# Ripple Relay – A Cost Effective And Reliable DSM Tool For Municipalities

## 1. Problem statement

Eskom and municipal electricity distributors are often under strain to meet national and local demand during morning and evening peak periods that are driven by the residential sector. For municipalities, this extends to financial losses as they charge customers a fixed per kWh tariff but pay a time of use rate to Eskom. Residential geysers account for as much as 22% of the country's total winter peak demand and nearly half the domestic demand at evening peak. Curtailing this demand during peak periods whilst still delivering hot water to the consumer presents a solution.

| Quick Facts | |
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| **Name of Municipality:** | Nelson Mandela Bay Metro Municipality (NMBM) |
| **Year(s) implemented:** | Since 2005 |
| **Implementation status:** | Ongoing |
| **Policy driver:** | Peak demand and arbitrage opportunities |
| **Funding amount:** | Initial funding R146 million |
| **Funding source(s):** | Eskom DSM Programme and NMBM |
| **Impact:** Reduce peak loads and utility expenditure | |

**Typical winter and summer 24-hour electricity demand profile (South Africa)**

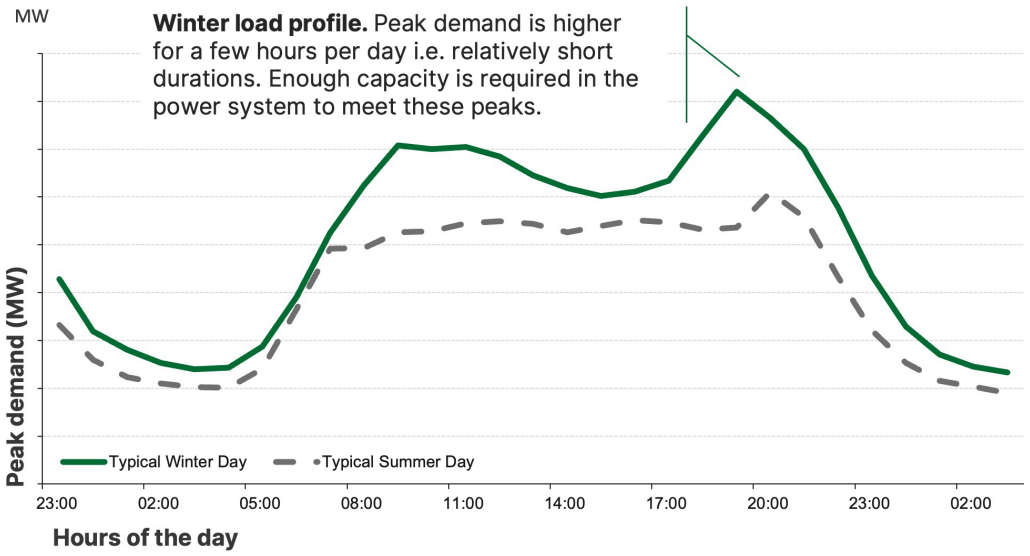


*Figure 1: Typical national and metropolitan municipality daily load profile*

## 2. Solution

NMBM supplies electricity to over 350 000 predominantly residential customers with a total electrical load of 550MVA, or 550MW of demand. Managing peak demand is crucial to system stability, reliability and cost management. Ripple relay is a proven technology that provides a sensible, cost effective solution which, when managed appropriately, has minimal to no impact on consumers. Ripple relays allow the utility to turn geysers on and off during peak demand periods and critical events, and has been used in South Africa for over 50 years.

A public-private partnership (PPP) between Eskom, NMBM and a technology provider was formalised in 2005 and has been implemented in three distinct phases. Phase 1, with a capital investment of R146 million funded primarily by Eskom's DSM programme, saw the installation of 21 500 switches and the establishment of a dedicated control centre. Phase 2 commenced in 2007 with the installation of an additional 67 500 switches. Phase 3 (2014) added 12 000 switches. In total, approximately one third of residential NMBM customers have a ripple relay installed. To maximise electricity savings and reduce the risk of insufficient heating time switches are only installed in geysers with an element of 3kW or greater. Moreover, lower income households (<3kW elements) tend to manually manage their hot water heating requirements compromising the effectiveness of switches, resulting in complaints and/or systems being bypassed and are therefore excluded from the programme.

