DNSP Intelligent Network Device

Project № PJ5002

Project Justification

This document justifies capital expenditure on the United Energy network.

REPEX Road Map

1. Asset Replacement – Modelled

a. 6 modelled asset categories

2. Asset Replacement – Modelled & Unmodelled

a. Pole top structures + SCADA/protection

3. Other Repex - Unmodelled

a. ZSS Primary Asset Replacement

(i) CEES - Capacitor Banks + Earth Grid + Neutral Earthing Resistors

(ii) CEES - Buildings

b. Non VBRC Safety Projects

(i) Intelligent Secure Substation Asset Management (ISSAM) – UE PL 2401 e.g.CCTV

c. Operational Technology

(i) OT Safety

- Service Mains Deterioration Field Works – PJ1385
- In Meter Capabilities IMC) – PJ1386
- Light Detection and Ranging (LiDAR) Asset Management – PJ1400
- OT Security – PJ1500
- DNSP Intelligent Network Device – PJ5002

(ii) OT Reliability

- Distribution Fault Anticipation Data Collection and Analytics (DFADCAA) – PJ1599
- Fault Location Identification and Application Development – PJ1600

(iii) OT Other

- Dynamic Rating Monitoring Control Communication (DRMCC) – PJ1413
- Test Harness – PJ1398
- Pilot New and Innovative Technologies – PJ1407

d. Network Reliability Assessment UE PL 2304 – Projects

(i) Automatic Circuit Re-closers (ACRs) and Remote Control Gas Switches (RCGSs)

(ii) Fuse Savers

(iii) Rogue Feeders

(iv) Clashing

(v) Animal Proofing

(vi) Communications Upgrade

e. CEES – Environment

f. CEES – Power Quality Maintained

g. Terminal Station Redevelopment HTS and RTS - UE-DOA-S-17-002 & UEDO-14-003

4. VBRC Projects

a. HV Aerial Bundled Cable Strategic Analysis Plan - UE PL 2053

b. DMA and MTN Zone Substation Rapid Earth Fault Current Limiter (REFCL) Installation

c. Other VBRC projects

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1. EXECUTIVE SUMMARY

Project Description

The Distribution Service Network Provider (DNSP) Intelligent Network Device project will install Mini Network Devices in those instances where UE's existing meter is removed following the introduction of metering competition. The project will commence on 1 December 2017 to coincide with the introduction of metering competition.

Project Driver

This project is focused on maintaining safety. It ensures that customers do not experience a deterioration in safety following the introduction of metering competition.

The following projects will deliver a combined reduction of 50% in the number of shocks experienced by our customers:

- PJ1385 Service Mains Deterioration Field Work; and
- PJ1386 In Metering Capability.

The forecast 50% reduction in the number of electric shocks can be achieved by these two projects with relatively low levels of capital expenditure. For this reason, both projects are justified by our 'As Low As Reasonably Possible' ALARP obligation. The planned reduction in electric shocks depends on maintaining the current functionality of UE's AMI meters and communication network.

From 1 December 2017, customers will be able to obtain an AMI meter from an alternative meter provider. As explained in the AEMC's Rule determination, in some circumstances UE's AMI meter will be removed from the customers' premises. Unless UE takes some remedial action, the safety benefits provided by UE's AMI meters and communications network will be lost for affected customers.

UE's obligation is to maintain safety, which necessarily requires UE to prevent any deterioration in safety over time. This document explores different options for maintaining safety, following the introduction of metering competition.

Benefits

As described above, the principal benefit from the proposed project is that it maintains safety to all UE customers at the lowest cost.

In addition to this benefit, which is underpinned by our compliance obligation to maintain safety, this project will also secure the 'network benefits' from the AMI program. Further details of these 'network benefits' – which are enjoyed by distribution customers, not UE – are set out in Appendix B of this document.

Options Analysis

This document considered four options:

- **Reference Case**

  This is the 'do nothing' option. It is not considered feasible because it would not enable UE to satisfy its compliance obligation to maintain safety.

