Grid India (Detailed Procedures for Security Constrained Unit Commitment (SCUC), Unit Shut Down (USD), and Security Constrained Economic Despatch (SCED) at Regional Level), 2023 [Draft]

Grid-India notified "Detailed Procedures for Security Constrained Unit Commitment (SCUC), Unit Shut Down (USD), and Security Constrained Economic Despatch (SCED) at Regional Level" on 07th September, 2023. The key highlights of the draft are mentioned below:

- This document aims to clarify the roles and duties of different parties involved and provide a framework for operation of Security Constraint Unit Dispatch (SCUC), Unit Shut down (USD) and Security Constraint Economic (SCED). SCUC focuses on boosting reserves for grid security, while SCED strives to optimize electricity generation to achieve National Merit Order after gate-closure for RTM.
- The procedure is applicable to thermal generating stations within regional entities whose tariff is determined u/s 62 of the EA, 2003 and also to the other regional thermal generating stations willing to participate in SCUC/ SCED. Thermal generating stations opting for SCUC are mandated to participate in SCED as well.
- The procedure defines the roles of NLDC, RLDC and RPC w.r.t the SCUC, SCED, USD and the settlement/ compensation mechanisms for the generators.
- The list of generating stations along with their synchronization time and date, need to be operational in the next two days will be published two days in advance at 10:00 hrs. Also, the list of units required to operate on the following day under different conditions (hot, warm, and cold) is published on the NLDC website daily at 15:00 Hrs, including the date and time.
- The following figure shows the timelines for SCUC.

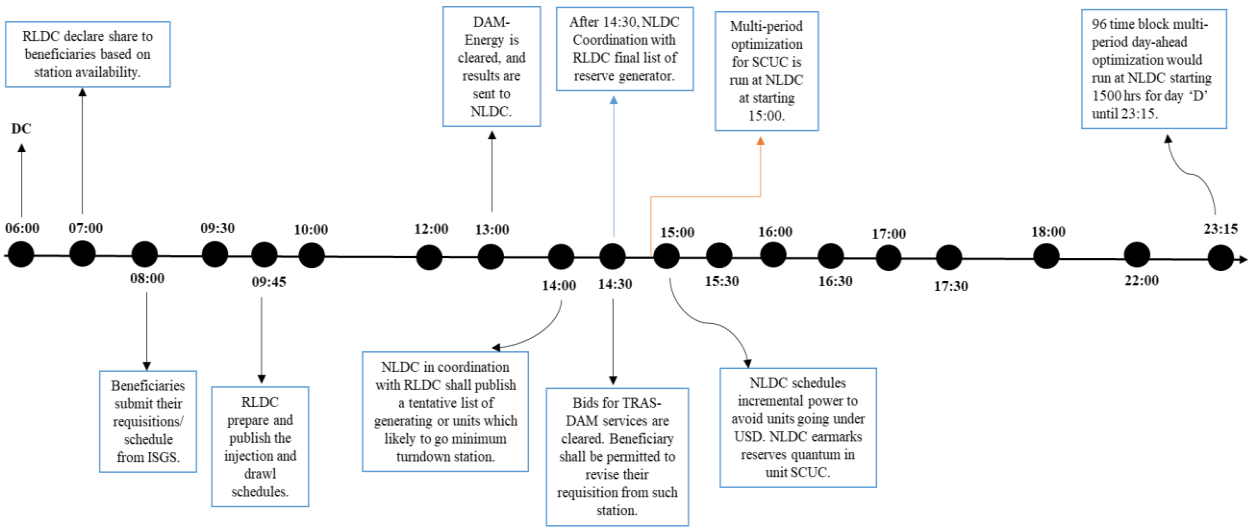

Figure 1: Timelines for SCUC

- The beneficiaries can revise their schedule for the units scheduled below the turndown level by 14:30 hrs. of D-1 and if not revised or not scheduled under SCUC, the units can either operate below the minimum turndown level or undergo Unit Shutdown (USD).
- NLDC indicates the reserve quantum earmarked in each unit brought on bar under SCUC by 15:00 hrs to the scheduling system. This quantum of power identified as reserves is not available for scheduling by beneficiaries or for sale by the generating station through the energy market. The document also mentions the running of a 96 time block multi-period day-ahead optimization at NLDC for day 'D' until 23:15 hrs.

