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இலங்கை மின்சார சபை
CEYLON ELECTRICITY BOARD

Your ref: PUC/LIC/2022/TL/93 My Ref: DGM(CS&RA)/GEN/05-08 Date: October 12, 2022

Director General
Public Utilities Commission of Sri Lanka
6th Floor, BOC Merchant Tower
No.28, St, Michael's Road
Colombo 3.

PUBLIC UTILITIES COMMISSION OF SRI LANKA
14 OCT 2022
4360

Dear Sir,

SUBMISSION OF THE DRAFT LONG TERM GENERATION EXPANSION PLAN (LTGEP) 2023-2042

This has reference to letter PUC/LIC/2022/TL/93 dated 2022-10-03 addressed to Additional General Manager – Transmission, requesting information in order to approve the Long Term Generation Expansion Plan 2023-2042.

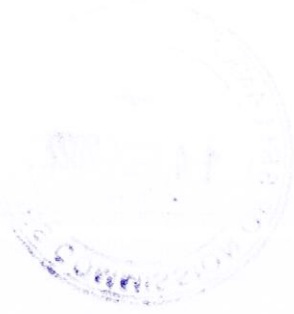
Accordingly, requested clarifications are forwarded herewith for your information please **(Annex-1).**

Yours faithfully,
CEYLON ELECTRICITY BOARD

Eng. (Dr.) D.C.R. Abeysekera
Actg. General Manager
(Authorized officer for Licenses EL/GB/09-001, EL/T/09-002, EL/D/09-003, EL/D/09-004, EL/D/09-005, EL/D/09-006)

Eng. (Dr.) D.C.R. Abeysekera
Actg. General Manager
Ceylon Electricity Board

Copy: Addl.GM (CS) *- fipls*
DGM(Tr & Gen Planning)/ Addl.GM (Tr – Non-Wired Operations) *- fipls*



Annex -1

Clarifications on draft LTGEP 2023-2042

Demand Forecast

1. **Non consideration of Railway Electrification project and Electrification of Transport sector in forecasting the future demand**

   Railway Electrification and related electrifications in the transport sector were considered in the short term demand forecast study.

2. **Non consideration of Railway Electrification project Under the transport sub sector in MAED Model demand projection**

   Though it has been considered under the demand study of transport sub sector, it is not shown in table 3.4 by oversight. Will update table 3.4 accordingly.

3. **Basis of forecasting a constant T&D loss of 7.25% from 2035 onwards**

   It is assumed that T&D losses would gradually decrease and come to saturation after 2035. Expected renewable development in large scale that is geographically distributed and the embedded generation in distribution network would remarkably contribute to the reduction of T&D losses and the saturation value will be further refined in future planning cycles after analyzing the behavior of the loss in future network.

4. **Non consideration of prospective change in demand due to tariff increase (Off grid solutions, conservations, Demand Side management, Industrial Sector contractions due to energy price & etc.)**

   Tariff increase happened after completion of our planning studies . Hence, any impact to the future demand would be studied in the next planning cycle. Furthermore, any future demand variation has to be studied with special analytical approaches as the ongoing load shedding conceals the exact demand picture.

   Energy conservation and demand side management activities in the recent past were captured through trend analysis used for the medium term forecast. Effect of industrial sector contractions due to recent economic situation would impact in long term and will be captured in the next planning cycle. This would not impose much impact on the anticipated generation and network expansions in view of achieving the government policy. Energy price increase is a global issue to be tracked with adaptation and industrial demand growth in such environment will have to be captured in future studies.

   Off-grid solutions are not yet prominent but should be further studied and considered in future planning cycles considering the institutional involvement in promotion of such and potential for implementation.

Study Parameters

1. **The impact of using a low exchange rate (201.5 LKR/USD) to the optimization process.**

   No impact to the optimization process as all the cost figures used as input in the optimization process were in USD.

2. **Will the biomass plants get selected due to low fuel cost if the current exchange rate is applied?**

   In our planning studies, biomass plants are not selected through optimization process, but are considered as a projection based on the available potential given by the Sri Lanka Sustainable Energy Authority. However, there is also no restriction imposed on the annual capacity additions of biomass power plants and can be incorporated case by case depending on their feasibility and possibility of providing grid concurrence, as mentioned in the LTGEP.

Renewable Generation

1. **Viability of implementing the already awarded renewable generation facilities**

   Renewable projects already awarded are considered as viable in planning stage and are included as committed capacity.

Thermal Power Candidates

1. **Source of the cost details mentioned in the Table 4.1**

   Simple cycle and combined cycle gas turbines - Gas Turbine World 2020 GTW Handbook

   Coal – Feasibility studies

   IC Engine-From IC Engine manufacturers

2. **Reason for having higher net capacities than the nameplate capacities in some of the candidate thermal plants in Table 4.1**

   Candidate power plants could not have any nameplate capacity and such data is not mentioned in the LTGEP report. The capacity indicated under plant name is only an identifying parameter (not the nameplate capacity) for the capacity of the candidate power plant. Different manufacturers have varying models in the same range of capacity. The actual plant capacity at the procurement stage can be a plant capacity with ±10% indicated in the name of the plant. The net capacity indicated in the table is the capacity (net) of the model which has been considered for planning studies.

