FRAMEWORK FOR SERVING ELECTRICITY DEMAND OF LARGE DISCRETE LOADS

CONSULTATION PAPER

Closing date for submission of comments:

03 April 2020

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ENERGY MARKET AUTHORITY
991G ALEXANDRA ROAD
#01-29
SINGAPORE 119975
www.ema.gov.sg

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1. Background

1.1. Currently, a consumer who has a large discrete load ("LDL"), i.e. with a peak demand ("PD") for electricity of 25.5 MW (30 MVA based on a power factor of 0.85)[1] or more, is required to connect at the transmission voltage level of 66 kV or above.

1.2. Traditionally, LDLs have typically taken around 3-4 years to become operational. This provides adequate lead time to plan and augment the power system to ensure sufficient power generation capacity as well as grid capacity to serve the LDL. However, in recent years, we have seen the rapid growth of LDLs in highly energy-intensive sectors such as data centres that can ramp up very quickly in less than 3-4 years.

1.3. The Transmission Agent Licensee, *viz.* SP PowerGrid Ltd ("SPPG"), will continue to administer the connection of the LDLs to the power grid and ensure adequacy of grid capacity to serve them. In addition to this, a framework is needed to facilitate orderly ramp up of LDLs so as to ensure that there will be sufficient generation capacity to serve their PD ("LDL Framework").

1.4. The Energy Market Authority ("EMA") has developed an LDL Framework that will require LDLs to provide reliable PD projections for the purpose of ensuring sufficient generation capacity to serve them, while providing sufficient flexibility for them to adjust their PD projections. The proposed LDL Framework is also designed to encourage LDLs to better project their PD projections. If there is significant over-projection of demand, there will be overcapacity in the generation sector, which will be unsustainable for generation companies operating in the Singapore Wholesale Electricity Market. The proposed LDL Framework is set out below.

[1] EMA will review and update the 30 MVA threshold from time to time to ensure it remains appropriate for our evolving electricity system.

2. Proposed LDL Framework

2.1. *Overview*

2.1.1. The LDL Framework is intended to apply to any (existing or new) consumer who is an LDL, i.e. a consumer with a power demand requirement of 30 MVA or more, to be served via the grid.

2.1.2. Under the LDL Framework, an existing or new LDL will have to provide to SPPG in the first instance, its initial annual PD projection for the next 4 years (i.e. initial 1-year, 2-year, 3-year and 4-year ahead PD projections). Thereafter, the LDL will have to provide its 4-year ahead PD projection on a rolling annual basis until it is no longer in the ramp up phase (i.e. it has reached steady state). When the LDL reaches its steady state PD, it will only be required to provide 1-year ahead PD projection on a rolling annual basis.

2.1.3. For LDLs in the ramp up phase, EMA will procure sufficient generation capacity to meet their 4-year ahead PD projections. *Section 2.2* sets out the proposed mechanism to encourage such LDLs to provide reliable 4-year ahead PD projections for the purpose of ensuring sufficient generation capacity to serve them, while providing sufficient flexibility for them to adjust their PD projections.

2.1.4. For new LDLs (i.e. those being connected to the grid for the first time in the current year), EMA will need to assess their initial 1-year, 2-year and 3-year PD projections taking into account the availability of generation capacity to serve them in the next 3 years (which is before new generation capacity can typically be made available). The allowable PD (which may be less than the proposed initial PD projections due to generation capacity constraint), if accepted by the LDL, will be subject to the same mechanism set out in *section 2.2.2 and 2.2.3* to give the LDL flexibility to subsequently adjust its PD projections.

2.2. *LDLs in Ramp-Up Phase*

2.2.1. For a given year ‘T’ (“Delivery Year”) during which power supply from the grid is needed, each new LDL or existing LDL in the ramp-up phase will be required to provide its PD projection up to 4 years ahead to SPPG. SPPG will maintain an LDL registry based on which EMA will procure sufficient generation capacity to serve the LDL’s PD in Delivery Year ‘T’.

2.2.2. The LDL may adjust its PD projection for the Delivery Year 'T' on an annual basis in accordance with the following:

(a) The LDL is allowed to reduce its PD projection for Delivery Year 'T' within a specified allowable reduction tolerance ("ART") range that gets tighter towards Delivery Year 'T' (refer to *section 3* for details on the ART).

