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## **Submission on Consultation Paper - Proposed changes to participant audit regime**

### **Submitter – Strategic Lighting Partners Ltd (SLP)**

1. Strategic Lighting Partners Ltd (SLP) is a management consultancy that focuses on lighting and its use as a strategic tool for the benefit of society.
2. For questions and clarification relating to this submission please contact:  
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### **Background of Submitter - Strategic Lighting Partners Ltd (SLP)**

3. SLP principals are Godfrey Bridger, with Masters degrees in Engineering and Business Administration, Bryan King with qualifications in mechanical engineering and a Masters in Business Administration and Crystal Beavis who has a Masters degree in Political Science and a Post Graduate Diploma in Management.
4. Godfrey and Crystal have governance experience on Boards with turnovers or assets in excess of NZ\$1 billion and all three principals have deep experience in owning, governing and managing small organisations and managing their relationships with stakeholders. Bryan King has owned a prominent lighting firm for several decades and has been a member of many standards committees for lighting for several decades. A summary of their experience can be [seen online](#)<sup>1</sup>.
5. SLP principals' experience cover a number of areas relevant to electricity distribution businesses including corporatisation and mergers of NZ's second and fourth largest Power Boards, board membership of NZ's largest electricity distribution company, leadership (as CEO) of the Energy Efficiency & Conservation Authority (EECA), business development for Counties Power and innovation/commercialisation leadership, and adviser to several local, and national government agencies in relation to road lighting.
6. In the road lighting sector, SLP have been active for several years as consultants to local government and state and federal governments in New Zealand and Australia

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<sup>1</sup> [www.strategiclightingpartners.com](http://www.strategiclightingpartners.com)

and have organised two very successful road lighting conferences in Auckland in 2014 and 2015 where 50% of participants rated the conference at an average of 9/10. These conferences ([seen here](#)<sup>2</sup>) had a high proportion of international presenters – the most recent being 80% of the 30 presenting. SLP also operate a monthly e-newsletter [Public Lighting Today](#)<sup>3</sup> to keep the sector informed with latest developments.

## **Introduction to Submission**

7. The SLP principal responsible for this submission has read all the consultation documents provided by the Electricity Authority. This submission starts with our summary of conclusions and recommendations (paragraphs 8 to 12) which is followed by evidence, justification and discussion for these conclusions. Finally, the questions asked by the consultation document (“Appendix B”) have been answered.

## **CONCLUSIONS AND RECOMMENDATIONS**

8. This submission commends the Electricity Authority for a comprehensive action plan to improve auditing practice in the New Zealand electricity sector.
9. We strongly endorse all the preferred changes recommended by the Electricity Authority in Issue C.7 Distributed Unmetered Load (DUML) especially as it reflects best practice for road lighting in other jurisdictions such as Australia.
10. We submit however that more changes are required in order for the Electricity Authority’s statutory objectives and goals (“to promote competition in, reliable supply by, and the efficient operation of, the electricity industry for the long-term benefit of consumers”<sup>4</sup>) to be met through the auditing process. Regulatory practices have not kept pace with technology and international industry practice in road lighting which is, as the EA suggests, the “most commonly recognised form of DUML”<sup>5</sup>. We submit that road lighting is in fact the largest proportion of all DUML.
11. We submit that the Electricity Authority needs to make further changes to the audit regime because road lighting is undergoing a world-wide “solid state”<sup>6</sup> revolution. This is for several reasons including large improvements in energy efficiency (greater than 50%), large reductions in maintenance costs (greater than 50%), improved lighting quality leading to improved safety and security, introduction of solar PV and electricity storage technologies, and most significantly, the integration of sensors and communications with control systems and metering – for every separate light or luminaire<sup>7</sup>.

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<sup>2</sup> <http://roadlightingconference.com>

<sup>3</sup> <http://www.pltoday.com/>

<sup>4</sup> Authority’s statutory objective in section 15 of the Electricity Industry Act 2010

<sup>5</sup> Section 5.8.1, page 76 of Consultation Paper - Proposed changes to participant audit regime, 10 November 2015.

<sup>6</sup> This term refers to the use of solid state semiconductor electronics and computing replacing legacy “high intensity discharge” (HID) lighting

<sup>7</sup> The industry name for the physical housing with its electronics and lamp. See also Figure 1.