- The draft procedure's outlines the compensation process for SCED generators experiencing Heat Rate Degradation (HRD). NLDC will release a monthly "National Statement of Compensation" due to Part Load Operation on account of SCED based on SCED statement of respective RPC. The SCED generator will receive compensation for HRD within 7 working days from the National Pool Account (of SCED) based on the monthly statement

The document can be accessed **here**.

CER Opinions

1. **Economics of Security Constrained Unit Commitment (SCUC):** The preliminary results of an ongoing study at Energy Analytics Lab (EAL), IIT Kanpur show that additional saving in power procurement cost may emerge with the adoption of for Security Constrained Unit Commitment (SCUC). The study used three month's data from five states in the northern region and estimated overall costs under alternate market arrangements.

2. **Master repository of NOAR:** It is suggested that the NOAR may share the data of variable charge/ compensation charge for respective plants participating in SRAS, TRAS, SCUC and SCED and publish it in the public domain (on its scheduling/ reporting portal). This will enable the discoms to dynamically optimize their own schedule as well, specifically the schedule of their own generating stations.

3. **Effective gate closure for discoms:** As per Clause 6.2 and Clause 6.3 of the draft procedure, *"Regional Load Despatch Centres (RLDCs) would prepare the entitlements and declare the share of each beneficiary on D-1 [by 0700 hrs]*. ***Beneficiaries shall submit their requisitions/ schedules from ISGS on D-1 [by 0800 hrs]****."* (emphasis added)

   "Based on the station availability and the schedules submitted by beneficiaries/ procurers, ***RLDCs shall prepare and publish the injection and drawl schedules [by 0945 hrs]. The power station then can participate in Day-ahead Energy Market (DAM-Energy) and/or Day-ahead TRAS Market (DAM-TRAS)****. The DAM-Energy shall be cleared [by 1300 hrs], and Power Exchanges would convey DAM results to NLDC after clearing of market (emphasis added)"*. (emphasis added)

   The above provision effectively advances "gate closure" for the beneficiaries to the extent of the capacity that may be cleared in the DAM-Energy market[1]. Given the increasing share of renewables across states, there is greater uncertainty for the beneficiaries to take informed decision on schedule about 20+ hours in advance. It is suggested that 90% of the unscheduled declared capacity of the generating station may be allowed for participation in the DAM-Energy market by the respective generators. Beneficiaries may be given a leeway for rest of the capacity (10% of the residual capacity) till RTM-Energy. These limits may be periodically revisited, based on experience of the stakeholders.

[1] Beneficiaries can revise the schedule upwards for those plants which would have a schedule lower than minimum technical turndown level.

4. **Pilot for SCUC:** Since SCUC is being implemented first time, it is suggested that a pilot may be introduced initially in order to understand the practical implications and challenges thereof. Based on the experience over a period of, say, 3 months the final procedure can be frozen after necessary fine tuning.

5. **Availability of generator in shut down condition to be on-bar:** Since signal for restart (hot/warm/cold) and shutdown may be given anytime within a block (i.e. not necessary at the interchange of the blocks), the relevant duration should be measured from the expiry of the current block in which the instruction to the generator is given by the load despatch centre. It is suggested that the following clarification may be **added** in the Clause 6.13 of the draft procedure *"The unit/ station should be available on, after the respective duration of revival (4 hrs. 8 hrs. or 12 hrs.) according to the type of start-up (hot, warm or cold), counted from the end of the block in which the respective instruction is given to the generator."*

6. **Reduced minimum shutdown duration for a generator:** The Clause 6.14.4, *"A generator can submit a lower time limit than the above to NLDC/ RLDCs, and the same would be considered."* need further clarification. Would such an exception needs to be specified each day or it needs to be specified periodically by a generator, till it is updated by the generator. Also, it may be clarified whether the above Clause is applicable only for minimum shutdown time or it will be applicable for the minimum dispatch duration as well.

