



Network Economics: Vodafone case study

Battery Theft

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Executive Summary

As part of the Future Networks Programme, Network Economics workstream, a series of case studies exploring areas where Operators can potentially reduce their Operational Expenditure (OpEx) and Capital Expenditure (CapEX) have been developed. This case study focuses on a key issue that affects mobile operators irrespective of their geographic location base station battery pilferage.

In recent years, Vodafone Italia has suffered a significant series of break-ins at base station sites – with peaks of over a thousand in a year. Aside from the clear CapEX investment required for re-securing the site and battery replacements, interrupting the battery replenishment cycle creates greater maintenance requirements, leading to increased OpEX.

To combat theft, Vodafone in conjunction with the Vodafone Automotive team and their battery suppliers, have installed concealed GPS devices within the battery casing and is indistinguishable from standard non-GPS enabled batteries. When unauthorised movements or vibrations above a certain threshold are detected, the GPS sensors are activated, and movements are monitored in real time, remotely from Vodafone’s Security Operations Centre (SOC).

It took approximately eight months for solution designer Narada Power Source, a leading battery manufacturer and global supplier, established in 1994 in Hangzhou/China¹, Narada were responsible from initiation to mould design implementation through to developing a solution fully warranted by the battery supplier. The solution has been extended to other suppliers including Shuangdeng Group Co., Ltd (China Shoto) and FIAMM Energy Technology S.P.A.

From a law enforcement perspective, the goal is not to intercept the batteries immediately but to also understand the dynamics for how these often organised criminal networks operate, transit routes, and hot spots, for example in the case of Vodafone Italia, many batteries were taken out of the country.

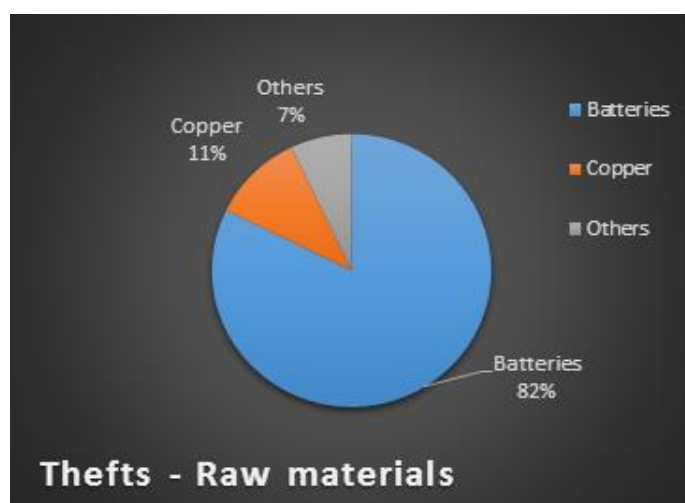


Figure 1: Provided by Vodafone Italy. Percentage of raw materials stolen

¹ <http://en.naradapower.com/index.php/about/company>

Vodafone implemented their GPS solution in November 2017, with early successes recorded. Where 320 GPS enabled batteries were installed in as many sites, thefts of 80 blocks (GPS enabled and standard batteries)² were recorded. While some remain under active investigation, Vodafone solution led to the recovery a significant amount of batteries which would have otherwise been written off as a cost to the business.

The GSMA will closely monitor the developments, however, at this early stage it is clear that the case for GPS enabled battery solution is positive and Mobile Network Operators (MNO) considering launching similar solutions should work with their battery manufacturers to implement similar solutions.

1 Introduction

Vodafone Italia S.p.A. is a mobile operator, provides mobile telecommunication services to customers in Italy, of which there is approximately 29 million customers with a market share of 29.5%. Vodafone Italia founded in 1995 and based in Ivrea, is a fully owned subsidiary of Vodafone Group PLC³.

Thanks to the EUR3.6 billion 'Project Spring', making Vodafone Italia the second largest operator in Europe⁴ and doubling Vodafone's investment in the development of mobile and fixed ultra-broadband in the last two years. Vodafone's 4G network reaches 98% of the population (over 7200 municipalities, of which 2,200 are with 4G+ network at 225 Megabytes per second (Mbps). Vodafone is attentive to technological evolution and continues to invest in the superiority of the network to offer the best possible experience to its customers.