This PPP initiative demonstrates the multiple infrastructure benefits that can be harnessed through a PPP including access to a customer base; speed of installation; risk mitigation; skills development; and reduced financing challenges. Under the agreement (a ten year contract which was renewed in 2014), the service provider is responsible for operating and maintaining the municipality's ripple relay system for 30% of proven savings. By providing the initial capital investment, Eskom eliminated the challenge of the municipality having to motivate and raise such a large amount of money, which may not have been overcome.

## 3. Achievement, impact and/or benefits

Over a 20-year period, NMBM has successfully rotated geyser load during the two hour morning (08h00 to 10h00) and evening (18h00 to 20h00[1]) peak periods on weekdays, shifting the load to off peak periods and in so doing achieving daily savings of between 35 to 45MWh during summer and 45 to 55MWh in winter. The monetary savings to NMBM are material at over R60 million per year, even after the technology partner has been paid their share of proven savings. Ancillary benefits include reducing and delaying the level of servicing and replacement of infrastructure as the system is shielded from extreme peak demand events.

The load is returned in tranches, with a 10 minute gap between each, over a period of 1 hour to avoid the comeback load overwhelming the system and causing it to trip. To date the municipality has had very few complaints about faulty systems resulting in cold water or interrupted service. This can be attributed to the service provider who has established a control centre to maintain the ripple relay system; undertakes maintenance; product innovation to improve performance and life expectancy of the switches; conducts site visits and is the first 'port of call' to deal with hot water related issues, avoiding the need for customers to go through the general call centre which may be time consuming and cause frustration. Consequently, less than 10% of the installed switches have been disconnected over a 20 year period.

## 4. Key role players

The willingness of all parties to enter into a PPP that delivers benefits at the national, local and individual level has been the key success factor. Eskom's willingness to invest over R140 million in 2005 was the catalyst and this investment ensures that it can rely on as much as 55MW of reduced demand during peak periods. The technology provider has also been instrumental as it has provided reliable equipment supported by a competent support team. Finally, NMBM had the foresight to recognise and pursue the opportunity. Other available funding

1 *During winter the evening peak is between 17h00 and 19h00. The system is not used on weekends and public holidays*

opportunities, such as performance contacting, can also be used to achieve the same outcomes and municipalities should explore all available options.

## 5. Expert tips and learnings

Ripple relays systems can be problematic if not properly maintained and operated. Consumers may bypass the relay if it fails or the system is not managed properly. The technology is proven but old, limited to one way communication. Any municipality looking to install or revive their ripple relay system should also consider the following:

- Focus installing ripple relays on existing households that do not have a solar water heater, heat pump or a geyser timer, as these technologies will offset each other resulting in compromised hot water service from the geyser.
- The programme must have a dedicated support service and respond timeously and effectively.
- A long term awareness initiative that continually updates consumers on the objectives and benefits
- Address customer resistance through by-laws and lobby for ripple relays inclusion in national regulations such as the Electricity Regulation Act (773) which mandates their installation.
- Align the use of the relays with loadshedding to minimize the impact of comeback loads.
- The limitations of single direction communication can be overcome by measuring the comeback load when geysers are turned on. This can help identify suburbs or areas with high system bypass rates.

## 6. Key takeaways

NMBM has operated a successful ripple relay system for over 20 years which has delivered significant energy savings and financial returns and is currently in the process of extending the PPP with the technology provider. A dedicated team of professionals have been responsible for this achievement. Historically, many large municipalities had made large investments in ripple relays but their performance has declined over the years due to a lack of investment, oversight and insufficient engagement with their consumers leading to resistance, rendering the systems largely obsolete with the result that the upfront capital investment has been lost along with the ongoing financial savings.

## 7. Next steps

NMBM recognises some of the limitations of the ripple relay system and the challenges of loadshedding, such as single direction communication; new competing and cost effective technologies that are easier to install and maintain; as well as significantly reduced savings during high periods of loadshedding. It has therefore started piloting smart meters to identify its next intervention, but in the interim, it will continue to benefit from the existing system by ensuring that what has worked until now is maintained.

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