7. **Reserve requirement calculated on the basis of supply availability?** Clause 6.8 of the proposed draft states that *"…The following shall be factored while calculating the TRAS Reserve Requirement "Z", for the purpose of SCUC for the next day.*
   6.8.1 The reserves created due to action of SCUC in the previous 7 days
   6.8.2 The reserves anticipated to be available in Section 62 plants
   6.8.3 Advance reserves procured, and reserve position intimated by the states".

   Thus, the reserve requirement for the next day 'considers' the availability of the reserve supply. **A method, independent of the supply, to ascertain reserve requirement for the next day should be developed and elaborated in the document.**

8. **Change in the overall economics of the power procurement:** As per Clause 6.17 of the proposed draft, *"Typically, the net sum of generation schedules under SCUC head would be zero, as only reserves are being created through SCUC and extra energy is not being scheduled."* As illustrated in the following figure 1, two generators committed under SCUC (say, G1 = 100 MW and G2 = 100 MW) have same capacity but different variable costs (say, Rs. 4/kWh and Rs.5/ kWh respectively). Generator G1 received 100% schedule (100 MW) from its respective beneficiary while G2 received 40% schedule (40 MW) i.e. below minimum turndown level. In order to create the reserves and prevent G2 to go under shutdown, the NLDC increased its schedule up to 55% under SCUC-up (55 MW) and reduced the schedule of G1 to 85% under SCUC-down (85 MW). Thus, the overall generation schedule remained equivalent to the original schedule (140 MW). While cost of power procurement for the beneficiaries does not seem to increase as they would be billed as per their schedule, the economics of power procurement for the subsequent blocks that cross over to the next day

(due to min up or min down time constraints) would be affected. Increase in schedule of higher VC plant and reduction in schedule of lower VC plant will **increase the overall system cost for the current blocks in D day**. The incremental cost of the same would be met through the pool account.

Due to minimum up/ down time constraints, the high-cost generator, which was revived, would be treated as 'must run' plant (by the system operator) for the minimum number of up/ down time hours that may spill over to the next day. Are these plants to be treated as 'must run' by the beneficiaries while preparing schedule for the 'constrained' hours pilling over to the next day? If so, the power procurement cost for the beneficiaries would effectively increase for the next (D+1) day.

