Network communications: 3G shutdown

UE BUS 6.01 - 3G shutdown - Jan2020 - Public

Regulatory proposal 2021–2026

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Contents

1 Overview

Business	United Energy
Title	Network communications: 3G shutdown
Project id	UE BUS 6.01 - 3G shutdown - Jan2020 - Public
Category	Replacement capital investment
Identified need	Maintain network reliability, efficiency, safety and compliance with regulatory obligations.
Recommended option	Option 2 - Upgrade 3G communication boxes and access points
Proposed start date	2021
Proposed commission date	2022
Supporting documents	1. UE MOD 6.05 - 3G shutdown - Jan2020 - Public 2. UE ATT006 - Telstra 3G service closure - 2019 - Public

Telstra's 3G communications network will be retired over the 2021–2026 regulatory period to make way for 5G technology. When the 3G communications network is retired, we will lose the capability to remotely communicate with a number of devices used to operate, control and monitor the network. This will impact on our ability to operate the network efficiently, safely, maintain reliability, and meet compliance obligations.

We have considered three options to manage the 3G network retirement, which are:

1. reference case where we do not upgrade 3G devices and lose Supervisory Control and Data Acquisition (**SCADA**) communications to end devices relying on the 3G network and lose communications to Advanced Metering Infrastructure (**AMI**) access points
2. upgrading communication control boxes and access points to maintain communications to end devices
3. use the National Broadband Network (**NBN**) wired access to communicate with access points and control boxes for SCADA communication.

The net present values (**NPV**) over 20 years for the three options are presented below. We recommend adopting Option 2, which is to maintain communication with devices by migrating them to 4G or 5G (**+nG**). This option has the least net cost.

Table 1 Option analysis ($000, 2019)

Option	NPV
1—Reference case: not upgrade 3G devices	-55,266
2—Upgrade 3G control boxes and access points	-5,492
3—Migrate communications to wired network	-21,516

Source: United Energy

The capital investment forecast for the recommended option is outlined below.

Table 2 Recommended option investment ($000, 2019)

Item	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Capital investment	2,860	2,860	-	-	-	5,720

Source: United Energy

2 Background

2.1 Communication 3G devices

We have a number of field devices on the network with which we remotely communicate. To communicate to these field devices we send a signal over the Telstra telecommunication network to:

- control boxes located near switchgear devices
- power quality (**PQ**) and voltage sensors (**sensors**)
- access points that then communicate with the AMI meters that collect the electricity interval (usage) and event data (alarms).

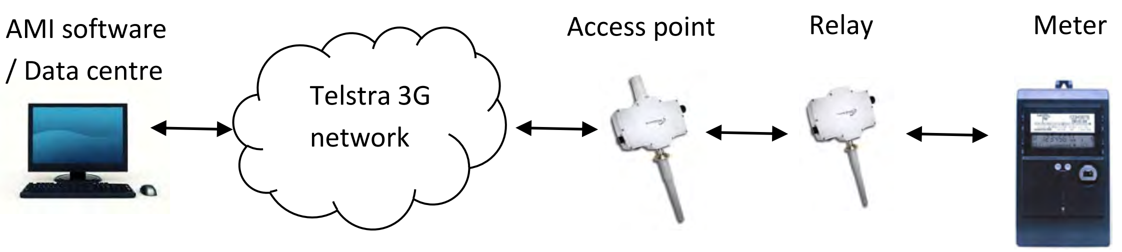
A number of the control boxes and all of the access points installed on the network operate over the 3G telecommunications network. To migrate to +nG networks, components in these control boxes (such as the modem and antenna), access points in the AMI network and modems in power quality and voltage sensors would need to be upgraded given the different set of frequencies and transmission protocols needed.

The end devices we communicate with via the control boxes and sensors perform important network functions such as:

- outage detection—used to detect the location of an outage, resulting in shorter outage times
- remote switching—used to switch electricity around the electricity network to minimise the effect of outages
- remote sensing—remotely monitor the condition/operation of assets and power quality by analysing the supply voltage, current flow and power factor data
- regulatory compliance—varies the operation mode of assets to ensure regulatory compliance.

Similarly, the access points are required to collect information from AMI meters installed at customers' premises. The access points provide 'long haul' communications back to our data centre where the AMI software/application is housed and processed. The figure below shows the main components of the AMI network.

Figure 1 AMI network components



Source: United Energy

The table below outlines the end devices with which we communicate via the 3G network.

