



IMPLEMENTING DEMAND RESPONSE IN THE NATIONAL ELECTRICITY MARKET OF SINGAPORE

CONSULTATION PAPER

Closing date for submission of comments and feedback:

19 NOV 2012

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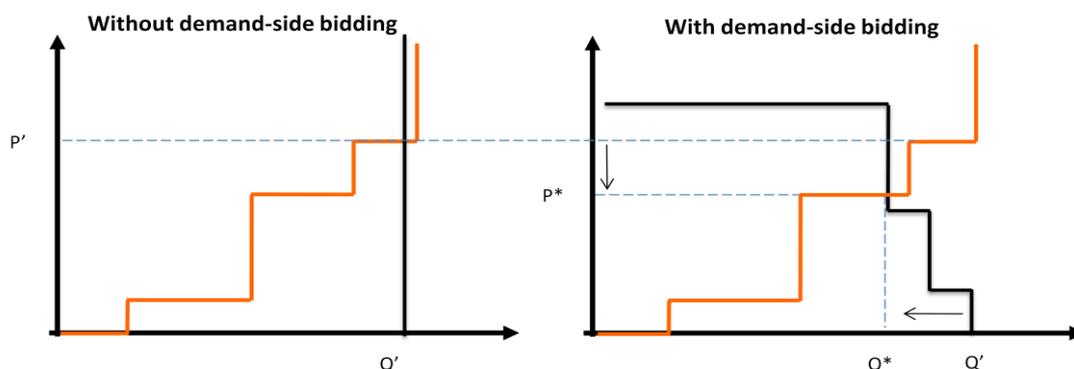
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EXECUTIVE SUMMARY

1. The Energy Market Authority (EMA) is reviewing the implementation of a demand response programme in the National Electricity Market of Singapore (NEMS). This consultation paper puts forth a suggested approach with the objective to seek views from the industry.
2. An effective demand response programme improves the overall efficiency of the market by allowing consumers to respond to real-time market pricing signals. In addition, demand response can lower peak electricity demand, thereby bringing about benefits such as reducing the need to start up less efficient power plants during peak periods and promoting efficient long-run investments for system expansion. For consumers, demand response provides an additional option for them to participate in the electricity market, with appropriate incentives to better manage their electricity usage in response to market conditions, which is aligned with the EMA's overall objective to promote greater variety of choices among contestable consumers as part of a competitive electricity market.
3. The proposed demand response programme comprises two distinct features:
 - (i) Demand side bidding; and
 - (ii) Incentive payments to demand response loads.

Demand Side Bidding

4. Demand side bidding allows consumers to bid their loads, either directly or through demand response aggregators which can include electricity retailers (collectively called "licensed load providers") for scheduling in the energy market, similar to how generators currently offer their capacity. Conceptually, this allows consumers to indicate their "willingness to consume" at various price points, producing a downward sloping demand curve. This contrasts with the current market design where the demand forecast used for the setting of prices within the NEMS is assumed to be inelastic. The enhanced interaction between both supply and demand conditions, supported by demand side bidding, would lead to a more efficient price discovery process in the wholesale market, thereby enhancing competition.



5. The demand side bidding will be co-optimised with the existing Interruptible Load (IL) scheme where loads can be offered for the provision of reserves. This means that the licensed load provider can offer the same load simultaneously into the energy market for demand side bidding as well as the reserves market for the IL scheme, and allow the Market Clearing Engine (MCE) in the NEMS to produce the least-cost solution based on the co-optimisation formula. The same load can be scheduled for dispatch for only one product (either energy or reserves) in any particular period.
6. There will be no limit on the amount of load that can be licensed and registered for demand response. For power system operation and security reasons, the amount of load reduction that can be scheduled for dispatch by the MCE is capped at 200 MW, for both the demand response programme and the IL scheme. This will be subject to a review, should the EMA observe the amount of load scheduled for demand response and the IL scheme approaches the cap over time.

Incentive Payments to Demand Response Loads

7. Demand side bidding would allow consumers to participate in the price discovery process in the NEMS and influence prices by adjusting their loads in response to real-time supply and demand conditions. Under the current market design, the marginal price for each half-hour period is used for settlement between generators and loads.¹ From the consumers' perspective, the benefits brought about by a consumer participating in the demand side bidding is not just limited to that consumer, but applicable to a broader consumer base. Hence, there is merit to consider providing the appropriate incentives to these consumers (through their licensed load providers), in recognition of the market-wide benefits brought about by these consumers.
8. Under the proposed incentive payment mechanism, the licensed load providers will be paid one-third of the additional consumer surplus per MWh of load reduction, capped at \$4,500/MWh (the current cap for the Uniform Singapore Energy Price (USEP)). The advantage of this payment method is that licensed load providers are paid only if benefits to consumers can be demonstrated. Effectively, this surplus sharing mechanism between the licensed load providers and consumers ensures that the majority of the benefits accrue to the broader consumer base, while providing an appropriate level of incentives for consumers to participate in the demand response programme.
9. The additional consumer surplus is based on the decrease in USEP as a result of demand response, measured across the consumer base that benefited from the price drop. The decrease in USEP can be calculated by running the MCE twice – once *with* the licensed load providers' bids to derive the USEP for that period, and once *without* the licensed load providers' bids to derive the counterfactual USEP. The EMA's view is that all contestable consumers will benefit from the proposed programme – those buying through the Market Support Services Licensee (MSSL) or retailers at wholesale prices will benefit directly, while those buying through retailers at fixed price contracts will also

¹ For illustration purpose, suppose the wholesale price was reduced from \$350/MWh to \$300/MWh as a result of the action of a consumer who participated in the demand side bidding, the wholesale price paid by consumers for that half-hour period would be \$300/MWh.

benefit from a more competitive retail price in the longer term as a result of the downward pressure on wholesale prices. Specifically, given that contestable consumers bear a portion of vesting contracts (of which the price is determined by the EMA), the relevant consumer base for consideration for the purpose of the demand response programme will be the non-vested load. This principle will be used when determining the additional consumer surplus derived from the licensed load providers and when determining the market participants to be charged for the uplift of the programme.

10. The EMA will conduct a review on the incentive payment mechanism after 3 years from the implementation date, taking into consideration the effectiveness of the demand response programme on the market, the level of payouts to the licensed load providers, as well as the uptake of demand response related products in the retail market.

Penalties and Anti-gaming Measures

11. Similar to the generators, licensed load providers who fail to comply with their dispatch schedules, will be subject to penalties. Given that the actions of the licensed load providers have an impact on market prices, the penalties are commensurate with the potential payouts to the licensed load providers.
12. In addition, the EMA recognises the possibility for licensed load providers to “game” the system by submitting load reductions at very low prices (which effectively ensures the dispatch of their load curtailment) that would have occurred anyway under “business-as-usual” circumstances. This runs contrary to the intent of the programme where licensed load providers (and their participating consumers) are required to take explicit and additional actions to reduce their load. One possible measure to address this is by introducing a price floor for the demand bids to ensure that there is no certainty of dispatch. Based on Cybele’s analysis of historical data, a price floor of \$300/MWh would be sufficient to address the gaming issue described. The EMA seeks views from stakeholders on what would be an appropriate level for the price floor, and whether there are alternative mechanisms which can achieve the same outcome.

Regulatory Requirements

13. A new class of license “Wholesaler (Demand Side Participation)” is proposed to be created to enable licensed load providers to participate in the programme. The licensed load providers will also be required to register with the Energy Market Company (EMC) and comply with existing market rules, as well as meet the requirements of the Power System Operator (PSO) for system security purposes.
14. Similar to the existing IL scheme, only contestable consumers can participate in the demand response programme. This is based on the consideration of several factors: i) consumers participating in the demand response programme require the installation of interval meters, which are currently used by the contestable consumers; and ii) this is to encourage the uptake of retail products that promote demand response, such as contract-for-difference (CfDs). In addition, to provide flexibility for different load types to participate in the programme, there would be 2 classes of demand response load facilities to distinguish loads with varying response times.

15. The proposed design of the demand response programme would allow contestable consumers to sign separate contracts with the proposed class of licensed load providers for demand response-related services, as well as electricity retailers for their supply of electricity. Given that there is a potential conflict of commercial incentives between the licensed load providers (which would require consumers to curtail electricity consumption) and electricity retailers (which typically earn more through higher sales of electricity to consumers), the EMA is also reviewing the Code of Conduct for Retail Electricity Licensees to prohibit electricity retailers from discouraging or prohibiting contestable consumers from participating in demand response or energy efficiency initiatives.

Consultation Process

16. This paper constitutes part of the EMA's consultation process to determine the implementation approach for demand response programme in the NEMS. After considering the feedback from key stakeholders on the proposed implementation approach, the EMA intends to issue a final determination paper to specify and detail our decision.
17. The EMA invites comments and feedback to the consultation paper. Please submit written feedback to EMA_PPD@ema.gov.sg by 19 Nov 2012 (5pm). Alternatively, you may send the feedback by post/fax to:

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Energy Planning and Development Division
Energy Market Authority
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Fax: (65) 6835 8020
18. Anonymous submissions will not be considered.
19. The EMA will acknowledge receipt of all submissions electronically. Please contact Ms Vivienne Low at 6376 7789 or Mr Eng Zhen-Hui at 6376 7589 if you have not received an acknowledgement of your submission within two business days.
20. The EMA can facilitate meetings with stakeholders on an individual basis to discuss their feedback to this consultation paper. Please contact EMA via EMA_PPD@ema.gov.sg if you wish to arrange a meeting.
21. The EMA reserves the right to make public all or parts of any written submissions made in response to this consultation paper and to disclose the identity of the source. Any part of the submission, which is considered by respondents to be confidential, should be clearly marked and placed as an annex which the EMA will take into account regarding the disclosure of the information submitted.

