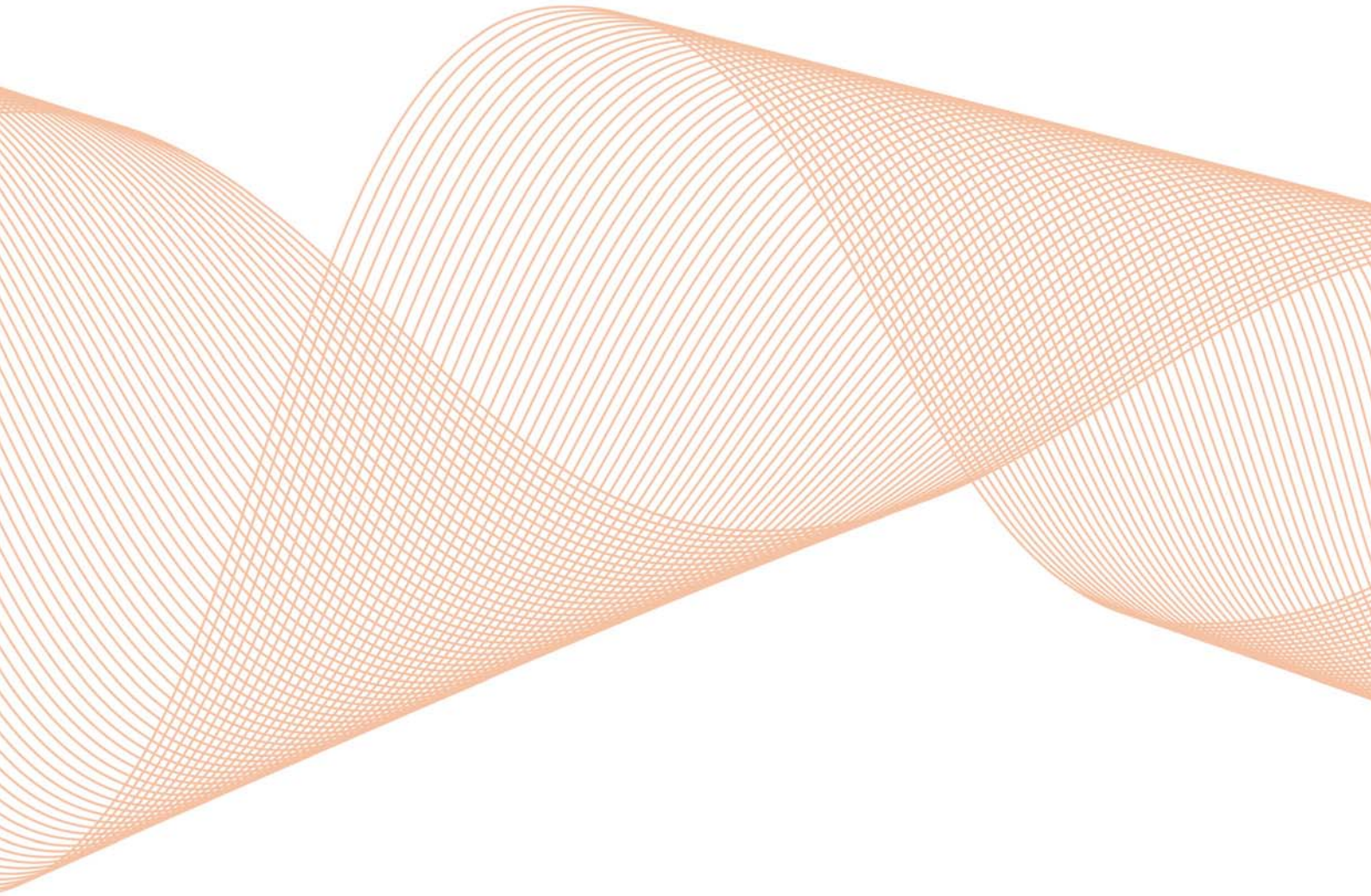
# Smart Grid Proposal

**ELECTRICITY NETWORKS CORPORATION**
**("WESTERN POWER")**

ABN 18 540 492 861



## 1.1 Smart metering infrastructure proposal

This document explains Western Power's proposal to implement smart metering infrastructure, including communications and IT systems through a phased deployment over coming AA periods. While the costs of this initiative are included in relevant chapters throughout this AAI, we have included this additional paper to provide a consolidated view of our smart technology proposal.

