16 February 2023

ATTN: Jessica Curtis – Project Leader
Australian Energy Markets Commission
Level 15 – 60 Castlereagh Street
Sydney NSW 2000

Dear Ms Curtis,

RE: Unlocking CER benefits through flexible trading (REF ERC0346) – IPWEA Submission on Minor Energy Flow Metering

IPWEA is the peak association for infrastructure asset managers and professionals who deliver public works and engineering services. Our members, as the road authorities and as the local government authorities, have primary responsibility for decisions about most Australian public lighting including whether to light, to what level to light to and in what manner to light roads and other public spaces. With our members' interest in mind, IPWEA's Street Lighting & Smart Controls (SLSC) Program was founded in 2016 to accelerate the efficient adoption of modern street lighting and smart controls technologies and best practices throughout Australia and New Zealand.

This submission focuses on the questions in the Consultation Paper about Minor Energy Flow Metering (e.g., Questions 14-16) and specifically addresses these questions from the perspective of street lighting as a leading use case. The content of the submission has been prepared with input from a range of street lighting customer and supplier organisations.

Summary

This submission strongly welcomes the proposal to adopt an opt-in Minor Energy Flow Metering regime in the National Electricity Market (NEM). There is a broad and compelling public benefits case to introduce a simple, effective and efficient regime that recognises the metering capabilities of smart street lighting controls and encourages their widespread adoption across some 2.5 million street lights and other similar devices.

Such reform would not only greatly improve metering accuracy in this largely unmetered segment of the electricity market but also deliver energy savings, maintenance savings, road and public safety improvements, a range of environmental gains and many other benefits.

The business case for smart street lighting controls is substantially influenced by the energy savings that smart street lighting controls can deliver as these savings account for perhaps 45-60% of the easily realisable financial benefit. However, securing these savings is contingent on having a regulatory approach that is able to readily recognise the variable electricity consumption data that they produce. The current absence of such a system in the NEM has hampered adoption of smart street lighting controls in Australia thus far in comparison to many international peers.

There is now solid precedent internationally for recognising the metering capabilities of smart street lighting controls. Such reforms have been a key enabler of widespread adoption in markets such as the United Kingdom, parts the United States and in New Zealand.

A key feature of successful regulatory reforms elsewhere is that they have adopted a streamlined version of their metering regime to apply to smart street lighting controls, setting aside or modifying aspects of their regimes that are not relevant to the nature of the small loads being measured.

This submission therefore welcomes AEMO's proposals to set-aside a number of aspects of the current NEM Type 4 metering approach and suggests that further consideration should be given to other aspects that may not be relevant, necessary or could inadvertently impose unreasonable, complex and costly requirements on a Minor Energy Flow Metering approach that would discourage widespread adoption.

The average residential road LED street light now uses 13-20W (and residential roads make up 70% of the national portfolio) and the average main road LED street light uses 80-150W (with a very small percentage using higher Wattages). It is therefore vital that the cost of adopting and complying with the regime is very low on a per lighting point basis if adoption is to be encouraged. Put simply, if it costs even a few dollars a year to meter a street light using $15-$150 of electricity a year, there will be little take-up and a significant lost opportunity to materially improve metering of these currently unmetered devices and help deliver a wide array of other broader public benefits that smart street lighting controls offer.

About Australian street lighting

Australia has an estimated 2.5 million street lights, about 90% of which are owned and managed by a dozen electricity distributors (all but one of which operate in the NEM). Based on an estimate developed by the IPWEA's Street Lighting & Smart Controls Program in recent weeks in conjunction with major LED suppliers, about 1.4 million of these street lights (57%) have been converted to LEDs so far leaving some 1.1 million to be converted in the next few years.

While this is welcome progress, few of the new LEDs are being co-deployed with smart street lighting controls and this is a missed opportunity that is out of step with other large-scale LED replacement programs underway elsewhere in the world. Indeed, as few as 4-5% of Australian street lights have been deployed with smart street lighting controls and most of those are on customer-owned lighting portfolios (e.g., the ACT, the cities of Darwin and Palmerston in the NT, the Queensland Department of Transport & Main Roads, South Australian Department of Infrastructure and Transport, Victorian Department of Transport and Planning).

While many Australian DNSPs have evaluated and trialled smart street lighting controls, Powercor's deployment of some 40,000 smart controls appears to be an exception at this point amongst DNSPs in the NEM.

There are a growing range for drivers that are likely to result in the bulk of the remaining legacy lights being changed to LEDs in the next very few years. These include: a compelling business case; the increasing push to save energy and reduce GHG emissions; Australia's recent ratification of the Minamata Convention on Mercury; and, the global winding down of legacy lamp production of all types.

The continuing rapid pace of LED deployment in Australia is a key reason for this submission suggesting that recognition of the metering capabilities of smart street lighting controls is urgently needed so as to not miss the opportunity of co-deployment of these systems as the remaining LEDs are rolled out. Many of these remaining conversions are on main roads where the potential energy savings are much larger and potential road safety gains more crucial.

Potential gains from a full Australian LED and smart controls deployment

A table of key facts and figures about Australian street lighting is presented below in Figure 1 summarising the number of street lights, the status of LED conversions and the potential additional benefits of a full transition to smart street lighting controls (A wide range of additional benefits are discussed in the response to Question 16 below).

In summary, total street lighting energy consumption has already been reduced by some 30% since 2016 (even while the number of lights grew by about two hundred thousand). There are about 1,070,000 street lights left to convert to LEDs which would save a further 350,000 MWhr/yr (and take total savings to about 60% compared to 2016 levels).

