

## Utility Load Manager (ULM)

The Utility Load Manager (ULM) is an innovative system developed in South Africa by Eskom and EON Consulting to help alleviate electricity network and system constraints by limiting residential load.

The ULM system's control methodology is regarded as a world first. It is patented locally and a global patent application is underway.

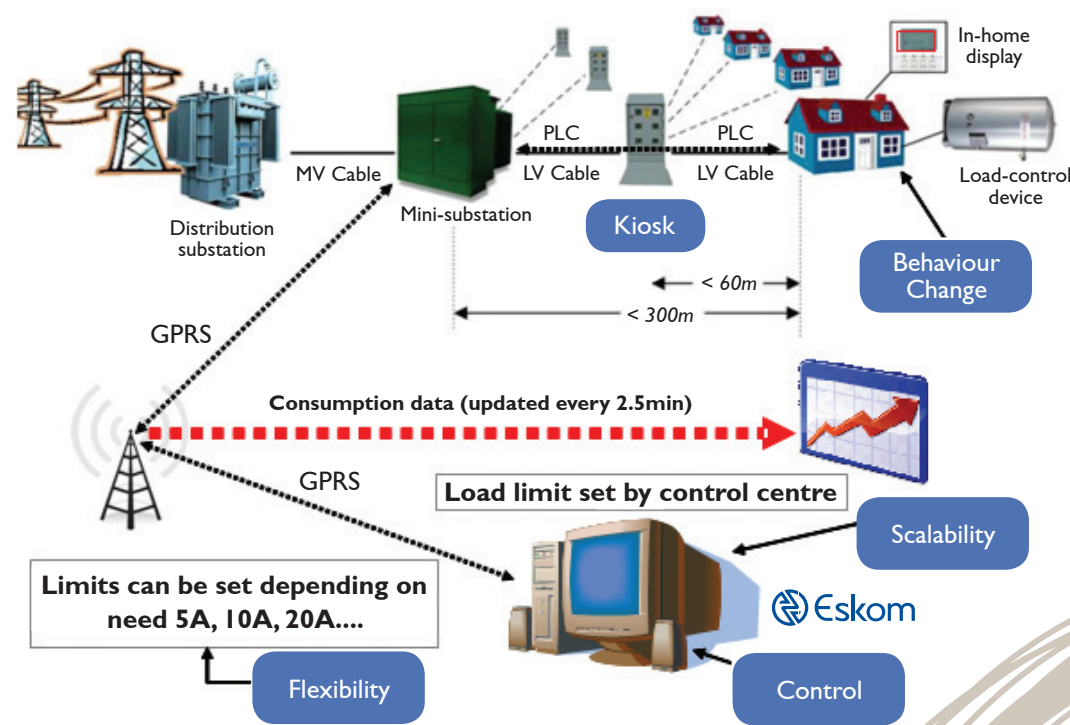
ULM has been designed to operate as a virtual power station. It is a real-time residential load management system that allows

the utility to limit residential loads and can integrate end-use consumption data with Eskom's systems and infrastructure.

It is an effective demand response mechanism that is flexible, scalable and interoperable across regional and national control centres.

The residential sector represents 17 to 20% of South Africa's total system load and is a significant contributor to both the morning and evening peak, resulting in an overall national load factor of 72%.