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SECTION 1 INTRODUCTION

1.1. Objective of the consultation exercise

- 1.1.1. The Energy Market Authority (EMA) is reviewing the implementation of a demand response programme in the National Electricity Market of Singapore (NEMS). This consultation paper puts forth a suggested approach with the objective to seek views from the industry.

1.2. Background

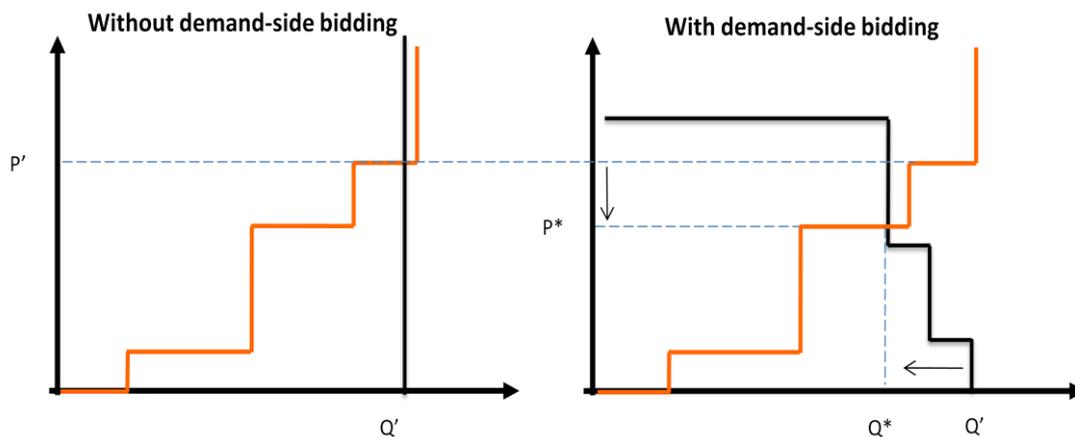
- 1.2.1. The NEMS has been in operation since 2003 with the objective of promoting an efficient supply of competitively priced electricity. It comprises a spot wholesale market for energy, reserve and regulation electricity products.
- 1.2.2. The current design of the NEMS already allows the participation of consumers to a certain extent. Contestable consumers can choose to buy electricity directly from the NEMS as a direct market participant (DMP) at half-hourly prices and manage price fluctuations in the wholesale electricity market on their own. In addition, contestable consumers can participate in the Interruptible Load (IL) scheme to allow their supply of electricity to be used as reserves to cater for system disturbances, in return for reserve payments.
- 1.2.3. Building on these initiatives, the EMA is reviewing how participation by consumers can be broadened through a demand response programme, where consumers can offer their loads for scheduling in the energy market. Demand response can be broadly defined as the change in electric usage from the normal consumption patterns in response to changes in the price of electricity over time, or in response to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardised.²
- 1.2.4. There are several key drivers for why the EMA is considering a demand response programme. First, the advancement of related technologies has made it possible for consumers to manage their energy consumption in a cost-effective manner. Examples of such technologies include smart grid technologies and energy management systems which enable consumers to respond to real time demand and supply conditions in an automated manner. The advent of such technologies will facilitate the participation of consumers in real-time markets, such as the NEMS. Second, with the progressive liberalisation of the electricity retail market, there has generally been a heightened awareness and willingness by consumers to participate in demand side initiatives. An example is the project “A 40 MW Virtual Power Plant (Demand Response System)” carried out under the EMA’s Smart Energy Challenge, where 12 consumers comprising approximately 40 MW of commercial and industrial load reduction participated in a demand response programme through an appointed aggregator. The feedback from the consumers participating in the programme was generally positive, which is an indication that there is interest among the consumers to participate in demand response initiatives.

² Refer to www.ferc.gov

1.3. Benefits of demand response

1.3.1. An effective demand response programme brings about market wide benefits in several ways. First, a demand response programme, which incorporates demand-side bidding, improves the overall efficiency of the market by allowing consumers to respond in real-time to market pricing signals. Conceptually, this allows consumers to indicate their “willingness to consume” at various price points, producing a downward sloping demand curve. This contrasts with the current market design where the demand forecast used for the setting of prices within NEMS is assumed to be inelastic. As shown in [Figure 1.1](#) below, allowing a mechanism for consumers to put in their demand bids results in lower wholesale electricity prices ($P' > P^*$) and a more efficient quantity ($Q' > Q^*$) of electricity consumed. By enabling demand response in the energy class of product, consumers can play a vital role in the price discovery process. The enhanced interaction between both supply and demand would bring about improved efficiency for the NEMS and thereby enhancing competition.

Figure 1.1: Comparison of price and quantity with and without demand side bidding



- 1.3.2. In addition, allowing demand side participation in the market will help to lower peak demand, as consumers have the incentives to redistribute demand from peak to non-peak periods. In the long-term, reducing the overall peak demand brings about system-wide benefits, including the avoidance of cost of system expansion to cater for peak periods, which may only occur for a relatively short period of time across the year. This can potentially reduce the cost of generation production as there is less need to run the less efficient power plants which are typically more expensive and have higher carbon emissions. Hence, the reduction in peak energy demand can help promote efficient long-run investments from the system expansion point of view, which will bring about overall system savings to the NEMS and the consumers.
- 1.3.3. Demand response can also improve system reliability by providing an additional resource to ensure electricity demand can be effectively met. This is especially so during periods of disturbances where system security could be threatened. For instance, in the event of multiple unplanned outages of generation sets, there could be a shortfall in supply to meet demand. In such instances, demand response can

be a useful resource, where the voluntary curtailment of such loads prevents or minimises the unnecessary load-shedding of other consumers.

- 1.3.4. In the retail market, demand response can facilitate retail product innovation and alternative contracting mechanisms for electricity retailers as well as potential aggregators. In the long run, demand response can be a value-added service and therefore presents new business opportunities for the respective parties to design different type of products based on the needs of consumers.
- 1.3.5. Ultimately, consumers will benefit as an effective demand response programme provides them with an additional option to participate in the electricity market. Consumers will be empowered and incentivised to manage their energy usage more effectively in response to electricity prices in the wholesale market. This is aligned with the EMA's overall objective to promote greater variety of choices among contestable consumers as part of a competitive electricity market.

SECTION 2 PROCESS OF ENGAGEMENT

2.1. Consultation Process

- 2.1.1. In April 2012, the EMA embarked on a consultancy study for the implementation of a demand response programme in Singapore. The scope of work for the study includes developing the market design framework for a demand response programme in Singapore as well as reviewing the necessary regulatory and market rules to support a demand response programme.
- 2.1.2. The consultancy study was undertaken by Cybele Capital Limited (thereafter 'Cybele'), which had been involved in the electricity market and work related to demand-side management in New Zealand, including the implementation of a Dispatchable Demand programme by the New Zealand Electricity Authority.
- 2.1.3. The EMA, with the support of Cybele, has engaged the key stakeholders in the electricity industry to seek inputs on the proposed development approach for the implementation of a demand response programme as part of the consultancy study. Cybele's final report is attached with this consultation paper in [Appendix 1](#) for reference.
- 2.1.4. Based on the outcome of the consultancy study and several rounds of industry engagement, a proposed market framework and the regulatory requirements for a demand response programme in Singapore have been identified in this consultation paper, which the EMA seeks further feedback and comments.

SECTION 3 APPROACH

3.1. Proposed Approach

- 3.1.1. Based on the outcome of the consultancy study and engagement with the industry, the EMA intends to introduce a demand response programme with two distinct features:
- (i) Demand side bidding; and
 - (ii) Incentive payments to demand response loads.
- 3.1.2. Demand side bidding allows consumers to offer their loads for scheduling in the energy market (see Section 1.3 on the details of the concept of demand side bidding). The setting of baseline and the measurement of load reduction are issues central to demand side bidding to ensure the long term sustainability of any demand response programme. This is particularly challenging in Singapore's context of an energy-only market, with no capacity market or day-ahead market which can form a natural baseline to measure the load reduction against.
- 3.1.3. One way of setting the baseline is to use historical load data for a particular consumer. Demand response load reduction would then be determined by comparing actual consumption against the pre-defined baseline. Although this method provides a simple way to calculate the baseline, it is easily subjected to gaming where consumers may artificially modify their baseline or use "business-as-usual" load reduction to qualify for payouts for demand response.³
- 3.1.4. Another way is to use a baseline based on what the licensed load providers bid into the market with the quantity of electricity they would use at various price levels to form a downward sloping demand curve. The demand bids forms a self-declared baseline which can be used to compare against actual consumption data for verification of load reduction. The EMA favours this approach for the setting of the baseline as the load reduction is verifiable, and the risk of gaming is mitigated because the consumer needs to comply with the dispatch schedule, or risk facing penalties.
- 3.1.5. Demand side bidding would allow consumers to participate in the price discovery process in the NEMS, and influence prices by adjusting their loads in response to real-time supply and demand conditions. Under the current market design, the marginal price for each half-hour period is used for settlement between generators and loads.⁴ From the consumers' perspective, the benefits brought about by the action of a consumer participating in demand side bidding is not just limited to that consumer, but applicable to a broader consumer base. Hence, there is merit to

³ An example is when a consumer shuts down a particular machinery for regular maintenance. In the baseline approach, the consumer can claim to be curtailing load during this period as there is a reduction of consumption compared to the baseline, and be paid accordingly, which runs contrary to the intent of the demand response programme.