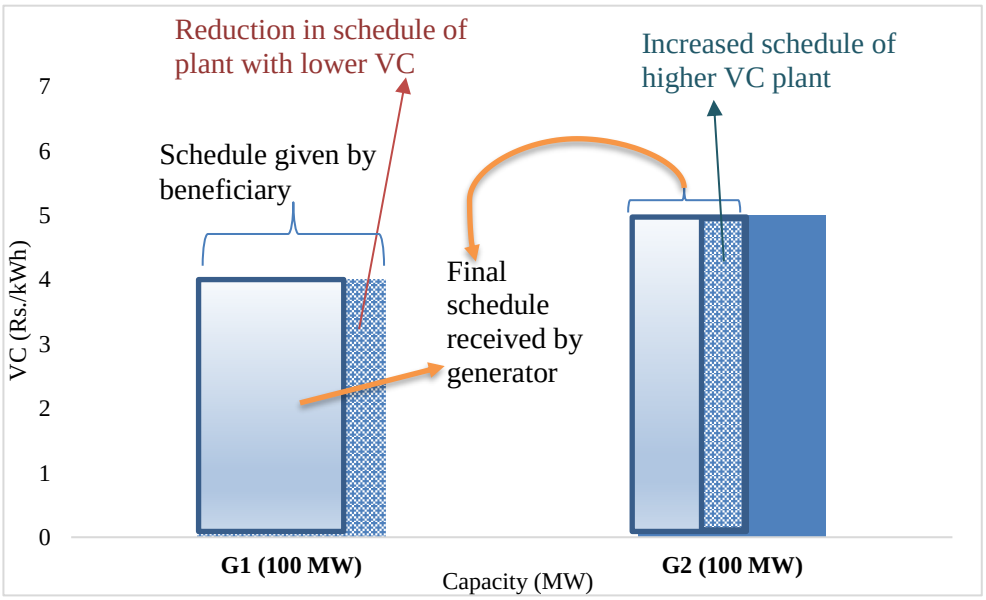

Figure 2: Increased generation costs to maintain reserves under SCUC

9. **Scheduling the remaining capacity of the generator which is given the increased schedule under SCUC:** The draft procedure does not explicitly explain the system operation in case two generators having different variable costs which have received the schedules from respective beneficiaries below their respective minimum turndown level. It may be further clarified that when two generators have received schedules below their respective minimum turndown level, one of the unit having higher VC may be allowed to go under shutdown and the schedule of the generating station/ unit having lower VC may be increased under SCUC-up. For e.g. consider three generators G1, G2 and G3 (as illustrated in Figure 2) having equal capacities of 100 MW and different variable costs, Rs. 4/ kWh, Rs. 5/ kWh and Rs. 6/ kWh and the schedules to these generators by their respective beneficiaries are 100 MW, 40 MW and 30 MW respectively. The minimum turndown level is 55% of their capacity. Thus, the schedule of only G2 may be revised to 40 MW + 30 MW (total 70 MW) under SCUC-up to bring it on-bar and generator G3 may be allowed to go under shutdown thus increasing the overall economic surplus while the remaining 30 MW capacity available on-bar from generator G2.

10. **Obligation of the generating station to arrange alternate supply for fulfilling the demand of the beneficiary?** Clause 7.2 of the proposed draft states that *"In case a generating station opts to go under unit shut down (USD), the generating company owning such generating station shall fulfil its obligation to supply electricity to its beneficiaries who had made requisition from the said generating station prior to it going under USD [i.e., before 1530 hrs], by arranging supply either*
7.2.1 by entering into a contract(s); or
7.2.2 by arranging supply from any other generating station or unit thereof owned by such generating company; or
7.2.3 rely on SCED for arranging the schedule 30 minutes before dispatch".
As per the current methodology adopted for the generator to go under reserve shutdown (RSD), a generator is not obligated to arrange for the alternate supply (as per the CERC order[2] dated May 05, 2017, in the matter of 'Approval of the detailed procedure for taking unit(s) under Reserve Shut Down and Mechanism for Compensation for Degradation of Heat Rate, Aux Compensation and Secondary Fuel Consumption, due to Part Load Operation and Multiple Start/ Stop of Units').

Since the generator declared the capacity (DC) for the respective time blocks, it was available to provide the energy with generation above the technical minimum. **The obligation of the generator opting to go under unit shutdown to supply the power to the beneficiary may be reviewed. The resultant risk should thus be shared between the generator and the beneficiary. It is highlighted that under the prevailing procedure, all the risk was on account of the beneficiary, which was also not justified. The procedure may reallocate the risk so that it shared by the generator, the NDLC (pool account) and the beneficiary (as explained below).**

