



Mobile Energy Efficiency

Case Study

Warid Pakistan expects to save more than US\$ 6 million per year after trialling energy efficiency solutions

Background

Mobile network operators (MNOs) spend approximately US\$ 15 billion on their annual energy use. Therefore, it is no surprise that energy efficiency is a strategic priority for them globally. This figure continues to climb as energy prices rise, and mobile use and data demand grow, increasing network infrastructure energy consumption.

In 2013, Cascadian, Warid Telecom and the GSMA collaborated to perform a Mobile Energy Efficiency Optimisation (MEEO) project in Pakistan. The GSMA's MEEO service helps MNOs lower their energy costs and carbon footprint by trialling energy efficiency solutions on cell sites, analysing their technical and financial performance, and rolling out the most attractive solutions. MEEO is a follow-on service to the GSMA's MEE Benchmarking service, which benchmarks MNOs' network energy efficiency against their global peers. More than 40 MNOs have participated in the benchmarking, accounting for over 200 networks worldwide. MEE Benchmarking provides a like-for-like comparison, uniquely normalising for factors outside an MNO's control, such as temperature and population density.

Pakistan is particularly challenging for power supply, even on-grid. Electricity shortages in Pakistan are severe and load shedding happens on a daily basis, for about 10 hours per day in major cities and up to 16 hours per day in rural areas. As a result, MNOs must install backup power at all cell sites to ensure high availability. Pakistan's high temperatures in many parts of the country mean that air-conditioning is also required to cool telecoms equipment.

Case study

OPPORTUNITY

Warid has participated in MEE Benchmarking since 2010 and has improved network energy efficiency by 15 per cent per connection over the past three years, deploying a range of energy-saving measures including free cooling. However, Warid realised that there was more opportunity to cut its costs and carbon emissions, and improve its ranking in the benchmarking. Warid signed up to a MEE Optimisation project, leveraging the combined expertise of Cascadian and the GSMA.

The project objectives were to identify the elements consuming the greatest amount of energy in Warid's radio access network and to trial equipment in Warid's radio network that could significantly reduce energy consumption and environmental impact, and improve performance cost-effectively.

An initial assessment showed that there were opportunities to reduce the energy used for air-conditioning, to use advanced batteries to reduce diesel generator runtimes, and to improve backup power supply performance.

To reduce cooling energy usage, Cascadian recommended trialling Coolsure's UTS-55W high efficiency alternating current/direct current (AC/DC) telecom split air-conditioners. Cascadian also proposed to trial the General Electric Durathon E4810 battery and to replace a diesel generator with Ballard's methanol powered fuel cell backup power system.

APPROACH

The approach taken was to:

- Assemble a team of energy experts from Cascadian, Warid and the GSMA.
- Choose a subset of 10 representative cell sites in Warid's network, install and commission remote monitoring equipment on the sites, and gather baseline data for a period of at least three weeks.
- Upgrade four of the cell sites with new, energy efficient equipment: an advanced cooling solution, an advanced battery solution and a methanol based fuel cell system for backup power.
- Gather data from all 10 representative cell sites for a period of three weeks.
- Assess and analyse the data, and produce a summary report.

SOLUTIONS TRIALLED

The Durathon E4810 battery, which uses a sodium nickel chemistry, was installed on an off-grid, outdoor cell site in Muzzafargarh, a remote city in the central region of Pakistan.

Warid's existing residential split air-conditioning units at two indoor, on-grid cell sites were replaced with the DC air conditioner UTS-55W units.

An existing diesel generator on one of Warid's on-grid cell sites in Lahore was replaced with a methanol fuel cell system using a 5 kilowatt (kW) fuel cell. The system includes an integrated fuel reformer that converts HydroPlus™, a liquid methanol-water mixture, into hydrogen gas to power the cell.

RESULTS

The **advanced battery trial** demonstrated significantly reduced diesel generator runtimes, deep discharge and fast charging capabilities, even with a sub-optimal configuration. At the trial outdoor cell site, with a 1.6 kW load, the battery was able to cycle continuously in order to limit generator runtime to 12 hours per day. This 50 per cent reduction in runtime projects to approximately 33 per cent fuel savings compared to a continuously running 20 kilovolt-ampere (kVA) generator. Trial measurements and analysis also showed that the majority of outages of grid power were highly regular in frequency and duration.

Two hours of battery backup, using advanced batteries such as the Durathon at these on-grid sites, could reduce diesel genset runtimes by 74 per cent, saving on fuel and maintenance costs as well as cutting emissions.

If the solution was installed at all suitable off- and on-grid sites across Warid's network, this would save annually an estimated US\$ 3.6 million of energy costs with an 18 month financial payback and 9,650 tonnes of carbon dioxide (TCO₂). Approximately 20 per cent of the total network is suitable, as the solution is not applicable where a 24 Volt DC system is running on the network.