(b) If the LDL needs to increase or reduce its PD projection beyond the ART range, it is allowed to do so but only to the extent that the increase or reduction can be offset by other LDLs' adjustments to their PD projections for Delivery Year 'T' (refer to *section 4* below for details on the Offsetting Mechanism).

2.2.3. After the final adjustment is made to the 1-year ahead PD projection, it will become binding on the LDL for Delivery Year 'T'. A charging framework will be imposed on the LDL in Delivery Year 'T' if its actual PD during the year deviates from the binding 1-year ahead PD projection (refer to *section 5* for details on the charging framework).

2.3. *LDLs in Steady-State*

2.3.1. Once the LDL has completed its ramp-up and reached its steady state PD, it will only be required to provide binding 1-year ahead PD projections on an ongoing basis and subject to same charging framework described in *section 5*.

2.3.2. The LDL is deemed to have reached its steady state PD if its binding 1-year ahead PD projection increases/decreases by no more than 5% year-on-year for 5 consecutive years, or if its 5-year historical electricity demand did not vary by more than 5% year-on-year.

2.3.3. After the LDL has reached its steady state PD, if it needs to subsequently increase or decrease its binding 1-year ahead PD projections by more than 5%, it is deemed as no longer in steady state and will be subject to the requirements set out in *section 2.2*.

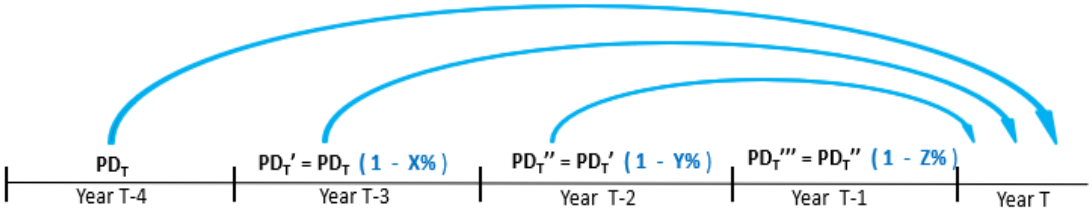
2.4. *Treatment of LDLs with Embedded Generators ("EGs")*

2.4.1. The same requirements apply to an LDL with EG (i.e. its own onsite generation capacity for self-supply of electricity) so long as its maximum power requirement to be supplied from the grid (including to backup its EG) is 30 MVA or higher.

3. Allowable Reduction Tolerance ("ART")

3.1. In respect of a given Delivery Year 'T', each LDL will be allowed to reduce its most recent PD projection for the year annually in year 'T-3', 'T-2' and 'T-1' ("Adjustment Years") within an ART range of -X% to 0%, -Y% to 0% and -Z% to 0% respectively. *Figure 1* illustrates the maximum reduction in the PD projection for Delivery Year 'T' that the LDL is allowed to make in Adjustment Year 'T-3', 'T-2' and 'T-1'.

Figure 1: Illustration of ART Range Towards Delivery Year 'T'



3.2. EMA will set the ART range tighter towards year 'T' (i.e. X% > Y% > Z%) as the LDL is expected to be able to provide more accurate PD projection closer to the Delivery Year 'T'. This is to enable EMA to conduct more robust generation capacity planning and ensure adequate supply to deliver reliable electricity to all consumers.

3.3. A wider ART can potentially result in over-procurement of generation capacity and the associated cost will need to be recovered from all consumers. To mitigate this while providing flexibility for LDLs to plan and manage their PD towards the Delivery Year, EMA would set X%, Y% and Z% at 15%, 7.5% and 5% respectively.

4. Offsetting Mechanism

4.1. In respect of a given Delivery Year 'T', all LDLs who wish to increase or reduce their respective PD projection in Adjustment Year 'T-3', 'T-2' or 'T-1' will be required to submit their request to SPPG by a specified date (to be determined) in those Adjustment Years.