- **Option 1: Perform Manual Neutral Integrity Testing**

  Option 1 would replace remote Neutral Integrity Testing with manual testing in order to meet our ongoing obligation to conduct Neutral Integrity Testing. It therefore adopts the simplest technical approach to ensuring compliance.

- **Option 2: Install Mini Network Devices**

Option 2 would install Mini Network Devices in those cases where UE's meter must be removed. The Mini Network Device is small enough to be accommodated in any meter box. It ensures that UE's customers do not experience a deterioration in safety following the introduction of metering competition.

- **Option 3: Install 80% Mini Network Devices, Purchase 20% AMI Data and Control Functionality.**

  This option installs Mini Network Devices in 80% of cases, and seeks to purchase the remaining data and control functionality in the remaining 20% of cases. However, the commercial analysis shows that this option is uneconomic for the competitive meter provider and UE's customers.

Table 1 below presents UE's assessment of the alternative options. It shows that Option 2 is the lowest cost option that enables UE to maintain safety over time. Furthermore, Option 2 secures all of the 'network benefits' from the AMI rollout program, which are very substantial in present value terms[1]. In terms of this project justification, however, the financial benefits to customers from these network benefits are secondary to the regulatory obligation to maintain safety.

Table 1: Option Assessment (in present value terms)[2]

	"Status Quo" Reference Case	Option 1: Perform Manual Neutral Integrity Testing where UE Meters are Removed	Option 2: Install Mini Network Devices	Option 3: Install 80% Mini Network Device, Purchase remaining 20% AMI data and control functionality
Maintains Safety	No	No	Yes	Partially
Net Cost ($) (PV)	$0	$7,290,932	$4,013,997	$7,819,280
Secures Network Benefits	No	Very limited	Yes	Partially
Project Ranking	Not feasible	2	1 Recommended	3

Recommendation

For the reasons set out in Table 1, Option 2 is recommended at a project capex cost of $5,118,800. It should be noted that this cost exceeds the amount shown in Table 1, which is expressed in present value terms.

Option 2 is the only option that will maintain safety by ensuring that safety is not degraded for those customers that choose to obtain a competitively provided meter in preference to retaining UE's meter. UE regards it as essential that customer safety should not be compromised by the introduction of metering competition. The modest capex required to deliver Option 2 also ensures that all UE customers continue to obtain the network benefits set out in Appendix B.

1 For example, Deloitte's 2008 cost benefit study estimated the network benefits to be $587 million in present value terms. Only a fraction of these benefits would be attributable to Option2, but it provides an indication of the value of the network benefits to distribution customers.

2 It should be noted that the above table is expressed in present value terms. Therefore, the (undiscounted) forecast capex for Options 1 and 2 exceeds the amounts set out above.

2. Objectives / Purpose

The purpose of this project is to ensure that the safety of standard control services is maintained in circumstances where UE's meter is required to be removed from a customer's premise, following the introduction of metering competition from 1 December 2017.

In the absence of remedial action, some UE customers will experience a degradation in safety and an increased risk of electric shocks compared to other UE customers. Such an outcome would be unacceptable and contrary to our regulatory obligations.

3. Strategic Alignment and Benefits

3.1 Asset Management Strategy and Strategic Themes Alignment

This project supports the following key United Energy strategic themes:

- Compliance with our obligation to maintain safety, which means that it must not deteriorate over time.
- Reduce the risk of injury
- Meeting customer expectation of a safe electricity supply
- Maintain systems to industry standard.

3.2 National Electricity Rules Expenditure Objectives Alignment

This project maintains safety in accordance with clause 6.5.7(a)(4) of the National Electricity Rules (NER). As explained in this project justification, the proposed project achieves this outcome efficiently and prudently in accordance with the capital expenditure criteria specified in clause 6.5.7(c) of the NER.

4. Alternative Options Considered

4.1 Background and Identified Options

The AEMC has now finalised its Rule that introduces competition in the provision of meters[3] from 1 December 2017. An important aspect of this new Rule is that UE's existing meter will be removed if there is insufficient room in the meter box to retain the meter alongside the new service provider's meter. We will discuss the AEMC's Rule determination in more detail shortly.