A full smart street lighting controls deployment could further reduce the energy consumption of the national street lighting portfolio by about 95,000 MWhr/yr (and take total savings to about 68% compared to 2016 levels). This is based on relatively conservative assumption of average additional energy savings from smart controls of 20%. In practice, many international deployments are achieving 30% energy savings through a combination of dimming, trimming and enabling constant light output controls (see response to Question 16 for an explanation of these different terms in the context of street lighting). Those installations employing presence/traffic sensing devices are achieving even larger energy savings.

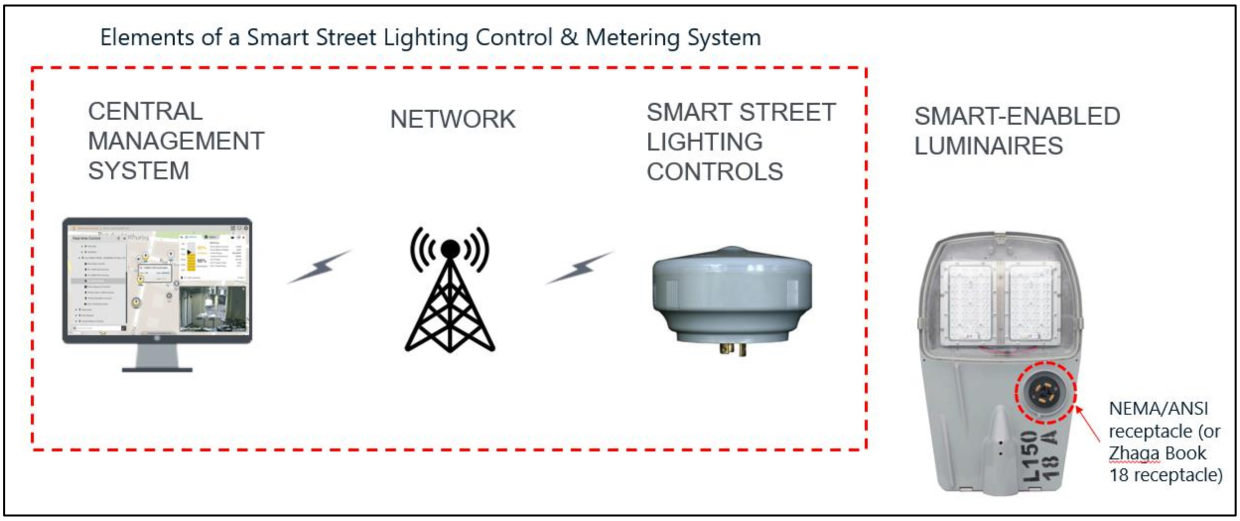
FIGURE 1: KEY STREET LIGHTING FACTS & FIGURES

	2016 IPWEA SLSC Roadmap Figures[1]	2023 Estimated Figures[2]	Estimated Figures with Full LED Conversion	Estimated Figures with Full LED & Smart Controls Conversion
# Lights	2,317,000 (150,000 LEDs)	2,500,000 (1,430,000 LEDs)	2,500,000 (1,070,000 additional LEDs)	
Total Estimated Street Lighting Energy Use	1,181,000 MWh/yr	825,000 MWh/yr	475,000 MWh/yr	380,000 MWh/yr (e.g. 95,000 MWhr/yr of additional savings with full smart controls deployment)
Total Estimated Emissions	1,251,000 tCO2-e/yr	875,000 tCO2-e/yr	505,000 tCO2-e/yr	405,000 tCO2-e/yr (e.g., 100,000 tCO2-e/yr of additional savings with full smart controls deployment)

About smart street lighting controls

Smart street lighting controls refer to a system consisting of three elements: 1) smart street lighting controls on street lights; 2) a communications network; and, 3) software (usually referred to as a central management system). Together these three components allow for monitoring, management and control of street lighting and other forms of public lighting.

FIGURE 2: ELEMENTS OF A SMART STREET LIGHTING CONTROL & METERING SYSTEM



[1] SLSC Roadmap - SLSC
[2] Estimate developed by the IPWEA SLSC Program with the assistance of major lighting suppliers in early 2023

In slightly more detail, the three key elements of a smart lighting control system are as follows:

1. **Smart Street Lighting Controls**
   Smart street lighting control devices generally attach to luminaires via standardised 7-PIN NEMA/ANSI C136.41 receptacles (or more recently, via the alternative Zhaga Book 18 receptacles). The control devices have embedded metering capabilities which are able to measure a range of electrical parameters (e.g., voltage, wattage, current, power factor). Note also that in some systems, the metering capability can be embedded in the luminaire power supply instead of the control device.
   Beyond metering capabilities, the control device can also generate alerts, send dimming/brightening and switching signals to the luminaire power supply, read embedded asset data from the power supply and operate the light autonomously like a traditional photocell if communications fail for any reason. These devices have an integrated wireless communication module to communicate with a central management system.

2. **Communications Network(s)**
   Communication networks are used by the smart street lighting controls to send and receive data. There are a number of different RF communications approaches used by leading global suppliers of smart street lighting controls (e.g., LTE, CAT-M1, NB-IoT, LoRaWAN, WiSUN, 6LowPAN and proprietary ultra-narrowband star networks). The communication network can be comprised of an array of smart street lighting control devices that communicate with a local access point using one of the non-cellular communications technologies listed above. The access point will then typically have a cellular backhaul capability. Alternatively, the controllers can each have an integrated cellular module to communicate directly via a cellular network (e.g., using LTE, CAT-M1 or NB-IoT).