Vodafone has expanded its 1 Gigabyte per second (Gbps) fibre-to-the-home (FTTH), the first commercial fibre optic in Italy, available in over 1,200 cities thanks to the partnership with Open Fibre. Vodafone has also brought ultra-wideband connectivity to several industrial districts across the country. In May 2017, Vodafone launched the 4.5G mobile network to navigate at twice the speed of 4G in the cities of Florence and Palermo with up to 800 Mbps. In total, 10 cities will have access to 4.5G.

2 Business Imperative

Vodafone Italia has recently faced an increase in break-ins at their Radio Access sites with batteries. Over the last fiscal year (2017-18), break-ins have reached a peak of over a thousand across the network with affecting approximately 8% of base stations (owned by Vodafone) in the overall network, and up to 25% in specific provinces.

Unfortunately these is not an isolated events or relegated to Italy, in 2015 it was report that five contractors removed back up batteries and insulating wire selling them for scrap metal worth more than £15,000⁵. Although not Vodafone sites in particular, reports of thefts have

² (a block is 1 battery – GPS or standard – while a string is made by 4 blocks; in a site, we can consider 2 as the average number of strings used)

³ https://en.wikipedia.org/wiki/Vodafone_Italy

⁴ <https://www.reuters.com/article/vodafone-colao-idUSL6N0H20DK20130906>

⁵ <https://www.mobilenewscwp.co.uk/2018/01/26/vodafone-contractors-spared-jail-stealing-mast-batteries/>

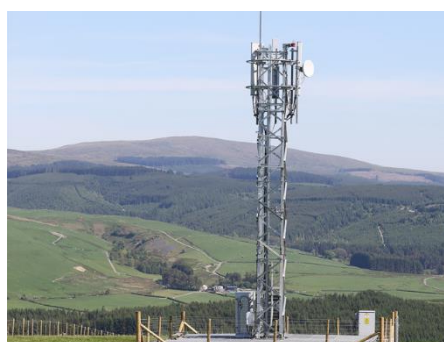
been report in many other countries, such as India, Canada and Australia – highlighting this as a global problem.

As batteries age, MNOs must plan and budget for the replacement of exhausted battery blocks at end of their life; for Vodafone Italy this is approximately every 7 years. However, when batteries are stolen, the replenishment cycle is interrupted which forces the operator to expend more CapEx to restore sites battery power or redirect OpEx where part of the budget allocated to end of life replacement is spent on replacement equipment. In addition, further maintenance visits are required to maintain batteries on different lifecycles.

On site-theft is being combatted with sophisticated active and passive protection systems that include the introduction of GPS solutions inside battery equipment. It is in the provinces where the quality of the public network energy supply is less optimal, and where the highest number of battery thefts are recorded. For this reason, thefts sometimes also have a major impact on the service (cell availability), because the operator notice the theft due to the outage of the site, and this happens in dozens of cases.

3 Vodafone: The Solution

The anti-theft GPS enabled battery solution project lead by Vodafone Italy Technology and Security Operation department is the result of a strategic agreement involving Vodafone Italy, Vodafone Automotive and Narada Power Source and is a first in class innovation with no similar project currently available on the market.



The technology was applied by the Vodafone Automotive teams GPS tracking solution for vehicles. Utilising their experience, testing and expertise, Vodafone Italia applied the same technology for installing GPSs in the Radio Access site batteries. All Vodafone's Radio Access sites are monitored centrally by Vodafone's Security Operations Centre (SOC) central platform based in Milan. The GPS solution can achieve positive results when applied, works well in predominately rural and isolated areas or where the frequency of theft is high. The introduction of GPS enabled batteries enables improved monitoring of incidents including geo-location data to establish patterns that may warrant the implementation of additional security solutions.

A single GPS enabled batteries are installed per site, mixed within standard batteries that look identical to standard batteries. By involving the battery manufacturer in the process, the battery manufacturer continues to honour the warranty of the batteries even with the GPS installed.