Table 3 Devices with 3G communication

End device	Device purpose	Quantity of control boxes / RTUs/ PQMs	Quantity of access points
Automatic Circuit Reclosers & Remotely Controlled Gas Switches	Fault Isolation, remote switching, remote sensing	499	-
Remote Terminal Units	Remote switching, remote sensing	1	-
Power Quality Meters	Regulatory compliance	62	-
3G access points	AMI network communications	-	306
3G micro access points	AMI network communications	-	34
Total 3G devices		**562**	**340**

Source: United Energy

2.2 3G network shutdown

5G technology has been created to keep up with the constant demand for increased bandwidth. Telstra will be deploying 5G between 2020 and 2025. As a consequence the 3G network will be retired to free up spectrum needed for 5G.

On 9 October 2019, Telstra officially announced that it would shut down its 3G network in 2024, stating:[1]

> *In view of such compelling changes and a global decline in 3G usage, it was inevitable we reconsidered the changing requirements of businesses, such as yours.*
>
> *So here's our way of offering you a chance to take a leap into the future with our next generation mobile technology, as we decommission our 3G services in 2024.*

Telstra's notification of the 3G network shutdown is also attached.

[1] UE ATT006 - Telstra 3G service closure - 2019 - Public Telstra. See also 3G Service Closure Redefne your business with a new generation of technology, 9 October 2019 <www.telstra.com.au/content/dam/shared-component-assets/tecom/campaigns/3g-exit/3G-Service-Closure_v2.pdf>.

3 Identified need

When the 3G network is retired, we will no longer be able to communicate with the end devices listed in table 3. The identified need in this business case is to:

- maintain compliance
  - we need to continue to retrieve and process data from the AMI meters to be compliant with our obligations in the National Electricity Rules (**Rules**) including Chapter 7 Part E on the provision, storage and management of meter data.
  - new Victorian legislations (as well as the Bushfire Royal Commission's recommendations) require the dynamic reconfiguration of Automatic Circuit Reclosers (**ACR**) during summer season in particular on total fire ban and code red days.[2]
  - the Victorian Electricity Distribution Code requires us to manage assets in accordance with the principles of good asset management.[3] This cannot be met without being able to communicate with the associated assets to maintain network safety and reliability (discussed below).
- maintain safe network operations—the communications network is used for:
  - condition monitoring, such as sensing oil level in transformers, enabling the remote detection of unsafe oil level
  - reading power quality meters that ensure the voltage is within correct ranges and measuring harmonic content
  - transmitting meter data is used to undertake neutral integrity testing, under which we are made aware of faulty neutrals at customers' houses that could lead to electric tingles or shocks, and could potentially be life threatening
  - transmitting meter data which is used to improve the geographic information system (**GIS**) models of the electricity network, improving customer notifications of planned outages including for life support customers.
- maintain efficient network operation—we need to communicate to access points to perform:
  - remote meter reading—without being able to receive customers' meter data from our access points, we would need to undertake manual meter reads
  - outage detection—AMI meter data alerts us of customer outages and whether electricity has been restored
  - functions such as re-energisation and de-energisation that would otherwise require manual operation
  - remote AMI reprogramming for example for solar customers, which would otherwise require site visits
  - smart meter voltage management used to reduce load at times of generation capacity constraints avoids load shedding.
- maintain reliability—once a fault is detected, the 3G network is used to:

[2] Our Fire Prevention Plan has been approved by Energy Safe Victoria and is a regulatory obligation in accordance with the *Electricity Safety Act 1998*

[3] Essential Services Commission (Victoria), Electricity Distribution Code Version 9A, August 2018, section 3.

- communicate with switches to supply customers via an alternative route where possible. Without this, switching could only occur manually at the site.
- narrow down the fault location and dispatch the field crew to the correct position.
- use automated switching programs (Fault Locator Isolation & Supply Restoration (**FLISR**)) to isolate and restore supply which significantly reduces outage times for customers.

4 Options analysis

This section outlines options to address the identified need. In this analysis, costs are the direct expenditure required to implement the option and benefits are the quantified effects. This means benefits can be presented as negative benefits where the effects are detrimental.