12. These changes are bringing about, and have the potential to make, major economic and social improvements to society, but current electricity regulatory frameworks – beyond the auditing processes - are hindering the introduction of these substantial benefits. However, this submission necessarily restricts its scope to that specified by the Electricity Authority consultation paper on auditing and therefore **recommends**:
- i. That the strategic benefits capable of being delivered by modern road lighting warrants greater targeted consultation with stakeholders - including Local Government and industry - on auditing standards for DUML and specifically road lighting;
  - ii. That the Code be modified to provide auditing standards applicable to the new road lighting control systems currently available on the market that meter electricity use by each luminaire in the range of 15W to 300W. Such a modification should supplement current code standards<sup>8,9</sup> that were drafted for metering loads of orders of magnitude greater than this;
  - iii. That the auditing requirements of the Code be modified to require road lighting distribution assets to be transparently identified in order to justify the distribution charges levied on local government customers. We submit that there is substantial evidence to show there is no rational transparent justification for distribution charges, although this is an Electricity Authority pricing objective;
  - iv. That auditing requirements for DUML and road lighting, in particular, be changed to anticipate the rapid introduction of new solid state lighting technologies and control systems which will result in making the current Electricity Authority preferred changes (endorsed above by SLP in paragraph 8) redundant. Nevertheless the current proposed changes are critically important as they provide an important foundation for the transition to the new technologies.

## **Road Lighting**

13. This submission focuses on the proportion of Distributed Unmetered Load (DUML) which is road lighting because imminent disruptive technological changes in road lighting have the potential to bring about significant economic and social improvement. In any case, SLP understands that the largest proportion of DUML is road lighting.
14. There are five fundamental components of road lighting some of which are illustrated in Figure 1:
- a. the network of cables that provide road lights with electricity, which are usually owned by one of the 28 electricity distribution companies;
  - b. the poles or “columns” that support the lights, which are owned either by the distribution companies if they carry electricity, or by one of the 78 “road

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<sup>8</sup> Part 10 of the Code.

<sup>9</sup> Refer UK OFGEM processes for “Equivalent Metering” for road lighting control and metering systems

controlling authorities” (RCA). SLP understands that the ownership is split approximately evenly between these two categories;

- c. the “luminaires” that provide electrical, electronic and physical support to the old “lamp” technology, which are owned by the RCAs including the 77 local governments excluding regional authorities but including the NZ Transport Agency (NZTA);
- d. the “lamp” (or “bulb”) that converts electrical energy to light (in the case of Light Emitting Diodes (LED) the “lamp” is part of the “luminaire”) and;
- e. the switching systems that control the supply of electricity to the road lighting, most often collectively controlling electricity supply to many lights covering several km distance at a time (although a few councils use individual control with luminaire mounted photocells). The owners of these systems have historically been distribution companies, but - with the introduction of modern solid state systems – the control and ownership of switching systems is likely to change to local government, leaving only protection switchgear in the ownership of the distribution company.



**Figure 1 Street Lighting Terminology (Source: IPWEA Practice Note 11<sup>10</sup>)**

<sup>10</sup> Institute of Public Works Engineers Australasia, Practice Note 11: “Towards More Sustainable Street Lighting”, July 2014, page 12.

### **Road Lighting in New Zealand**

15. The Energy Efficiency and Conservation Authority (EECA) estimates<sup>11</sup> that there are 370,000 road lighting luminaires in New Zealand. About 80% of these are yellow High Pressure Sodium (HPS) a 40 year old technology, 2% solid state LED<sup>11</sup> and the balance of NZ road lights are estimated made up of even older technology (Mercury Vapour).
16. HPS road lighting represented a major advance in energy efficiency when introduced. However, the new highly efficient Light Emitting Diode (LED) lights are, as McKinsey & Co reported in 2011<sup>12</sup>, a *“totally different technology” ... which “is upending the role of the replacement business and transforming the landscape of the lighting industry value chain entirely ...”*.

### **Solid State Road Lighting**

17. The new solid state LED road lights (which according to EECA currently make up only about 2% of NZ road lighting) have the following advantages over widely used High Pressure Sodium (HPS) lamps and luminaires. They:
  - a. last up to four times longer;
  - b. save at least half the energy;
  - c. contain no toxic Mercury (compared to all other road lighting technologies including the more advanced),
  - d. are not sensitive to vibration (again, compared to virtually all other technologies)
  - e. turn on and re-start instantly;
  - f. are ideally suited to “finely customised” computer control,
  - g. due to their semiconductor nature, allow optics that target light only where it is required (ie there is little “light pollution”), and;
  - h. emit white light with high Colour Rendering Index<sup>13</sup> (CRI).
18. Credible international road safety research has shown that driver reaction times and peripheral vision are improved by white lighting over that of HPS yellow lighting.
19. Progress in conversion to solid state lighting has been significantly more rapid in USA, UK and parts of Europe than in NZ. There are significant barriers to change and in the faster moving jurisdictions, Governments have recognised this and have intervened to reduce these barriers.