⁴ For illustration purpose, suppose the wholesale price was reduced from \$350/MWh to \$300/MWh as a result of the action of a consumer who participated in the demand side bidding, the wholesale price paid by consumers for that half-hour period would be \$300/MWh.

consider providing appropriate incentives to consumers who participate in the demand side bidding, in recognition of the market-wide benefits brought about by these consumers. As such, the EMA is considering how to design the incentive payments for such customers as part of the demand response programme.

- 3.1.6. The EMA is of the view that an incentive payment mechanism coupled with an effective design of the demand side bidding (with the relevant anti-gaming mechanisms and the appropriate metering and measurement) can provide sufficient conditions for the uptake of demand response by consumers.
- 3.1.7. With respect to the payment mechanism, several methods have been considered. One way is to pay the licensed load providers in the same way as generators are paid. Loads which are scheduled for curtailment (or dispatch) would be paid the prevailing Uniform Singapore Energy Price (USEP) for the half-hour period. The EMA is of the view that this will result in over-compensation as there will be double payment made to the licensed load providers (i.e. an additional payment on top of the savings for the electricity consumption reduced which would have been otherwise realised). Furthermore, there may be cases where the licensed load providers will be paid for curtailment even when there is no corresponding increase in consumer surplus (i.e. no reduction in the USEP) and no direct benefits generated for the market.
- 3.1.8. An alternative payment mechanism is to pay licensed load providers a share of the additional consumer surplus generated as a result of the action of the curtailed load. The advantage of applying such payment mechanism is that it is easy to calculate, and provides sufficient and adequate incentive for load providers to reduce their load.
- 3.1.9. The EMA favours this principle of incentive mechanism where participating consumers will be paid only if additional consumer surplus (from the lowering of the USEP) as a result of the demand response programme can be demonstrated. Effectively, this is a surplus sharing mechanism between the load providers and the rest of the consumer base and ensures that benefits accrue to the consumers before a payout occurs.
- 3.1.10. Details of the demand side bidding and incentive payment mechanism are described in Section 4.

SECTION 4 MARKET DESIGN FRAMEWORK

4.1. Demand Side Bidding

4.1.1. In designing the proposed demand side bidding, the EMA has taken into consideration the following principles:

- (i) The treatment of loads under the demand side bidding is to be symmetrical to that of generators, as far as practicable; and
- (ii) Sufficient safeguards need to be put in place to ensure compliance and reduce the chances of gaming, particularly since the demand side bids are used to set wholesale market prices.

4.1.2. Consumers can participate either directly as a market participant or through an aggregator which can include electricity retailers (collectively called “licensed load provider”).⁵ The licensed load providers are only required to submit bids for periods when they intend to offer load reductions to the NEMS. The demand side bids will be introduced largely on the same basis as that of generation offers in the NEMS under Section 6 of the Market Rules. This includes submitting demand bids 65 minutes before the actual trading period. Similar to that for generators, the licensed load provider will be allowed to submit up to 10 tranches of price-quantity pairs in a single bid. Each tranche of load reduction must be at least 0.1 MW in size, as per current arrangements for the IL scheme on the basis that loads smaller than this threshold is unlikely to influence prices in the wholesale electricity market.

4.1.3. The licensed load provider will need to bid into the market the total load of the registered facility for that period, i.e. both the load it intends to consume and the load it intends to reduce (with its associated prices) for that period. The total load then forms the baseline to measure load reductions for purpose of measurement, compliance and verification. The advantage of this design is that it obviates the need to set an artificial baseline to measure the load reductions, which can be subject to gaming, leading to overpayments. Instead, the licensed load providers will be held against the total load (including the reduction quantities) of that consumer for that half-hour, which will require the licensed load providers to be accurate about the consumption levels of that consumer when submitting the bids. Details of the bidding process as part of a chronological example are provided in Appendix 2.

4.1.4. If the load facility has been registered to provide for IL, the licensed load provider can offer the loads simultaneously into the energy market for demand side bidding as well as the reserves market under the IL scheme for co-optimisation by the Market Clearing Engine (MCE) in the NEMS to generate the dispatch schedule. In addition, while the licensed load provider can offer the same load into both the energy market and reserves market, that load can only be scheduled for dispatch for only one product, based on the co-optimisation formula used by the MCE.

⁵ Refer to Section 5 for licensing requirements for the proposed demand response programme.

4.1.5. Table 4.1 shows an illustrative example of how a load could participate under the proposed demand side bidding mechanism. In this example, the licensed load provider has a consumer with a 15 MW load facility, of which the consumer is prepared to reduce by 3 MW at a price of \$2,000/MWh during 2:00-2:30pm on a particular day. To participate in the NEMS for that period, the licensed load provider would need to bid the load and the corresponding prices into the market. For the other periods where there are no load reductions, the licensed load provider does not have to bid into the market.

Table 4.1: Illustrative example of how load could participate in demand side bidding

Load (MW)	Bids (\$/MWh)	Comment
12 MW	-	This represents the minimum load (or non-curtable load) that the consumer would like to at least consume during that period
3 MW	\$2,000/MWh	This shows that the consumer is willing to reduce 3 MW of load when the price is above \$2,000/MWh.

4.1.6. The demand side bids consisting of a series of price-quantity tranches from all licensed load providers will be included in the MCE. The MCE will then produce a dispatch schedule based on all the offers and bids by the generators and the licensed load provider(s).

4.1.7. If the licensed load provider is scheduled to provide the 3 MW reduction during that period, the consumer (through the licensed load provider) will be required to demonstrate the reduction of load from 15 MW (at 2:00pm) to 12 MW in that period within a specified time period. The licensed load provider would have complied with the dispatch schedule only if:

- (i) The total load at 2:00pm is at least 15 MW;⁶ and
- (ii) The load reduction to 12 MW occurs within a pre-defined time; and
- (iii) The total load from the reduction to the end of the period is not more than 12 MW.

4.1.8. If the licensed load provider is not scheduled to provide the 3 MW reduction during that period, the consumer (through the licensed load provider) will be required to maintain a consumption of at least 15 MW throughout the period from 2:00-2:30pm.⁷

⁶ In the event that the licensed load provider is scheduled for load reductions for consecutive periods, this condition is waived for the subsequent periods, as the end of that period forms the starting consumption of the subsequent period.

⁷ In the event that the licensed load provider bids for consecutive periods and is scheduled for load reductions in current period but is not scheduled in the subsequent period, the licensed load provider will have to ramp up to their non-scheduled load consumption within the pre-defined time in the subsequent period as the end consumption of the current period forms the starting consumption of the subsequent period.

4.1.9. Failure to meet any of the above conditions (whether scheduled or not) would be deemed as non-compliance with the dispatch schedule and there will be corresponding penalties imposed on the licensed load provider.⁸

Volume Cap and Interaction with IL

4.1.10. There will be no limit on the amount of load that can be licensed and registered for demand response. For power system operation and security reasons, the amount of load reduction that can be scheduled for dispatch by the MCE will be capped at 200 MW, for both demand response and the IL scheme.⁹ The current caps and zonal limits for IL for Primary, Secondary and Contingency reserve classes will remain unchanged. This will be subject to a review, should the EMA observe the amount of load scheduled for demand response and the IL scheme approaches the cap over time.

Additional Safeguards

4.1.11. In the design of the proposed programme, the intent is for licensed load providers (and their participating loads) to provide a service to improve the efficiency of the market through curtailment of loads, in exchange for the proposed payments. As such, the curtailment of the loads offered under the proposed programme must be an explicit action taken by the licensed load providers, which would not have otherwise occurred under “business-as-usual” circumstances. This is shown in Table 4.2, which shows the consumption pattern of a consumer for illustrative purpose.

Table 4.2: Illustrative example of load consumption pattern

Half-hourly time periods	Participating Load (MW)	Comment
Period X ₁	10	Base-load consumption by a consumer
Period X ₂	10	
Period X ₃	10	
Period X ₄	8	Reduction of load under normal operating circumstances (e.g. switching off of equipment at the end of the day)
Period X ₅	5	

4.1.12. With reference to Table 4.2, a reduction offered by the licensed load provider into the market from Period X₁ (from 10 MW) to Period X₂ (to 5 MW) will constitute an explicit action taken by the licensed load provider for a curtailment of 5 MW of load, and will therefore be eligible for payments.

⁸ There will be no penalty imposed on the licensed load provider if they “over-provide” the load reduction, such as the case if the load is dropped at 2:00pm from say 15.4MW (greater than 15MW), or if the load at the end of the period is say 11.9 MW (less than 12 MW), or if the curtailment time period is shorter than the pre-defined time.

⁹ The cap applies only for the load reduction volumes, and not the entire load of the facility. For example, in the example shown in Table 4.1, only the 3 MW of potential load reduction would count towards the cap, not the remaining 12 MW.

- 4.1.13. Conversely, a reduction offered by the licensed load provider into the market from Period X_4 (from 8 MW) to Period X_5 (to 5 MW) is an action the consumer would have taken anyway under “business-as-usual” conditions. As such, the licensed load provider should not be paid in such circumstances as there was no additional service provided.
- 4.1.14. However, there is a possibility for the licensed load provider to “game” the system by submitting very low bids during such periods which effectively ensures the dispatch of the load. Hence, safeguards need to be in place to avoid paying licensed load providers for load curtailments which would have occurred otherwise.
- 4.1.15. One possible way to address is by introducing a price floor on the bids which the licensed load providers are allowed to offer into the market. The price floor should be calibrated in such a way that the pricing signals to licensed load providers to curtail load in response to high prices are preserved, while at a sufficiently high level to ensure that the licensed load providers are not effectively guaranteed the dispatch of the curtailment load (through bidding in at very low prices). Based on Cybele’s analysis of historical data, a price floor of \$300/MWh would be sufficient to address the gaming issue described. The EMA seeks views from stakeholders on what would be an appropriate level of the price floor which would adequately address the issue highlighted above.
- 4.1.16. The price floor mechanism may not be the only way to address the gaming issue described. The EMA therefore seeks inputs from the stakeholders on what alternative safeguards can be put in place to address this.