During AA3 we will deploy three phase smart meters on a new and replacement basis and the supporting communications system. The supporting communications is required to ensure that the benefits to customers are delivered; network planning and operating efficiencies are achieved; and future opportunities (such as electric vehicles, increased renewables) can be efficiently introduced and managed when required.

## 1.2 Summary

We will invest an additional $109 million during AA3 to deliver smart metering infrastructure (SMI). This investment comprises the additional cost of the supporting communications for the 280,000 non-compliant three phase meters that need to be replaced prior to December 2015 and all new and replacement three phase meters during the AA3, the operating and maintenance costs of the communication system and meters as well as supporting education and incentive based pilot schemes to maximise the likelihood that the benefits of these meters can be realised and measured.

We have a unique opportunity to minimise the costs and maximise the benefits of rolling out smart meter technology because of the need to replace the non-compliant meters. This program will result in around one third of our meter population being 'smart' by the end of the AA3 period.

Investigating this technology is part of ongoing practices to understand and test new technology that can add to the quality of our service and reduce the costs of providing services. We believe that smart meters can deliver both.

To test these propositions we have previously undertaken trials of smart meters and have undertaken a cost benefit analysis of an accelerated roll out. The former has provided us with more information on the benefits that can be realised through smart meters and lessons on how to improve the benefits realised. The latter is aimed at informing the broader policy debate over the role of governments and electricity network businesses in the roll out of smart meter technology. Although this cost benefit analysis was designed to consider an accelerated roll out of smart meters, we have also drawn from this information to assess the costs and benefits of a number of more constrained scenarios.

Leveraging smart technology is a key contributor to our evolution towards building an intelligent network, a key component of our Network Investment Strategy (Appendix K), which aims to improve operational and capital efficiency and meet the changing needs of customers and stakeholders.

The scenario we are proposing for AA3 has been shown to deliver a net benefit to the market of $149 million over 20 years.

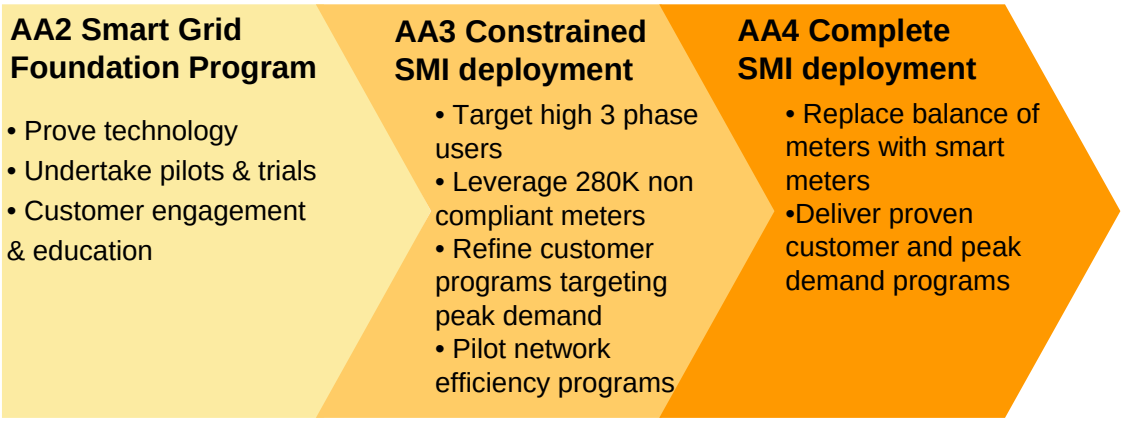
This program will target high energy consumers with a new or scheduled three phase meter replacement in urban regional and metropolitan areas.

Importantly, our own experience and experience elsewhere has shown that in the absence of education and behavioural change programs the benefits of smart meters

may not be realised. Therefore, to ensure that we do not waste this opportunity, our proposal includes education based customer engagement programs. These programs are required to raise awareness and understanding of the opportunities and benefits of SMI, and increase participation in targeted demand management programs to realise customer benefits and achieve a reduction in peak demand.

During AA3 we will further develop and refine customer programs to identify the most efficient and effective ways of delivering benefits to the market, particularly customers and the network.

