

**POWER SYSTEM OPERATION CORPORATION LIMITED**  
**New Delhi**

Date: 05-02-2019

To  
All Stakeholders / Individuals / Agencies

**Subject: Consultation Paper on Security Constrained Economic Dispatch of ISGS Pan India**

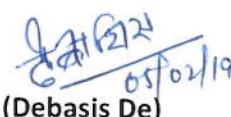
Sir / Madam,

As directed by the Hon'ble Commission, POSOCO placed the Consultation Paper on Security Constrained Economic Dispatch (SCED) of ISGS Pan India on the POSOCO website on 29<sup>th</sup> September 2018 for stakeholder feedback/suggestions till 28<sup>th</sup> October 2018. The last date for giving feedback/suggestions was subsequently extended to 20<sup>th</sup> November 2018 based on requests received for the same.

Feedback/suggestions have been received from following Agency/Individual:

- Association of Power Producers (APP), India
- NTPC Ltd.
- SLDC Gujarat
- Tata Power Ltd.
- PTC India Ltd.
- Multitudes Intellect, Gurugram
- Wartsila, Finland
- Mr. David Palchak /Dr. Jaquelin Cochran, NREL, USA
- Mr. MG Sreekanta Murthy, ISO New England, USA
- Mr. Deepak Rama Subramanian, EPRI, USA

**Hon'ble CERC vide Suo-Motu Order in Petition No. 02/SM/2019 dated 31<sup>st</sup> January, 2019** has directed POSOCO to implement Pilot on Security Constrained Economic Dispatch (SCED) of Inter-State Generating Stations (ISGS) Pan India on a trial basis for six months before 1<sup>st</sup> April 2019. The CERC Order is available at <http://www.cercind.gov.in/2019/orders/02-SM-2019.pdf>. The Commission also directed POSOCO to publish the comments received and its views thereon in its website. The comments of POSOCO along with detailed comments by Stakeholders are made available at <https://posoco.in/documents/consultation-papers/security-constrained-economic-dispatch/>.

  
05/02/19

(Debasis De)  
Chief General Manager  
NLDC, POSOCO.

**POSOCO's observations on Agency / Individual Comments on the Consultation Paper on  
Security Constrained Economic Despatch (SCED)**

S. No.	Agency / Individual	Gist of the comment	POSOCO's observations
1.	Association of Power Producers (APP) / NTPC	Although the POSOCO paper on Security Constraint Economic Dispatch of ISGS Pan India intends to optimize schedules of ISGS and thereby minimize the total generation cost, it is not in conformity with the Scheme issued by MOP and is different in many aspects.	<p>It is in line with the spirit of the scheme issued by MOP. Main differences are</p> <ol style="list-style-type: none"> <li>Exercise in the consultation paper is done across all generators rather than company wise.</li> <li>Mathematical treatment is provided for dealing with different constraints as a simple merit order stacking based approach without honouring constraints for each time block would be difficult to implement.</li> </ol> <p>Including all Inter State Generating Stations (ISGS) generators (section 62 and 63 of EA 2003) would improve the scope of savings. Company-wise optimisation will also occur in this process.</p> <p>Incidentally, of the population of thermal ISGS being scheduled by RLDCs, around 72 % generation participation is from NTPC stations and there is a significant quantum of around 16000 MW from non-NTPC stations offering enhanced scope for optimisation.</p>
2.	PTC	There needs to be clarity on which entities can participate in real time markets to ensure the health and stability of this market. IPPs/Merchant Power Plants scheduled by RLDCs/NLDC should also be included in real time market.	Including more generators would improve the scope of savings. Once a Real Time Market (RTM) is ushered in by the Central Commission, more market players could participate as the RTM would be based on competition. In the absence of RTM, we have only those power plants whose tariff is either determined or adopted