3. **Central Management System Software**
   Central management system (CMS) software, which is often cloud-hosted, provides the user interface to send commands, visualise and export data and to run reports and analytics for asset monitoring activities. Most leading CMS solutions are interoperable and support interfacing capability to enable integration with 3rd party applications (e.g., to export data feeds from the CMS to a metering data services provider, the Distribution Network Service Provider (DNSP), the maintenance provider and the customer).

In the continuing transition of street lights to being digital devices, a further energy-related element to consider is the progressive merging of smart city sensors with street lights. As per the figure below, some street lights meeting Zhaga Book 18 requirements are able to accommodate a variety of low-cost smart city sensors (e.g., to count traffic, count people, measure climatic parameters, measure noise levels). The energy consumption of such sensors, while generally only 1-3W, is variable. Such luminaires are already being deployed in Australia by both DNSPs and councils.

FIGURE 3: LUMINAIRE WITH SMART CONTROLS ON TOP AND SENSORS BELOW

Global Status of Smart Street Lighting Controls as Compared to Australia

By the end of 2023, more than 30 million street lights are expected to be controlled by smart street lighting controls[3] around the world. As such, smart street lighting controls are easily one of the most globally successful smart city use cases.

Of note internationally are the following developments:

- Backed by NZTA funding, already committed projects in New Zealand to upgrade legacy street lighting to LEDs with smart controls will result in smart controls being used on about 75% of the nation's street lights.
- The UK is approaching 40% of its 6 million street lights having smart controls (including very large deployments in major cities such as London (56,000), Birmingham (95,000), Manchester (56,000) and Edinburgh (54,000).
- Major US cities such as Los Angeles (154,000), Chicago (270,000) and Detroit (65,000) have deployed smart controls across their lighting networks, as have major US utilities such as Georgia Power (400,000+), Florida Power & Light (500,000) and Oklahoma Gas & Electric (250,000).

[3] https://www.berginsight.com/the-installed-base-of-smart-street-lights-approaches-20-million-units-worldwide

- Other major world cities such as Madrid (225,000), Milan (142,000), Montreal (135,000), Buenos Aires (91,000), Abu Dhabi (370,000), SEAS Denmark (98,000) Jakarta (160,000) and Singapore (110,000) have undertaken large scale LED deployments with smart controls.
- India's Street Light National Program (operating under a government managed ESCO) has deployed about 11.4m LEDs with a sizeable proportion of recent installations having smart controls.
- Belgian power utility, Fluvius, is in the midst of upgrading 1.2 milliion smart and connected LED street lights for completion by 2028.

Many leading global suppliers of these systems are active in Australia and have experience of deploying several hundred thousand and up to several million smart controls.

In contrast and as noted above, as few as 4-5% of Australian street lights have been deployed with smart street lighting controls and most of those are on customer-owned lighting portfolios.

QUESTION 14: METERING REQUIREMENTS FOR SECONDARY SETTLEMENT POINTS

• Are current NEM metering installation requirements likely to limit the uptake of secondary settlement points and the associated benefits?

Without reform, the current NEM metering installation requirements are highly likely to continue to limit the uptake of smart street lighting controls capable of providing metering data. It is our view that traditional Type 4 meters are not a reasonable substitute for smart street lighting control systems (e.g., due to cost, physical size and lack of relevant street lighting functionality).

The electricity consumption of most of the 2.5 million street lights in Australia is currently unmetered and billed for based on a calculated methodology. In the NEM this is referred to as Type 7 metering. Under the Type 7 metering approach, the electricity consumption of street lighting is billed on a deemed basis determined by entries in a National Electricity Market Load Table for Unmetered Connection Points maintained by AEMO. Entries in the unmetered load table are based on independent lab tests of each model of luminaire or other type of device.

The Type 7 metering approach inherently assumes that street lighting loads are constant, remain as first measured in lab tests and that lights turn on at full power at sunset and turn off at sunrise. Some of the inherent inaccuracies in the current Type 7 metering approach are that:

- actual luminaire energy consumption can change over its lifetime;
- luminaires and photocells experience faults at typically 5- 15% per year that can leave them either off or on 24 hours a day until repaired;
- photocell switching times drift as dirt accumulates on their optical windows; and
- street lighting inventories may not always have a high level of accuracy.

From the perspective of the objectives of the National Electricity Market there is therefore a strong case to be made that a Minor Energy Flow Metering could:

1. **Materially improve the accuracy of street lighting electricity metering and billing**. Indeed, when speaking to councils, road authorities and utilities at a Sydney IPWEA SLSC conference in 2019, major US utility Georgia Power reported dramatic improvements in street lighting inventory accuracy and billing with their 400,000+ LED and smart controls deployment. Georgia Power stated that their previous inventory inaccuracy level of about 11% dropped to well under 1% with the deployment; and
2. **Materially improve the flexibility for customers by being able to accommodate variable loads in street lighting** (e.g., that would enable dimming/brightening, trimming, constant light output controls and the addition of smart city sensors to lights) and **thereby encourage customers to achieve further energy savings** using these capabilities by rewarding them on their bills.