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<sup>11</sup> <https://www.eecabusiness.govt.nz/technologies/lighting/road-lighting/>

<sup>12</sup> Lighting the Way: Perspectives on the global lighting market, McKinsey & Company, July 2011, Page 18.

<sup>13</sup> Colour Rendition is the ability of a lamp to illuminate objects in a way that their colours appear similar to when illuminated by light sources such as daylight and the incandescent lamp. In general the higher the CRI, the better – ie an incandescent lamp or daylight will have a CRI of 100 whereas High Pressure Sodium has a CRI of approximately 20.

## Control Systems

20. Control systems are now available that allow each solid state LED luminaire to be individually controlled so that lighting levels can be adjusted from off to full output in smooth increments. These systems are relatively new to the market and there are no such systems in use in the 94,000 km of roads in New Zealand other than a very few test sites with less than 100 luminaires, however Auckland Transport is in the early stages of a 44,000 unit deployment. NZTA has declared in its M30 specification that all Council procured luminaires subsidised by NZTA are required to be “controls enabled”, a move that allows for easy retrofit of CMS controls.
21. By contrast, the United Kingdom is probably the world’s most prolific user of such controls systems having started installing them about 15 years ago. Recently published research<sup>14</sup> indicates that Councils in England and Wales have used control systems to provide “part-night lighting on 12,101 km of road... ; dimming on 10,519 km of road... ; and switch off on 946 km of road.”<sup>14</sup>
22. There are more than 20 different types road lighting control systems available on the market and virtually all of them allow the street lighting circuits to be permanently powered so that each luminaire is controlled independently by sophisticated Central Management Systems (CMS) communicating over power-line or radio-frequency. These systems also monitor the electronic characteristics of each luminaire to measure electricity usage and other operating characteristics valuable to road lighting stakeholders.
23. Thus road lighting control systems provide the ability to meter electricity usage for individual road lights which, for solid state LED lighting, corresponds to between 15W and 300W (motorway lights). These small metered loads were never envisaged by the *Electricity Industry Participation Code 2010*.
24. We therefore **recommend** that the auditing requirements of *Electricity Industry Participation Code 2010* be amended for road lighting to recognise these modern metering systems that are embedded within the commercially available road lighting controls. The current Code never anticipated metering of such small loads on the network. It acts as a barrier to Territorial Local Authorities being able to economically apply smart lighting systems that provide accurate measurements (in place of unmetered load estimates) and that will allow for the introduction of incentives to reduce wasteful practices in electricity use .

## Integration of Smart Lighting with “Smart Cities & Towns”

25. As street lighting enters the digital age, so too does a range of other outdoor infrastructure items which can be grouped under a conceptual umbrella frequently called the “Smart City”. Ubiquitous in nature and positioned physically in the public domain, street lighting increasingly appears to be the ideal “physical backbone” for enabling the Smart City in practical ways. There is a strong economic justification for

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<sup>14</sup> R Steinbach, C Perkins, L Tompson, S Johnson, B Armstrong, J Green, C Grundy, P Wilkinson, P Edwards, “The effect of reduced street lighting on road casualties and crime in England and Wales: controlled interrupted time series analysis”, *Journal of Epidemiological Community Health* 2015;0:1–7.

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street lighting renewal, and this provides opportunities for cities, towns and villages to simultaneously deploy a range of Smart City infrastructure approaches. Not only could these technologies improve the data and information available to councils, but also they could provide new sources of revenue.