4.2. Incentive Payments and Penalties for Demand Response

Load benefitting from demand response

- 4.2.1. The beneficiaries of the proposed demand response programme are consumers whose load are not exposed to the vesting price (which is regulated by EMA), and would thereby benefit from the lowering of USEP due to the proposed programme. This group of consumers consists of the contestable consumers buying at wholesale prices through the Market Support Services Licensee (MSSL) and the contestable consumers buying through retailers.
- 4.2.2. Contestable consumers buying at wholesale prices through the MSSL and some retail contract consumers (whose contract prices are pegged to USEP) would benefit through a direct lowering of the USEP prices as a result of the proposed programme.
- 4.2.3. For consumers on fixed price contracts with retailers, there is feedback from some stakeholders in the industry that such consumers are not affected by the lowering of USEP and hence would not benefit from a demand response programme. Taking this feedback into consideration, and on balance, drawing references from Cybele’s assessment and independent studies, the EMA’s view is that consumers on fixed price contracts will ultimately benefit from a downward pressure on wholesale market prices through more competitive retail prices in the long-run. An effective

demand response programme will therefore benefit all contestable consumers regardless of their retail contract arrangements, i.e. spot or fixed price contracts.

- 4.2.4. Contestable consumers buying at fixed prices will benefit, given that in the wholesale market design, market participants who buy on behalf of consumers such as retailers procure electricity from the wholesale market at USEP to sell to consumers. From this perspective, USEP is an input to retail prices and market participants can then choose whether to pass on the benefits to their consumers. Evidence from other markets show that such price benefits from the wholesale market will be passed on to consumers as long as the retail market is sufficiently competitive.
- 4.2.5. Studies in other jurisdictions confirm the positive correlation between wholesale and retail prices. In particular, there is evidence that retail prices move in tandem with wholesale prices, and that retail market offers by retailers are more competitive in response to lower wholesale prices.¹⁰ Furthermore, regulators such as the Office for Electricity and Gas Markets (Ofgem) of the United Kingdom have used wholesale prices as an input to retail prices paid by consumers, for the purpose of analysing the competitiveness of retail electricity market. This applies to consumers with both variable and fixed price contracts as wholesale prices form the largest component of retail prices.¹¹
- 4.2.6. Such consumers will also benefit as the level of USEP serves as a check on the contracted retail prices. This is consistent with the intended design of the wholesale and retail markets in Singapore, where contestable consumers have a choice to buy through retailers or at wholesale prices (either as a direct market participant or through the MSSL). The latter option helps to ensure the competitiveness of the retail market, because contestable consumers can choose to buy at wholesale prices if the retail market prices were uncompetitive. As such, the lowering of the USEP through a demand response programme will benefit retail contract consumers at fixed prices due to increased competitiveness in the retail market.
- 4.2.7. The EMA has also sought the independent view of Professor Frank Wolak on this particular issue. Professor Wolak is the Holbrook Working Professor of Commodity Price Studies in the Department of Economics and Director of the Program on Energy and Sustainable Development at Stanford University and has substantial experience in the design of electricity markets, including chairing the Market Surveillance Committee of the California Independent System Operator for the electricity supply industry in California between 1998 and 2011. Professor Wolak's assessment is that given that fixed price retail contracts essentially constitute a hedge against short-term fluctuations in the USEP for the period of the retail contracts, lowering the monthly bill of these consumers because of the efforts of

¹⁰ Empirical evidence on the relationship between wholesale and retail prices in the Finnish, Norwegian and Swedish markets are provided in Johnsen and Olsen (2008)'s 'The relationship between wholesale and retail electricity prices in households in Nordic countries', published by the Norwegian Research Council (renergi project number 173109); and Lewis, Johnsen, Narva and Wasti (2004)'s 'Analysing the relationship between wholesale and end-user prices in the Nordic electricity market', financed and published by Finland Ministry of Trade and Industry (ref 5/2004).

¹¹ Based on Ofgem's Electricity and Gas Supply Market Report, published November 2010.

demand response customers during the term of their retail contracts would be inconsistent with the original motivation for purchasing fixed price retail contracts. However, if the actions of consumers participating in the demand response programme (who are making binding financial commitments to reduce their demand) lower the average USEP, consumers on fixed price retail contracts will benefit from these actions in future periods when retailers and these customers negotiate future fixed price retail contracts. This is because the negotiations for the future fixed price contracts will factor in the anticipated lowering of the USEP brought about by the customers making financially binding decisions to reduce their demand in response to hourly USEPs. This will result in lower fixed price retail contracts given that the opportunity cost of purchasing energy at the USEP is lower as a result of the known impacts on future USEPs due to the demand response programme. In that way, customers on fixed price retail contracts will benefit from the demand response programme through lower fixed price contracts in the future.

4.2.8. Overall, the EMA's view is that all contestable consumers will benefit from an effective demand response programme. Specifically, given that contestable consumers bear a portion of vesting contracts (which price is determined by the EMA), the non-vested load are the actual beneficiaries.¹² This principle will be used when determining the additional consumer surplus derived from the licensed load providers and when determining the market participants to be charged for the uplift from the programme.

Payment to licensed load providers

4.2.9. The level of payments to the licensed load provider in exchange for the service they provide in the market is a key design element of the programme. The EMA has carefully considered various methods of payments, taking into consideration how to ensure fair remuneration to licensed load providers (and their customers participating in the proposed programme), while avoiding overpayment to safeguard the interests of the rest of the consumer base.

4.2.10. As highlighted earlier, the EMA is of the view that licensed load providers should be paid a share of the additional consumer surplus generated as a result of the load curtailment dispatched. The proposed payment to licensed load providers will be subject to review 3 years after the start of the demand response programme, taking into consideration the effectiveness of the demand response programme on the market, the level of payouts to the licensed load providers as well as the uptake of demand response related products in the retail market.¹³

4.2.11. The increase in consumer surplus as a result of the proposed programme is proposed to be calculated as follow:

¹² Vesting contracts cover the non-contestable consumers first and the remaining volumes are spread out equally among the contestable consumers. For example, if the vesting contract level is 55% and the non-contestable load is 30%, the remaining vesting contracts (or 25%) are borne by contestable consumers.

¹³ An increase in uptake of such products will reduce the need for incentive payments through the wholesale electricity market.

Additional consumer surplus =

$\max \{[(\text{USEP without curtailment}) - (\text{USEP with curtailment})] \times \text{non-vested load}, 0\}$

- 4.2.12. When a licensed load provider is scheduled for curtailment in a particular period, the MCE will be run twice to calculate the additional consumer surplus using the above formula – once without the scheduled curtailed load and the other with the scheduled curtailed load. The USEP generated in the first instance serves as a “counterfactual” price as if the demand response programme was not in place, while the USEP generated in the latter case will be the corresponding clearing price paid by consumers for that half hour.
- 4.2.13. Only licensed load providers whose loads are scheduled for curtailment in the proposed demand response programme are eligible for payments. The payments to the licensed load providers will be paid based on a sharing factor of the additional consumer surplus calculated. The intent of such a design is to ensure that payments are made to licensed load providers (and their customers) only when additional consumer surplus has been generated as a result of the curtailment of load as part of the programme. The proposed sharing factor for the calculation of the payment to demand response aggregator is one-third of the additional consumer surplus generated.¹⁴ This will ensure that the majority of the benefits (i.e. two-thirds of the additional consumer surplus generated) accrue to the rest of the consumer base, specifically the non-vested load, while providing a fair return to licensed load providers for the service they provide in the market.
- 4.2.14. In addition, the maximum payment to the licensed load providers for each MWh of load curtailed is proposed to be pegged to the existing price cap for USEP, currently set at \$4,500/MWh. This is in recognition that generators and licensed load providers provide similar services to the market, and therefore the maximum payment to licensed load providers should not exceed that of the generators. There will be no partial payment to licensed load providers in the event when they are partially compliant to their dispatch schedule.
- 4.2.15. Tables 4.3-4.5 provide illustrations on how additional consumer surplus and payments to the licensed load providers are calculated. The figures used are solely for illustrative purpose.
- 4.2.16. Table 4.3 examines the situation where there is no change to the counterfactual USEP and the actual USEP with the scheduled curtailment. In this case, there is no payment to the licensed load provider(s) whose load is scheduled for curtailment.

¹⁴ A more detailed analysis of how the one-third sharing factor was derived can be found in Cybele’s final report in Appendix 1.

Table 4.3: Calculation of payments to licensed load providers- no change to USEP

No changes to USEP with and without scheduled curtailment	
Scheduled demand response curtailment	10 MW for ½ hour (or 5 MWh)
Counterfactual USEP (without scheduled curtailment)	\$500/MWh
USEP for period (with scheduled curtailment)	\$500/MWh
Non-vested load for ½ hour period	1,125 MWh ¹⁵
Additional consumer surplus generated	\$0
Consumer surplus allocated to licensed load provider	\$0
Payment to licensed load provider based on consumer surplus	\$0/MWh
Check whether USEP cap is breached	No
Final payment to licensed load provider	\$0/MWh

4.2.17. Table 4.4 examines the situation where there are changes between the counterfactual USEP and the USEP with the scheduled curtailment, and the licensed load provider(s) is paid based on its allocated share of the additional consumer surplus.