The following diagram illustrates the phases of this program which will include important critical decision points. The AA3 program will be dependent on the outcome of the ERA's review of our investment proposal and particularly the SMI program, as well as a robust business case yet to be completed. The AA4 program will take into account the AA3 experience, further business cases as well as any broader government policy commitments.




### 1.2.1 The benefits of smart metering infrastructure

We consider that SMI will provide Western Power with benefits in the form of improved operational efficiency, improved information to manage the network, more efficient ways of improving the reliability of services to customers and more opportunities to manage peak demand through incentive programs and tariff options rather than continuing to rely on network solutions.

We consider that the benefits to customers include improved reliability performance, increased ability to manage the costs incurred and reduced network costs over time where peak demand does not grow as rapidly.

Our cost benefit analysis of our proposed program for AA3, using conservative assumptions, shows a net benefit to the market of $149 million over 20 years.

During AA2, we completed a smart grid foundation program which deployed a pilot of 11,000 smart meters and the associated communications backbone on a localised basis. In addition to improving Western Power's understanding of the benefits and ability to analyse the information, this program contributed to informing WA policy development regarding smart meters in light of the Ministerial Council on Energy (MCE) findings that smart meter deployment in WA would provide a positive net benefit. From this pilot, Western Power has gained insights into the costs and benefits available through smart meters. Information from the smart grid foundation program has verified that a positive net benefit from smart meter deployment is achievable in WA.

Peak load growth is a significant challenge for our network, contributing to growth in the capacity requirements of the network and driving higher energy prices. Smart grid and SMI are new technologies shown to both help reduce peak demand and enable customers to reduce their overall energy consumption.

Western Power has a unique opportunity to leverage the mandatory replacement of 280,000 non compliant three phase meters to be undertaken during AA3, which have a higher proportion of large energy consumers. These customers have on average 63% higher electricity consumption than single phase customers in the Western Power Network. A very achievable 10% reduction in energy usage, as seen in trial results, for this group would result in a saving of approximately $170 per annum (at the present 22c flat A1 residential tariff rate) which approximates the incremental cost of the SMI program per customer over two years. SMI provides opportunity for more efficient management of network assets both by reduced operating costs (field service costs) and achieving greater system efficiencies through utilising the real-time information to manage network performance and more efficiently and effectively plan for growth and maintenance activities.

**Lessons from AA2 Smart Grid Foundation Program**

Western Power's Smart Grid Foundation Program as part of Perth Solar City has built a significant capability and provided a number of lessons and learning's in relation to both the technology and the education based customer engagement required to achieve mutual benefits for the network and its customers.

**Selection and deployment of technology**

The pilots have demonstrated that smart metering and communications technology is technically robust and secure and can be deployed cost effectively across the Western Power Network. To achieve greatest efficiencies and benefits realisation, the communications and systems infrastructure should be rolled out in parallel with the installation of smart meters.

SMI technology has also proven to be successful in air conditioning direct load control trials, both technically and in terms of customer response to the program and resulted in peak demand reduction of up to 20%.

**Customer engagement**

Western Powers surveys showed that while 73% of customers were positive about receiving a smart meter, 42% did not understand the benefits and 88% wanted further information. Consistent with this the trial identified that a SMI roll out must be supported by both broad reach and targeted education based community engagement programs in order to maximise the benefits.

**Customer incentives**

For successful delivery of sustainable energy efficiency and peak demand management programs they must be linked to an incentive mechanism to provide greater ownership and accountability and ensure that payment is directly linked to desired end outcomes.

**Peak demand management**

SMI and the real time energy consumption data it provides gives the necessary visibility of individual and local residential peak demand, thereby enabling demand management programs that target areas where there is a real potential for deferral of network augmentation.

### 1.2.2 Cost and price impacts

The incremental cost of the proposed smart grid deployment for AA3 is $109 million. This cost includes both operating expenditure and capital expenditure associated with SMI[1].

The capital investment will be $85.8m and will include[2]:

- implementing secure two way communications infrastructure, leveraging existing fibre backbone where possible, as well as a smart grid Network Management System (NMS) and service order interfaces
- implementing network management capabilities for SMI and enabling customer, network and market products and services, e.g. Home Area Network, in home displays, customer and installer portals, demand management programs, data and network security, software licensing and support

The operating and maintenance expenditure will be $23.6m and cover:

- the cost of managing the roll-out of the new meters
- operating the smart grid communications systems
- operating the smart grid Network Management and IT Systems
- smart grid customer programs for encouraging peak demand and energy efficiency management
- community engagement, education and demand management programs (see 1.4 below)

We are continuing to assess the cost and benefits of a full accelerated roll-out of smart meters. If this is mandated in WA, Western Power would consider the cost and delivery impacts and make appropriate applications under the existing mechanisms in the Code to recover costs or submit revisions to the access arrangement (through the trigger event provisions).