If UE's meter is removed and no other remedial action taken, the current functionality provided by UE's AMI meters and communications network will be degraded. UE is implementing two projects that together will reduce the number of electric shocks by 50%:

- PJ1385 Service Mains Deterioration Field Work; and
- PJ1386 In Metering Capability.

This safety outcome meets our ALARP obligation because it can be achieved with relatively low levels of capital expenditure. However, maintaining this safety outcome depends on the continuing functionality of UE's AMI meters and communications network. As already explained, the development of metering competition from 1 December 2017 will result in this functionality being degraded over time unless remedial action is taken.

This project is focused on ensuring that the safety outcomes delivered by PJ1385 and PJ1386, continue to be provided to all UE customers in the future. UE's obligation to maintain safety means that we cannot allow safety to deteriorate over time.

A secondary concern is the potential loss of 'network benefits' that will also arise if the AMI functionality is allowed to degrade. A list of these network benefits is provided in Appendix B. However, from a project justification perspective, the loss of network benefits is regarded as a secondary consideration to the regulatory obligation to maintain safety.

The AEMC's Rule determination recognised the importance of ensuring that the introduction of metering competition does not lead to a loss of AMI benefits, including safety. To address this concern, the AEMC provided three options for the incumbent distributor in the event that a competitive meter is installed:

1. The existing meter can be retained providing that there is sufficient room in the meter box.
2. The distributor could install a new (smaller) network device adjacent to the new meter.
3. The distributor could negotiate with the new meter provider (the 'Metering Coordinator') to allow the distributor to continue to provide network-related services.

In relation to the third option, the AEMC commented as follows[4]:

> "*Concerns have been raised by the Victorian DNSPs and the ENA in relation to the potential for retailer-owned or third party Metering Coordinators to exercise market power when negotiating the terms and conditions of access to services and functions that are likely to be sought by DNSPs.*
>
> *The potential for the exercise of market power by Metering Coordinators and the factors that might act to mitigate these concerns are discussed in Appendix E. Although the Commission considers that there are likely to be sufficient mitigating factors, it also recognises that if Metering Coordinators do behave in this manner then DNSPs may not be able to access network-related services at an efficient cost. The final rule therefore allows the Victorian DNSPs to continue to use the meters they installed as part of the AMI program as a network device, provided both the network device and the*

[3] AEMC, National Electricity Amendment (Expanding competition in metering and related services) Rule 2015, 26 November 2015.

[4] AEMC, National Electricity Amendment (Expanding competition in metering and related services) Rule 2015, Rule Determination, 26 November 2015, page 524.

new meter can be accommodated within the metering facility, for example if they are unable to reach an agreement with Metering Coordinators to access equivalent services."

It is evident from the above discussion that UE must take action to ensure that the current functionality of the AMI meters and communications network is maintained as metering competition develops. In this context, the purpose of the options considered in this document is to identify the lowest cost approach to maintaining safety. The options are:

- Reference Case: The "Reference Case" will maintain the status quo
- Option 1: Perform Manual Neutral Integrity Testing
- Option 2: Install Mini Network Devices
- Option 3: Install 80% Mini Network Devices, Purchase 20% AMI Data and Control Functionality.

4.1.1. Reference Case - Status Quo

The "Reference Case" maintains the status quo. This option is unacceptable because our obligation to maintain safety will not be satisfied.

4.1.2. Option 1 – Perform Manual Neutral Integrity Testing

In those cases where UE's existing meter is removed, Option 1 would replace remote Neutral Integrity Testing with manual testing in order to meet our ongoing obligation to conduct Neutral Integrity Testing. As such, this option fails to maintain the lower risk of electric shocks for these customers provided by the Service Mains Deterioration Field Work and the 'In Metering Capability' projects.

In addition, as more UE meters are removed, the AMI network will need to be augmented to expand the number of relays and access points to address the degradation of the communications network. Option 1 allows for this additional augmentation, which will ensure that the remaining customers with UE meters do not also experience a degradation in safety.

