DSM – Does South Africa need a paradigm shift ?

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The term Demand Side Management (DSM) was first used in the United States in the early 1980s and later adopted in the United Kingdom, Europe and Australia. In terms of DSM implementation in South Africa, the concept is still relatively new. While Eskom formally recognized DSM in 1992, the first DSM plan was only produced in 1994. Since then Eskom has spearheaded many DSM initiatives and continues to lead the way in promoting the efficient use of electricity. The principle of Demand Side Management (DSM) is therefore not new to the electrical fraternity and in the interests of energy conservation, should without question, both be well understood and supported.

The Eskom DSM website (1) defines Demand Side Management as the process whereby an electricity supplier influences the way electricity is used by customers. *"DSM means the planning implementation and monitoring of end-user's activities designed to encourage consumers to modify patterns of electricity usage, including the timing and level of electricity demand."*

The website goes on to define Electricity Demand as "*the amount of electricity required by all electric equipment operating at one time in a building, an area or a city. The prime objective of DSM is providing constant, efficient use of electricity thus resulting in lesser amounts of electricity during peak times thus managing the demand effectively. If electricity is managed in this way, the demand is more consistent and consequently electricity suppliers are more able to meet the requirements of all of its consumers."*

In hindsight it is unfortunate that in the same website, one of the benefits of DSM is listed as:
"Delaying the requirement for infrastructure capital investment."

It is equally unfortunate that this website describes the key benefit of DSM as the efficient use of electricity, *without influencing the customer production and satisfaction levels*, resulting in significant cost savings for the provider *and thus the consumer as well*.

As a consequence to the Government and Eskom self-inflicted power crisis, whilst the general public may not necessarily be familiar with the acronym "DSM" (Demand Side Management) it is the general public, commerce and industry that have been subjected to the costs and inconveniences of "Load shedding".

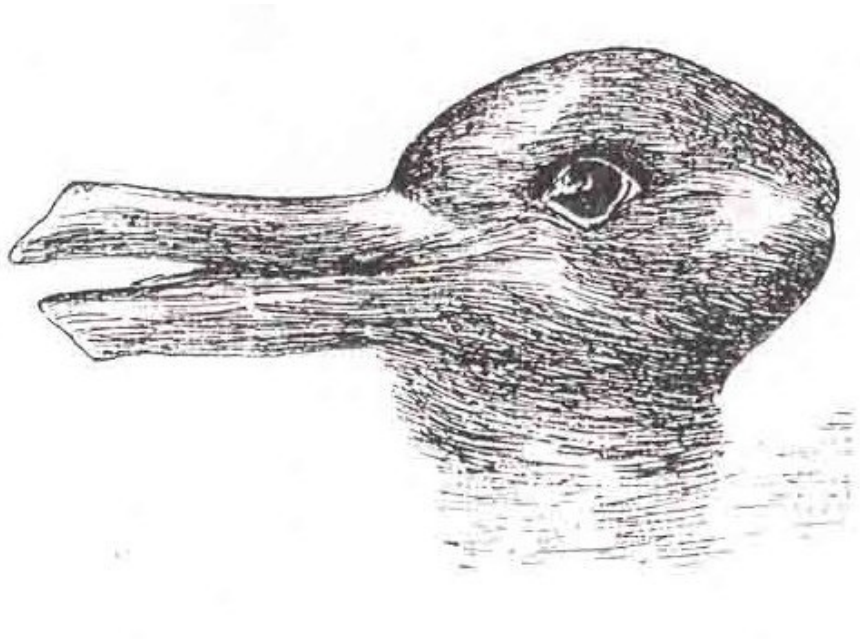
Again, with the benefit of hindsight, our favourite utility may wish to consider rephrasing the comments
i) "without influencing the customer production and satisfaction levels" and
ii) "*resulting in significant cost savings for the provider and thus the consumer as well"*

The obvious question that needs to be asked is:
When and how can the consumer expect to benefit from these *"significant cost savings"* ?

Paradigm shift, (2) sometimes known as *extraordinary science or revolutionary science*, is the term first used by Thomas Kuhn in his influential 1962 book *The Structure of Scientific Revolutions* to describe a change in basic assumptions within the ruling theory of science. It is in contrast to his idea of normal science.

The term "paradigm shift" has found uses in other contexts, representing the notion of a major change in a certain thought-pattern — a radical change in personal beliefs, complex systems or organizations, replacing the former way of thinking or organizing with a radically different way of thinking or organizing.