The GPS sensor remains 'asleep' until vibration or movement occurs within predefined parameters e.g. geofencing i.e. where GPS detects movements outside a specific BTS site meaning an unauthorised move. When the battery is 'woken', the platform will start to feed GPS data to the SOC, which can monitor the movements and notify the police or the relevant surveillance company closest to where batteries were stolen.



Figure 2: Photos supplied by Vodafone, shows Narada Batteries, other suppliers may have differences.

The installation or replacement of battery banks is a standard activity for an MNO. The integration of a block with GPS increases the working time for no more than 15 to 20 minutes per site, necessary for checking the proper integration and operability with the central platform and to record data related to each installation. The integration into the existing infrastructure procedures is dependent on ensuring work is managed by the same subcontractors or by a selected third party.

4 Economic benefits

The GSMA Network Economics Model estimates that this solution provides economic benefits, with potential savings in CapEX and OpEX for MNOs. For an archetypal tier 1 operator in a developed (high urban pop.) country (of similar profile to Vodafone Italy), the savings potentially recognized are associated with the reduced number of thefts of blocks/batteries on sites, (top range assumes 100% of batteries stolen are recoverable with GPS tech). Consequentially, reducing the number of sites requiring re-securing following theft (USD2-4000 per site).

When assessing the overall MNO OpEX calculation, the Vodafone GPS battery solution can deliver OpEX savings realized from the reduction in the number of site visits.

This cost assumption is based on estimated cost of general site visit including travel cost (fuel, average distance to travel per site), and labour costs – incurred following visitation of incident sites (to replace batteries/blocs)

5 Market Context

The effectiveness of the solution is providing valid support to police in targeting theft issues. Before Vodafone began monitoring and analysing the theft of their batteries, the general assumption was that batteries were being stolen for recycling lead contents or for the use of single-use batteries within Italy . However, the Vodafone data revealed that batteries were also being transported out of the country and beyond EU borders for the re-use of batteries or as scrap metal or extraction of acid. The understanding of these dynamics has supported the authorities in recovering large quantities of batteries, as well as bringing criminals to justice. It must be noted that not all stolen GPS batteries can be recovered; however, all stolen GPS batteries help to understand the dynamics of crime and lead to the identification of hot spots where they transit.

Vodafone Italy started the rollout of GPS battery in November 2017 and in round about six months, approximately 320 GPS batteries have been installed with 270 blocks active in as many BTS sites and are continuing rollout to the remaining high-risk sites. Over the same period, more than 80 have been stolen. Thanks to the tracking of stolen GPS batteries, more than 700 blocks (largely non-GPS batteries) have been recovered from several sequestrations made by police forces.



Figure 3: Recovered batteries by Italian Police force.

Quote from Security Operations team.

«The solution adopted has allowed us to map the phenomenon in its entirety; combining different technologies we have rebuilt the whole criminal chain. We have provided the police with extensive photographic and logistical documentation that, together with real-time information on battery movements, led us to important results, both in terms of volume and severity of the crimes. The evidence provided has also allowed to make arrests in the act of committing crime, configuring the case of "criminal association", far more feared than the simple crime of "theft".

Thanks to the implemented technology we have built long-autonomy GPS devices that have led us to locate storage centers, allowing the police to seize a large number of batteries, also recovering those without GPS module.

By directly striking the receivers instead of individual thieves on the sites, it has been possible to reduce the demand for this material. Although the number of batteries with GPS is still modest and the contrast activity is only at the beginning, we can consider ourselves more than satisfied with the results obtained».



Figure 4: Battery Shelter at Mast sites: Entry broken to entry and forcibly remove batteries.

6 Conclusion

Theft is a key cost element for operators for both the CapEX and OpEX sides; it is not solely applicable to batteries alone but can be extended to other equipment including generators and solar panels that also suffer significant levels of theft, as well as copper from cabling and grounding systems. The installation of GPS enabled batteries can contribute to the reduction of these costs, and in assisting law enforcement, the overall message is loss prevention.

The GSMA will closely monitor the developments, however, at this early stage it is clear that the case for GPS enabled battery solution is positive and Mobile Operators considering launching similar solutions should work with their battery manufacturers to implement similar solutions.