Table 4.4: Calculation of payment to licensed load providers- change in USEP

DRA(s) is paid based on the allocated share of consumer surplus	
Scheduled demand response curtailment	10 MW for ½ hour (or 5 MWh)
Counterfactual USEP (without scheduled curtailment)	\$500/MWh
USEP for period (with scheduled curtailment)	\$495/MWh
Non-vested load for ½ hour period	1,125 MWh ¹⁶
Additional consumer surplus generated	\$5,625
Consumer surplus allocated to licensed load provider	\$1,875
Payment to licensed load provider based on consumer surplus	\$375/MWh
Check whether USEP cap is breached	No
Final payment to licensed load provider	\$375/MWh

¹⁵ Illustrative figures of total system demand of 5,000 MW and 55% vesting level are used.

¹⁶ Illustrative figures of total system demand of 5,000 MW and 55% vesting level are used.

4.2.18. Table 4.5 examines the situation where the licensed load provider(s) is paid at USEP price cap, because its equivalent allocated share of the additional consumer surplus exceeds that of the USEP price cap.

Table 4.5: Calculation of payment to licensed load providers- change in USEP, capped at \$4,500/MWh

DRA(s) is paid based on the USEP price cap	
Scheduled demand response curtailment	10 MW for ½ hour (or 5 MWh)
Counterfactual USEP (without scheduled curtailment)	\$500/MWh
USEP for period (with scheduled curtailment)	\$400/MWh
Non-vested load for ½ hour period	1,125 MWh ¹⁷
Additional consumer surplus generated	\$112,500
Consumer surplus allocated to licensed load provider	\$37,500
Payment to licensed load provider based on consumer surplus	\$7,500/MWh
Check whether USEP cap is breached	Yes
Final payment to licensed load provider	\$4,500/MWh

Payment in the event of energy deficit

4.2.19. In the event that there is an energy deficit in the system, the Constraint Violation Penalty (CVP) in the MCE kicks in and USEP clears at the cap of \$4,500/MWh to signal the shortage of supply. Should the demand response volume scheduled for dispatch be less than the energy deficit, the USEP remains at \$4,500/MWh. Based on the additional consumer surplus formula previously described, the licensed load provider will not be paid because there is no change in the USEP as a result of the CVP. However, the EMA recognises the value of load reduction by the licensed load providers during such periods where demand response resource can bolster system security and help to reduce the amount of energy deficit in the system. Hence, the incentive payment mechanism should be designed in such a manner to send the correct market signal for the licensed load providers to bid the loads in during such periods.

4.2.20. Conceptually, there is additional consumer surplus created from demand response due to the decrease in energy deficit.¹⁸ However, the counterfactual price cannot be determined due to the CVP. Given that the implied Value of Loss Load (VoLL) is \$5,000/MWh in the NEMS, this price can be used for the purpose of deriving the

¹⁷ Illustrative figures of total system demand of 5,000 MW and 55% vesting level are used.

¹⁸ There will be a gain in consumer surplus from the load that had avoided load shedding in an Under Frequency Load Shedding or energy deficit event, due to demand response.

counterfactual USEP, on the basis that the load which had avoided load shedding as a result of the demand response has an implied value of \$5,000/MWh.¹⁹

4.2.21. In the event of an energy deficit, the additional consumer surplus to licensed load providers will be calculated as follow:

Additional consumer surplus =

$\max \{[(\text{implied VoLL}) - (\text{energy price cap})] \times \text{non-vested load}, 0\}$

4.2.22. The payment to the licensed load provider based on the one-third additional consumer surplus per MWh of curtailment provided by the licensed load provider or the cap of \$4,500/MWh, whichever is lower, still applies.

Collection of payment

4.2.23. The payment to licensed load provider is proposed to be collected from the contestable consumers, given that they are the beneficiaries of the proposed programme. In considering the collection mechanism to support the payment to licensed load provider, the EMA's preference is to avoid the introduction of a new fee component in the NEMS, taking into consideration feedback from some electricity retailers in prior engagements that a new fee component in the NEMS may require the review of existing retail contracts with consumers. Transparency can still be achieved by publishing the equivalent amount that has been paid to the licensed load providers, so that market participants and consumers are informed of the cost of the demand response programme.

4.2.24. The proposed collection mechanism will be done through the Hourly Energy Uplift Charge (HEUC) to market participants buying on behalf of contestable consumer loads.²⁰ Given that the beneficiaries of the demand response programme are the non-vested load, the uplift for payment to the demand response aggregators should conceptually be collected through market participants buying on behalf of the non-vested loads. However, to avoid modifications to the current vesting credit/debit arrangements, an equivalent method is to collect through market participants buying on behalf of contestable consumers. This is because the vested portion of the contestable consumers is spread out equally among all contestable consumers, and the contestable consumer base will pay the same amount regardless of whether the uplift is computed based on non-vested loads or contestable consumer loads. Details of the collection mechanism are provided in Appendix 3, along with a working example.

4.2.25. Market participants may choose to pass on the HEUC component to their consumers or to absorb the charges, similar to how retailers may currently choose to pass on vesting credits or debits to their consumers or absorb these charges. The EMA takes a strong view on how retailers communicate the implementation of this proposed programme to any consumer. Retailers are required to abide by the

¹⁹ Refer to EMC paper EMC/RCP/60/2012/CP38. Available at http://www.emcsg.com/f1027,70943/CP38_Review_of_VoLL_60RCP_.pdf

²⁰ HEUC captures any differences between total amounts received from market participants buying on behalf of consumers and total amounts paid to generators for energy, reserve and regulation products.

Code of Conduct for Electricity Retail Licensees and avoid misrepresentation when presenting or explaining the proposed programme to their consumers, particularly on the benefits to consumers and the corresponding charging mechanism.

Penalties

4.2.26. Given that licensed load provider are eligible for payments from the market, and that the offers made by licensed load provider can potentially change the USEP and impact market participants, designing the compliance regime for the proposed scheme is important to ensure that the licensed load providers provide the scheduled curtailment load when required. Should licensed load providers fail to deliver at least the scheduled curtailment load, a penalty will be imposed on the licensed load providers. The level of penalty is commensurate with the potential payouts to the licensed load providers, i.e. one-third of any additional consumer surplus demonstrated to be generated, and to be capped at the USEP price cap of \$4,500/MWh.

4.2.27. In the event the licensed load provider curtails its load even though it is not dispatched to do so, there will not be a counterfactual price to calculate the additional consumer surplus to calculate the penalty. In such cases, the licensed load providers will be required to pay a penalty if the consumption is less than scheduled, using the following formula:

$$\text{Penalty Value} = \text{Max} \{ [2 \times (\text{USEP} + \text{HEUC}) \times \text{deviation from dispatched quantity} \times 1/2], \$5,000 \}^{21}$$

4.2.28. The EMA recognises that there may be bona fide reasons where the licensed load provider(s) is unable to comply with the scheduled curtailment. An example of a bona fide reason is the need to ensure human safety due to unforeseen circumstances, resulting in the inability to meet the requirements of scheduled curtailment. As such, provisions are proposed to be made in the market rules where the affected licensed load provider(s) can appeal to the Market Surveillance and Compliance Panel (MSCP) on such grounds for the MSCP's consideration to reduce (or waive) the penalty.

4.2.29. Table 4.6 below summarises the payment and penalty matrix for the licensed load providers for each case where they are dispatched to curtail and whether there was actual curtailment.

²¹ This is analogous to the formula used in separately proposed Automatic Penalty Scheme.

Table 4.6: Payment and penalty matrix for licensed load providers

Performance Matrix	Licensed load providers who curtailed	Licensed load providers who did not curtail
Licensed load providers who are scheduled for load reduction	Receive one-third of additional consumer surplus per MWh as payment, capped at \$4,500/MWh.	Pay one-third of additional consumer surplus per MWh as penalty, capped at \$4,500/MWh.
Licensed load providers who are <u>not</u> scheduled for load reduction	Pay penalty as described in 4.2.27.	No payment or penalty.

SECTION 5 REGULATORY AND MARKET REQUIREMENTS

This section covers the regulation and related requirements to support the proposed demand response programme as discussed in Section 4.

5.1. Eligibility of load

5.1.1. Similar to the IL scheme, the EMA is proposing that only contestable consumers are allowed to participate in the demand response programme. This is to encourage the uptake of retail products that promote demand response, such as contract-for-difference (CfDs). In addition, for purpose of performance and compliance, load providers will likely need interval meters which are currently installed for contestable consumers. Load providers who are contestable can participate in the demand response programme either directly as a DMP or indirectly through a licensed load provider as described in 4.1. Table 5.1 provides a breakdown of the number of contestable consumer accounts by average monthly consumption levels.²²

Table 5.1: Breakdown of contestable consumer accounts by average monthly consumption levels (as of July 2012)

x=Average Monthly Consumption (MWh)	Number of Accounts	Percentage of Contestable Load (%)
$x \geq 100$	1,745	91.3
$50 \leq x < 100$	955	4.5
$25 \leq x < 50$	1,605	2.3
$x < 25$	3,207	1.9
Total	7,512	100

²² For illustrative purpose, a 0.1 MW load (the minimum participation size for the proposed demand response programme) operating 10 hours a day for 25 days a month will have a monthly consumption of approximately 25 MWh.

