Project:	**Helderstroom LMS System**	Client:	**Dept: Public Works**
Author:	Clive Maasch	Consultant:	
Tel:	021- 5520420	Date:	30 January 2007
Fax:	021- 5520421	Ref:	ED_CT_0006

Load Management System For Prisons Defer Capital Expenditure and Saves Electricity during Peak Periods

SSE Cape has supplied and installed a number of load management systems employing the LMS 2 Load switch manufactured by **SSE** in Pretoria.

We profile one of our most recent systems employed by the Dept of Prison Services for a rather unique purpose of deferring capital expenditure.

Requirement Overview:

The Load Management system for Helderstroom Prison was installed as part of the contracts to upgrade the prison from steam boilers to electricity.

The hot water upgrade became necessary because of the high running cost and maintenance of the aging steam boiler system.

The necessity of a using a Load Management System arose because the electrical load that was to be added with this upgrade would cause the peak demand to exceed the Eskom connected capacity.

The solution was to defer the added electrical load consumption into the “off-peak” times. This would cause the hot water to be generated when other loads were not in use. It would allow the upgrade to be installed and commissioned, without the need to increase the Eskom connected capacity. This would be a large saving.

The idea to defer loads was then extended to include the domestic hot-water cylinders in the residences on the premises, and so be able to reduce the peak even further. The objective was to try to get the next electrification upgrade (the kitchens) to “fit” into the current Eskom connected capacity as well.

This Load Management system was commissioned to meet the above requirements, summarized here:

- To Monitor the Electrical supply (load) to the facility.
- To monitor and shed the new hot water elements as needed.
- To shed the domestic hot water cylinders as needed.
- To endeavor to meet the Load Shed Target set by the Supervisor.

As an added benefit, the local reservoir supplying the facility with clear water was also monitored. The reservoir level would be shown on the computer graphic screen. The benefit to the client is that they would not need to travel to the reservoir daily to check the level (for pump control). The level would be conveniently communicated to the local personnel for control of the pumps to the reservoir.

Tariffs and Savings:

This is a brief and basic insight into the Eskom Billing method (Tariff structure), and how the Load Management System needs to operate to meet its objective.

Electrical Billing / Tariff

Large electrical consumers are subject to a two-part tariff structure. The Electrical Account for a month would show these two items:

1. **Consumption:**
   The amount of electricity used is measured, and billed for. This is the consumption of electricity, used for lighting, heating, motors, pumping etc. The billing unit is “kWh” or more simply “kilowatt-hours”.
2. **Peak / Capacity:**
   The time of usage is also logged, averaged in 30-minute time-slots. The reading of highest 30-minute slot in a meter-month is billed for. The billing unit is “kVA”. The reason for this item is that is shows the maximum load (peak) that the client presents to the electrical supply, which affects the capital cost of supply line size, transformer and switchgear ratings.

Potential Saving Area

There is not much one can save on the first item (Consumption) without simply kerbing electrical usage. Eliminating wastage is a good strategy here. But security lights must be on, and electricity made available for services.

But not all Electrical appliances and services need be available all the time. There are some services that can be “held off” for a limited time without affecting the service or function. These are “deferrable Loads”. Examples are:

- Hot water Heaters for Tanks (can be off for a long time)
- Domestic Hot water Cylinders (can be off for a short time)
- Water Pumps to reservoirs (can be off for a long time)
- Air Conditioners (can be off for a few minutes)
- Refrigeration (can be off for a short time)

By switching these deferrable loads off at critical times, it is possible to reduce the second item in the Electrical Bill – the “Peak”.

The Purpose of Reducing the Peak

There are two clear and separate reasons for reducing the Peak.

- **Financial saving:**
  The financial saving can be substantial. This alone can be a motivation. The complete Load Management System can be paid for in the saving in anything from 6 to 18-months, thereafter the savings are directly to the Clients benefit.

- **Capital Deferment:**
  This is an even stronger motivation point for installing a Load Management System. If the supply capacity is going to be exceeded due to expansion, the large capital cost of upgrading the supply can often be “deferred” by a few years if the Peak can be kept in check.

Technical Overview:

The system comprises of the following components:

Computer System:
A Pentium III computer is dedicated to this purpose. It is located in the Supervisor's Office. A Central Telemetry station communicates to the computer vial serial port, and via radio communications to other telemetry stations in the field that do data collection and control. A UPS will mains power outages for about two hours.

Supervisory Software:
The SCADA (Supervisory Control and Data Acquisition) software was used as the basis for the Load Management System. ADROIT provides the graphical display screens; data archiving, printing and trend displays to the Operators and Supervisors.

Load Management Algorithm:
The actual controlling algorithm for scheduling the load management was written in "VB Script" that executes under the Scada "front-end".

Eskom Meter Point:
The electrical consumption and peak is measured at the main incoming point. There are Electrical meters here. The meters put out "pulses" as the electricity passes through them.