26. A 'smart' street lighting network that can be remotely controlled and monitored, may become a platform for carrying or enabling a range of other technologies. The following list was specifically requested in the recent EOI put out by The City of Chicago in the USA in September 2015<sup>15</sup> and provides tangible examples of the type of smart controls and communication features that comprise the "Smart City":

- i. wi-fi or other internet services;
- ii. fibre optic network expansion;
- iii. cellular data, cell phone towers, or signal amplifiers;
- iv. Vehicle-to-Infrastructure connections;
- v. Vehicle-to-Vehicle connections;
- vi. Bluetooth/near-field-communications;
- vii. music and/or emergency broadcasting speakers;
- viii. motion or noise sensing;
- ix. cameras – video, photography;
- x. transportation metrics - vehicle/pedestrian/bicycle counting;
- xi. parking space monitoring;
- xii. climate monitoring: temp, snow, ice, rain, flood, humidity, air quality etc;
- xiii. environmental monitoring: methane/natural gas leakage, vibration etc;
- xiv. 'smart' parking management;
- xv. traffic monitoring & management, adaptive to public safety;
- xvi. automatic vehicle location (AVL);
- xvii. navigation systems: open, public, or subscription;
- xviii. Blue Button personal security system;
- xix. device charging stations;
- xx. Electric Vehicle (EV) charging stations.

27. Large manufacturers including General Electric (GE), Philips, and Silver Spring Networks are offering systems that integrate many of the above with their established road lighting systems, and several entrepreneurial operations funded by large organisations like Cisco and others have launched, or are about to launch, new products along the lines above.

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<sup>15</sup> Chicago Smart Lighting Project RFI

28. A final strategic example of why it's important to remove regulatory barriers to innovation is the recent announcement of Los Angeles City's agreement with Philips and Ericsson to install special street lights<sup>16</sup> with inbuilt "small cell" cellphone communications towers to be distributed throughout the city. "They're cheaper to rollout than big cell towers and deliver faster connectivity" says Forbes, who also says that "the small cell market is expected to grow 43% annually through 2020, according to ABI Research"<sup>17</sup>. This development is expected to provide Los Angeles City with an income of about USD\$720,000 per year<sup>18</sup>.
29. Local Governments everywhere are under pressure to provide extra services with less funding. Solid state LED lighting, controls and sensors provide local governments with opportunities to both save money and increase revenue while at the same time increase residents' safety, amenity and quality of life.
30. It is therefore important for the regulatory framework to remove barriers to these desirable benefits wherever possible. We therefore **recommend** that the regulatory framework for road lighting include more focused consultation with Territorial Local Authorities and the road lighting industry.

### **Lack of pricing justification**

31. In 2014 NZTA and EECA commissioned PriceWaterhouseCoopers (PWC) to analyse a SOLGM survey of street lighting in 26 Territorial Local Authorities (TLA) and report back on the impact of LED lighting on Distribution companies and their TLA customers.
32. PWC say in the executive summary of their report<sup>19</sup> that:
33. *"The majority of distribution companies are subject to an overarching regulatory regime that sets maximum average prices based on their costs (in particular, the cost of the asset base). Distributors which are consumer owned are exempt from price-quality regulation. Under such regulation distributors can structure prices in whatever manner they wish to recover an overall level of revenue. While road lighting only provides a small contribution to distribution revenues, if RCAs change lighting technology it is likely to lead a change in pricing methodologies in response (and in a way that would be consistent with the current regulatory regime)."*
34. *"Based upon the current operating environment, we believe that there are likely to be 3 potential responses by distribution companies in response to a significant uptake in LED road lighting and the consequent lower energy consumption:*
  1. *There will be no changes to the pricing structures due to the low proportion of revenues generated by road light lines charges;*

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<sup>16</sup> Called "SmartPoles"

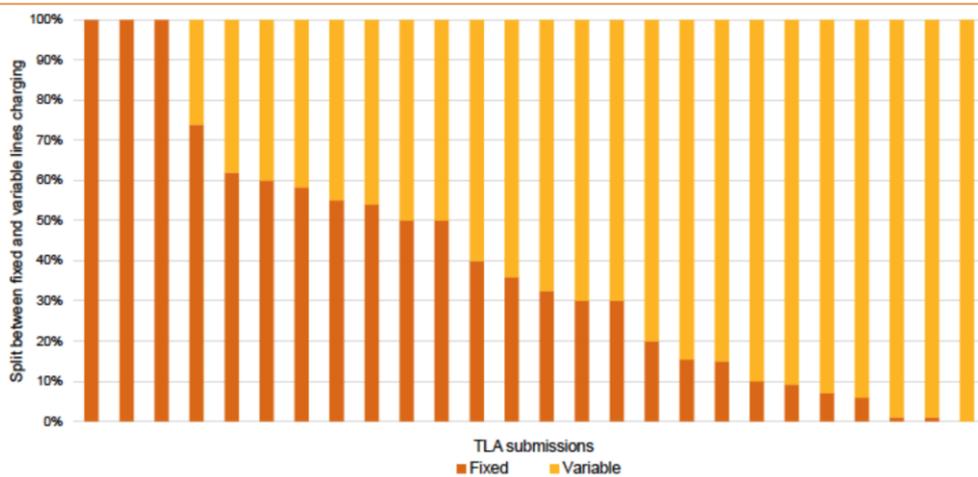
<sup>17</sup> <http://www.forbes.com/sites/aarontilley/2015/11/05/los-angeles-becomes-first-city-to-test-the-future-of-wireless-connectivity-with-small-cells-on-streetlights/>