Table 1 sets out Western Power's forecast incremental investment in SMI and customer programs during AA3 and the impact on average prices per annum.

[1] Both operating and capital cost estimates in this paper include an allocation of indirect costs consistent with the methodology outlined in Section 7.2.3 of the Access Arrangement Information document.

[2] 280,000 non-compliant three phase meters and 52,000 additional meters forecast to be newly installed or replaced from 2013 onwards in urban areas will be MCE compliant. The cost of the MCE compliant meters is forecast to be the same as the cost of the current meters. Therefore, these costs are included in the metering cost forecasts and not in the Smart Meter expenditure forecast.

**Table 1: Investment in smart metering infrastructure operating and capital expenditure during AA3 ($ million real at 30 June 2012)**

| Item | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | AA3 Total |
|---|---|---|---|---|---|---|
| SMI incremental cost of 280,000 non-compliant 3 phase meters and 52,000 BAU 3 Phase meters | 1.83 | 23.45 | 23.93 | 14.42 | 6.92 | 70.55 |
| Systems to enable customer demand management (DREDS, power factor correction infrastructure) | - | - | 2.23 | 5.21 | 7.95 | 15.39 |
| **Total incremental SMI Capital Expenditure** | **1.83** | **23.45** | **26.15** | **19.63** | **14.88** | **85.95** |
| | | | | | | |
| SMI systems control (operations, support & maintenance of SMI systems, Home Area Network (HAN), smart meter programs, software licensing) | - | 2.44 | 2.97 | 2.71 | 2.71 | 10.83 |
| SMI two way communications for 3 phase operations & maintenance | - | 0.67 | 0.82 | 0.81 | 0.79 | 3.09 |
| SMI Preliminary Planning | 3.97 | - | - | - | - | 3.97 |
| Customer demand management programs (incentives, rebates, In Home display (IHD) | - | 0.12 | 0.24 | 1.98 | 3.42 | 5.77 |
| **Total incremental SMI Operating Expenditure** | **3.97** | **3.23** | **4.03** | **5.51** | **6.92** | **23.66** |
| | | | | | | |
| **Total incremental SMI Expenditure** | **5.81** | **26.67** | **30.18** | **25.14** | **21.80** | **109.61** |
| **Impact on average prices $per annum** | **3.76** | **3.21** | **6.75** | **11.03** | **14.27** | |

## 1.3 Technology selection and deployment strategy

Western Power will deploy a unified smart grid platform that bridges the gap between our existing network transmission and distribution smart grid systems and the customer smart meter and home area network.

Implementing SMI will require products and services from multiple technology providers. The technology will be chosen through a competitive worldwide tender process and will comprise smart meters, communications system and smart grid network management systems. This will involve tendering for smart meters and field deployment services, evaluating and testing smart meters, and installing, commissioning, and enabling Home Area Network (HAN) by integrating smart meters to the communications backbone.

The chosen technology will be secure, scalable, IP based and deliver to the requirements and performance identified by national (MCE) and state (Office of Energy and stakeholder) working groups. Disaster recovery will be provided for the network management system and the last mile wireless radio frequency mesh and backhaul communications will be designed with redundancy where practicable. The chosen technologies will be cost effective for all Western Power Network locations.

Supporting the technology will be a suite of applications to meet MCE minimum functional requirements including but not limited to:

- Remote meter reading and connect/disconnect
- Remote meter software and tariff configuration
- Remote communications configuration and Home Area Network (HAN) Energy Services Portal provision and management and HAN service provision
- Demand Management functions (planned and emergency) and interfaces with System Management control and monitoring systems
- Customer portals, real time and near real time
- Customer real time outage data integration with existing trouble call and customer management systems
- Customer power quality measurement
- Support for multi-utility metering where cost effective

### 1.3.1 Deployment strategy

Western Power has selected a constrained deployment scenario during AA3 because it:

- targets higher three phase energy consumers
- leverages 280,000 non-compliant three phase meter replacement
- limits the impact on tariffs when compared to more aggressive deployment
- allows for further refinement of programs to identify the most efficient and effective way to deliver benefits for the complete roll out during AA4
- allows for sufficient time for planning, procurement, policy and program development and engagement with key stakeholders groups and system and process change

Table 2 shows the proposed deployment schedule for smart meters in AA3.