It is to be noted that it is likely that due to RSD for a particular generation unit, other generating units may receive higher schedule thus partially fulfilling the gap on account of the RSD. The remainder gap remains the concern for the system operator. Furthermore, the generator may not be left with adequate platform for seeking the compensatory capacity, except the Day Ahead Contingency (DAC) or the Intra-day Contingency, both of which often have low liquidity and, thus may not provide sufficient opportunity for the generator undergoing RSD for the alternate procurement. In case NLDC/ RLDC has a spinning reserve above the minimum reserve quantum earmarked for each unit, the remainder capacity may be scheduled from the same. Since the generators available under spinning reserves are likely to have lower energy charge rate (ECR) than the one undergoing RSD, there would not be any additional incremental cost to the system. The capacity so scheduled from the spinning reserve and that scheduled earlier from the other plants under operation, would thus make good any gap in schedule for the beneficiaries. The beneficiary would pay as per ECR of the plant undergoing RSD, while actual energy would be supplied by a plant of lower ECR. The saving on this account should recouped into the pool account. This would also provide correct economic

[2] CERC order in the matter of Approval of the detailed procedure for taking unit(s) under Reserve Shut Down and Mechanism for Compensation for Degradation of Heat Rate, Aux Compensation and Secondary Fuel Consumption, due to Part Load Operation and Multiple Start/Stop of Units. https://cercind.gov.in/2017/regulation/SOR132.pdf

signals to the generator as well as the beneficiary. A generator may still be given an option to arrange the alternate supply (at lower ECR), as feasible within the available timeline.

Furthermore, clarifications are required for the following points w.r.t Clause 7.2 –

a. <u>In case, the generating station does not have/ own any other units</u> - The final schedule to the generator will be received after 14:30 hrs., when all the day-ahead clearings have been completed and no further market contract option is available for the generator (except RTM and Day-Ahead Contingency, with no assurance of its bid getting cleared) opting to go under unit shutdown due to schedule below minimum turndown level.

b. <u>Unavailability of information of reserves available under SCED to the generating stations</u> – The generating station does not have any visibility of the resources available under SCED as it is run post RTM clearing and 30 minutes prior to dispatch and the required resources may not be available under SCED as already mentioned in draft Clause 8.5.3, which states that *"Note that there is no guarantee that SCED can provide the incremental schedule to meet the minimum turn down level, and hence this feature may be used as last resort to accommodate small (say, 5 MW, 10 MW, etc.) difference with respect to the zero MW level"*. Thus, there is no assurance of the supply availability to the generator whether the alternate supply can be made available. Thus, it is suggested that the available resource optimization may be undertaken by the NLDC at 14:30 hrs. under SCUC, post finalization of the schedule of the generating stations.

c. <u>Provisions if the generator is unable to provide the required supply to the beneficiary</u> - While, we suggest alternate approach regarding the alternate supply, we note that the draft procedure, while mandating a generator (undergoing RSD) to secure alternative supply, does not mention the consequence if such a generator is unable to provide alternative supply to the beneficiary. In its absence, this provision would remain ineffective, if implemented.

Further it is suggested that if the generator opts to go under shutdown due to schedule below minimum turndown level in a few blocks, NLDC/ RLDC may provide for the energy to the beneficiary through SCUC for the time blocks when the schedule is below the minimum turndown level **<u>plus the minimum down time</u>** of the generator.

11. **Increase in overall amount of compensation towards part load:** The draft Clause 9.9 states *"Compensation due to Part Load Operation due to SCUC to SCUC generator shall be paid from their respective regional 'Deviation and Ancillary Service Pool Account'."*
    Due to SCUC-up and SCUC-down (and increase in RE integration), as more units will be on-bar and running at their respective minimum turndown level or at part load (lesser than their respective declared capacity), the overall compensation on account of part load operation for such units will increase, thus leading to overall increased power purchase cost for the beneficiaries.

12. **Amount towards part load compensation received by generator should be credited to the ancillary services pool account:** Post SCUC, and due to RSD of some of the generating units,

schedule of some of the generating units may be above the threshold and thus should receive part load compensation only as per schedule post SCUC.