4.2. Any proposal by an LDL in an Adjustment Year to reduce its PD projection for the Delivery Year 'T' within its ART will be approved. However, the LDL may also request in an Adjustment Year to either increase or reduce its PD projection for the Delivery Year 'T' beyond the applicable ART range

("Request"). Under the Offsetting Mechanism, EMA will in the Adjustment Year take into account the net change in the total PD projections across all LDLs for Delivery Year 'T', to fully or partially accommodate/offset all Requests as follows so as to ensure that generation capacity in the Delivery Year 'T' will remain sufficient to serve all consumers (refer to *Appendix 1* for work examples illustrating the Offsetting Mechanism):

(a) If there is a net reduction in the total PD projection across all LDLs, all Requests to increase PD projection will be approved. The total PD increase can be used to fully or partially offset the remaining Requests of LDLs to reduce PD projection beyond their ART. More specifically, such LDLs with proposed PD reduction beyond their ART will be scaled down proportionately such that the total adjusted PD reduction can be fully offset by the total PD increase.

(b) Conversely, if there is a net increase in the total PD projection across all LDLs, all Requests to reduce PD projection will be approved. The total PD reduction can be used to fully or partially offset the Requests of LDLs to increase PD projection. More specifically, the proposed PD increase by these LDLs will be scaled down proportionately such that the total adjusted PD increase can be fully offset by the total PD reduction.

5. Charging Framework

5.1. EMA is planning to establish a forward capacity market ("FCM") to procure in advance sufficient generation capacity via competitive auctions for delivery from 2023. In conjunction with the FCM, there will be a market-determined generation capacity charge to be levied on all consumers based on their actual consumption in the Delivery Year to recover the procurement cost.

5.2. After the final adjustment is made to the 1-year ahead PD projection, it will become binding on the LDL for Delivery Year 'T'. The following charging framework will be imposed to incentivise the LDL to manage its consumption in the Delivery Year 'T' to minimise deviation from its binding PD projection:

(a) For each half-hourly period in the Delivery Month when the LDL's actual consumption is within ± 5% of its binding PD projection in the Delivery Month, it will pay the prevailing generation capacity charge based on its consumption (as per non-LDLs).

(b) For each half-hourly period in the Delivery Month when the LDL's actual consumption is less than 95% of its binding PD projection, the LDL will

pay the prevailing generation capacity charge based on 95% of its binding PD projection.

(c) For each half-hourly period in the Delivery Month when the LDL's actual consumption is more than 105% of its binding PD projection, the LDL will pay the prevailing generation capacity charge for the 105%, and a higher generation capacity charge at 2 times the prevailing generation capacity charge for the excess consumption above 105% of its binding PD projection for these half-hourly periods.

5.3. Each LDL will be required to install a load limiting device ("LLD") as part of the grid connection scheme to safeguard the security and reliability of electricity supply to other consumers.[2] For a given Delivery Month, when there are two occurrences of the LDL's actual half-hourly consumption exceeding 105% of its binding PD projection, the LLD will be activated by SPPG and triggered from the third time onwards. The counter would be reset for each Delivery Month.

6. Indicative Implementation Schedule

6.1. The indicative timeline to implement the LDL framework is set out in *Table 1*.

Table 1: Implementation Schedule

Milestone	Indicative Timeline
Issuance of EMA's Final Determination Paper	By Q3 2020
Modification to the appropriate code of practices/ license conditions/ regulations	By Q4 2020
Commencement of LDL Framework	By Q1 2021

7. Request for Comments

7.1. EMA would like to invite written comments on the above LDL Framework as well as any response to the list of questions provided in *Appendix 2*. Where applicable, please provide justifications, data and explanations to support your comments/responses.

[2] An LLD is a device installed at the grid connection point i.e. between the grid and a consumer's premises including his load facilities therein. The LLD will be automatically triggered (when certain operational set points are breached) to discontinue electricity supply to the consumer.

7.2. Please submit all written comments via email to: ema_mdsd@ema.gov.sg

7.3. All submissions should reach EMA by 5pm on 03 April 2020 in the format shown at *Appendix 3*. You are requested to include a soft-copy of your submission in both PDF and Microsoft Word format.

7.4. EMA will acknowledge receipt of all submissions via email. Please contact Mr Choon Kiat Tan (6376 7552) or Ms Harivina Gunnaasankaraan (6376 7489) if you do not receive an acknowledgement of your submission within two business days.

7.5. Please note that EMA will not consider anonymous submissions. EMA reserves the right to make public all or part 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 appendix (with justification on the need to maintain confidentiality). EMA will take this into account in the disclosure of the information submitted.