**Table 2: Deployment schedule for these smart meters**

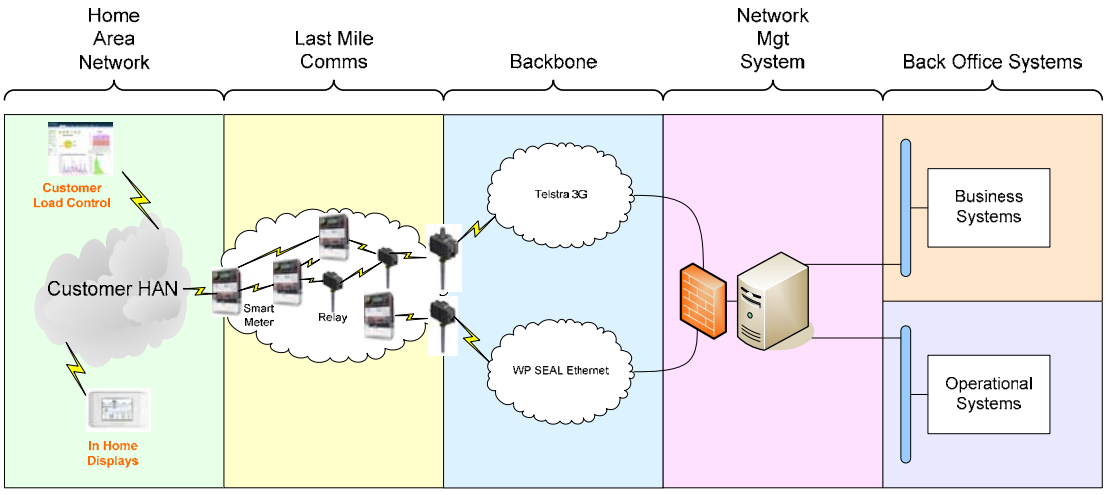
| Program | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | AA3 Total |
|---|---|---|---|---|---|---|
| Three phase non-compliant replacement per annum quantities | | 110,000 | 110,000 | 60,000 | | 280,000 |
| 3 Phase New & Replacement with Communications enabled | | 12,702 | 12,928 | 13,158 | 13,395 | 52,183 |
| Total | | | | | | 332,183 |

### 1.3.2 Communication radio mesh, backbone and smart grid network management system

In AA3, we will invest $74.2 million to establish and maintain secure two way communications infrastructure. This comprises meter communications cards ($30 million), access points and relays, a smart grid-AMI Network Management System and SMI service order interfaces and demand management operational interfaces. Figure 1 shows the communications infrastructure from the customers' home area network to our business system interface.

The infrastructure will cover urban areas including Geraldton, Kalgoorlie, Bunbury and Albany. It will ensure communications coverage for approximately 85% of the smart meters that we roll out during the AA3.

**Figure 1: Architecture of Western Power's proposed communications backbone for smart grid**




## 1.4 Programs to deliver benefits

We will give a significant focus to customer engagement, education and benefits realisation during the implementation of SMI. This is consistent with the learning's

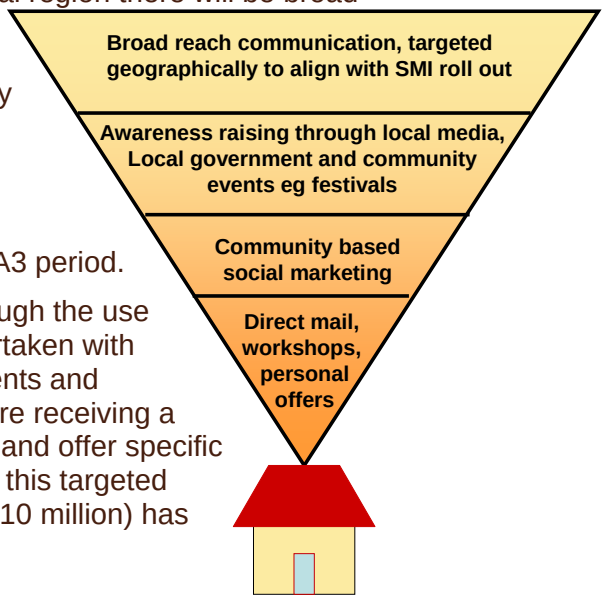
from our trials and the recommendations by the International Energy Agency that "Regulators should require customer education to be part of any smart grid launch"[3].

