

# पावर सिस्टम ऑपरेशन कॉर्पोरेशन लिमिटेड

(भारत सरकार का उद्यम)

## POWER SYSTEM OPERATION CORPORATION LIMITED

(A Govt. of India Enterprise)



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संदर्भ संख्या: पोसोको/एनएलडीसी/2020/

दिनांक: 19<sup>th</sup> June, 2020

सेवा मे,

**Member Secretary NRPC/WRPC/SRPC/ERPC/NERPC  
All Regional Entity Generators including participating SCED Generators  
All SLDCs – for intra-state generators**

**विषय:** Extension and Expansion of Pilot on Security Constrained Economic Despatch (SCED) – Detailed Procedures regarding

**संदर्भ:** CERC Order in Petition No. 08/SM/2020 (Suo-Motu) in the matter of Extension and Expansion of Pilot on Security Constrained Economic Dispatch (SCED) dated. 18th April, 2020

महोदय,

Hon'ble Central Commission vide Order in Petition No. 08/SM/2020 (Suo-Motu) in the matter of Extension and Expansion of Pilot on Security Constrained Economic Dispatch (SCED) dated. 18th April, 2020 directed to expand the ambit of SCED by including more inter-state and intra-state generators.

In accordance with the directions of the Hon'ble Commission, a revised detailed procedure is being issued and is enclosed as Annex - I. The detailed procedures also available on the POSOCO website [www.posoco.in](http://www.posoco.in) under the SCED section. A detailed feedback report was submitted by POSOCO on 31<sup>st</sup> January, 2020 on the past experience, which may be referred for the benefits and the optimisation results of the pilot on SCED, for the period from April – December, 2019 and is available at: ([https://posoco.in/wp-content/uploads/2020/02/POSOCO\\_SCED\\_Pilot\\_Detailed\\_Feedback\\_Report\\_Jan\\_2020.pdf](https://posoco.in/wp-content/uploads/2020/02/POSOCO_SCED_Pilot_Detailed_Feedback_Report_Jan_2020.pdf))

In this connection, generators willing to participate in the SCED mechanism are requested to kindly communicate their willingness at the earliest at the email ID [sced@posoco.in](mailto:sced@posoco.in). A copy of the communication the willingness may also be submitted to the concerned RPC and RLDC. Based on the willingness received from the generators, a meeting would be convened at a convenient time to take this forward.

सादर धन्यवाद,

संलग्न: As above

**Copy to: Secretary, CERC  
ED NRLDC/WRLDC/SRLDC/ERLDC/NERLDC**

भवदीय,

(देबाशिस दे)

कार्यकारी निदेशक

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**Power System Operation Corporation Ltd.  
National Load Despatch Centre (NLDC)**

**Procedure for Pilot  
on  
Security Constrained Economic Despatch for  
Generating Stations pan India**

*Prepared in Compliance to CERC Order in  
Petition No. 08/SM/2020 (Suo-Motu) dtd. 18th April, 2020*