S. No.	Agency / Individual	Gist of the comment	POSOCO's observations
			completely by the Central Commission which can participate in the SCED without any dispute in respect of variable charges.
3.	APP / NTPC / TATA Power	<p>Company-wise optimisation recommended by MoP. Sasan and CGPL inclusion will not result in more savings.</p> <p>High Powered Committee (HPC) is set up for addressing the unique problem of CGPL which is an imported coal based plant and other similar power plants</p>	<p>Including all ISGS generators (section 62 and 63 of EA 2003) would improve the scope of savings. Company-wise optimisation will also occur in this process.</p> <p>Further, the issue raised by CGPL is a larger issue; implementation of SCED would not aggravate the same as being higher up in the merit order, instances of under-requisitioning from CGPL is rare. For instance, in the year 2017-18, the availability of CGPL was 79.1% while the scheduled plant load factor was 75.7%; so there is only a small cushion of 3.4% available for SCED on an annual basis. As the savings are more during night hours, cheaper pit head stations would be asked to increase generation first under SCED before CGPL's turn comes.</p>
4.	APP / TATA Power	<p>The mechanism would almost congest the ISTS networks completely, leaving least capacity for Day ahead Bilateral market and collective transactions. Also, the congestion in Inter regional transmission corridors might increase the costs of intra region generation sources for the beneficiaries</p>	<p>Inter-regional congestion is occurring occasionally in the grid. Refer monthly reports by POSOCO <a href="https://posoco.in/reports/monthly-reports/monthly-reports-2018-19/">https://posoco.in/reports/monthly-reports/monthly-reports-2018-19/</a> Further, the SCED routine would run only after the Day Ahead Markets (DAM) and contingency applications get cleared and hence there should be no fear on this account.</p>

S. No.	Agency / Individual	Gist of the comment	POSOCO's observations
5.	APP / TATA Power	There can be a situation that this exercise may develop the need to augment transmission capacities at certain corridors and the costs for such transmission capacity will again be burdened ultimately to the consumers	Transmission planning done by CEA / CTU is a coordinated activity, which considers several aspects. SCED results can form a part of the operational feedback from POSOCO to transmission planners. Benefits of augmenting the transmission corridor ultimately will be decided by the planners. Consumers will be benefitted due to any such transmission augmentation as cheaper power would substitute costlier power.
6.	APP / TATA Power	CERC has published a discussion paper on "Redesigning Real Time Markets" which envisages gate closure at 6 time blocks before the (T)th block and takeover by the system operator for RT operations. While there are apparent differences between the envisaged RT market operations and the current POSOCO optimization exercise (in terms of participants and the price basis), the two operations need to be reconciled.	Please refer to section 7.7. and Figure-33 of the consultation paper. This framework would actually serve as a test bed / pilot project and act as a precursor to market based Ancillary Services Mechanism as proposed by the Staff of the Commission. SCED and RTM would be consistent with each other. Once RTM becomes a vibrant market, the scope for savings through SCED may gradually reduce.
7.	PTC	it is suggested that gate closure should take place 3 hours before delivery of power	Please refer to section 7.7. and Figure-33 of the consultation paper. This framework would actually serve as a test bed / pilot project and act as a precursor to market based Ancillary Services Mechanism as proposed by the Staff of the Commission. SCED and RTM would be consistent with one another. Once RTM becomes a vibrant market, the scope for savings through SCED may gradually reduce.

S. No.	Agency / Individual	Gist of the comment	POSOCO's observations
			Gate closure would have to be introduced suitably; whether it should be three (3) hours before or shorter would need a separate debate.
8.	APP / TATA Power	Will it require a change in the POC mechanism?	No change in transmission pricing mechanism is needed for implementation of SCED. All the POC computations are done for the peak scenario when plants are fully despatched and there is minimal scope for optimization during these hours as also brought out in the consultation paper.
9.	APP / TATA Power	Mark up needs to be in line with that provided under RRAS - a minimum of Rs. 0.50/ unit	<p>CERC Order on SCED specifies that <i>"For any decrement in the schedule of a generator due to optimization, the generator shall pay to the aforesaid National Pool Account (SCED) for the decremental generation at the rate of its variable charge after discounting compensation due to part load operation as certified by RPC as per the provisions of IEGC."</i></p> <p>So, loss due to Heat Rate degradation is being taken care of.</p>
10.	APP / TATA Power / NTPC	Generators whose schedules are being decreased, also need to be compensated for degradation of operational parameters SHR, APC etc.	<p>CERC Order on SCED specifies that <i>"For any decrement in the schedule of a generator due to optimization, the generator shall pay to the aforesaid National Pool Account (SCED) for the decremental generation at the rate of its variable charge after discounting compensation due to part load operation as certified by RPC as per the provisions of IEGC."</i></p>