13. **Demand response to be considered for SCUC:** The proposed draft considers the available generation capacity while calculating the SCUC for day-ahead and three days in advance. The demand response program, being always available on-bar, may provide for the SCUC-up requirement of the system and may even have a faster response time as compared to bringing a generating unit/ station on-bar or increasing the schedule of a generator. Hence, it is suggested that the demand response should become an inherent part of the overall SCUC procedure.

14. **Consideration of day-ahead SCED:** The draft Clause 10.1, *"The incremental/ decremental day-ahead SCED schedules shall be maintained under a separate head in the scheduling system"*, creates an ambiguity as the procedure discussed prior to this Clause considers only the SCED scheduled post clearing of RTM and only mentioned in the above Clause 10.1. It is suggested that the procedure for day-ahead SCED may be included/ described for the generating stations and the accounting and settlement under SCED may be clarified considering the same.

15. **Mechanism for sharing of SCED benefits:** As per the Detailed Feedback Report on Expanded Pilot for SCED March 2021[3], the Central Commission decided to bring parity for sharing the net savings as a result of SCED during the extended period with the benefit sharing mechanism (sharing of net gains) specified for Real Time Market (RTM) in respect of tied capacity of generators. The Commission directed that the net savings as a result of SCED after adjusting heat rate compensation for part load operation of the generators shall be shared in the following manner:
    As a first step, the share towards 'untied capacity' of merchant generators as well as generators with part capacity tied would be segregated from the net benefits, in the ratio of contribution of such generators to SCED, for every time block. The remaining benefits are then shared in the ratio of 50:50 between the generators (with tied capacity, participating in SCED) and the concerned beneficiaries/ Discoms, aggregated on a monthly basis as per Regional Energy Account (REA) and weekly SCED accounts in proportion to their final schedule from the generating stations covered under SCED pilot. The benefit of generators with tied capacity is shared between SCED Up and SCED Down generators in the ratio of 60:40 for respective time block. Based on the above, if a generator's share exceeds 7 paise/ kWh the same is restricted to a ceiling of 7 paise/ kWh and the gains over and above 7 paise/kWh would be shared among Discoms. The cap of 7 paise/ kWh is, however, not be applicable in respect of 'untied capacity' of merchant generators as well as generators with part capacity tied, for its untied capacity.

    As per Annexure-3 of the draft procedure, the benefits shall be shared as follows -

*"… 3. The benefits shall be shared in the **ratio of 50:50 between the generators and the concerned beneficiaries**, aggregated on a monthly basis as per Regional Energy Account (REA)/ State Energy Account (SEA) and NLDC monthly SCED accounts.*

[3] https://posoco.in/wp-content/uploads/2021/04/POSOCO_SCED_Expanded_Pilot_Detailed_Feedback_Report_Mar_2021.pdf

4. The total net SCED benefits corresponding to the Beneficiary shall be distributed in proportion to their final schedule from the SCED generator as per the Regional Energy Account (REA)/ State Energy Account (SEA).

5. In case of merchant generators, they shall be beneficiaries of their schedule generation as per REA/ SEA(other than SCED/ SCUC) and this schedule energy shall be considered for deriving their share in other 50% saving marked for beneficiaries.

6. In case of part tied up generators, they shall be beneficiaries of their schedule generation under T_GNA and for rest capacity scheduled shall be shared with beneficiaries as per REA/ SEA for deriving their share in other 50% saving marked for beneficiaries.

……..

8. The benefits corresponding to the SCED generator out of the total Net SCED benefits shall be distributed in the ratio of their total schedule under SCED Up and SCED Down respectively. This shall be based on the block wise SCED Up and SCED Down energy aggregated on monthly basis. Benefits as computed above for the SCED generators would then be summed up for the month."

The ratio of sharing between SCED Up and SCED Down generators should be clarified and be retained as per the prevailing provisions. Also the absence of the cap in the benefits of the generator may lead to reduction in the overall gains of the beneficiaries and may lead to additional gains for the generators.