### 1.4.1 Education based community engagement

The primary objective of community engagement is to achieve participation in customer demand management programs.

Community engagement will be phased in parallel with the deployment of technology and targeted to maximise benefits to customers and the network.

Prior to implementation of smart meters in a geographical region there will be broad reach communication to raise general awareness about the new technology as well as the opportunities and benefits it provides to customers. This will be closely followed by engagement through the local media and in conjunction with local government to leverage existing sustainability programs, which has been shown to work effectively in the Perth Solar City program. For this engagement $4.2 million has been allocated over the AA3 period.




More tailored, personalised and direct engagement through the use of community based social marketing can then be undertaken with existing community groups and at local 'grass roots' events and workshops. This will include targeting individuals who are receiving a smart meter via direct mail to engage directly with them and offer specific programs from which they are most likely to benefit. For this targeted education and communication $30 per meter (totalling $10 million) has been allocated.

### 1.4.2 Customer focussed demand management programs

Western Power will build on the smart grid foundation program pilots and trials to further refine customer programs with a particular focus on cost effective ways of achieving peak reduction and savings to customers. Funding for this will be linked to the numbers of customers engaged to participate in the programs. For these demand management programs $21.1 million ($5.6 million Opex and $15.5 million Capex) has been allocated to achieve the benefits in the CBA. These costs include activities associated with the following:

- providing customers with in-home displays (IHD), portals and web applications (approximately 30,000 IHD's in AA3 and establishment of portal) to ensure they can access real time consumption data
- providing financial incentives and rebates for customers to opt in to direct load control programs
- financial incentives and rebates to reduce peak consumption upon notification
- continuing to work with governments and appliance manufacturers to have enabling chips as standard in new appliances (this will assist in the

[3] Heffner, G. Smart Grid – Smart Customer Policy Needs. International Energy Agency, April 2011. Available at: http://www.iea.org/papers/2011/sg_cust_pol.pdf

establishment of demand management programs, control systems, installation of load control devices)

- installation of power factor correction network equipment at large customer premises where poor power factor has been identified by smart meter interval data

Western Power will continue to work with the Government and retailers to improve the design of customer friendly opt in tariffs that offer real opportunities to save money by changing behaviour.

## 1.5 NFIT compliance

The proposed SMI deployment meets the new facilities investment test. The detailed cost benefit analysis model (attached to the confidential AAS part of the submission) was used to assess a range of deployments including the proposed constrained option as detailed in section 1.5.1.

### 1.5.1 SMI deployment scenarios

A range of options have been identified and assessed for the possible implementation of SMI. These are summarised in Table 3:

**Table 3: SMI Deployment Scenario's**

| | Option | NPV of Benefits to Market over 20 years | PV of Costs to Western Power over 20 years |
|---|---|---|---|
| 1 | **All meter roll out by area**<br>Full Area based SMI roll out (1&3ph) starting July 2013.<br>Completed in AA4 ( 8 years)<br>@ 120k meters pa | $193.6M | $457.9M |
| 2 | **Non-compliant & all BAU meters**<br>Commence SMI roll out July 2013 Replace all non compliant meters and BAU growth and replacement smart meters (1&3ph)<br>Completed in AA4 | $169.7M | $417.1M |
| 3 | **Non-compliant & 3ph BAU meters**<br>Commence SMI roll out July 2013 Replace all non compliant meters and 3 phase BAU growth and replacement smart meters<br>Completed in AA4<br>**(Constrained Scenario – Recommended for AA3)** | $148.9M | $406.3M |
| 4 | **Delayed until AA4**<br>Replace all non-compliant and BAU 3 phase meters from 11/12 with no communications chip fitted until AA4.<br>AA4 retrofit communications chip over 3 years with SMI. Complete roll out in 2023/24 (AA5) | $94.3M | $351.3M |

The constrained scenario (Option 3) has been chosen as the recommended option as it targets higher energy consumers, leverages replacement of 280,000 non-compliant meter replacement, limits the impact on tariffs and allows for further refinement of programs to ensure they deliver benefits during AA4. In addition it allows realistic time for planning, stakeholder engagement and delivery.