<sup>18</sup> <http://pltoday.com/city-of-los-angeles-turns-street-lights-into-real-estate/>

<sup>19</sup> PriceWaterHouseCoopers, "Review on the likely impact of an uptake in LED road lighting", 28 October 2014.

2. *Any losses arising from more efficient road lights are passed on to the distributors wider customer base;*
3. *Pricing structures move closer towards becoming fully fixed in order to continue to meet the costs of delivery."*
35. *"We believe that the latter option is the most likely response. Recent moves by some distribution companies (e.g. Vector and WEL Networks) have also been towards an entirely fixed pricing regime. The lines charge would then be unchanged or nearly unchanged and savings would therefore likely result from the reduction in the energy charge alone, consequent on the reduction in energy consumption."*
36. *"We note that regulatory mechanisms are being implemented by the Commerce Commission which potentially compensates distributors for revenue foregone as a result of energy efficiency initiatives. These mechanisms, while not yet tested, may influence the distributors' response to LED uptake."*
37. This ability for distributors to charge on a fully fixed or fully variable (or anything between) charge without transparent justification appears to be in contradiction to the key principle of the regulation of monopolies that charges for services must be transparently set to ensure efficient investment occurs in the public interest.
38. We therefore **recommend** that the audit regime specified in the *Electricity Industry Participation Code 2010* be modified to require distributors to have their road lighting assets audited to clearly identify and justify the charges being levied on their road lighting customers. This extra effort is important as the current uncertain regime highlighted above by PWC is providing a barrier for TLA's who are not skilled in electricity economics and management.
39. When such an auditing regime is established, the wide variation in charging by distributors shown in Figure 2 below (from 0% to 100% fixed) can be expected to converge to a relatively narrow band across all TLAs. Unless or until this audit regime is implemented, distributor line charges will continue to be inefficiently priced, and a likely convergence towards fixed charges – as suggested by PWC – will serve to discourage efficient investment and innovation in road lighting and smart city infrastructure, and may even encourage off-grid solutions that may be sub-optimal from an overall economic efficiency viewpoint.

Figure 8: Fixed vs. variable charge regimes for RCA line costs



Source: 2014 SOLGM Survey

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Figure 2 Fixed vs variable charge regimes for RCA line costs (Source: PWC Report 2014<sup>20</sup>)

Table 3: Major distributor pricing structures<sup>4</sup>

Distributor	Variable Proportion	Fixed Proportion	Market share
Vector	53%	47%	26%
Powerco	Unavailable	Unavailable	16%
Orion	0%	100%	9%
Wellington Electricity	15%	85%	8%
Unison	72%	28%	6%
WEL Networks	0%	100%	4%
Aurora Energy	26%	74%	4%

Table 1 Major distributor pricing structures (Source: PWC Report 2014<sup>20</sup>)

<sup>20</sup> PriceWaterHouseCoopers, “Review on the likely impact of an uptake in LED road lighting”, 28 October 2014.

## Consultation Questions and Answers

Submitter	Strategic Lighting Partners Ltd
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#	Question	Comment
Question 1	Do you agree the opportunities to improve the audit regime identified by the Authority are worthy of attention?	Yes
Question 2	Do you agree that the problems identified with the existing purpose of the audit regime are correct? If not, why not?	Yes
Question 3	Do you agree with the proposed purpose of the audit regime? If not, why not?	Yes
Question 4	Do you agree with the proposed purpose of the audit regime being incorporated into guidelines but not the Code? If not, why not?	Yes
Question 5	Do you agree with the problems identified with the governance arrangements of the audit regime? If not, why not?	Yes
Question 6	Are there any other gaps in auditing best practices not identified here that should be addressed as part of this review?	Yes there are, please refer to submission above
Question 7	Do you agree with the proposed used of tailored Auditor Protocol? If not, why not?	Yes
Question 8	Do you have any feedback on the proposed tailored Auditor Protocol attached as Appendix D?	Only that it is an excellent protocol
Question 9	Do you agree with the proposal for the Authority to set audit scope, focus and materiality levels through risk-based planning? If not, why not?	Yes, and we note that this risk-based approach has not been followed for road lighting as addressed by our submission above
Question 10	Do you agree with the proposed changes to auditor appointment? If not, why not?	Yes.