As noted in detail in the response to Question 16, the business case for smart street lighting controls is substantially influenced by the energy savings that smart street lighting controls can deliver but securing these savings is contingent on having a regulatory approach that is able to readily recognise the variable electricity consumption data that they produce. The current absence of such a system in the NEM has hampered adoption of smart street lighting controls thus far in comparison to many international peers. This is evidenced by Australia's comparatively very low adoption rate of such systems compared to jurisdictions where such reforms have been made (see section entitled, 'Global Status of Smart Street Lighting Controls as Compared to Australia' above).

• If changes are needed, what of the following minimum requirements need to be set in the NER for market participation and settlement at secondary settlement points?

• A physical display at the metering point

AEMO's proposal to recognise remote display of metering data is strongly supported. Indeed, there would be no clear benefit from requiring a physical display on the smart street lighting control itself as these devices are typically 5m-25m in the air making reading of any display impractical.

For many other types of street furniture, the same reasoning applies (e.g., when cameras or ITS equipment are attached to poles and other road side infrastructure at elevation).

In preference, the metering installation should be recognised in its entirety as being the elements shown in Figure 2 above (e.g., the smart street lighting control device, the communication network and the CMS (and whatever displays are used to access the CMS)).

For reference, a typical CMS is capable of the following functionality:

- All control devices can be individually mapped in a database and from there to the CMS with a unique identifier creating a verifiable link between each device and the data in the CMS;
- Display current, historical and aggregated metering data (e.g., by associated NMI) in a manner that is easier for stakeholders to understand (and far exceeds the capabilities of traditional meters with physical displays);
- Secure storage, access control capabilities (e.g, using multi-factor authentication) and user-specific admin rights; and
- Many street lighting CMS can and do already handle other types of street furniture and could therefore readily use the same approach to provide metering data about these devices.

• Minimum service specifications

Some aspects of the minimum service specifications do not appear relevant to Minor Energy Flow Metering and requirements may need to be modified accordingly. Some examples follow:

- We support AEMO's proposal to not require remote disconnection, reconnection, on-demand meter reading, scheduled meter reading and meter installation inquiry services from Minor Energy Flow Meters. However, the use of CMS to perform these functions should not be excluded. We note that, based on discussions with suppliers, data streams from individual smart street lighting controls can be easily activated or deactivated when they are exported from CMS APIs (e.g., into MSATS or similar systems). It also appears possible to decommission devices in a typical CMS and remove the data streams at the front end, as well as recommission devices to re-enable data streams. Such systems also allow for the execution of on-demand meter data reads remotely at any time and are able tolock certain data fields with values in a CMS without the ability for users to change the information (e.g., the unique identifiers for metering devices and installation and testing information provided by metering providers).
- We are unclear how current requirements to physically test or inspect meters would apply to smart street lighting controls *in situ* but note that any such requirements should be carefully considered and likely rejected. Firstly, it is highly unclear what additional information could be gleaned from a physical inspection of a sealed device without a display or secondary access ports that cannot already be ascertained via the CMS. Secondly, the high cost of a single truck movement and traffic control to access a device that is 5m-25m in the air would be very costly and likely negate the full NPV benefits of the LED and smart controls installation.
- Also of relevance in this context is that CMS can provide the capability to enter and associate a variety of additional information of interest for a metering device in the database (e.g., the date of installation and commissioning; result of installation test procedures; site IDs and switchboard IDs (if applicable); asset details; associated NMI details; and, any other information deemed relevant and useful by the involved parties and the customer).

• **Remote communications**

- We agree with AEMO that remote communications are necessary for smart street lighting controls (and Minor Energy Flow Metering generally) and that manual meter reading is not feasible or practical.

  In situations where remote communications are not possible (e.g., due to a lack of a reliable communication network, due to the use of historic luminaires or decorative luminaires that cannot easily accommodate smart controls or where customers decline to adopt smart controls (or other forms of Minor Energy Flow Metering)), the currently applied unmetered Type 7 deemed metering approach should be maintained for the unmetered loads without the need for change.

• **Accuracy and data requirements**

- **Accuracy** - The National Electricity Rules Chapter 7 S7.4.3 Table S7.4.3.1 of Overall Accuracy Requirements for Metering Installation Components states that the, "Maximum allowable overall error (+/-%) at full (active) load" for Type 4 metering is 1.5% and as per Table S7.4.3.5 the maximum allowable overall error at 10% rated load is 2.5%. Applying these accuracy requirements to Minor Energy Flow Metering does not seem unreasonable and is an accuracy level already met by most suppliers.

- **Individual NMIs For Each Street Light** – At present most street lighting accounts for councils and road authorities fall under a single NMI or small handful of NMIs. These may encompass several tens of thousands of lights for a larger council. We do not support the assignment of new NMIs for each street light as there would be no clear benefit and significant additional administrative and billing complexity in assigning an individual NMI to each street light under a Minor Energy Flow Metering regime. Alternatives should be considered (e.g., such as recognising the unique identifier of the device as a reasonable substitute for a NMI rather than creating additional identifiers).

- **5 Minute Metering** – We do not support this proposal if it implies collecting unique (and largely identical) readings every five minutes from a low-power device as this would have very low value and may have significant cost implications (e.g., in terms of storage on the device, transmission volumes, storage in the CMS and processing). At a minimum, interpolation of readings between time-stamped readings should be allowed for systems that have threshold monitoring for any changes in power consumption beyond the previous reading.