Kuhn used the duck-rabbit optical illusion to demonstrate the way in which a paradigm shift could cause one to see the same information in an entirely different way.



Paradigm shifts tend to be most dramatic in sciences that appear to be stable and mature, as in physics at the end of the 19th century. At that time, physics seemed to be a discipline filling in the last few details of a largely worked-out system. In 1900, Lord Kelvin famously stated, *"There is nothing new to be discovered in physics now. All that remains is more and more precise measurement."* Five years later, Albert Einstein published his paper on special relativity, which challenged the very simple set of rules laid down by Newtonian mechanics, which had been used to describe force and motion for over three hundred years. In this case, the new paradigm reduces the old to a special case.

In the later part of the 1990's, 'paradigm shift' emerged as a buzzword, popularized as marketing speak and appearing more frequently in print and publication. It is sometimes referred to as abused and overused to the point of becoming meaningless.

“Paradigm shift” is however a meaningful term that may be appropriate in the context of the present power crisis in South Africa together with the high handed approach that has been used to threaten consumers with power cuts or load shedding if they “do not reduce electricity consumption”.

It is not impossible that a radical change in personal beliefs may be necessary to replace the former way of thinking or organizing with a radically different way of thinking or organizing both from the electricity utility's and the consumer's points of view.

Demand Side Management and Energy efficiency

It is well known and generally accepted that Demand Side Management includes two fundamental parameters. These include:

- Energy efficiency
- Maximum demand control

Both of these are related to the efficient USE of energy.

Energy efficiency relates to the saving of power (WATTS). Some typical examples include:

- Energy efficient compact fluorescent lamps (CFL)
- High efficiency motors

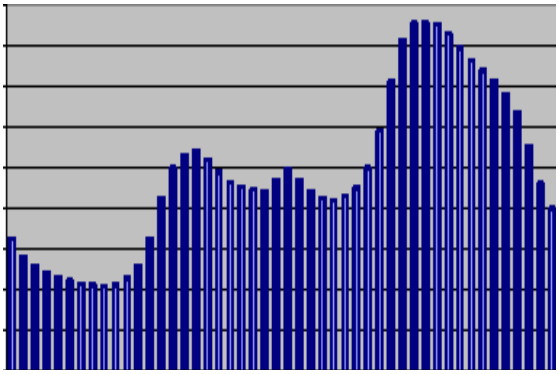
Energy efficiency motivates the users of electricity to consume less electrical power.

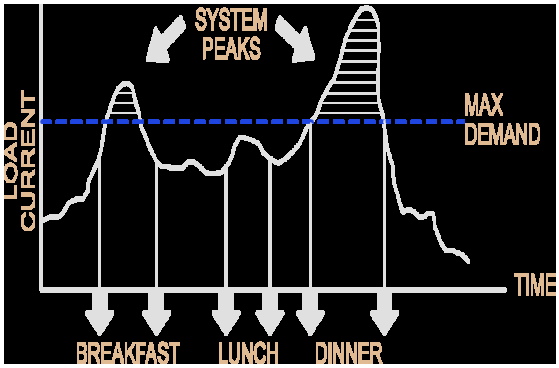
The efficient USE of energy relates more to Load Management.
Load Management addresses three related parameters:

- Load shifting
- Peak clipping
- Valley filling

Load Profile

In electrical engineering, a **load profile** is a graph of the variation in the electrical load versus time. A load profile will vary according to customer type (typical examples include residential, commercial and industrial), temperature and holiday seasons. In the electricity generation sector, a load curve is a chart showing the amount of electricity customers' use over a period of time. Electrical utilities and generation companies use this information to plan how much power they will need to generate at any given time.





Conferences on Generation and the Power Crisis

Two highly successful South African Institute of Electrical Engineers (SAIEE) events were recently held at the Eskom College in Midrand on February 11 and February 19 2008. Both events, "Power Crisis Coping Forum" and "Generation Conference" directly and indirectly addressed the extremely topical subject of the power crisis.

One question that remained unanswered after both events related specifically to the question of the Eskom load profile control. Also not fully explained was the load shifting programs that would be used in achieving such control.

Pursuant to these two events and in recognition of the need to further address that question, the SAIEE hosted a third event in the form of a breakfast talk (3) on March 25 2008 at which Andrew Etzinger, Eskom's Distribution General Manager (Demand Side Management Department) was invited to present his views and deliver feedback on the Eskom DSM programme.