5.2. Licensing Requirements, Market Participation and Asset Registration

- 5.2.1. The EMA is proposing that a new class of licence “Wholesaler (Demand Side Participation)” be created to participate in the programme as licensed load providers. This includes single site participants, multi-site aggregators and retailers. The proposed license fee for the new class of licence will be pegged to the prevailing licence fees for “Wholesaler (Interruptible Load)”. Details of the proposed class of licence are attached in the [Appendix 4](#).
- 5.2.2. The EMA has also considered whether the proposed class of licence can be merged with the “Wholesaler (Interruptible Load)” licence. While the licence conditions of both classes of licences are similar, the technical and regulatory requirements for the respective classes of licences may vary in the future. Hence, the EMA’s preference is introduce a new class of licence as proposed, rather than to merge with the “Wholesaler (Interruptible Load)” licence.
- 5.2.3. Licensed load providers will also be required to obtain the proposed class of licence from the EMA before registering with the Energy Market Company (EMC) as the relevant market participant and comply with the market rules.
- 5.2.4. In addition, the licensed load providers will need to register with Power System Operator (PSO), the facilities or assets of which load reductions will be made. As part of the registration, licensed load providers will be required to provide the location and meter numbers of the facilities of which load reductions will be made. Each registered facility should be able to provide load reduction of at least 0.1 MW.
- 5.2.5. For licensed load providers aggregating load from more than one facility or site, they will be required to go through the same registration process. In addition, licensed load providers aggregating load from more than one site will need to register them in blocks, according to the IL zones. In addition, the ramp down rates of each facility or site will need to be specified in each registered block.

5.3. Class of Licensed Load Providers

- 5.3.1. The EMA recognises the possibility where there are different types of loads that can participate in the proposed demand response programme. As such, there is a need to differentiate the payouts to licensed load providers with different response times. Based on system security considerations, the EMA’s assessment is that the licensed load provider should not take more than 10 minutes to curtail the required scheduled load. As such, the EMA is proposing different classes of load facilities with different ramp rate requirements that can participate in the demand response programme (see [Table 5.2](#)).

Table 5.2: Classification of demand response load facilities

Class of registered load facilities	Class A	Class B
Response Time	Within 5 min.	Between 5 min and 10 min.
Payments	Payment based on 100% of dispatched load curtailment.	Payment based on 75% of dispatched load curtailment. ²³

5.4. Metering and Communications requirements

- 5.4.1. The communications requirement for single site and multi-aggregated sites will be determined by the PSO. The requirement for the demand response programme is proposed to be similar to that for the IL scheme.²⁴
- 5.4.2. For licensed load providers aggregating loads from other load providers, they will be required to put in the required metering infrastructure (or “shadow meters”) on their own to ensure performance of the loads that they are aggregating on behalf of.

5.5. Measurement and Compliance

- 5.5.1. The licensed load providers who have submitted bids to the EMC to provide load reduction for dispatch are expected to consume according to the dispatch schedule instructions, which will be monitored by the PSO.
- 5.5.2. In addition, the licensed load providers’ metered energy (MWh) consumption can be compared against their dispatch schedule by the EMC. For example, if a load provider is dispatched to consume at 15 MW for that half-hour period, a metered consumption of less than 7.5 MWh will be non-compliant with the dispatch schedule.
- 5.5.3. Licensed load providers who fail to comply with their dispatch schedule (reported either by the PSO or EMC) will face a penalty as previously described. In addition, in cases of repeated non-compliance, licensed load providers may have their licences revoked by the EMA.

5.6. Retailers’ code of conduct

- 5.6.1. The proposed design of the demand response programme would allow contestable consumers to sign separate contracts with the proposed class of licensed load providers to provide for demand response-related services, as well as electricity retailers for their supply of electricity. Given that there is a potential conflict of commercial incentives between the licensed load providers (which would require consumers to curtail electricity consumption) and electricity retailers (which typically earn more through the higher sales of electricity to consumers), the EMA recognises the possibility that electricity retailers may through representations to the consumers (such as through marketing practices and materials or explicit contractual clauses) discourage or prohibit consumers from participating in the

²³ For example, for a Class B load facility with a scheduled load reduction of 10 MWh for that period, the payouts will be based on 7.5 MWh.

²⁴ Refer to EMC paper on A Guide to Providing Interruptible Load in Singapore’s Wholesale Electricity Market. Available at http://www.emcsg.com/f146,16653/Guide_to_providing_IL_website_21082012.pdf

proposed demand response programme. This will restrict the choices available to consumers and runs contrary to the objective which the EMA has set out in this consultation paper. As an additional safeguard to protect consumers, the EMA intends to modify the relevant provisions in the Code of Conduct for Retail Electricity Licensees to prohibit electricity retailers from discouraging or prohibiting contestable consumers from participating in demand response or energy efficiency initiatives.²⁵ This is aligned with the EMA's mandate to create a competitive electricity market and to promote greater variety of choices among the contestable consumers for related electricity services.

5.6.2. The proposed modification is an additional clause in Section 2.2.2 of the Code of Conduct for Retail Electricity Licensees as follow (full details in [Appendix 5](#)):

“A licensee shall comply with the following when retailing electricity:

- (k) not discourage or prohibit consumers from participating in demand response and energy efficiency initiatives.”

SECTION 6 SUMMARY

- 6.1. The Energy Market Authority (EMA) is reviewing the implementation of a demand response programme in the National Electricity Market of Singapore (NEMS). The development of a demand response programme will improve the overall efficiency of the market by allowing consumers to respond in real-time to market pricing signals. The enhanced interaction between both supply and demand will bring about improved efficiency for the NEMS and thereby enhance competition.
- 6.2. This consultation paper puts forth a suggested approach with the objective to seek views from the industry on the following:
- (i) The proposed demand side bidding mechanism;
 - (ii) The proposed incentive payment mechanism;
 - (iii) The additional safeguards that can be put in place to address the potential gaming issue, including the appropriate level of the price floor; and
 - (iv) The regulatory changes required to support the implementation of the proposed demand response programme.

²⁵ The Code of Conduct for Retail Electricity Licensees sets forth minimum standards of performance in accordance with which a Licensee is required to conduct its retail activities.

- 6.3. The indicative timeline of the EMA's consultation process for implementing demand response in the NEMS is summarised in Table 6.1.

Table 6.1: Indicative timeline for the EMA's consultation process

Process		Date
1	Issue of the EMA's Consultation Paper	22 October 2012
2	Feedback from stakeholders on the Consultation Paper due	19 November 2012
3	Issue of the EMA's Final Determination Paper	Q1 2013

REQUEST FOR COMMENTS AND FEEDBACK

EMA invites comments and feedback to the consultation paper. Please submit written feedback to EMA_PPD@ema.gov.sg by 19 Nov 2012 (5pm). Alternatively, you may send the feedback by post/fax to:

Policy and Planning Department
Energy Planning and Development Division
Energy Market Authority
991G Alexandra Road, #01-29
Singapore 119975
Fax: (65) 6835 8020

Anonymous submissions will not be considered.

EMA will acknowledge receipt of all submissions electronically. Please contact Ms Vivienne Low at 6376 7789 or Mr Eng Zhen-Hui at 6376 7589 if you have not received an acknowledgement of your submission within two business days.

EMA reserves the right to make public all or parts of any written submissions made in response to this consultation paper and to disclose the identity of the source. Any part of the submission, which is considered by respondents to be confidential, should be clearly marked and placed as an annex which the EMA will take into account regarding the disclosure of the information submitted.

Appendix 1

Please refer to Cybele Capital Limited's Final Report attached separately.

Chronological example

- 1.1 The following simplified examples illustrate the sequence of events for the proposed demand response programme via a chronological process.
- 1.2 Licensing from EMA: Load provider will need to apply for Wholesaler (Demand Side Participation) licence from the EMA.
- 1.3 Market Participant Registration with EMC: Licensed load provider needs to register as a market participant with EMC under the Electricity Market Rules.
- 1.4 Asset Registration with EMC and PSO: Licensed load provider needs to register its demand blocks with EMC and PSO with a list of the facilities or site in which load reductions will be made. An example of registered block is shown in table below:

Site	Address	Meter Number	Capacity	Response Time
Site 1	ABC	123456	0.5 MW	Within 5 min
Site 2	EDF	234567	0.1 MW	Within 5 min
Site 3	HIJ	345678	0.2 MW	Within 10 min
Site 4	XYZ	456789	0.3 MW	Within 5 min

- 1.5 Demand Side Bidding- Example 1: The licensed load provider (Class B) with total load of 15 MW is bidding in 3 MW of load reduction for prices above \$2,000/MWh for trading period 11:30am-12:00pm and is dispatched by MCE to provide 1.5 MW of load reduction.

Example 1: Bid of 3 MW load reduction but scheduled to provide 1.5 MW of load reduction								
Time Period	Actual Time	Sequence of events						
Period T-65 mins (gate closure)	10:25:00	Based on forecasted price from EMC, load provider submits the following demand-side bid to EMC: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Trading Period</th> <th>Load</th> <th>Price</th> </tr> </thead> <tbody> <tr> <td>11:30-12:00 (T)</td> <td>12 MW 3 MW</td> <td>Nil \$2,000/MWh</td> </tr> </tbody> </table>	Trading Period	Load	Price	11:30-12:00 (T)	12 MW 3 MW	Nil \$2,000/MWh
Trading Period	Load	Price						
11:30-12:00 (T)	12 MW 3 MW	Nil \$2,000/MWh						
Period T-25 mins	10:55:00-11:05:00	EMC will run the MCE and publish Short-Term Schedule (STS) based on all the demand bids and generation offers submitted.						
Period T-30 seconds	11:25:00-11:29:30	EMC will run the MCE and publish the Real-Time Schedule (RTS) prices and dispatch quantities of energy (include demand response reductions), reserve and regulation products. For this example, the licensed load provider is scheduled for 1.5MW of load reduction.						
Period T	11:30:00-12:00:00	The licensed load provider will perform as per dispatched schedule to curtail 1.5 MW by reducing its						

		load to 13.5 MW by 11:40:00, which is monitored by the PSO.
+5 business days		The licensed load provider's performance will be measured by comparing their metered energy consumption against their dispatched order.
+21 business days		Payments to be made to compliant licensed load providers.