  We also don't see a need for 5 min interval data to support subtractive settlement in street lighting specifically (and potentially for other street furniture applications) because there is no primary and secondary metering settlement point in the sense these phrases are used in the AEMO proposal and AEMC Discussion Paper. That is, the primary settlement point for the purpose of street lighting is not a single physical meter but a virtual NMI aggregating energy data for a group of the customer's associated luminaires, sometimes for thousands at the same time using a deemed approach. A secondary metering settlement point would not appear to have a relevant meaning in this context.

• **Are there any other service or technical requirements that need to be specified for metering installations at secondary settlement points in the NER?**

- As noted in the Summary, careful consideration should be given to as to what aspects of the current NEM Type 4 metering approach are either not relevant, unnecessary or could inadvertently impose unreasonable, complex and costly requirements on a Minor Energy Flow Metering approach that would discourage widespread adoption. Put simply, if it costs even a few dollars a year to meter a street light using $15-$150 of electricity a year, there will be little take-up and a significant lost opportunity to materially improve metering of these currently unmetered devices and help deliver a wide array of other broader benefits that smart street lighting controls offer.

- As a cautionary example, our understanding based on feedback received from major suppliers of smart street lighting controls systems is that the European Measuring Instruments Directive does allow smart street lighting controls systems to seek accreditation. However, in practice, application of the Directive to such systems has been viewed as onerous and NOT widely taken up thus far. Industry meetings are understood to be continuing but key suppliers have paused submitting their systems for approval based on their understanding of how the requirements would be applied. Concerns have been expressed about such matters as requirements that would necessitate changes to manufacturing systems, verification requirements applying to 100% of all production (as opposed to a sampling approach) and physical removal and testing requirements in the field.

• Should changes be made to the accreditation and registration of metering providers and metering data providers for secondary settlement points?

- We agree with AEMO that a new category should be created in the Rules to develop bespoke requirements for Minor Energy Flow Metering. It is reasonable to expect that different requirements, processes and procedures should apply to specialist areas such as street lighting smart controls systems and street furniture.
- We also agree that DNSPs should be able to act as metering coordinator, metering provider and metering data provider for Minor Energy Flow Meters where they own and maintain street lighting assets. Processes and systems that a DNSP develops and implements to manage metering for their own assets could also be used to offer these services to other customers.

QUESTION 15: MINOR ENERGY FLOW METERS FOR USE AT SECONDARY SETTLEMENT POINTS

• Should the requirements that apply to type 4 metering installations be amended to create a new minor energy flow metering installation, or are there more flexible regulatory approaches to enable market settlement for secondary settlement points?

As noted in the response to Question 14, Type 4 may be workable with modifications that set aside the unrequired or unwarranted or non-relevant aspects of the regime, giving due consideration to the nature of the small loads being measured in Minor Energy Flow Metering and difficult to access location of devices such as street lights.

Modifying the metering regime would be consistent with the precedent set in other international markets. Of note are the following international precedents:

FIGURE 4: RELEVANT INTERNATIONAL PRECEDENT

JURISDICTION	RELEVENT PRECEDENT

United Kingdom	○ The UK Elexon system (described in BSCP520 Unmetered Supplies Registered in SMRS - Elexon Digital BSC), is effectively a meter-equivalent regime that is a hybrid part way between the use of unmetered load tables and a full smart metering regime. It was one of the first approaches to recognise the data from street lighting CMS and is now in its third iteration. It has been widely taken up with up to 40% of the UK's street lights now using smart street lighting controls.
	○ While the Elexon system was developed some years ago (e.g., before the full level of current capabilities of smart street lighting controls had emerged), it does suggest one possible useful enhancement. Elexon relies on continuing use of unmetered load tables to establish assumptions about full load energy usage. Such an approach may no longer be technically needed in most circumstances but, being able to default to a reference unmetered load table entry, may be useful for circumstances where:
	  ○ Communications is lost with the CMS for a sustained period;
	  ○ There are historic luminaires or decorative luminaires amongst a lighting portfolio that cannot easily accommodate smart controls; and/or
	  ○ where customers decline a Minor Energy Flow Metering regime.
	Continuing use of the unmetered load tables as a backstop allows the regime to confidently substitute deemed consumption data if the smart street lighting controls system does not perform as expected for any reason and also accommodates a mixed

	portfolio of lighting (which will inevitably continue for some years for all customers). ○ UK metering data aggregator, Power Data Associates, plays a pivotal role in administering smart street lighting accounts and has expressed a willingness to provide briefings and respond to questions from the AEMC and AEMO about the UK approach. Introductions can be facilitated as required.
New Zealand	○ The New Zealand Commerce Commission implemented a rule change in 2021 recognising the 'CMS-monitored Street Lighting' as profile class reference HHS. ○ Our understanding is that the NZ approach uses a 'golden meter' as a reference point to validate the performance of a street lighting smart controls system and then applies any needed correction factor to the data. As per the UK system, this simple approach appears to be treating the CMS data as effectively a proxy for metering data. ○ Already committed projects in New Zealand to upgrade legacy street lighting to LEDs with smart controls will result in smart controls being used on about 75% of the nation's street lights.
United States	○ Regulatory regimes for metering in the United States are largely state-based but generally based on ANSI C12.1/20. ○ The pioneer in establishing a regime recognising the metering capabilities of smart street lighting controls was the state of Georgia. Working with Georgia Power, a number of systems have been accredited and deployed across the state. ○ Our understand is that PECO in Pennsylvania, Eversource (NStar) in Massachusetts, San Diego Gas & Electric and National Grid in New England are all understood to have systems subsequently approved by their regulator and implemented. ○ In 2021, the US adopted two new standards recognising the metering-related capabilities of smart street lighting controls and setting performance-related requirements. Suppliers also noted the very recently adopted ANSI C136.50 and ANSI C136.52. ○ Georgia Power's principal street lighting engineer is also the chairperson of the ANSI standards committee that developed C136.50 and C136.52. He has been particularly helpful in the past in providing explanations and advice about the US approach. Introductions for AEMO and the AEMC can be facilitated as required.
Europe	○ As a cautionary example, our understanding based on feedback received from major suppliers of smart street lighting controls systems is that the European Measuring Instruments Directive does allow smart street lighting controls systems to seek