### Approved Suppliers and Systems



Functional layout of ULM System

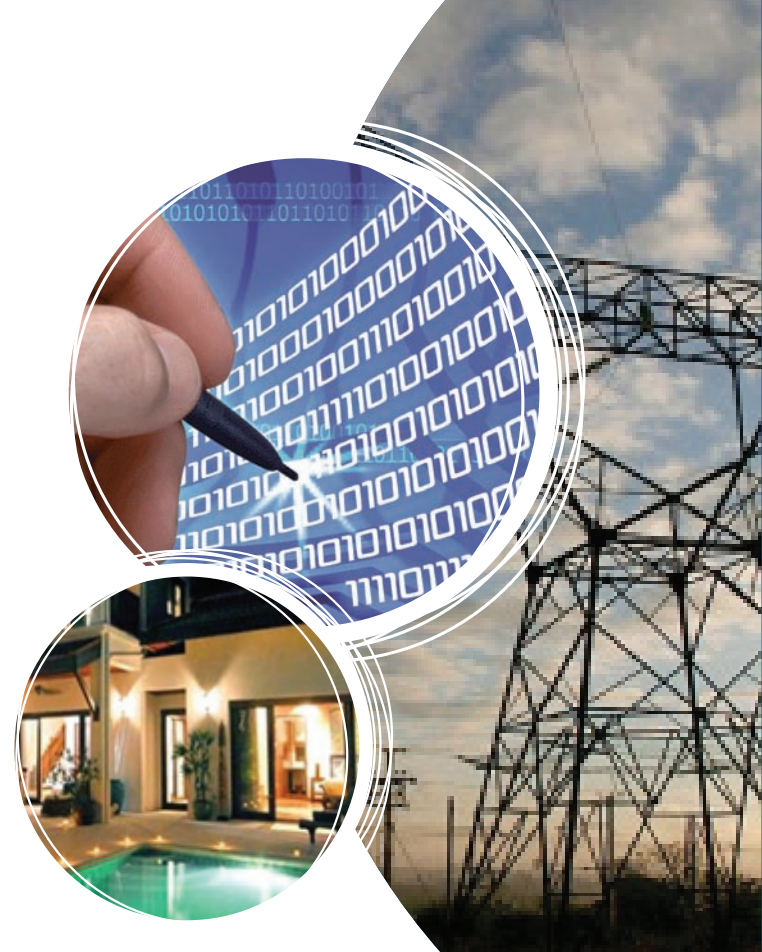
The ULM system comprises a backend system, field hardware and customer display unit. It enables load to be limited at end-user level via a central control point at Eskom National Control. More than 6 740MW of load could be displaced during network constraint periods by national implementation of the ULM in the residential sector alone.

During periods in which Eskom experiences severe system and network constraints, the system controller can limit the supply to the residential sector to any predetermined value (between 5 and 60 A) in terms of the MW load reduction required to stabilise the network at that particular time.

The signal is immediately sent via general packet radio service (GPRS) to a master controller unit located in the mini-substation. This then sends a signal via power line carrier (PLC) to a remote master located in the kiosk or stubby box. The remote master controls the individual home and sends the message to the display unit located in the home. The display unit shows the instantaneous consumption of the household as well as the kWh consumption. This allows the household to see consumption change as electrical appliances are switched on and off.

When the power utility has a supply or network constraint, a message is sent to the display unit instructing the household user to limit power usage. If the household conforms to the limit, by switching off appliances, it will continue to get limited power for the duration of the load limit period. However, if the household continues to exceed the limit in terms of power usage, it is automatically disconnected from the electrical network. The household can then SMS to a specified number and be reconnected for a few minutes to conform to the imposed limit, or will be cut off again for non-conformance.

**Display unit located in household:**



The power limit, or ration, drives behaviour and allows the customer to operate low consumption appliances like CFL lighting, fridge, television set and alarm system while keeping high-consumption stoves, space and water heaters turned off to conform to the set limit.

The signal process takes micro seconds from control to end-user and the end-user has five minutes (this duration can also be predetermined by Control) to respond by curtailing load. The entire network response in terms of total MW load reduction can be achieved within 15 to 30 minutes.

The ULM system, which is installed in the mini substation and the kiosk, or stubby box, has been designed specifically to ensure quick implementation with minimal impact on the existing network design and specifically for use on all existing reticulation networks.

During the research pilot project 20 000 ULM units were installed in Midrand, Gauteng, and total load displacement of 15 to 20MW was achieved. The project was well received; an independent audit conducted by the University of Free State showed that customers who participated in the pilot responded positively to the load limiter device.

The technology will be rolled out countrywide. National implementation of the ULM system to more than 8-million residential customers will displace in excess of 6750MW of load and cost between R8- and R12-billion.



## Future use of ULM

The ULM system will be used to reduce load and once Eskom has sufficient generating capacity, and load shedding is no longer a threat, the system can be used to its full potential.

Eskom and the various metros and municipalities have a significant problem in terms of revenue management and South Africa currently experiences non-technical losses of between R5- and R9-billion per annum.

The ULM system is designed specifically to assist in managing revenue and energy streams with real-time reconciliation of all parameters.

The ULM system will also enable and facilitate the following:

- Energy losses determination through real time, automated energy balancing
- Protection against theft of energy, with tamper-proof and alarm notification
- Direct communications platform into the house (bi-directional communication)
- Carbon emissions reduction
- Valuable data from the consumer base can be used for network planning, demand forecasting and understanding consumer behaviour
- Low voltage customer network link data and network fault finding
- Time of use (TOU) metering data

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