3. **It is mentioned in the plan that all new natural gas fired power plants should have the capability to operate from synthetic fuels such as Hydrogen, to satisfy the policy requirement of achieving carbon neutrality by 2050. Doesn't the imposition of this requirement increase the capital cost of the technology?**

   At present, most of the state of the art gas fired plants are manufactured to operate on synthetic fuels at least in blended form. This is not expected to incur any significant additional cost. However once hydrogen supply chain is established it can be expected to incur an additional cost for its fuel supply infrastructure and storage.

   It is expected their prices would become competitively attractive with the technological advancements in future and the associated costs could be differentiated and identified in our future plans.

Fuel Prices

1. **Weights used in deriving the weighted averages of Crude oil, LNG and Coal prices used in the planning study.**

	Actual Data			Forecast Data			Sum
Year	Recent Year -2	Recent Year -1	Recent Year	Recent Year +1	Recent Year +2	Recent Year +3	
Weight	2	2	3	1	1	1	10

2. **Non consideration of current fuel prices which are very high compared to the fuel prices used in the planning study**

   For planning studies that are done for a long span (20 years) it is not prudent to consider price variations caused in a single year. The fuel prices tend to fluctuate and are presently at a very high value due to global economic factors. However, for comparison purposes the event of occurrence of high fuel prices throughout the period of whole 20-years, is already considered and illustrated as a sensitivity, in section 10.3.1.

3. **Weights used in deriving the weighted averages of auto diesel, fuel oil and naphtha prices used in the planning study**

   Prices of auto diesel, fuel oil and naphtha based on a percentage value of weighted average crude oil price. The percentage is based on simple average of past three-year data.

Fuel	Percentage to Crude Oil
Diesel	108 %
Furnace Oil	118 %
Naphtha	85 %

Reference Case

1. **Reference Case should be the case with the lowest present value cost unconstrained by policy guidelines. But the Reference Case of the plan has constraints; achieving 60 % RE by 2030, maintaining 60% RE beyond 2030 and no coal fired plant additions beyond 2030.**

   The reference case has been developed without considering any constraints and maintaining the operational capability of the system as stipulated in the grid code. Achieving 60% RE by 2030 and maintaining it beyond 2030 is an output of the reference case, not a constraint. Decision to cease adding coal power plants beyond 2030 also cannot be considered as a constraint as it is a decision taken with regard to the operational capability of the system (under high renewable penetration) as well as the practical implementation of power plants.

   The reference case has been selected based on conducting several least cost options with different RE penetration levels unconstrained by the policy guidelines.

2. **Does the present value cost come down further if the above constrains are also removed? If yes provide the revised reference case.**

   No, it is not possible lowering the present value of the reference case further.

Base Case

1. **The open cycle operation of Kerawalapitiya NG -1 and Kerawalapitiya NG - 2 is to be commenced in 2023 and 2024 respectively, which seems not realistic when the current status of the two plants is considered.**

   These power projects are also not expected at beginning of the year as described in item (c) of General Notes under the Base Case Plan. Realistic timeline according to project progress has been considered in the modelling of the Base Case Plan.

   Please refer item (c) of General notes *"..., However, for committed power projects actual commissioning month has been considered based on the present progress of the project."*

   Please note that in preparation of LTGEP, all data related to project progress has been updated until April 2022, and any consequences of further project implementation delays has been captured in Chapter 14 (Contingency Analysis).

2. **Moragolla hydro plant is to be commenced its operations in 2024, which seems not realistic when the current status of the two plants is considered.**

   According to latest update from the project, it is still possible to be commissioned in year 2024.

3. **A 20MW/50MWh Battery Energy Storage Facility should be available at the beginning of 2024, which seems not realistic as it needs at least 1.5 years to implement such facility.**

   Please note that item (c) of General Notes under Base Case Plan is applicable only to Thermal Capacity Additions. Renewable and Storage Power Additions as mentioned in Table E3 (Base Case) should be commissioned within the year specified and is sufficient to be made available by the end of respective year. This note can be added to the report for more clarity.

   Hence it is sufficient that this project is completed by end of 2024 which gives sufficient time for implementation.

Implementation Schedule

1. **20 MW/50 MWh Standalone Battery Energy Storage is planned to be commissioned at the beginning of 2024 in the base case. But as per the implementation plan the same plant to be completed at the end of 2024.**

   As mentioned earlier, renewable and BESS project are sufficient to be available within the year (latest by the end of the year) mentioned. Hence implementation is considered by the end of year 2024.

   Will add a note in the Base Case Plan for more clarity.