The theme of Andrew's talk was to open and close his presentation with as he called them, six "Tough Questions". The six questions were:

1) *How will the Power Conservation Programme (PCP) be implemented?*
2) *Is there a role for utility driven DSM after introduction of the Power Conservation Programme?*
3) *Is there a role for load shifting programmes given that energy efficiency is a priority?*
4) *How do we entrench a savings culture in South Africa?*
5) *How do we best capture opportunities presented for business development and job creation?*
6) *What policy and regulatory changes are required to improve effectiveness of DSM?*

It was question number 3 in particular that caught this writer's attention.

3) *Is there a role for load shifting programmes given that energy efficiency is a priority?*

In consideration of the unfortunate situation that this country finds itself in today, all of Eskom's efforts in achieving their Power Conservation Programme are both understandable and necessary. However, it is within question 3 that a disturbing message is revealed.

A comment made during the presentation exposed an alarming misconception that may exist in some quarters of our favourite utility. That perception is that Eskom's load profile is *"relatively flat"*

This then begs the question *"Relative to what?"*

Until proven otherwise, it is suggested that until the load profile of Eskom or of any other electricity utility is shown to be truly "flat", opportunities exist for improving both the utilization and economics of this scarce energy resource.

It is conceded that the Department of Minerals and Energy's recently published Regulations of the ELECTRICITY REGULATION ACT, 2006; incorporate ambitious requirements for licensees to include facilities allowing it to remotely control the supply of electricity to water heating geysers, heating ventilation and cooling systems as well as swimming pool drive and heating systems. (4)

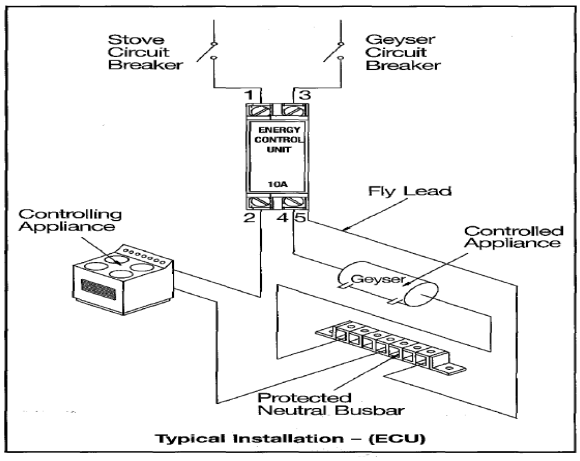
However in consideration of the less than perfect history and experiences in regard to licensee investments into ripple control systems for water heating geysers, any further investment into any system that is dependent on a sophisticated management and control backbone remains questionable. The chronic national shortage of skills in itself must cast some doubt on the sustainability of such measures.

Whilst centralized remote switching of the electricity supply to disconnect selected loads certainly does provide electricity utility licensees with the opportunity for bulk load shedding, this undemocratic process is unlikely to curry favour with the general electricity consuming public.

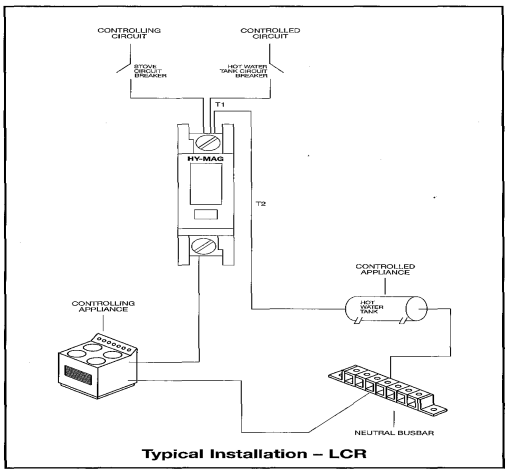
It is unfortunate that only limited recognition has been given to unobtrusive, proven devices that have been used and available to South African utilities and consumers for at least three decades that passively and automatically achieves the load shifting function without requiring any backbone infrastructure, control or maintenance.

These clip mounted “Load Control Relays” (5) are designed to control any non-essential load. They are designed to fit easily into standard residential, commercial or industrial panel boards and operate on the principle of monitoring any peaking loads (of which cooking loads are a prime example) and shedding any non-essential loads. It becomes apparent the any load shedding is effectively under the control of the user through their own electricity usage patterns and actions.

Particularly in the case of thermal storage loads such as water heaters or under floor heating the function of these devices, whilst being automatic, is unobtrusive and far less likely to encourage tampering and by-passing.