Appendix 1

Offsetting Mechanism

Worked Example 1: Net <u>reduction</u> in total PD projection across all LDLs

Delivery Year 'T': 2023				
	LDL_1	**LDL_2**	**LDL_3**	**LDL_4**
Most recent PD projection for 2023 made in <u>2019</u> (MW) *[A]*	30	30	36	40
In Adjustment Year 'T-3' i.e. <u>2020</u>:				
Proposed new PD projection for 2023 (MW) *[B]*	29	22	40	30
Change (MW) *[C = B - A]*	-1	-8	4	-10
Net Change in Total PD for 2023 (MW) *[D = Sum of C across all LDLs]*		-15		
ART Range in Adjustment Year 2020 (i.e. -X% to 0%)		*-15% to 0%*		
Maximum <u>reduction</u> in PD projection for 2023 allowed to be made in 2020 (MW) *[E = -15% x A]*	-4.5	-4.5	-5.4	-6
Absolute percentage <u>reduction</u> *[F = |C| ÷ A x 100%]*	N.A.	**26%**	N.A.	**25%**

1. **LDL_1**: LDL_1's proposed change in PD projection of -1 MW will be approved since this is within its ART range of -4.5 MW to 0 MW. Therefore, LDL_1's approved PD projection for 2023 = 29 MW.

2. **LDL_3**: As there is a net reduction (-15 MW) in the total PD projection across all the 4 LDLs, the request of LDL_3 to increase its PD projection (i.e. by 4 MW) will be approved. Therefore, LDL_3's approved PD projection for 2023 = 40 MW.

3. **LDL_2 and LDL_4**: LDL_2's and LDL_4's proposed reduction in PD projection exceeds their ART range of -4.5 MW to 0 MW and -6 MW to 0 MW respectively. *Before applying the Offsetting Mechanism*, LDL_2 and LDL_4 will be allowed to change their PD projection by <u>-4.5</u> MW and <u>-6 MW</u>. Accordingly, LDL_2's and LDL_4's approved PD projection *before applying the Offsetting Mechanism* = 25.5 MW and 34 MW respectively.

   Under the Offsetting Mechanism, LDL_3's proposed increase in PD projection of <u>4 MW</u> can be used to offset the additional PD reduction requested by LDL_2 (<u>-3.5 MW</u>) and LDL_4 (<u>-4 MW</u>) beyond their respective ART tolerance range. More specifically, LDL_3's PD increase of 4 MW will be allocated to LDL_2 and LDL_4 in inverse proportion to their absolute percentage reduction in PD projection:

LDL_2:

$$Initial\ allocation\ of\ LDL2's\ PD\ increase = \frac{\frac{1}{26\%}}{\frac{1}{26\%}+\frac{1}{25\%}} \times 4\ \text{MW} = 1.96\ \text{MW}$$

LDL_2's approved total reduction in PD projection for 2023 = 4.5 MW + 1.96 MW = 6.46 MW. Its approved new PD projection for 2023 = 30 MW – 6.46 MW = 23.54 MW

LDL_4:

$$Initial\ allocation\ of\ LDL4's\ PD\ increase\ = \frac{\frac{1}{25\%}}{\frac{1}{26\%}+\frac{1}{25\%}} \times 4\ \text{MW} = 2.04\ \text{MW}$$

LDL_4's approved total reduction in PD projection for 2023 = 2.04 MW + 6 MW = 8.04 MW. Its approved new PD projection for 2023 = 40 MW – 8.04 MW = 31.96 MW

Summary table of projections	**LDL_1**	**LDL_2**	**LDL_3**	**LDL_4**
PD projection for 2023 made in 2019 (MW)	30	30	36	40
Adjusted PD projection for 2023 in 2020 after ART and the Offsetting Mechanism (MW)	29	23.54	40	31.96