2. **80 MW/320 MWh Standalone Battery Energy Storage is planned to be commissioned at the beginning of 2026 in the base case. But as per the implementation plan the same plant to be completed at the end of 2026.**

   Same as above

3. **100 MW/400 MWh Standalone Battery Energy Storage is planned to be commissioned at the beginning of 2027 in the base case. But as per the implementation plan the same plant to be completed at the end of 2027.**

   Same as above

4. **Four 350 MW Pumped Storage Plants are planned to be commissioned at the beginning of 2029, 2030, 2031 and 2032 respectively in the base case. But as per the implementation plan the same four plants to be completed at the mid of 2030, end of 2030, end of 2031 and end of 2032 respectively.**

   The commissioning date of a power plant can be any date within the mentioned year. The implementation plan shows a generic timeline presented only for the information purposes. However the commissioning year mentioned in the base case is the date obtained for an expedited project implementation process.

General

1. **Implementation plans of the proposed hydro power capacity extensions**

   No hydro capacity extensions are proposed in the base case but possible hydro capacity extensions are mentioned in the report.

2. **Impact of delaying the required LNG infrastructure with associated natural gas distribution network which is expected from year 2025 onwards**

   This will not impact the base case plan. However, in the event of further delay in LNG infrastructure, it is expected that the converted and newly constructed LNG plants shall operate from oil. Considering the variation of fuel prices, a change in merit order is not expected, hence would not have any impact on the planning study results expect on the total operational cost.

3. **Why the Battery Energy Storage System proposed for energy shifting purpose should have minimum 4-hour duration of storage?**

   The system demand profile and the production time of energy from renewable energy sources are not in alignment. In order to achieve the required energy share target of 70% Renewable Energy by 2030, the system requires this scale of energy shifting capacity.

   Note that in our studies the Battery is operated at 80% of Maximum Depth of Discharge, considering the lifecycles availbity for operation 10 years life time requirement. Hence effective storage duration of BESS is actually 3.2 Hours. Further, a minimum capacity needs to be reserved at any given time for both charging and discharging, to provide necessary fast frequency response to the system.

4. **Basis of considering a maximum allowable limit of 65% for the System Non-Synchronous Penetration.**

   The value utilized is only a guideline for simulations in long term planning studies considering experiences from international practices. There is no limit imposed in actual operation. However, it is prudent to note that, the SNSP level increase shall require further studies on system stability aspects and the power system to be actually operated for testing purpose for a minimum period of time. Following the international practices, this is expected to be a phase-by-phase increase as explained in section 9.2 of Chapter 9.

   During LTGEP studies sensitivities were conducted on the base case, under different SNSP limits to calculate the cost implications of each SNSP value. The results indicate a low variation on operational cost with further increase in SNSP value. The operational cost saving needs to be validated with the additional investment cost required for maintaining stable and reliable operation of the system under different SNSP levels.

   Considering that the reliability and quality of supply has a higher priority than economy of supply

we recommend planning for a very reasonable SNSP of 65% initially and increase it gradually upon carrying out more studies and gaining more operational experience with asynchronous technologies.

5. **Percentage of externality costs internalized into the capital costs of each generation technology in the form of additional capital investment**

   In the planning process, the cost of total power plant including environmental impact mitigatory equipment with latest technologies is taken. Exact cost of each associated equipment for mitigation of environmental impacts needs to be obtained from specific manufacturers.

   In the case of Coal plants, increase of capital investment is approximately about 27%.

   Due to the present government policy coal power plants have not been considered as candidates in arriving at the base case. No environmental mitigatory measures have been internalized into the capital cost of remaining candidate technologies such as LNG, Wind, Solar, etc.

6. **Input data files of the OPTGEN/SDDP model of the planning study (Shall be submitted before 14th October 2022)**

   Will be submitted.

7. **Another case (Revised base case) developed inserting the current fuel prices and considering a realistic implementation plan for the committed generation plants.**

   All committed power plants have considered realistic timelines according to the implementation plans available by April 2022. The consequences of implementation delays of major power projects are already captured in Chapter 14, under contingency analysis. The effect of considering high fuel price variations is also elaborated in section 10.3.1 under Chapter 10. Hence, there is sufficient information available in the LTGEP itself to see the impact of high fuel prices and delay in project implementation.

   From long-term planning perspective, accommodating such and preparing a Base Case plan again will have minimum effect on the final outcome.

   It must be noted that this plan is a rolling plan prepared once in two years for a twenty year planning horizon. For a plan that is produced once in two years, carrying out such additional studies repeatedly would delay the approval process extending the validity of the plan to the next planning period. It must be also considered that a long-term transmission development plan (LTTDP) has not been prepared beyond 2018-2027 period due to the unavailability of a completely approved generation plan. We request the commission for the early approval of the LTGEP for us to conclude LTTDP studies for the period 2023-2032. Any changes to fuel prices and impact to implementation timelines which have no direct impact and can be considered in subsequent LTGEP planning studies.