The present value cost of Option 1 is estimated to be **$7.29M.**

4.1.3. Option 2 – Install Mini Network Devices

In this option, if an existing UE meter must be removed, it will be replaced with a Mini Network Device. As already explained, this situation arises where there is sufficient room in the meter box to retain UE's meter alongside the new service provider's meter.

The UE Mini Network Device with a supply fuse mounted over the unit will replace the UE meter and the current supply fuse. The size of this new Mini Network Device and fuse will be similar to the current fuse. It can therefore be accommodated in all meter boxes.

Option 2 maintains safety in accordance with our regulatory obligations. The cost of this option reflects the assumed number of meters lost to competitive meter providers; the number of UE meters that will be removed; and the cost of installing Mini Network Devices.

This option would also secure the network benefits listed in Appendix B, which is a secondary consideration to the question of compliance with our safety obligations. It is important to emphasise that distribution customers are the ultimate beneficiaries of the 'network benefits' from AMI meters.

The present value cost of Option 2 is estimated to be **$4.01M.**

4.1.4. Option 3 – Install 80% Mini Network Devices, Purchase the Remaining 20% of the AMI data and Control Functionality

Option 3 combines Option 2 with the alternative solution of purchasing data from the competitive meter provider.

The Option assumes that 80% of cases where there is insufficient space to retain the existing UE meter would be addressed by the installation of a Mini Network Device. It is intended that the remaining 20% of cases would be addressed by purchasing the data and control functionality from the competitive meter provider.

In assessing the feasibility and costs of Option 2, UE has considered the steps that the Metering Coordinator would be required to take in order to ensure that UE maintains its current AMI functionality, which is critical to maintaining safety. This assessment indicates that the Metering Coordinator would need to perform the following additional actions, which would not otherwise be required:

- Upgrade the meter firmware to accommodate data delivery capability (with all required life cycle testing)
- Upgrade communications card firmware to collect and log the required datasets (with all required life cycle testing)
- Volumes will require an upgrade of the communications network in order to return these bigger datasets more frequently and the near real time requirements for the alarms (Small volumes will be satisfactory, but then may require a data plan change should 3G being used)
- Purchase, install and configure the relevant head-end software module to handle the engineering data.
- Upgrade of the smart meter head end and shared services to be compatible with the new module collecting the engineering data (with all required life cycle testing)
- Setup servers and storage to process and store the data for the required legal obligations
- Build/provide B2B processes and interfaces back to UE

From a commercial perspective, the Metering Coordinator is highly unlikely to undertake these additional activities. Given the fixed nature of these costs, the cost per meter of doing so is likely to be prohibitive.

It should also be noted that robust 2-way B2B near real time interfaces would need to be built between the Meter Coordinator and UE to provide near real time alarming, action requests and controls on demand in near real time and provide the data volumes on a frequent basis (currently hourly, moving towards every 30 minutes). It is expected that the cost of each B2B interface to design, configure, build and test will be in excess of $1M with all the relevant security features. Additionally the implementation, configuration and testing of the shared market protocol utilised by all interfaces will exceed $500k.

Our assessment of the Option 2 project costs (which is an alternative to procuring the data from the Metering Coordinator) is that UE would only be prepared to purchase data at a maximum price of $10 per meter per year or less. It follows from this analysis that Option 3 will fail to maintain safety for 100% of UE's customers.

In addition to the costs of purchasing data and control functionality (which is uneconomic), this option will also require the augmentation of the AMI network as described in Option 1. This augmentation is required to address degradation of the communication network, as some UE meters are removed and not replaced with a Mini Network Device. The present value cost of Option 3 is estimated to be **$7.82M.**

4.2 Technical Summary

Table 2: Technical Summary

Alternative	Reference Case - Status Quo	Option 1 - Perform Manual Neutral Integrity	Option 2 – Install Mini Network Devices	Option 3 –Install 80% Mini Network Devices, Purchase the Remaining 20% of the AMI data and Control Functionality
Technically Viable	Yes	Yes	Yes	Yes
Maintains Safety	No	No	Yes	Partial
Network Flexibility	No	Yes	Yes	Yes
Outcome	Not feasible. It does not comply with the regulatory obligation to maintain safety.	Not feasible. It does not comply with the regulatory obligation to maintain safety.	Maintains safety by continuing to provide full network monitoring and control functionality (AMI meters are retained as Network Devices or replaced with mini Network Devices)	Will result in some loss of network monitoring and control functionality.