1.6 Demand Side Bidding-Example 2, the licensed load provider (Class B) is bidding in 3 MW of load reduction for prices above \$2,000/MWh for trading period 11:30am-12:00pm and is not dispatched by MCE to provide any load reduction.

Example 2: Bid of 3 MW load reduction but not scheduled to provide any load reduction								
Time Period	Actual Time	Activity						
Period T-65 mins (gate closure)	10:25:00	Based on forecasted price from EMC, licensed load provider submits the following demand-side bid to EMC: <table border="1" data-bbox="718 1003 1401 1111"> <thead> <tr> <th>Trading Period</th> <th>Load</th> <th>Price</th> </tr> </thead> <tbody> <tr> <td>11:30-12:00 (T)</td> <td>12 MW 3 MW</td> <td>Nil \$2,000/MWh</td> </tr> </tbody> </table>	Trading Period	Load	Price	11:30-12:00 (T)	12 MW 3 MW	Nil \$2,000/MWh
Trading Period	Load	Price						
11:30-12:00 (T)	12 MW 3 MW	Nil \$2,000/MWh						
Period T-25 mins	10:55:00-11:05:00	EMC will run the MCE and publish Short-Term Schedule (STS) based on all the demand bids and generation offers submitted.						
Period T-30 seconds	11:25:00-11:29:30	EMC will run the MCE and publish the Real-Time Schedule (RTS) prices and dispatch quantities of energy (include demand response reductions), reserve and regulation products. For this example, the licensed load provider is not scheduled to provide any load reduction.						
Period T	11:30:00	The licensed load provider will perform as per dispatched schedule to maintain its load consumption at 15 MW for the entire trading period. The licensed load provider's performance will be monitored by PSO. For the whole ½ hour period, the load provider's load must be at least 15 MW at any time.						
+5 business days		The licensed load provider's performance will be measured by comparing their metered energy consumption against their dispatched order. In this case, where 0 MW of load reduction was						

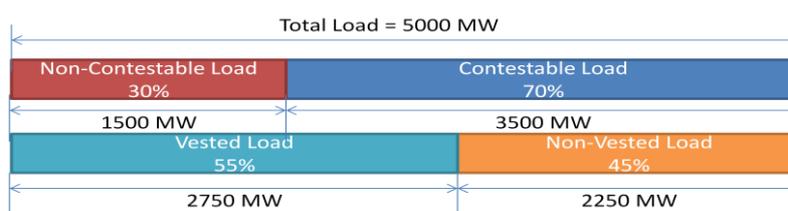
		dispatched, the metered consumption for the particular Period T should be at least 7.5 MWh.
+21 business days		Payments to be made to compliant licensed load providers.

Breakdown of HEUC incorporating demand response

Charges	Market Participants buying on behalf of contestable consumer loads	Market Participant buying on behalf of non-contestable consumer loads
HEUC (original)	As per current market rules	As per current market rules
HEUC (DR)	(Payment to licensed load providers)/ contestable load	Nil
HEUC	HEUC (original) + HEUC (DR)	HEUC (original)

Further Explanation of Payment Mechanism

The following shows an example of the average price paid by a contestable consumer, taking into consideration its vested and non-vested share. The figures used are solely for illustrative purposes. The example shows that contestable consumers pay the same average price, regardless whether the uplift is collected from non-vested or contestable consumer loads.



**Example: Total Payment to Demand Response Providers for a particular period = \$1,000
Assume Vesting Price= \$220/MWh; USEP= \$180/MWh for that period**

Method 1: Collection from Non-vested Load via HEUC	Method 2: Collection from Contestable Load via HEUC
<p>HEUC (DR) = Total Payment to DR/Non-vested Load = \$1,000/2,250 MW = \$0.444/MWh</p> <p>Weighted average electricity price for contestable consumers for that period = [Share of vested load X Vesting Price] + [Share of non-vested load X (USEP+ HEUC for DR)] = [25%/70% X \$220] + [45%/70% X (\$180 + \$0.444)] = \$78.571 + \$116.00 = \$194.57/MWh</p>	<p>HEUC (DR) = Total Payment to DR/ Contestable Load = \$1,000/3,500 MW = \$0.2857/MWh</p> <p>Weighted average electricity price for contestable consumers for that period = [Share of vested load X Vesting Price] + [Share of non-vested load X (USEP)] + HEUC (DR) = [25%/70% X \$220] + [45%/70% X (\$180)] + 0.2857 = \$78.571 + \$115.714 + \$0.286 = \$194.57/MWh</p>

Electricity Licence for Wholesaler Licensee (Demand Side Participation)

granted under

the Electricity Act (Cap. 89A) to

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PART I: SCOPE OF THE LICENCE

1. The Energy Market Authority of Singapore (the “Authority”), in exercise of the powers conferred by Section 9 of the Electricity Act (Cap. 89A) (the “Act”), hereby grants to Company XXX, (“the Licensee”), a company incorporated in the Republic of Singapore with Registration Number xxxxxxxx, an electricity licence (the “licence”) authorising the Licensee to participate in demand side activities in any wholesale electricity market operated by the Market Company, subject to the conditions of this licence (the “Conditions”).
2. The Conditions are subject to modification in accordance with their terms or Section 12 of the Act.
3. Subject to paragraph 4 below, this licence shall be for a term of 10 years commencing on the date set out below. The Licensee may, no later than 2 (two) years prior to the expiry of this licence, apply to the Authority, in writing, for a renewal of the licence. The renewal shall be on such terms and conditions as the Authority deems fit and will be notified to the Licensee, in writing, no later than 1½ (one and a half) years prior to the expiry of this licence.
4. The Authority may at any time during the term of this licence revoke or suspend this licence in accordance with Section 13 of the Act.

Chief Executive

Energy Market Authority of Singapore

PART II: CONDITIONS OF THE LICENCE

Condition 1: Interpretation

1. Unless the context otherwise requires, words and expressions used in this licence shall be construed as if they were in an Act of Parliament and the Interpretation Act (Cap. 1) applied to them and references to an enactment shall include any statutory modification or re-enactment thereof or any legislation substituted therefor after the date when this licence comes into operation. A reference in this licence to a body, whether statutory or not, which ceases to exist or whose functions are transferred to another body includes a reference to the body which replaces it or which substantially succeeds to its functions, powers or duties. A reference in this licence to the word “including” or a grammatical variation thereof means “including but not limited to”.
2. Unless the context otherwise requires or the term is otherwise defined in paragraph 3 of this Condition, all terms defined in the Act shall have the same meaning when used in this licence.
3. In this licence, unless the context otherwise requires:
 - “authorised business” means, in respect of the Licensee, the business of trading in any wholesale electricity market operated by the Market Company for the purpose of participating in demand side activities;
 - “director” means any person who is a “director” within the meaning of Section 4(1) of the Companies Act (Cap. 50);
 - “load” means the withdrawal of energy from the transmission system;
 - “load facility” means any facility that draws energy from the transmission system;
 - “demand response load” means the load reduction capacity of a load facility that can be dispatched by the Market Company for energy in any wholesale electricity market operated by the Market Company;
 - “power system” means a system comprising (a) the transmission system; and (b) generation facilities and load facilities, as defined in the market rules, connected to the transmission system;
 - “Power System Operator” means the Authority acting in its capacity as the person responsible for ensuring the security of supply of electricity to consumers and arranging for secure operation of the transmission system in accordance with the market rules and applicable codes of practice as described in Section 3(3)(e) of the Act;
 - “regulatory contract” means an agreement or arrangement which an electricity licensee is required, by condition of licence, to enter into under Section 9(7)(a)(ii) of the Act;
 - “related enterprise” in relation to the Licensee or its subsidiary means any company or partnership over which the Licensee or its subsidiary, as the case may be (either directly or through another subsidiary company) is able to exercise control, that is, to direct the decision-making process of the company or partnership, whether through holding issued share capital or voting power of the company or partnership; and
 - “relevant legislation” means the Act and the Energy Market Authority of Singapore Act (Cap. 92B), and includes in each case the regulations made thereunder.
4. For the purposes of the restriction on the transfer of this licence, the provisions of Section 11 of the Act shall apply and, accordingly:

- (a) this licence is not transferable without the approval in writing of the Authority; and
 - (b) any purported transfer of this licence shall be void.
- 5. Any reference in this licence to a numbered paragraph is a reference to the paragraph bearing that number in the condition in which the reference occurs.
- 6. Where in this licence the Licensee is required to comply with any obligation within a specified time limit, that obligation shall be deemed to continue after that time limit if the Licensee fails to comply with that obligation within that time limit.
- 7. The provisions of Section 99 of the Act shall apply for the purposes of the service of any document pursuant to this licence.