**Assumptions contained in the base Cost Benefit Analysis** (attached to the confidential AAS part of the submission)**:**

- Year 1 of the model is financial year (FY) 2011/12
- Smart meter deployment will commence in January 2012 (half way through Year 1 of the model) and be completed at the end of financial year 2018/19 (Year 8 of the model)
- Single phase, three phase and circuit transformer metering will be rolled out geographically as a single continuous deployment program, targeting locations that will bear maximum benefits at the earliest point
- Meter life is assumed to be 15 years, resulting in some meters being replaced twice during the 20 year analysis period
- Communications deployment will commence in FY 2011/12 and lead the smart meter deployment. Completion by end of FY 2018/19 if not before
- The 280,000 non-compliant three phase meters Western Power is obliged to replace by 2015 have been identified as a separate group to ensure they are completed by the end of 2015
- Customer enabling programs are assumed to be voluntary and that customers would be recruited by opting into the various programs. A corresponding marketing budget has been included as a cost for this purpose
- A significant budget has been included in the analysis for customer engagement and education. This is a key differentiator from other cost benefit analysis and is critical to ensuring "benefit realisation" through customer acceptance and uptake of new technology, which will enable customers to take advantage of new products and capabilities. This is anticipated to drive uptake of customer enabling programs such as Direct Load Control (DLC)
- A carbon price has been assumed. This was derived from ACIL Tasman carbon price modeling conducted as part of a report commissioned by Western Power[4] for the Mid West Energy Project: Southern Section
- The use of electric vehicles has been assumed to gradually increase at a rate of 0.8% per annum starting in 2015. This is based on modelling from reports

[4] *Net market benefits of Mid West transmission link June 2010*

by AECOM[5] for the Department of Environment and Climate Change and Jamison[6] for NRMA motoring and services

- Western Powers costs and benefits only include direct costs

**Revised assumptions to those contained in the Cost Benefit Analysis (for the assessment of alternative SMI deployment scenario's referred to in table 3):**

Meter deployment for scenarios 1, 2 and 3 are delayed until July 2013 to allow sufficient time for planning, procurement, policy and program development and engagement with key stakeholders groups and system and process change. Scenario 4 delays meter deployment until AA4.

The nominal exchange rate for AUD to USD is from Western Power treasury as at 5 August 2011.

### 1.5.2 Alternative technologies

There are alternative technologies that have been available for sometime that can also enable individual customer programs to target energy efficiency and peak demand reduction. To date these have had extremely low up take. Examples include direct load control of customers' air conditioners and other appliances (using radio or other communication signals from a system control centre) or in home displays wirelessly connected to a local device that measures the current being drawn by the building. However these technologies are individually costly when compared to AMI on a per customer basis, have benefits limited to their specific application and cannot be efficiently integrated with other technologies or adapted to meet future needs.

The SMI proposal has the advantage of being a modular, open platform interoperable technology that is compliant with developing national and international standards being adopted by Australia and other major markets including USA. This is a platform that is adaptable and can be built on to meet future requirements and developing standards in the most cost effective way.

If these technologies including the Zigbee HAN and smart energy profile (interoperability of communications) are not adopted, customers will not be able to benefit from the adoption of these standards into smart appliances.

In addition they do not deliver the range of network operating efficiencies or provide the required visibility of energy consumption to the network to deliver targeted demand management programs and defer network augmentation.

Alternative SMI communication technologies to the home (such as NBN) will be considered for the Western Power Network rollout if they are found to be more cost effective and able to deliver the recommended MCE SMI minimum functionality and performance, however, that is unlikely to be the case based on early pilots and trials in other states.

---

[5] *Economic Viability of Electric Vehicles, AECOM 4 September 2009. Available at: http://www.environment.nsw.gov.au/resources/climatechange/ElectricVehiclesReport.pdf*

[6] *Fuelling Future Passenger Vehicle Use in Australia, Jamison February 2010. Available at: http://wag.org.au/documents/doc-174-jamison-group-fuelling-future-passenger-vehicle-use-in-australia-february2010.pdf*