be Saved

In South Africa, electrical energy has suddenly become a scarce commodity. As such we must expect the price of it to rise quickly. Indeed recent articles in the press have ESKOM asking for a further 54% increase this year in addition to the 14% increase already in place. This would probably be followed by a further 50% next year. The cost of electricity is also likely to increase even more for “peak time” usage. While these developments can be taken negatively, I think that South African cold stores have plenty of scope to respond. Indeed, I would argue that in some cold stores, power consumed could be reduced by over 40% without the need for major capital investment.