Worked Example 2: Net increase in total PD projection across all LDLs

Delivery Year 'T': 2023				
	LDL_1	**LDL_2**	**LDL_3**	**LDL_4**
Most recent PD projection for 2023 made in 2019 (MW) *[A]*	30	30	36	40
In Adjustment Year 'T-3' i.e. 2020:				
Proposed new PD projection for 2023 (MW) *[B]*	29	40	28	45
Change (MW) *[C = B - A]*	-1	10	-8	5
Net Change in Total PD for 2023 (MW) *[D = Sum of C across all LDLs]*		6		
ART Range for 2020 (i.e. -X% to 0%)		-15% to 0%		
Maximum reduction in PD projection for 2023 allowed to be made in 2020 (MW) *[E = -15% x A]*	-4.5	-4.5	-5.4	-6
Absolute percentage increase *[F = |C| ÷ A x 100%]*	N.A.	**33%**	N.A.	**13%**

1. **LDL_1**: LDL_1's proposed change in PD projection of -1 MW will be approved since this is within its ART range of -4.5 MW to 0 MW. Therefore, LDL_1's approved PD projection for 2023 = 29 MW

2. **LDL_3**: As there is a net increase (6 MW) in the total PD projection across all the 4 LDLs, the request of LDL_3 to reduce its PD projection (i.e. by 8 MW) will be approved. Therefore, LDL_3's approved PD projection for 2023 = 28 MW

3. **LDL_2 and LDL_4**: LDL_2 and LDL_4 proposed to increase PD projections. *Before applying the Offsetting Mechanism*, LDL_2 and LDL_4 will not be allowed to increase their PD projection.

   Under the Offsetting Mechanism, LDL_1's and LDL_3's total approved reduction in PD projection of -9 MW can be used to offset the proposed PD increase requested by LDL_2 (10 MW) and LDL_4 (5 MW). More specifically, LDL_1's and LDL_3's total approved PD reduction of -9 MW will be allocated to LDL_2 and LDL_4 in inverse proportion to their absolute percentage increase in PD projection:

LDL_2:

$$Allocation\ of\ LDL2's\ PD\ reduction = \frac{\frac{1}{33\%}}{\frac{1}{33\%}+\frac{1}{13\%}} \times 9\ \text{MW} = 2.53\ \text{MW}$$

Under the Offsetting Mechanism, LDL_2's approved total increase in PD projection for 2023 = 2.53 MW.
Its approved new PD projection for 2023 = 30 MW + 2.53 MW = 32.53 MW

LDL_4:

$$Allocation\ of\ LDL4's\ PD\ reduction\ = \frac{\frac{1}{13\%}}{\frac{1}{33\%}+\frac{1}{13\%}} \times 9\ \text{MW} = 6.47\ \text{MW}$$

Under the Offsetting Mechanism, LDL_4's approved total increase in PD projection for 2023 = 6.47 MW.
Its approved new PD projection for 2023 = 40 MW + 6.47 MW = 46.47 MW

Summary table of projections	**LDL_1**	**LDL_2**	**LDL_3**	**LDL_4**
PD projection for 2023 made in 2019 (MW)	30	30	36	40
Adjusted PD projection for 2023 in 2020 after ART and the offsetting mechanism (MW)	29	32.53	28	46.47

Appendix 2

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Additional Questions for Respondents
- What are the challenges in providing four-year ahead PD projections and one-year ahead binding PD projections? - Would the definition for “steady state” be consistent with how your company views “steady state” production? - Has the LDL Framework provided sufficient flexibility for your company’s investment decision and start-up timeframes? - Should all LDLS (i.e. existing and new LDLs) be subject to the LDL framework?
- Has the ART range provided sufficient flexibility to adjust your 4-year ahead PD projections for your company’s operations? - Is the proposed ART range consistent with how your company would make PD projections? If not, what would be an acceptable ART range that is consistent with your company’s planning parameters over a projection time frame of four-years ahead?
- How frequent should the Offsetting Mechanism be conducted?
- What are your views on the installation of a load limiting device or LLD? - Is the charging framework adequate for encouraging your company to mimimise deviation from its binding PD projection?

Appendix 3

FORMAT FOR SUBMISSION OF COMMENTS

FRAMEWORK FOR SERVING ELECTRICITY DEMAND OF LARGE DISCRETE LOADS ("LDLs")

S/No.	Please indicate in each cell in this column, the section/paragraph in **the consultation paper** to which your comment refers	Comments
1		
2		
3		
. . .		
Any other comments		

Comments submitted by:

Name :
Designation :
Company :
Email :
Contact No. :