S. No.	Agency / Individual	Gist of the comment	POSOCO's observations
			So, loss due to Heat Rate degradation is being taken care of.
11.	APP / NTPC / TATA Power	Entire benefit of low cost of generation is being passed on to the DSM pool.	The sharing of benefits/savings has been accepted in principle by the Commission. However, methodology of sharing shall be decided after the results of the pilot and the extent of savings are available.
12.	APP / TATA Power	Will there be an impact on procurement of coal by the generators?	No significant impact on coal procurement is envisaged. Merit order based scheduling is already being followed to a large extent by SLDCs while giving requisition in ISGS in the decentralised mechanism. <a href="http://meritindia.in/">http://meritindia.in/</a> With this decentralized scheduling and despatch model in place, a thin layer of optimization utilizing the generation resources available at the inter-state level can mop up residual cheaper generation resulting in overall savings.
13.	APP / TATA Power	Restrictive provisions in PPA of IPPs (CGPL and Sasan) on sale of surplus power beyond that requisitioned by beneficiaries.	At present, all Generating Stations that are regional entities and whose tariff is determined or adopted by the Commission for their full capacity are providing Reserves Regulation Ancillary Services (RRAS).  Participants in SCED are proposed to be the same as those in RRAS.
14.	NTPC	Backup calculations indicating station-wise break-up for the period	These figures are available; in fact, all the graphs and computations indicated in the consultation paper

S. No.	Agency / Individual	Gist of the comment	POSOCO's observations
		as a whole may be provided to know the indicative financial implications as a result of change in schedule due to the optimization.	would not have been possible without these figures at the back end.
15.	SLDC, Gujarat	The proposed methodology to maintain spinning reserve, decreases the cheaper generation and dispatch up to tech minimum of the next costly generation, thereby the per unit end cost goes high.	Keeping reserves in the system has an associated cost. A methodology to keep reserves is suggested in the paper. During the night hours, the cost of maintaining reserves is reduced.
16.	SLDC, Gujarat	NLDC should update central sector URS and should be fetched by State and to be displayed on their decision display.	URS information is already available on the respective RLDC websites. The present exercise utilizes the mechanism collates the information from RLDCs as suggested by Gujarat.
17.	SLDC, Gujarat	The present ancillary (RRAS) is designed primarily to maintain 50 Hz and address congestion and thereby also cover SCED and therefore it is opined to plan for new mechanism which really address deficit position of the state by scheduling economic power from the balance untied resources.	The present exercise is an off shoot of RRAS mechanism. RRAS mechanism does not change the schedules of constituent states. The suggestion of SLDC Gujarat for scheduling the deficit of any state is feasible through market mechanisms. RTM would be the right step for meeting such deficits which is being ushered in by the Central Commission.
18.	NTPC	Generating units need to be compensated for operation at lower loading factor.	CERC Order on SCED specifies that <i>"For any decrement in the schedule of a generator due to optimization, the generator shall pay to the aforesaid National Pool Account (SCED) for the decremental generation at the rate of its variable charge after discounting compensation due to part load</i>

S. No.	Agency / Individual	Gist of the comment	POSOCO's observations
			<p><i>operation as certified by RPC as per the provisions of IEGC."</i></p> <p>So, loss due to Heat Rate degradation is being taken care of.</p>
19.	NTPC	<p>As per MoP RE flexibility scheme, as RE is must run, it is suggested that the schedule of identified thermal stations for replacing RE power shall be considered with RE power first under the Flexible RE Scheme. The balance thermal schedule may be then considered under the optimization exercise.</p>	<p>If a mechanism evolves where RE power is replacing non-RE power then only the balance thermal schedule can be considered under the optimization exercise.</p>
20.	PTC	<p>The reserve requirement may be estimated by the nodal agency on day-ahead basis along with day ahead scheduling of all available generating stations.</p>	<p>Assessment of the quantum of reserves needed is an important topic. Work is also in progress on the same.</p> <p><a href="https://posoco.in/spinning-reserves/">https://posoco.in/spinning-reserves/</a></p>