	accreditation. However, in practice, application of the Directive to such systems has been viewed as onerous and NOT widely taken up thus far. ○ Industry meetings are understood to be continuing but key suppliers have paused submitting their systems for approval based on their understanding of how the requirements would be applied. ○ Concerns have been expressed about such matters as requirements that would necessitate changes to manufacturing systems, verification requirements applying to 100% of all production (as opposed to a sampling approach) and physical removal and testing requirements in the field.

• Are there other changes to requirements for type 4 metering installations that should also be considered for a minor energy flow metering installation?

Based on domestic and international experience, it is highly unlikely that smart street lighting controls would be deployed on legacy street lighting types so, in terms of energy consumption, LEDs are the relevant benchmark. The average residential road LED street light now uses 13-20W (and residential roads make up 70% of the national portfolio) and the average main road LED street light uses 80-150W (with a very small percentage using higher Wattages). Given this low consumption per lighting point, it is therefore vital that the cost of adopting and complying with any Minor Energy Flow Metering approach is very low on a per lighting point basis if adoption is to be encouraged. Put simply, if it costs even a few dollars a year to meter a street light using \$15-\$150 of electricity a year, there will be little take-up and a significant lost opportunity to materially improve metering of these currently unmetered devices and help deliver a wide array of other broader benefits that smart street lighting controls offer.

On this basis, further consideration should be given as to what aspects of the current NEM Type 4 metering approach are either not relevant, unnecessary or could inadvertently impose unreasonable, complex and costly requirements on a Minor Energy Flow Metering approach that would discourage widespread adoption.

Areas already identified by AEMO for consideration and by others in the preparation of this submission and noted above in response to Question 14 are as follows:

1. There being no need nor benefit of a physical display at the metering point
2. Caution needed in setting any requirements to physically test smart street lighting controls *in situ*
3. The additional complementary information that a CMS can hold should be both accommodated and encouraged
4. There should be recognition of the remote communications as a key element of a smart street lighting controls system

5. There should be no requirement for individual NMIs related to each street light (or recognition of a reasonable already existing proxy)
6. There should be no requirement for 5-minute metering (unless interpolation is allowed)

• What different obligations will need to be placed on metering providers and metering data providers for minor energy flow metering installations? Should these obligations be set out via AEMO's proposed approach of new categories in the NER?

- As noted in the response to Question 14, we agree with AEMO that a new category should be created in the Rules to develop bespoke requirements for Minor Energy Flow Metering. It is reasonable to expect that different requirements, processes and procedures should apply to specialist areas such as street lighting smart controls systems and street lighting furniture.
- We also agree that DNSPs should be able to act as metering coordinator, metering provider and metering data provider for Minor Energy Flow Meters where they own and maintain street lighting assets. Processes and systems that a DNSP develops and implements to manage metering for their own assets could also be used to offer these services to other customers.

• What would be an appropriate inspection and testing regime for minor energy flow metering installations?

- As noted in the response to Question 14, we are unclear how current requirements to physically test or inspect meters would apply to smart street lighting controls *in situ* but note that any such requirements should be carefully considered and likely rejected. Firstly, it is highly unclear what additional information could be gleaned from a physical inspection of a sealed device without a display or secondary access ports that cannot already be ascertained via the CMS. Secondly, the high cost of a single truck movement and traffic control to access a device that is 5m-25m in the air would be very costly and likely negate the full NPV benefits of the LED and smart controls installation.

QUESTION 16: MINOR ENERGY FLOW METERS FOR STREET FURNITURE

• Should minor energy flow meters be able to be used for street furniture?

Minor Energy Flow Metering Approach Could Improve Accuracy & Flexibility Compared to Current Type 7 Metering of Street Lighting in the NEM

As noted above in the response to Question 14, the electricity consumption of most of the 2.5 million street lights in Australia is currently unmetered and billed for based on a calculated methodology. In the NEM this is referred to as Type 7 metering. Under the Type 7 metering approach, the electricity consumption of street lighting is billed on a deemed basis determined by entries in a National Electricity Market Load Table for Unmetered Connection Points maintained by AEMO. To re-iterate, from the perspective of the objectives of the National Electricity Market there is a strong case to be made that a Minor Energy Flow Metering could:

1. **Materially improve the accuracy of street lighting electricity metering and billing**; and
2. **Materially improve the flexibility for customers by being able to accommodate variable loads in street lighting** (e.g., that would enable dimming/brightening, trimming, constant light output controls and the addition of smart city sensors to lights) and **thereby encourage customers to achieve further energy savings** using these capabilities by rewarding them on their bills.

As a result of introducing the ability to readily dim, trim, enable CLO and add smart city devices, a Minor Energy Flow Metering framework would substantially increase the financial viability for customers to invest into smart street lighting controls and metering systems, thereby increasing the rate of adoption for these types of systems and unlocking other non-energy related benefits (see below for a more detailed discussion of energy and non-energy related benefits).