We considered a number of options and scenarios before selecting three options for cost benefit analysis. These, and the reason they were not considered further, are outlined below:

- using other 3G networks—we considered using Optus' or Vodafone's 3G networks. Through previous trials, we established that only Telstra's network is sufficiently reliable and has the coverage needed. These providers have also indicated they will be retiring their 3G networks. Furthermore the access points are securely locked to Telstra network at the factory which means they must be sent back to vendor to have them refurbished if changing service provider (i.e. replace Telstra SIM with another provider SIM).
- refurbishing access points—while control boxes can be refurbished (i.e. replacing the modem, antenna and battery as per our recommended option) it is not economically viable to refurbish, rather than upgrade, access points. Access points must be sent back to the vendor to be refurbished meaning it requires two site visits. Additionally these devices were installed during the AMI rollout and are now nearing the end of their life; even if they were refurbished with a new modem, they would need to be replaced within the next 5 years and costs to refurbish would be higher than that to purchase new +nG devices.
- delaying the upgrade of communication boxes and access points—as observed with the 2G shutdown, Telstra may lower the spectrum available to 3G before the final shutdown. This has a detrimental effect on communications reliability.

4.1 Option 1—Reference Case: not replace 3G devices

Option 1 does not replace 3G communications devices. The table below outlines the present value (**PV**) of the costs of this option.

Table 4 Option 1 PV of cost ($000, 2019)

Item	Cost	Benefit
Reliability	-	-16,818
Protection device manual reconfiguration	-	-4,246
Meter reading	-	-30,225
Power quality meter reading		-1,079
Capital investment	2,897	-
Net benefits	**-**	**-55,266**

Source: United Energy

4.1.1 Benefits

Reliability

The reliability impact of operating the network without communication services has been calculated using the 2018 automated switching programs (Fault Locator Isolation and Supply Restoration (**FLISR**)) operational data where FLISR was able to successfully restore supply to 64,680 customers in in less than 1 minute. Given that 35%

of poletop control boxes use our private communication radio network, the total number of impacted customers have been normalised to 42,042customers.

Without a communication network neither automated switching programs nor network operators could switch around a fault quickly and hence it has been estimated it would take an average of one hour per fault to restore supply based on onsite manual switching.

The reliability impact from not having communications with control boxes is provided in the table below.

Table 5 Reliability impact ($000, 2019)

Description	Value
Number of impacted customers due to 3G shutdown/absence	42,042
Average outage time (hours)	1
Average customer load (residential, industrial, urban, and rural) (kW)	1.3
Energy not served (MW)	55
VCR	42.76
Value of energy unserved (per annum)	**2,337**

Source: United Energy

Meter reading

Without 3G communication to access points we are unable to retrieve and process mandated metering data. As a result we would need to undertake manual meter reads by locally implementing software in the access points that would allow a drive-through vehicle to wirelessly read the meters.[4] This would be required on a daily basis to collect the meter data. It has been conservatively estimated that the additional requirements outlined in the table below would be required.[5]

Table 6 Meter read cost ($ 000, 2019)

Item	Unit	Cost per unit ($ 000)	Total
Additional workforce per annum	42	100	4,200
Vehicles	42	50	2,100
Software licence	1	1,000	1,000

Source: United Energy

[4] This is hypothetical and there is no guarantee that vendor would agree to develop such a customised access point.

[5] There is also a cost to collect power quality data added in to the modelling for this option.

We note in actuality, that AMI meters installed prior to 1 December 2018 must provide 30 minute data daily to the market whereas meters installed post this date must be capable of being read on a 5 minute basis, which is not achievable via this approach.

With respect to meter reading a pure 'do nothing' approach where we fail to collect metering data would result in fines of $20,000 per meter and the possible loss of our distribution license.

Manual reconfiguration

On total fire ban days and code red days, we are required to alter protection settings to high risk areas of the network to reduce the risk of fire ignitions, which is undertaken via the 3G communications network. Without 3G communications this would need to be conducted manually. For the purpose of developing a cost for this business case it has been assumed this task can be undertaken with the current workforce at a typical field worker's hourly rate.

In 2018 there were 5 total fire ban days. Based on this, the total cost per annum for this reconfiguration is shown in the table below.

Table 7 Annual cost to manually adjust reclosers ($000, 2019)

Number of devices in HBRA	Total cost to manually suppress and re-enable a device (two visits) $000	Total fire ban days / Code Red Days p.a.	Total p.a.
59	2.0	5	590
Total per annum			**590**

Source: United Energy

Compliance

With respect to metering, we can maintain compliance with the Rules by implementing a semi manual meter read process as discussed above. Not meeting this requirement would result in fines of $20,000 per meter for the meter fleet of 682,772 meters resulting in total fines of $13.5 billion.

Without the network visibility or remote operations capability we would most likely be unable to meet our obligations around good asset management. The compliance dis-benefits are unquantifiable.

4.1.2 Costs

There is a potential one-time cost from needing to remove unused assets from the network. This has not been quantified given the option would already result in uneconomic outcomes.