Condition 2: Composition of the Board of Directors

- 1. The Licensee shall procure that at all times its directors shall not be employed by nor hold any office or engagement with:
 - (a) any person authorised by an electricity licence or exempted from the obligation to hold an electricity licence, to engage in an activity referred to in one or more of subsections (b), (e), or (g) of Section 6(1) of the Act; or
 - (b) a gas transporter under the Gas Act (Cap. 116A).
- 2. The Authority may, on such terms as it may specify in writing and notified to the Licensee, waive or vary any of the requirements of this Condition.

Condition 3: Prohibition of Acquisition of Shares

- 1. The Licensee shall not directly or indirectly through its related enterprises acquire or hold any shares in:
 - (a) any person authorised by an electricity licence or exempted from the obligation to hold an electricity licence, to engage in an activity referred to in one or more of subsections (b), (e), or (g) of Section 6(1) of the Act; or
 - (b) a gas transporter under the Gas Act (Cap. 116A).
- 2. The Authority may, on such terms as it may specify in writing and notified to the Licensee, waive or vary any of the requirements of this Condition.

Condition 4: Compliance with Market Rules

- 1. The Licensee shall not trade in any wholesale electricity market operated by the Market Company unless it is registered as a market participant in accordance with the market rules. The Licensee shall at all times comply with the provisions of the market rules applicable to the Licensee.
- 2. If the Licensee applies to the Market Company for registration as a market participant, the Licensee shall notify the Authority:
 - (a) of the filing of such application;
 - (b) upon being registered or denied registration as a market participant;

- (c) upon having its registration as a market participant suspended or terminated; and
- (d) no later than 2 (two) months before any application is filed by the Licensee to withdraw its registration as a market participant.

Condition 5: Codes of Practice

1. The Licensee shall be subject to and shall comply with any codes of practice and standards of performance issued or approved under Section 16 of the Act that apply to the Licensee.
2. The Licensee may be required to participate in the development of any code of practice and standard of performance to be issued by the Authority if such code of practice or standard of performance will directly or indirectly affect the authorised business of the Licensee.
3. The Licensee may propose modifications to a code of practice or standard of performance that is in force at the relevant time by notifying the Authority in writing of the proposed modification. The Authority may:
 - (a) review the proposed modification to a code of practice and determine whether the proposed modification should be made, in accordance with the code modification process set out in the relevant code; and
 - (b) review the proposed modification to a standard of performance to determine whether the proposed modification should be made.
4. The Authority may by written notification, exempt the Licensee from compliance with any code of practice, in whole or in part, and subject to such terms and conditions as the Authority may determine.
5. (1) The Licensee shall not:
 - (a) with regard to its authorised business or the electricity industry,
 - (i) make, prepare, attest to or certify, orally or in writing, any representation or statement that is false, incorrect or misleading or open to misconstruction by any person; or
 - (ii) make any representation or statement, orally or in writing, or give any answer, orally or in writing, or otherwise conduct itself in a manner that is likely to mislead any person; or
 - (b) mislead or otherwise create any confusion in the mind of a person about its authorised business.
- (2) If the Authority is satisfied that the Licensee is contravening or has contravened any provision of paragraph (1), the Authority may, by notice in writing to the Licensee, direct the Licensee to take such steps, as are specified in such direction, to correct such false, incorrect or misleading representation, statement or answer or to correct such confusion, including without limitation, by requiring the Licensee to publish a correction or to write to such persons to set out the correct facts within a specified period of time as directed by the Authority.

- (3) The Authority may take enforcement action against the Licensee in accordance with the provisions of the Act if the Licensee fails to comply with the direction of the Authority issued under paragraph (2) above.

Condition 6: Regulatory Contracts

1. The Licensee shall enter into the following regulatory contracts:
 - (a) an agreement with the Power System Operator for the purposes of creating a contractual relationship between the Power System Operator and the Licensee as a market participant; and
 - (b) if deemed necessary by the Authority, an agreement with a market support services licensee to obtain market support services.
2. The Licensee may be required to participate in the preparation of any regulatory contract to which the Licensee will be a party.
3. If after a period which appears to the Authority to be reasonable, or such period agreed to between the parties and approved by the Authority, or such other period as stipulated by the Authority from time to time, the Licensee has failed to enter into a regulatory contract, the Authority may, at the request of the Licensee or the party aggrieved by such failure, determine any terms of the regulatory contract in such manner as appears to the Authority to be reasonable. The Licensee shall thereafter enter into the regulatory contract on the terms determined by the Authority.
4. Paragraph 3 of this Condition shall not apply to any regulatory contract under which the Authority or an entity that is operated by or to which the Authority has a shareholding is a party, in which case an independent third party shall be appointed to negotiate any terms that remain unresolved as between the Authority or the aforesaid entity, as the case may be, and the Licensee.
5. Any dispute arising under a regulatory contract to which the Licensee is a party shall be resolved in accordance with the dispute resolution provisions of the regulatory contract.

Condition 7: Provision of Dedicated Data Communication Services

1. The Licensee shall if deemed necessary by the Power System Operator, procure data communication links between the control centres of the Power System Operator and **the demand response load**, as specified by the Power System Operator for the purposes of real-time monitoring of **the demand response load**.

Condition 8: Investigation of Offences

1. The Licensee shall monitor its activities with respect to compliance with this licence and shall report any suspected non-compliance to the Authority.
2. Where it comes to the attention of the Licensee that another electricity licensee has breached its electricity licence or relevant legislation, the Licensee may report any suspected non-compliance to the Authority.

3. Where the Licensee reports suspected non-compliance by itself or another electricity licensee, or requests the Authority to institute a prosecution against any person for contravening a provision of relevant legislation in relation to the authorised business, the Licensee shall furnish to the Authority:
 - (a) a written report on the suspected non-compliance or contravention; and
 - (b) any relevant information and evidence in the possession or control of the Licensee and requested by the Authority within 30 (thirty) days of the Authority's request.
4. Where the Authority receives any information from any person other than the Licensee indicating that an offence under relevant legislation may have been committed in respect of activities or property belonging to or managed by the Licensee, the Authority may, subject to Section 5 of the Act, inform the Licensee of such information and the Licensee shall furnish to the Authority, within 30 days of the Authority's request,:
 - (a) a written report on the suspected offence; and
 - (b) any relevant information and evidence in the possession or control of the Licensee and requested by the Authority.
5. The Licensee and its directors and officers shall give full assistance and cooperation to the Authority and its prosecuting officer or counsel in connection with any prosecution proceedings arising from paragraphs 1 through 4 of this Condition.

Condition 9: Information, Access and Audit Rights of the Authority

1. The Licensee shall promptly inform the Authority of any circumstances that result, or are likely to result, in a change in the information provided to the Authority and shall provide updated information to the Authority in a timely manner.
2. Without prejudice to the powers of the Authority to call for information under or pursuant to any other conditions in this licence or relevant legislation, the Licensee shall, at its own cost, furnish to the Authority such information as the Authority requires pursuant to Section 4 of the Act and in such form as the Authority requires.

Condition 10: Payment of Fees

1. The Licensee shall, at the times stated hereunder, pay to the Authority fees of the amount specified in, or determined under, paragraphs 2 to 5.
2. The Authority shall, after the issue of this licence, notify the Licensee in writing of the initial fee to be paid and the Licensee shall pay such fee to the Authority within 30 (thirty) days.
3. The Authority shall notify the Licensee on or before the 1st of April of each subsequent year in which this licence is in effect of the fee to be paid and the Licensee shall pay such fee to the Authority on or before 30th April of each such subsequent year.
4. Without prejudice to any other powers of the Authority under this licence or the Act, if the Licensee shall fail to pay in full any fee due pursuant to this Condition on or before the due date for payment thereof the Licensee shall pay to the Authority interest at the Prescribed Rate described in paragraph 5 below, which interest shall accrue daily on

the amount unpaid on and from such due date to the date of actual payment and shall be compounded monthly at the end of each calendar month.

5. The Prescribed Rate shall be the rate which is four percentage points (4%) above the arithmetic average of the rates quoted in Singapore by The Development Bank of Singapore Limited, Overseas-Chinese Banking Corporation Limited and United Overseas Bank Limited (or such other banks as the Authority may specify in writing from time to time) as being the respective prime lending rates of such banks for each day of the period for which interest accrues, and in respect of any day during such period which is not a day for which such a rate is quoted the last preceding rate quoted shall apply.

Proposed amendments to the Code of Conduct for Retail Electricity Licensees

2.2.2 A Licensee shall comply with the following when retailing electricity:

- (a) immediately and truthfully identify itself to a consumer in the manner specified in section 2.3;
- (b) clearly indicate that any offer to sell made by the Licensee is not being made by a person authorised by the Authority to transmit electricity or provide market support services;
- (c) not seek to mislead or otherwise create any confusion in the mind of a consumer about the identity of the Licensee, its promotion campaigns or trade mark, or those of other Electricity Licensees;
- (d) not exert undue pressure on a consumer;
- (e) provide sufficient time for a consumer to read thoughtfully and without harassment all documents provided by the Licensee;
- (f) not make, orally or in writing, any representation or statement, give any answer or otherwise conduct itself in a manner that is false or is likely to mislead a consumer with regard to any term in an offer to sell;
- (g) provide only accurate, verifiable and truthful comparisons;
- (h) not make any oral representations regarding retail contracts or related rights or obligations unless such representations are reflected in a written offer to sell;
- (i) ensure that all representations made in the Licensee's promotional material truthfully and accurately represent actual conditions, situations and circumstances; **and**
- (j) not use, in any document provided to a consumer, print that, due to its size or other visual characteristics, is likely to impair materially the legibility or clarity of the document; **and**
- (k) **not discourage or prohibit consumers from participating in demand response-related or energy efficiency-related initiatives.**