Figure 1: UTS-55W cooling unit performance, Islamabad cell site

MEASUREMENTS*	EXISTING	COOLSURE	DIFFERENCE	SAVINGS
Average Outdoor Temperature (°C)	28.2	28.7	0.5	
Average Indoor Temperature (°C)	21.7	22.6	0.9	
Average Site Power (VA)	4482	3839	-643	14%
Average Air Conditioning Power (W)	1321	558	-763	58%

* Temperature Set Point = 22°C

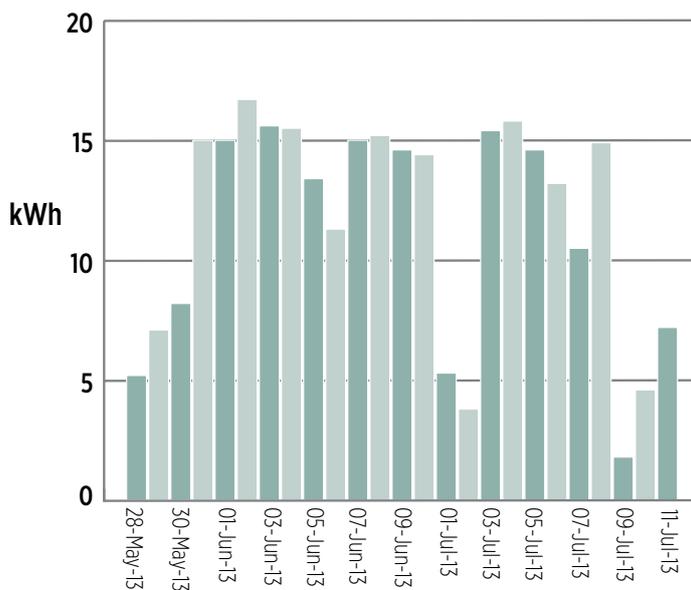
The **advanced cooling trial** showed that if the system was installed across Warid's network at all suitable indoor cell site locations (approximately 2,100 sites), it would annually save US\$ 2.6 million in energy costs with a 14 month financial payback, and 10,070 TCO₂. In the trial, upgrade of the existing cooling system to the advanced UTS-55W system reduced average cooling power by 58 per cent to 558 W on the Islamabad cell site (see Figure 1) and 57 per cent to 708 W on the Lahore cell site. However a more conservative 50 per cent average savings figure was used in the calculations above for the 2,100 sites. Indoor cell sites equipped with UTS-55W units used six to eight per cent less total energy on average than comparable outdoor cell sites with compressor based cooling systems, showing that the advanced cooling solution could be deployed instead of converting indoor sites

to outdoor sites, thereby saving energy and site conversion costs.

The **fuel cell trial** showed it to be a potential alternative to diesel generators in Pakistan with the total cost of ownership equivalent to a diesel generator. The reduced fuel theft from fuel cells, as diesel is significantly more prone to fuel theft than methanol, and the positive revenue impact due to their increased reliability versus diesel generators was factored into the business case. The fuel cell's light weight, small footprint and almost silent operation would also make it financially attractive in some residential and urban areas in Pakistan, e.g. where genset-less operation is required. Additionally, methanol prices are less variable than diesel prices in Pakistan, which may reduce opex fluctuations using the system.

The fuel cell system provided power during a total of 224 grid outages for a total of 198 hours, producing over 295 kWh of energy (see Figure 2). Average methanol fuel consumption was 1.6 litres per hour, compared to 2.5 litres of diesel per hour for Warid's diesel generators. The system demonstrated reliability of 99.5 per cent, compared to 85 per cent to 97 per cent for a typical diesel generator, highlighting the drawbacks of relying on diesel generators for backup power. The fuel cell also showed an almost 40 per cent reduction in exhaust CO₂ emissions and nearly 100 per cent cuts in carbon monoxide, oxides of nitrogen and particulate matter emissions.

Figure 2:
Fuel cell kWh generated per day,
Lahore cell site



**IN SUMMARY, THE TRIALS SHOWED
POTENTIAL ANNUAL SAVINGS
OF US\$ 6.2 MILLION IN ENERGY AND
19,720 TCO₂ FOR THE NETWORK.**

GSMA: The GSMA represents the interests of mobile operators worldwide. Spanning more than 220 countries, the GSMA unites nearly 800 of the world's mobile operators with 250 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and Internet companies, as well as organisations in industry sectors such as financial services, healthcare, media, transport and utilities. The GSMA also produces industry-leading events such as Mobile World Congress and Mobile Asia Expo. For more information, please visit the GSMA corporate website at www.gsma.com. Follow the GSMA on Twitter: [@GSMA](https://twitter.com/GSMA). For further information on MEE services, please visit www.gsma.com/mee or contact Mark Anderson on andersonm@gsma.com

Warid Telecom: Warid Telecom is a 100% owned company of the Abu Dhabi Group and offers state-of-the-art telecommunication services at over 7,000 destinations in Pakistan. Warid Telecom launched its cellular services in Pakistan in May 2005. As an organisation, Warid Telecom prides itself in being contemporary, approachable and constantly innovating. With achievements ranging from having one of the largest postpaid bases, most loved youth & prepaid brands, international roaming and nationwide coverage, Warid Telecom's selection of value added services makes communication effective and enjoyable. www.waridtel.com

Cascadian: Cascadian is a venture backed solutions integration and service company focused on delivering green energy solutions. Cascadian works in partnership with other highly innovative and advanced technology companies around the world in providing complete turnkey power solutions to telecom companies looking for innovative ways to lower their carbon footprint and reduce the use of fossil fuels, and to decrease their overall energy costs. www.cascadian.com



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