5. Economic Evaluation

5.1 Costs and Benefits of Options

The results of the economic evaluation of the options are set out in the table below.

Table 3: Economic Evaluation Summary

	"Status Quo" Reference Case	Option 1: Perform Manual Neutral Integrity	Option 2: Install Mini Network Devices	Option 3: Install 80% Mini Network Devices, Purchase the Remaining 20% of the AMI data and Control Functionality
Maintains Safety	No	No	Yes	Partially
Net Cost ($) (PV)	$0	$7,290,932	$4,013,997	$7,819,280
Secures Network Benefits	No	Very limited	Yes	Partially
Project Ranking	Not feasible	2	1	3

Option 1 includes the following costs:

- For those instances where UE's meter must be removed, an allowance has been made for the costs of performing manual Neutral Integrity Testing to meet the ongoing regulatory safety obligation. This cost commences in 2028.
- The cost of relays and access points that will need to be added as AMI communication is degraded by meters that are removed.
- An indicative cost allowance has been included to reflect the loss of network benefits. However, the inclusion of this cost does not have a bearing on the option assessment.

Option 2 is the cost of installing Mini Network Devices in meter boxes where there is insufficient space to retain UE's current meter.

Option 3 includes the following costs:

- The costs of procuring data and control functionality from Metering Coordinators. As already discussed, this cost is prohibitive.
- The costs from having to perform manual Neutral Integrity testing for some customers.
- The cost of some additional relays and access points that will need to be added to avoid degradation o the AMI communications network.

Appendix C provides a copy of the output of the model used to develop cost estimates for Options 2 and 3. As shown in Table 3, the remaining options do not maintain safety – and therefore the costs of these options is no longer a relevant consideration.

5.2 Evaluation of Options

UE's evaluation of the alternative options is summarised below:

- **Reference Case** is not feasible because it does not meet UE's obligation to maintain safety.

- **Option 1** fails to maintain the lower risk of electric shocks for all customers that will be provided by the proposed Service Mains Deterioration Field Work and the 'In Metering Capability' projects. In addition, this option will not secure any of the network benefits described in Appendix B. Option 1 is rejected for these reasons.
- **Option 2** is the lowest cost option and it maintains safety by continuing to provide full network monitoring and control functionality after the introduction of metering competition. It also retains all of the network benefits described in Appendix B.
- **Option 3** will not maintain safety, as the Metering Coordinators will be unable to provide the AMI data and control functionality to UE's near real-time specifications at an economically acceptable price. In addition, Option 3 is higher cost than Option 2.

Option 2 is the preferred option because it is the lowest cost option that enables UE to maintain safety over time.

Furthermore, Option 2 secures all of the 'network benefits' from the AMI rollout program (summarised in Appendix B), which are very substantial in present value terms[5]. It is noted, however, that these benefits (which accrue to distribution customers) are a secondary consideration in this project justification.

5.3 Description of Benefits

The preferred option enables UE to operate its network following the introduction of metering competition by utilising Network Devices with no change to the expected network benefits. The benefits include:

- Complying with the Neutral Integrity Testing regulatory safety obligation at least cost; and
- Securing the network benefits from the AMI rollout, as described in Appendix B.

5.4 Optimum timing and CAPEX profile

It is noted that this project starts in 2017. The costs shown below include real escalators.

[5] For example, Deloitte's 2008 cost benefit study estimated the network benefits to be $587 million in present value terms. Only a fraction of these benefits would be attributable to Option2, but it provides an indication of the value of the network benefits to distribution customers.

Table 4: Estimated Annual Cash Flow - Option 2

CAPEX Forecast ($'000)	2016	2017	2018	2019	2020	Total
Option 2 - **Install Mini Network Devices**	0.0	452.4	1,530.8	1,555.4	1,580.2	**5,118.8**

Note: The capex amounts shown in the table above are undiscounted, and are consistent with the present value costs shown for Option 2 in Section 3.4 and Table 3.