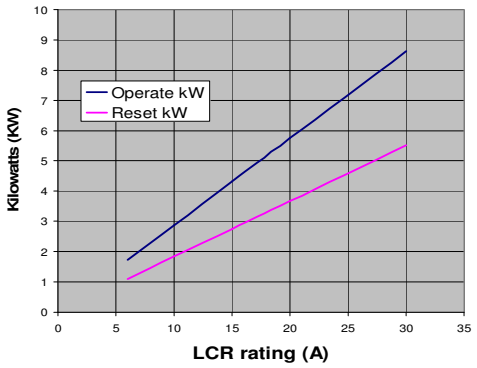
Typical Installation – (ECU)

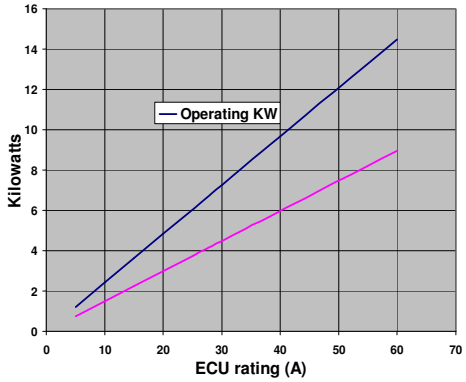


Typical Installation – LCR

The objective and function of both LCR and ECU devices is the same. Both include “Controlling” and “Controlled” circuits. The differences between the two devices are that the ECU is electronically operated with high accuracy whilst the LCR is thermally operated with longer time constants, but more cost effective. “Controlling” loads typically include peaking load appliances such as cooking appliances. “Controlled” can be any type of load, but the most unobtrusive applications use thermal storage type of loads such as water heaters and under floor heating.

Typical operating kilowatt and resetting kilowatt characteristics for each of these devices are shown in the curves below.





It is important to understand that neither of these devices is intended *to save energy costs*. Their primary function is to control peak demand. The major benefit of these devices is to the electricity supply utility, rather than to the consumer.

Having said this, the consumer still may enjoy several advantages including:

1) Water heater (geyser) load shedding is limited to short periods for example whilst cooking
2) Use of additional geysers or heating without requiring supply or installation upgrading
3) Elimination of any applicable maximum demand charges

Whilst the promotion of Power Conservation is admirable from a utility who it is assumed is in the business of earning revenue from the sale of it's product (electricity), it should not be forgotten that Load Shifting when carried out effectively *and economically* **does not result in the loss of sale of a single unit of electricity.**

After all, despite the present power shortage, it becomes easy to lose sight of the fact that electrical utilities are actually in the business of selling electricity!!

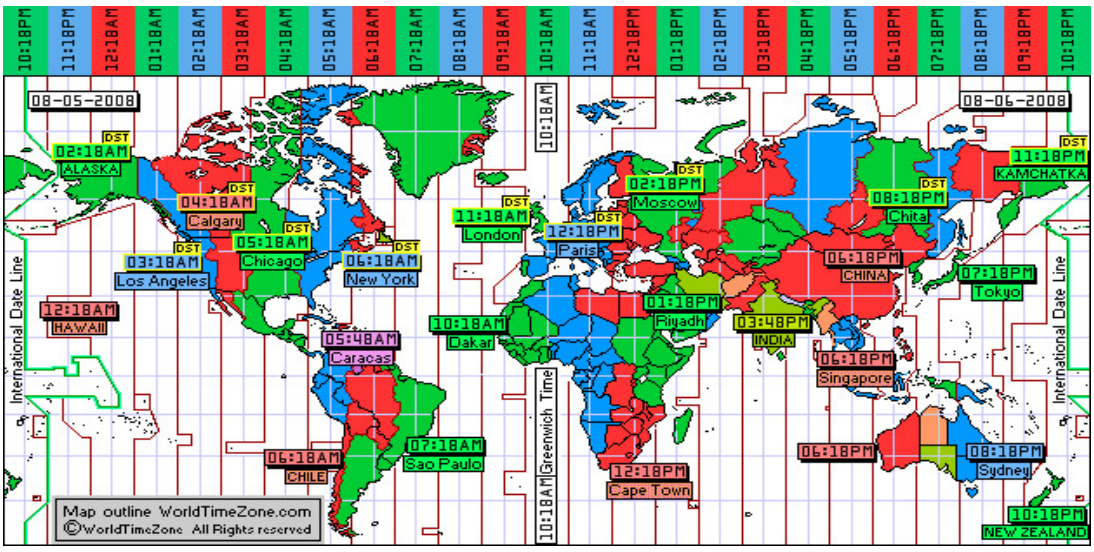
The major benefit to utilities is that peaking load usage is automatically delayed *to individual off peak periods*. There is also a major benefit to both utilities and consumers through a consequential reduction in Maximum Demand costs and penalties.