S. No.	Individual /Agency)	Gist of the comment	POSOCO's observations
21.	Multitudes Intellect	Company-wise optimisation recommended by MoP. Sasan and CGPL inclusion will not result in more savings.	Including all ISGS generators (section 62 and 63 of EA 2003) would improve the scope of savings. Company-wise optimisation will also occur in the process.
22.	Multitudes Intellect	The mechanism would almost congest the ISTS networks completely, leaving least capacity for Day ahead Bilateral market and collective transactions. Also, the congestion in Inter regional transmission corridors might increase the costs of intra region generation sources for the beneficiaries	Inter-regional congestion occurs only occasionally in the grid. Refer monthly reports by POSOCO <a href="https://posoco.in/reports/monthly-reports/monthly-reports-2018-19/">https://posoco.in/reports/monthly-reports/monthly-reports-2018-19/</a> Further, the SCED routine would run only after the Day Ahead Markets (DAM) and contingency applications get cleared and hence there should be no fear on this account.
23.	Multitudes Intellect	There can be a situation that this exercise may develop the need to augment transmission capacities at certain corridors and the costs for such transmission capacity will again be burdened ultimately to the consumers	Transmission planning done by CEA / CTU is a coordinated activity, which considers several aspects. SCED results can form a part of the operational feedback from POSOCO to transmission planners. Benefits of augmenting the transmission corridor ultimately will be decided by the planners. Consumers will be benefitted due to any such transmission augmentation as cheaper power would substitute costlier power.
24.	Multitudes Intellect	CERC has published a discussion paper on "Redesigning Real Time Markets" which envisages gate closure at 6 time blocks before the (T)th block and takeover by the system operator for RT	Please refer to section 7.7. and Figure-33 of the consultation paper. This framework would

S. No.	Individual /Agency)	Gist of the comment	POSOCO's observations
		operations. While there are apparent differences between the envisaged RT market operations and the current POSOCO optimization exercise (in terms of participants and the price basis), the two operations need to be reconciled.	actually serve as a test bed / pilot project and act as a precursor to market based Ancillary Services Mechanism as proposed by the Staff of the Commission. SCED and RTM would be consistent with another. Once RTM becomes a vibrant market, the scope for savings through SCED may gradually reduce.
25.	Multitudes Intellect	Will it require a change in the POC mechanism?	No change in transmission pricing mechanism is needed for implementation of SCED. All the POC computations are done for the peak scenario when plants are fully despatched and there is minimal scope for optimization during these hours as also brought out in the consultation paper.
26.	Multitudes Intellect	Mark up needs to be in line with that provided under RRAS - a minimum of Rs. 0.50/ unit	<p>CERC Order 02/SM/2019 on SCED specifies that <i>"For any decrement in the schedule of a generator due to optimization, the generator shall pay to the aforesaid National Pool Account (SCED) for the decremental generation at the rate of its variable charge after discounting compensation due to part load operation as certified by RPC as per the provisions of IEGC."</i></p> <p>So, loss due to Heat Rate degradation is being taken care of.</p>
27.	Multitudes Intellect	Generators whose schedules are being decreased, also need to be compensated for degradation of operational parameters SHR, APC etc.	CERC Order on SCED specifies that <i>"For any decrement in the schedule of a generator due to optimization, the generator shall pay to the aforesaid National Pool Account (SCED) for the decremental</i>

S. No.	Individual /Agency)	Gist of the comment	POSOCO's observations
			<p><i>generation at the rate of its variable charge after discounting compensation due to part load operation as certified by RPC as per the provisions of IEGC."</i></p> <p>So, loss due to Heat Rate degradation is being taken care of.</p>
28.	Deepak Ramasubramanian, EPRI USA / Multitudes Intellect	<p>Entire benefit of low cost of generation is being passed on to the DSM pool.</p> <p>If say over the period of a year, there is a net surplus in the DSM pool, how would that impact the individual states/beneficiaries? Would it decrease their rates? Or would it improve the reliability of the power system which would result in a decrease in any expected unserved energy? Or would it result in a more resilient and less congested power system?</p>	<p>The sharing of benefits/savings has been accepted in principle by the Commission. However, methodology of sharing shall be decided after the results of the pilot and the extent of savings are available.</p>
29.	Multitudes Intellect	<p>Will there be an impact on procurement of coal by the generators?</p>	<p>No significant impact on coal procurement is envisaged. Merit order based scheduling is already being followed to a large extent by SLDCs while giving requisition in ISGS in the decentralised mechanism.</p> <p><a href="http://meritindia.in/">http://meritindia.in/</a></p> <p>With this decentralized scheduling and despatch model in place, a thin layer of optimization utilizing the generation resources available at the inter-state level can mop up residual cheaper generation resulting in overall savings.</p>
30.	Multitudes Intellect		