6. PROJECT FINANCIALS

The project financials for internal budgeting purposes are detailed below.

Table 7: Project financials - Preferred Option (Option 2)

PROJECT COST	
Year Budgeted	2017 to 2020
Required Service Date	31 Dec 2020
Budgeted Cost ($A excluding GST)	$4,675,000
Business Case Cost ($A excluding GST)	$4,675,000
Business Case Cost + UE overheads + Escalators ($A excluding GST)	**$5,118,800**

Note: The capex amounts shown in the table above are undiscounted, and are consistent with the present value costs shown for Option 2 in Table 1 and Table 3.

7. Recommendation

Option 2, at a CAPEX cost of **$5,118,800** is the least cost recommended option that meets the regulatory obligation to maintain safety. In the absence of this project, safety will be degraded over time and a growing number of customers will be exposed to an increased risk of electric shocks.

In addition to maintaining safety, Option 2 secures all of the network benefits from the AMI rollout program, which are very substantial in present value terms[6].

[6] For example, Deloitte's 2008 cost benefit study estimated the network benefits to be $587 million in present value terms. Only a fraction of these benefits would be attributable to Option2, but it provides an indication of the value of the network benefits to distribution customers.

APPENDIX A – HIGH LEVEL SCOPE OF WORK

The scope includes:

- Initiate project, identify and obtain resources
- Develop / purchase equipment as required (i.e. mini Network Devices)
  - Test the Network Device functionality
  - Plan equipment rollout
  - Rollout equipment
  - Test Network Devices into service.
- Modify processes and complete all documentation
- Closeout project.

APPENDIX B – LIST OF NETWORK BENEFITS

1. Automated Neutral Integrity Testing, which satisfies our safety obligation at least cost:
    - Service mains - loss of neutral detection (i.e. detection as it fails).
    - Service Mains Deterioration (i.e. detect and replace before it fails).
2. Integration of Meter Ping to Network Control Centre staff and Call Centre for near real-time confirmation of supply presence to avoid unnecessary truck rolls.
3. Last gasp power fail / restore provides near real-time knowledge of customers on/off supply and potential nested outages.
4. LV cross-referencing of customers to distribution substations ensures notifications of planned outages go to the correct customers, and correct aggregation of loads to the correct distribution substations.
5. LV phase identification enables transformer phase load balancing, and allows power quality issues to be addressed quickly.
6. Theft and meter bypass detection enables recovery of lost funds due to unlawful power use.
7. Candling fuse detection enables fuse replacement before it causes an outage that could also result in a potential fire start.
8. Network Load Management (NLM) tools for distribution substations to better manage loads.
9. Network Load aggregation – conductor segment, fuse, etc, enables accurate comparison of loads against asset limits to correct and avoid possible asset deterioration and overloads.
10. Continue existing analytical capability with no interruptions / loss of data.
11. Provision of more accurate customer outage information via a web portal.
12. Identification of live conductors on the ground and the fault location will reduce exposure of these electrical hazards to UE workers and the public, and also has the potential to reduce fire starts. This functionality utilises AMI and SCADA data.
13. Improved data quality/process issues enables better asset management efficiencies including extended asset life and reduced asset replacement costs.
14. LV Reticulation problems identified accurately to the pole/pit or relevant underground section and repaired quickly.
15. Supply point overloads identified and corrected.
16. Accurate voltage monitoring and enhanced future near real-time SCADA integration for voltage regulator control.
17. Unauthorised energy export detection (e.g. unlawful implementation of solar panels contributing energy into the network without appropriate approval).

APPENDIX C: OUTPUT FROM COST MODEL

The material below provides a high level summary of the costs for Options 2 and 3. The material provided is limited to these options as the remaining options are rejected on the basis they fail to meet UE's obligation to maintain safety.