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#	Question	Comment
Question 11	Do you agree with the proposed Code amendments? If not, why not?	We have not had time to scrutinise the suggested improvements, but we strongly endorse the rationale for the proposed changes
Question 12	Do you agree with the issues identified in this section and that the proposed solutions adequately address the issues?	Yes, we strongly endorse the “Preferred” solutions (not the others)
Question 13	Are there any other solutions that the Authority should be considering in relation to the decision-making process?	Yes, in general they are addressed by the above submission
Question 14	Do you agree there is a need for improving education within the audit regime and has the issue been correctly identified?	Yes, and we endorse the Authority’s proposals.
Question 15	What other improvements do you believe the Authority should consider?	We have suggested some which are identified in the submission above, but there are several more that fall outside of the scope of consultation for the auditing regime, so we have not therefore included them
Question 16	Do you agree with the issues leading to the requirement to automate systems?	Yes
Question 17	Do you agree with the requirement to automate systems? If not, why not?	Yes
Question 18	Apart from the proposed solutions given in the table, are there any other improvements that the Authority should consider?	Yes, a more extensive programme to gather, integrate, automate and report on all aspects of the sector’s compliance. The power of IT systems needs to be more recognised.
Question 19	Do you agree with the issues identified in this section?	Yes
Question 20	Are there other possible solutions that the Authority should consider in regards to the requirements to hold quality certification?	The Authority’s proposal appears to be very complete, we can add nothing.

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#	Question	Comment
Question 21	Do you agree with the proposed solutions to assist new entrants? If not, why not?	Yes
Question 22	Are there other possible solutions that the Authority should consider?	This is not an area of our expertise, so we are unaware of any
Question 23	Do you agree with the issues identified in this section for DUML?	Yes, we strongly endorse the Authority's approach which satisfy a transition to a future which the Authority and the Code has not considered – which we deal with in our submission above
Question 24	Are there other possible solutions that the Authority should consider in regards to DUML audits?	Yes, this is our area of expertise and we deal with this in our submission above
Question 25	Do you agree with the objectives of the proposed amendment? If not, why not?	Yes, but as we submit above, the objectives need to be substantially expanded
Question 26	Can you see any options or implications that have not been considered as part of this consultation paper? If so please elaborate.	Yes, but the consultation scope does not allow us to address them
Question 27	Do you consider that the Authority has captured all the costs of the proposed changes? If not, what other costs to you expect will be incurred due to the proposed changes?	Not for DUML auditing (our area of submission focus). The Authority's estimated costs look too low. However in addition, our submission would increase the costs as well, but dramatically increase the economic benefits available to the economy which elsewhere have indicated conservative benefit cost ratios greater than four.
Question 28	Do you consider that the Authority has captured all the benefits of the proposed amendment? If not, what other benefits do you expect the proposed changes to lead to?	No, as identified in the answer to Q27.
Question 29	Do you agree the benefits of the proposed changes outweigh the costs? If not, why not?	Yes, but with our submission implemented, the benefits will outweigh the costs much more than the Authority has estimated

#	Question	Comment
Question 30	Do you agree the proposed changes are preferable to the other options? If you disagree, please explain your preferred option in terms consistent with the Authority's statutory objective in section 15 of the Electricity Industry Act 2010.	Yes. We strongly endorse the approach taken by the Authority which is in our view highly consistent with the Authority's statutory objective. But if our submissions were implemented, we submit that the Authority would be in substantially GREATER compliance
Question 31	Do you agree the Authority's proposed amendment complies with section 32(1) of the Act?	Yes. But if our submissions were implemented, we submit that the Authority would be in substantially GREATER compliance.
Question 32	Do you have any comments on the drafting of the proposed amendment?	Yes. The Authority's changes to the code are strongly supported but they do not go far enough to encourage uptake of innovative and more efficient technologies. The additional changes submitted by SLP will need the same professional quality effort that has been clearly demonstrated in the Authority's consultation documents and proposals.