There is a telemetry outstation at the Eskom Meter point. This measures the electrical load of the whole facility, by monitoring the meter pulses from the incoming Eskom meters. This information is transmitted to the Central Telemetry station, and then to the Computer, via UHF radio communications.

Plant-rooms:
The main hot water heating elements for the Facility is located in 4 plant-rooms, two in each of two main prison blocks. There is a telemetry outstation in one plant-room of each block to collect the monitored signals and to control the heating elements. The two plant-rooms in each block are linked by cable for the monitoring and control signals.

Load Switches:
Every domestic hot water cylinder of the prison residential area will have a radio load switch fitted. This would allow the hot water cylinders to be switched off for a period of time over peak demand times, and so allow a substantial measure of control of the Electrical load.

Reservoir:
There is a telemetry outstation at the reservoir, which measures the water level. This information is sent to the computer for display on the graphic screens. (This is an auxiliary function, and has nothing to do with the load shed algorithm).

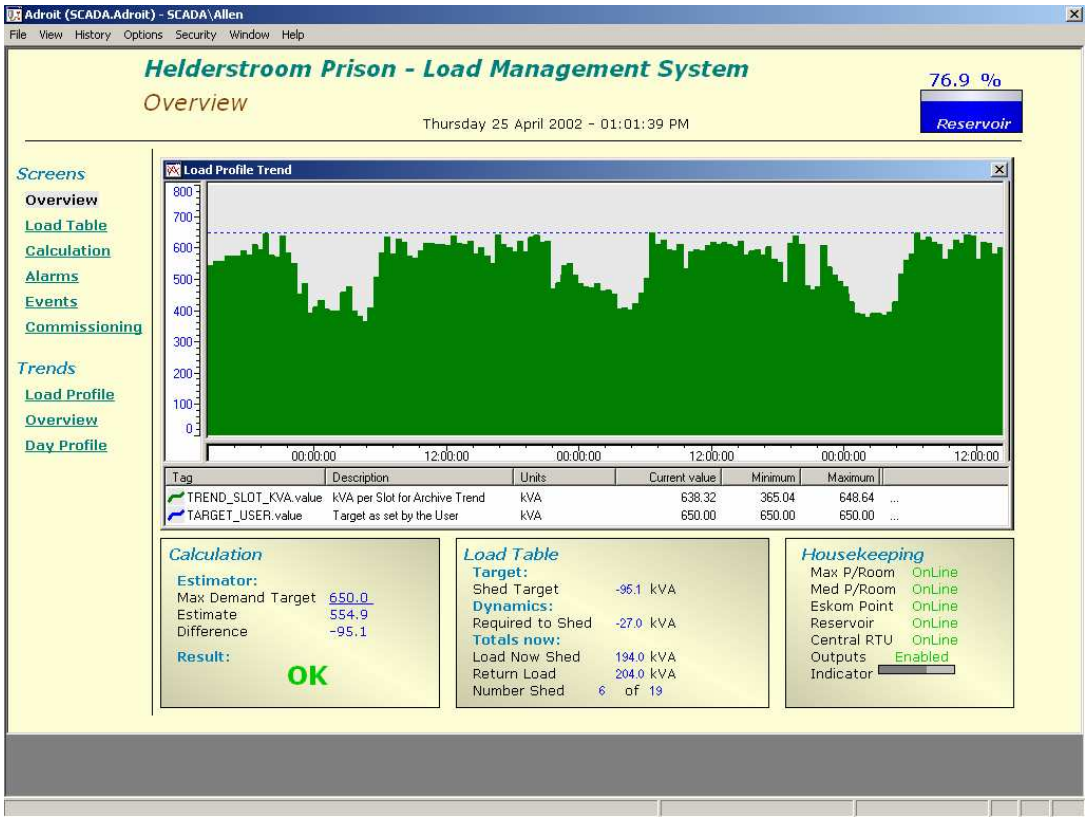
Remote Support:
A Modem is connected to the computer, and via a dedicated phone line, remote access is gained to the system from our offices so that we can monitor the performance of the system, do upgrades to the algorithm, and even provide remote instruction to Operators and Supervisors.

Daily Operation:

The System will largely run on it's own. There is not much to be done on a daily operational basis. However, it is very useful to monitor the incoming Eskom load and watch the action taken by the system. This will give the Supervisor a "feel" for the system, and thus be able to field any queries that may occur (like cold water complaints), and to predict the Load situation for the day, week and month.

The Supervisor will have to adjust the Load Shed Target from time to time, to adjust for the seasonal load each month, additional load that may be added to the facility (like extra street lighting etc).

Typical Operator Screen Layout.



Conclusion

The system has achieved its objective, especially during the winter months when demand for electricity is much higher. The Department has implemented additional systems subsequent to the success of the one installed at Helderstroom Prison.