A Minor Energy Flow Metering Approach Would Materially Improve the Business Case for Smart Street Lighting Controls and Thereby Deliver a Wide Range of Benefits

From the perspective of the customer and operator of the lights, there are a broad array of benefits from smart street lighting controls that are particularly hard to realise if the energy-related benefits (summarised in the table below in items 19-23) are not readily obtainable through a reform such as the one proposed.

Note that the table below attempts to quantify the benefits for a 100W LED street light (which was chosen as roughly the average energy consumption of a main road LED currently being deployed). The energy-related savings benefits will increase/decrease in proportion to the difference in the rated wattage of a street light.

FIGURE 5 – BENEFITS OF SMART STREET LIGHTING CONTROLS

BENEFIT	DESCRIPTION	ESTIMATED NPV/LIGHT (100W EXAMPLE)
1. **Improved Road Safety / Safer Communities**	Detecting faults within hours rather than the low frequency of current night patrols (typically at 2-4 times per year) materially reduces the accident risk on sections of main roads with outages and improves public safety. AS/NZS 1158 recognises that good street lighting can reduce the risk of accidents on main roads by about 30% and, more broadly, improved street lighting is recognised as having amongst the best benefit cost ratios of all road safety measures (see SLSC Roadmap Section 3). How shorter duration outages specifically translate into reduced risks and societal cost savings is unclear but likely that road authorities would view this as an important broader societal benefit.	Unclear but material
2. **Higher Service Levels**	Smart controls offer a generalised benefit of higher service levels (eg through a range of capabilities such as detecting faults within hours, being able to finely set lighting levels in response to community need, more accurate billing and being able to provide much greater information to all stakeholders.	Unclear
3. **Installation Time Savings**	Eliminating most paperwork through automatic downloading of asset data embedded in luminaires, GIS location, energisation date etc has been cited overseas as saving up to 10-15 minutes on site when doing mass installations.	\$25-\$50
4. **Offset Traditional Photocell Cost**	No photocell needed (and currently embedded in street lighting capital costs)	\$10-\$15
5. **Lower Failure Rates than Photocells**	Traditional photocells have an appreciable failure rate while stated failure rates of smart controls are lower (e.g, 0.5% per year as compared to PE failure rates of 2-3% per year) but this is yet to be demonstrated in Australia.	\$0-\$15

6. Offset Night Patrol Costs	Night patrols are required under AS/NZS 1158 to keep outage rates down on main roads where there are no natural reporting parties. These typically involve late night survey crews driving each road 2-4 times per year. This is a benefit to the operator and the road authority.	$20-$40
7. Longer Luminaire Life	Any amount of dimming, trimming and enabling of constant light output controls results in the LED power supply (the key point of failure risk) being run at a lower level and hence, lower internal temperature. This lengthens life which is a benefit to the operator and the road authority. Modelled as up to one year of additional luminaire life.	$0-$30
8. Ability to Support Smart City Functionality	Luminaires wired to the Zhaga Book 18 standard are able to accommodate additional smart city sensors. Additionally, there may be the ability to support other smart city devices on the same comms network (attached to the poles or in other locations).	Unclear
9. Reduced Environmental Impact	In addition to reduced GHG savings, being able to dim or shut-off in off-peak hours may have material local environmental benefits for species affected by artificial lighting at night (now recognised as a pollutant by many parties)	Unclear
10. Automated Fault & Performance Reporting	Currently many fault handling and performance reporting tasks (eg to management and under regulatory reporting requirements) are semi-manual. Modelled as saving ¼ of an administrative staff person's time over a typical large utility portfolio.	$0-$1
11. Automated Day-Burner Detection	Faults that result in lights being on 24 hours a day can cause internal heating of the power supply (key failure risk) and shorten life as well as use excess energy. Not modelled due to lack of information.	Unclear
12. Maintenance Optimisation	Large operators of smart street lighting controls have regularly sited a variety of maintenance optimisation benefits including minimising incorrect location visits, minimising repeat visits and being able to more optimally plan maintenance routing (for example, by knowing	$10-$25

	all faults in a given area rather than having fault reports come in over time). Modelled as up to a 5% savings on typical LED maintenance tariffs.	
13. Asset Management Benefits	Longer term asset management benefits from validated asset/inventory/age/GIS information	Unclear
14. Billing / Inventory Accuracy Improvements	Higher DNSP and customer confidence in inventory accuracy, less DNSP staff time on investigations of billing issues. Modelled as saving ¼ to ½ of an administrative staff person's time over a typical large utility portfolio.	\$1-\$2
15. Insight into Network Performance	Widely cited by overseas DNSPs as providing low-cost insights into electrical performance of the network to the level of about every 5th-10th customer. The metering devices provide data for multiple power quality parameters that DNSP can use for this purpose (e.g., line voltage and frequency). Many devices also have the capability to send last gasp messages for power outages in real time.	\$0-\$50
16. Reduced Call Handling from Fault Reports	Negate most DNSP call handling of faults (and repeat call handling) because of automated detection and ability to respond quickly and correctly. Modelled based on typical call handling costs in DNSP submissions to AER and that up to 5% of lights are reported as faulty each year via a call or repeat call.	\$2-\$4
17. Greater Certainty in Litigation	Ability to quickly document proof of lighting status with high degree of confidence.	Unclear
18. GIS location	Ability to locate asset with high degree of confidence. Benefits partly accounted for in billing, inventory and maintenance assumptions above so not separately modelled but likely to have other benefits.	Unclear
19. Dimming	Using smart street lighting controls to permanently dim or shut-off lighting in the off-peak hours is common practice in other jurisdictions (for example, some 70 UK councils and county councils do this). For modelling purposes, a common regime of dimming by 50% for 50% of the night hours has been used.	\$75-\$150