S. No.	Individual /Agency)	Gist of the comment	POSOCO's observations
		Restrictive provisions in PPA of IPPs (CGPL and Sasan) on sale of surplus power beyond that requisitioned by beneficiaries.	<p>At present, all Generating Stations that are regional entities and whose tariff is determined or adopted by the Commission for their full capacity are providing Reserves Regulation Ancillary Services (RRAS).</p> <p>Participants in SCED are proposed to be the same as those in RRAS.</p>
31.	NREL, USA	<p>It might be worth pointing out in a section that the base case could in fact be an optimistic view of what happens in daily scheduling and therefore an optimized system could produce even greater benefits than the model indicates.</p> <p>I would actually think this was a low estimate of savings because you are not fully capturing the inefficiency of the plants at low heat rate. An optimization that took into account the increased costs at low load would favor higher heat rates, and you would see greater benefit from an optimization, I think.</p>	<p>While heat rate degradation on account of reduction in generation is not being considered in the optimization, the heat rate improvements on account of increase in generation is also not being captured.</p>
32.	NREL, USA	<p>Moving to a MIP seems necessary to get the binaries for the startups, but maybe to get around this in an LP, there is usually a way...</p>	<p>Presently Linear Programming is being tried as it is simple and practical. Gradual shift to Mixed Integer Programming (MIP) is essential for the purpose of factoring unit commitment, maintaining reserves besides Hydro Thermal Coordination where availability of hydro units on bar also becomes important.</p> <p>Implementation of the SCED in the form given in the consultation paper would pave the way for these new vistas.</p>

S. No.	Individual /Agency)	Gist of the comment	POSOCO's observations
33.	Deepak Ramasubramanian, EPRI, USA	Provision of a small numerical example would help clear the doubts regarding sign convention and TTC calculation.	<p>Available Transfer Capability is assessed considering the present network and load generation balance. These figures are available in public domain and are changed depending on changing conditions. <a href="https://posoco.in/market/monthly-atc-inter-regional/">https://posoco.in/market/monthly-atc-inter-regional/</a></p> <p>Scheduled interchange is calculated based on the generation schedule of the importing and exporting regions. Margin from ATC is the difference between net regional import ATC and Scheduled net inter regional exchange.</p>
34.	M. G. S. Murthy, ISO NEW England, USA	whether ATC was based on all lines in scenario or N-1 contingency scenario was not clear. It may be worthwhile for you to consider N-1 contingency scenario for flow limits simultaneously.	<p>n-1 contingency scenario is considered while assessing ATC.</p> <p>Available Transfer Capability is assessed considering the present network and load generation balance. These figures are available in public domain and are changed depending on changing conditions. <a href="https://posoco.in/market/monthly-atc-inter-regional/">https://posoco.in/market/monthly-atc-inter-regional/</a></p>
35.	M. G. S. Murthy, ISO NEW England, USA	Current model proposes reserves as a separate optimization function. Another improvement can be in the area of co-optimized reserves clearing.	Co optimisation of energy and ancillary services is also an option. This is under deliberation for implementation as Ancillary Services mechanism in India has already been implemented.
36.	WARTSILA, Finland	By keeping the batteries and ICE on standby mode and deploying them sequentially, and only when needed, fuel wastage and CO2 emission that are inevitable with spinning plants can be avoided to truly unlock efficiency gains in the system.	Technology changes are expected to be a gradual phenomenon. Complying with environmental norms is inevitable. It is not clear how this suggestion impacts the SCED algorithm proposed in the consultation paper.