Project Justification: DNSP Intelligent Network Devices							
AEMC Rule Change - Expanding Competion in Meetring and Related Services costs (Excludes any Ring-Fencing costs)							
Price of Network Devices (NTUs)	$85						
Installation costs	$120						
Antennae	$45						
Per Meter Cost of getting data from Metering Data Providers	$10						
ESCALATORS	**1.0014**	**1.0044**	**1.0092**	**1.0149**	**1.0201**		
Meter Churn Contestable Scenarios	**Annual Gross Volumes 2016**	**2017**	**2018**	**2019**	**2020**	**2016- to 2020 Counts total**	**Intelligent Network Devices Required**
Total UE AMI customers	656,500	663,000	669,500	676,000	682,500		
Meter Churn Due to Retailer churn	0	146	1,750	1,750	1,750	5396	$ 917,291.67
Meter churn for Adds & Alts	0	208	2,500	2,500	2,500	7,708	$ 1,310,416.67
Meter churn due to Faults	0	145	1,738	1,808	1,880	5,571	$ 947,000.84
Cummulative meter churn	**0**	**499**	**5,988**	**6,058**	**6,130**	18,675	**$ 3,174,709.18**
Option 2 Costs							
Total cost of Intelligent Network Devices Required		$ 42,429.17	$ 508,968.03	$ 514,890.55	$ 521,066.84		**$ 1,587,354.59**
Total cost of Intelligent Network Devices Installs		$ 59,900.00	$ 718,543.10	$ 726,904.31	$ 735,623.77		**$ 2,240,971.18**
Antenae cost - 10% of new installs	0	$ 2,246.25	$ 26,945.37	$ 27,258.91	$ 27,585.89		$ 84,036.42
Develop and Test New Network Device	0	$ 300,000.00					$ 300,000.00
I FTE to manage the process		$ 12,500.00	$ 150,000.00	$ 150,000.00	$ 150,000.00		$ 462,500.00
Total Option 1 without Overheads							**$ 4,674,862.19**
Option 1 - Tatal with Overheads (100% Network Devices)		**$ 450,441.45**	**$ 1,516,813.02**	**$1,532,578.07**	**$ 1,549,018.62**		**$ 5,048,851.17**
Option 1 - Grand Total with overheads and escalator (Prefered Least Cost)		**$ 452,423.39**	**$ 1,530,767.70**	**$1,555,413.48**	**$ 1,580,153.90**		**$ 5,118,758.48**
Option 3 Costs							
Option 2 - Total cost for 80% Intelligent Network Devices		$ 33,943.33	**$ 407,174.43**	**$ 411,912.44**	**$ 416,853.47**		**$ 1,269,883.67**
Option 2 - Total cost for 80% Intelligent Network Devices Installs		$ 47,920.00	**$ 574,834.48**	**$ 581,523.45**	**$ 588,499.02**		**$ 1,792,776.95**
Antenae cost - 10% of new installs	0	$ 1,797.00	**$ 21,556.29**	**$ 21,807.13**	**$ 22,068.71**		**$ 67,229.14**
Develop and Test New Network Device	0	$ 300,000.00					**$ 300,000.00**
I FTE to manage the process		$ 12,500.00	$ 150,000.00	$ 150,000.00	$ 150,000.00		**$ 462,500.00**
Option 2 - Configuration of Shared Market Protocol Metering Data Providers		$ 500,000.00					**$ 500,000.00**
Extend Shared Market protocol to provide additional functionality required by UE (i.e. Last Gasp, Meter Pings, Nuetral Intregrity, Voltage, Current and phase) - Assume require 3 Interfaces to Metering Data Providers with dedicated links to get near real-time data		$2,000,000	$ 1,000,000.00				**$3,000,000**
Option 2 - Total without Overheads (80% NTUs/ 20% Data Costs)		$ 2,896,160.33	$ 2,153,565.20	$1,165,243.02	$ 1,177,421.20		**$ 7,392,389.75**
Option 2 - Total with Overheads (80% / 20%)		$ 3,127,853.16	$ 2,325,850.42	$1,258,462.46	$ 1,271,614.90		**$ 7,983,780.93**
Option 2 - Total with overheads and escalators (Not recommended)		**$ 3,141,615.71**	**$ 2,347,248.24**	**$1,277,213.55**	**$ 1,297,174.36**		**$ 8,063,251.86**