4.2 Option 2—Upgrade control boxes and access points

Option 2 would replace 3G devices with +ng compatible communications devices. While 5G devices are not yet available in the market they are expected to be once the 5G communication network is built. Based on previous experience in purchasing 3G and 4G devices, the cost of 4G or 5G devices are expected to be similar and so has not impacted the cost estimate. The table below outlines the present value of this option.

Table 8 PV of option 2 ($000, 2019)

Item	Cost	Benefit
Reliability	-	-
Protection device manual reconfiguration	-	-
Meter reading	-	-
Capital investment	5,492	-
Net benefits	**=**	**-5,492**

Source: United Energy

4.2.1 Benefits

The reliability, meter access points drive-throughs to read the meters, manual reconfiguration of protection devices on total fire ban and code red days and non-compliance dis-benefits outlined in Option 1 will not be incurred.

4.2.2 Costs

We have undertaken a bottom up build of the costs for upgrading from 3G to +nG devices. In so doing, we have separately built up the costs of control boxes and access points used for transmitting AMI data. Access points must be replaced because they do not communicate via a control box, which results in different costs. The key components of the build-up are:

- materials—material costs are based on the actual quoted rates for purchasing 4G modems, antennas and batteries required to refurbish control boxes and access points
- labour rates including field crews, traffic management and communication resources are based on contracted rates
- labour time is based on estimates undertaken by our estimators.

The material cost for control boxes includes the cost of installing a radio modem in 20% of sites. This has been undertaken to ensure we retain basic network control functionality at times of system wide cellular outages.

The average cost per device is shown in the table below.

Table 9 Average cost of upgrading sites ($ 000, 2019)

Item	Control boxes	Power quality meter	AMI access points	AMI micro access points
Materials	2.5	1.5	9.6	0.5
Head end communication analyst	0.2	-	0.5	-
Field time	1.5	1.3	0.9	0.4
Project management time	0.1	0.1	-	-
Total unit cost	**4.3**	**2.8**	**11.1**	**0.9**

Source: United Energy

4.3 Option 3—Migrate communications to wired network

This option proposes migrating the AMI network to utilise the NBN wired network. This has an initial high cost to install—on average 500 metres of fibre has to be run from the NBN terminations to the access points. Additionally, the NBN retailer has to provide additional switching / routing infrastructure at their nodes to enable this communication as not all of this is currently available.

Further, it is proposed that the SCADA Control boxes that are currently remotely telemetered with 3G could also be migrated to NBN wired network.

The table below outlines NPV of option 3.

Table 10 Option 3 PV of cost ($000, 2019)

Item	Cost	Benefit
Reliability	-	-
Protection device manual reconfiguration	-	-
Meter reading	-	-
Capital investment	21,516	-
Net benefits	**-**	**-21,516**

Source: United Energy

4.3.1 Benefits

The quantified reliability and manual reconfiguration dis-benefits outlined in Option 1 would be avoided. In addition to the quantified analysis, this option would present the following qualitative dis-benefits:

- should metering competition be introduced in Victoria, we may not be a metering provider in the future. Therefore, we would lose the capability to provide this option and would then incur costs to upgrade network devices outlined in Option 2 in addition to the costs of developing our own communications network.

- due to expected long lead times in provisioning NBN wired services and NBN coverage footprint, this option will take longer to rollout and we are likely to experience communication issues before the option can be completed.

4.3.2 Costs

We have forecast the cost for this technology based on the costs we would incur for the sites with no cellular coverage. This is shown in the table below.

Table 11 Average cost of upgrading to 3G ($, 2019)

Item	Control boxes	Power quality meter	AMI access points	AMI micro access points
Materials	2.5	1.5	9.6	0.5
NBN media provisioning	15.0	15.0	15.0	15.0
Head end communication analyst	0.2	-	0.5	0.0
Field time	1.5	1.3	0.9	0.4
Project management time	0.1	0.1	-	-
Total unit cost	**19.3**	**17.8**	**26.1**	**15.9**

Source: United Energy

5 Recommendation

The NPV of the three options considered is presented below. We recommend adopting Option 2, which is to replace 3G capable devices with +nG (i.e. 4G or 5G) capable devices.

Table 12 Option analysis ($000, 2019)

Option	NPV
1—Reference case: not upgrade 3G devices	- 55,266
2—Upgrade 3G control boxes and access points	-5,492
3—Migrate communications to wired network	-21,516

Source: United Energy

The capital investment forecast for the recommended option is outlined below.

Table 13 Recommended option investment ($000, 2019)

Item	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Capital investment	2,860	2,860	-	-	-	5,720

Source: United Energy