20. Trimming	Trimming refers to both optimising on and off times and to permanently trimming excess lighting above compliance requirements (e.g., because historic lighting types lumpy being available in high pressure sodium, for example, at only 150W, 250W and 400W). This results in overdesign that can be trimmed. For modelling purposes, an average 5% energy savings is assumed.	$15-$30
21. Constant Light Output Controls	Constant Light Output Controls refers to enabling a setting that holds lighting output constant at compliance levels throughout life by gradually ramping up power to compensate for lumen depreciation over time. Traditional lighting design included overdesign of 30% to allow for deterioration of lamp output. For modelling purposes, an average 4% energy savings is assumed.	$12-25
22. Smart City Device Energy Metering	Ability to properly measure energy consumption by smart city sensors added to street lights (e.g. traffic counters, environmental sensors, noise-level sensors) without having to have separate supply, metering or billing arrangements.	Unclear
23. Ability to Claim Environmental Credits	Ability to provide evidence of energy savings where environmental credit schemes recognise smart lighting controls.	$0-$5
	TOTAL ESTIMATED NPV (10-year NPV of 100W LED with dimming, trimming and CLO)	**$170 - $442** (+ many several yet to be quantified benefits)

Key conclusions from the above table are that:

1. The business case for smart street lighting controls is multi-faceted with benefits flowing to a number of parties in the case of DNSP-owned street lighting.
2. While the business case is complex with some benefits that are hard to quantify financially, even the most readily quantifiable benefits suggest an NPV of **$170-$442** that would be at or exceed the cost of procurement and operation of a smart control (even without several harder to quantify benefits being accounted for). Strong international precedent for large-scale deployment suggests that many other parties have reached similar conclusions.

3. However, the energy-related components of the business case make up a very significant fraction of the most easily realisable savings (some 45-60% in the scenario presented above). Without a Minor Energy Flow Metering regime, it seems challenging to capture the broader benefits.

The Inclusion of 'Other' Types of Street Furniture

While street lighting certainly appears to be the largest opportunity to apply a new Minor Energy Flow Metering regime in the public domain, there are a significant number of other outdoor installations consuming relatively small amounts of power that are often unmetered at present (e.g., as Type 7 loads or on Permanently Unmetered Supply arrangements). These include:

- Bus shelters
- Cameras (and increasingly other types of smart city devices)
- Traffic signals and illuminated signage
- Public barbecues
- Various telecommunications devices

In many cases, the cost of installing a traditional metering box in the public domain and the associated additional cabling/conduit can exceed the net present value of the energy consumption over the life of these types of low-energy devices. There would therefore be strong support for an alternative approach that could cost-effectively include such devices under a new Minor Energy Flow Metering regime.

• If so, should DNSPs be allowed to act as metering coordinator, metering provider, and metering data provider for street furniture under certain circumstances?

For the street lighting that is owned and managed by the DNSPs, it makes intuitive sense for the DNSPs to also play the roles of metering coordinator, metering provider and metering data provider. The DNSPs own the street lights (and manage the lighting inventory) and would typically own the smart controls, either own or have contracted for the communications network and have a software contract for the central management system. There would be little benefit in involving more parties and potentially, lots of additional complexity and costs in splitting ownership and contractual arrangements surrounding the smart street lighting controls amongst a number of parties.

Importantly, unlike traditional metering devices, smart street lighting controls are multi-faceted systems with their metering capability being just one of many capabilities that they deliver. Again, it would make little sense for a metering coordinator, meter provider or meter data provider to have oversight, management of or responsibility for these other aspects of the system.

Any regime of DNSP-managed metering should ensure that street lighting customers (who are paying for the capital and on-going costs of smart street lighting controls) have unrestricted access to raw metering data at no cost to ensure optimal outcomes from the smart street lighting controls.

With regards to ‘other’ types of street furniture, much of this has similar characteristics to street lighting and it may make good sense for DNSPs to also be able to play the roles of metering coordinator, meter provider and meter data provider for such currently unmetered devices on their network. This is potentially a cost-effective solution for the customers of these devices because the DNSP may be able to use the same or similar processes it has developed for its own street lighting assets and hence, offer cost-effective metering coordinator, metering provider and metering data provider services to customers.

Beyond DNSP-owned lighting, the regime should allow other parties to also act as metering coordinator, meter provider and meter data provider particularly where the public lighting is unmetered and not owned by the DNSP (e.g., for the lighting directly owned and managed by main road authorities and by councils such as capital cities and Northern Territory Councils who own and manage their own lighting).

• Would any other changes to the rules be required in relation to metering for street furniture?

- **DNSP Metering Data Access**
  Our understanding is that changes may be needed to allow DNSPs to access the electrical information that smart street lighting controls are producing. The grid monitoring capability (e.g., through power quality data the metering devices generate and the capability to send real time power outage alerts) has been widely cited by DNSPs in other jurisdictions as having benefit and should be allowed. Customers would generally have no objection to this data being available to DNSPs (and other market stakeholders) provided that the network benefits are properly reflected in lower capital and operating tariffs.

- **Metering Rules Changes**
  Areas already identified by AEMO for consideration and by others in the preparation of this submission are noted above in response to Question 14.