Sequential load shedding *with prioritizing* is also easily achievable through the use of multiple series connected devices in higher load consuming installations.

Both Government and Eskom have together succeeded in creating the power shortage situation. In this time of crisis it is hoped that they do not again fail to derive the full benefits of BOTH Power Conservation AND load profile control through Load Shifting.

In recognizing the benefits to be gained from Load Profile Control, in this time of national crisis, a *window of opportunity* has arisen in which a brave government can cut through all the red tape.

In this time of identified need, we can for once afford to behave a little undemocratically, through the declaration of a national emergency. Of course there will be those who will find all sorts of reasons why we should not follow the rest of the world in introducing a much needed time zone differential for our large country that spans up to 15 degrees of longitude. Of course there will be objectors who will find reasons for our people not to benefit from the advantages in quality of life that could be gained from Daylight Saving.



From the above world time zone map (6) it is interesting to note that South Africa, in the interests of retaining a single national time zone, is already out of phase with many African countries sharing similar longitudes. Even our close neighbour Namibia has recognized the benefits of daylight saving through the introduction a one hour winter time shift relative to South Africa.

And the costs associated with the introduction of Time Zones and Daylight Saving?
MINIMAL - if we achieve this under a national emergency situation and AVOID all the working groups, committees meetings, referenda etc. that such a proposal will no doubt precipitate.

So what if some of the concerns are real. So what if some of the doomsayer's predictions are justified? After a few years, (again at minimal cost), once Eskom's efforts have managed to get us over this electricity shortage period – we can very easily go back to where we were!

Alternatively, what if we actually come to enjoy the benefits of daylight saving ??

Conclusions

In order to conclude this presentation, firstly, we need to go back and answer Andrew Etzinger's third question posed in his breakfast talk of March 25 2008. His third question was:

> *"Is there a role for load shifting programmes given that energy efficiency is a priority?"*

That answer is easy, since I believe this to be an emphatic YES !!

The Department of Minerals and Energy have certainly indicated their commitment and intent in regard to DSM through the July 18, 2008 publication of Regulation No. R.773.

However publication of those regulations leads to some serious concerns in regard to both the methodologies being implemented as well as the not insignificant costs that would be incurred by licensees in compliance with these regulations which by the way, only have an implementation date of January 01, 2012.

The time has come to supplement preconceived ideas and methodologies and to consider a "paradigm shift" in fundamental thinking. The time has come to:

1) Implement additional means of Load Profiling control *without having to wait until 2012.*
2) Not to restrict load profile control actions to be solely under the control of the utility.
3) Improve consumer relationships through load shedding on a more democratic basis.
4) Recognize the proven technologies of individual consumer peak load control devices.
5) Use the window of opportunity to introduce daylight saving seasonal time changes.
6) Seriously consider the introduction of at least a second time zone in South Africa.

It does not matter how many more electricity power stations are approved, purchased, built and brought on line. More than a shortage of generation power, South Africans need to learn how to conserve our precious resources. We must also never forget the amount of water consumed in the generation of electricity. One of the most powerful energy conservation tools is the leveling of the national electricity load profile curve.

Notwithstanding the relative calm due reduced power outages during the recent winter months, neither South African consumers nor our electricity supply utilities can afford any degree of

complacency. Throughout history, authors have created or cited quotations relating to the opportunity in adversity.

This South Africa of ours has been offered one of these rare opportunities not only to learn, but to benefit from our adversity. But nothing happens automatically. In order to make things happen, it is possible that some difficult decisions might need to be made. And these difficult decisions will almost certainly need an opening of minds, even starting from a clean sheet.

Yes, it may be difficult to break away from long standing deeply entrenched preconceptions.

All South Africans, Government, Eskom and consumers, in the *interest of seeing some rapid results* need a paradigm shift in their thinking. Our opportunity in adversity has arrived !

(1) www.eskomdsm.co.za
(2) Wikipedia
(3) WattNow – June 2008
(4) Government Gazette Notice No. R.773 18 July 2008
(5) CBI-electric Low Voltage
(6) Map outline – WorldTimeZone.Com