***Revision-3: June 2020 (w.e.f 01<sup>st</sup> June, 2020)***

***Revision-2: October 2019 (w.e.f 01<sup>st</sup> October 2019)***

***Revision-1: April 2019 (w.e.f 18<sup>th</sup> April, 2019)***

***Revision-0: March 2019 (w.e.f 01<sup>st</sup> April, 2019)***

## Table of Contents

<b>1.</b>	<b>Preamble.....</b>	<b>3</b>
<b>2.</b>	<b>Objective.....</b>	<b>3</b>
<b>3.</b>	<b>Scope .....</b>	<b>3</b>
<b>4.</b>	<b>Role of National Load Despatch Centre (NLDC) .....</b>	<b>5</b>
<b>5.</b>	<b>Role of Regional Load Despatch Centres (RLDCs).....</b>	<b>6</b>
<b>6.</b>	<b>Role of Regional Power Committees (RPCs).....</b>	<b>6</b>
<b>7.</b>	<b>Role of SCED Generators.....</b>	<b>7</b>
<b>8.</b>	<b>Role of Beneficiary of SCED Generators.....</b>	<b>8</b>
<b>9.</b>	<b>Scheduling &amp; Despatch under SCED .....</b>	<b>9</b>
<b>10.</b>	<b>Data and Voice Communication .....</b>	<b>12</b>
<b>11.</b>	<b>Energy Accounting &amp; Settlement.....</b>	<b>12</b>
<b>12.</b>	<b>Distribution of Benefits due to SCED .....</b>	<b>16</b>
<b>13.</b>	<b>Settlement of Bank Interest.....</b>	<b>18</b>
<b>14.</b>	<b>Removal of Difficulties.....</b>	<b>19</b>
	<b>Annexure I - Mathematical Formulation of Security Constrained Economic Despatch..</b>	<b>20</b>
	<b>Annexure II: Schematic of Scheduling Process under SCED Procedure .....</b>	<b>21</b>
	<b>Format SCED1: Data to be provided by participating SCED generator (not participating in RRAS) to RLDCs/NLDC through respective RPCs.....</b>	<b>22</b>
	<b>Format SCED2: Data Display on RLDCs Website (for each SCED Generator).....</b>	<b>23</b>
	<b>Format SCED3: ...RPC "Regional SCED Monthly Statement" .....</b>	<b>24</b>
	<b>Format SCED4: NLDC "National SCED Monthly Statement" .....</b>	<b>25</b>
	<b>Format SCED5: ...RPC "Statement of Compensation due to Part Load Operation due to SCED" .....</b>	<b>26</b>
	<b>Format SCED6: NLDC "National Statement of Compensation due to Part Load Operation due to SCED" .....</b>	<b>27</b>
	<b>Format SCED7: ...RPC "Details of Beneficiary schedule energy from SCED generator" ..</b>	<b>28</b>
	<b>Format SCED8: ...RPC "SCED Generator Monthly Statement" .....</b>	<b>29</b>
	<b>Format SCED9: NLDC " National net SCED Benefits Distribution Statement""- SCED Generator.....</b>	<b>30</b>
	<b>Format SCED10: NLDC " National net SCED Benefits Distribution Statement""- Beneficiary.....</b>	<b>32</b>

## 1. Preamble

- 1.1 This Procedure is issued in accordance with Central Commission order dated 18th April, 2020 in Petition No. 08/SM/2020 (Suo-Motu) in the matter of Extension and Expansion of Pilot on Security Constrained Economic Dispatch (SCED), hereinafter referred to as "Expanded SCED Pilot".
- 1.2 SCED optimises the despatch of the generation resources at national level which are participating in the SCED Pilot and reduce the total variable charges for production of electricity. All the words and expressions used in the Procedure shall have the same meaning as assigned to them in various CERC Regulations.
- 1.3 This procedure would be applicable during the period of implementation of expanded SCED Pilot w.e.f 01<sup>st</sup> June, 2020.

## 2. Objective

- 2.1 The objective of the procedure is to lay down the roles, responsibilities, scheduling, despatch, accounting and settlement methodologies to be followed by the National Load Despatch Centre (NLDC), Regional Load Despatch Centres (RLDCs), State Load Despatch Centres (SLDCs), Regional Power Committees (RPCs) and participating SCED generators.

## 3. Scope

- 3.1 All the thermal generators already part of the SCED pilot as on 18<sup>th</sup> April, 2020 shall continue to participate in the expanded SCED pilot.
- 3.2 CERC vide Order No. 08/SM/2020 dated 18<sup>th</sup> April 2020 has decided to expand the ambit of SCED by including the thermal generators other than the thermal ISGS whose tariff is determined by the Central Commission. Accordingly, the following thermal generators may participate in the Expanded SCED Pilot:
  - (a) Generating stations whose scheduling is done by RLDCs;

- (b) Intra-state generating stations whose scheduling, metering, accounting and settlement is in place and whose scheduling related information exchange can be enabled through the SLDC interfacing with the concerned RLDC/ NLDC;

Provided that Scheduling for those generators whose scheduling, metering, accounting & settlement is done by SLDC, shall continue to be done by the respective SLDC while increment/ decrement instructions under SCED shall be communicated from NLDC to the respective SLDCs through the concerned RLDCs.

- 3.3 Generators, other than those already participating, willing to participate in the extended period shall be required to provide a one-time consent for participation in SCED pilot. Once the consent is communicated to POSOCO, it will be mandatory for the generator to participate in the SCED pilot for a minimum period of one month.
- 3.4 Detailed methodology would be formulated for intra-state generating stations in due course after discussion and finalization of modalities of interfacing and integration of intra-state generators in consultation with SLDCs in expanded SCED Pilot.
- 3.5 To begin with, the multi-fuel ISGS stations are being excluded in the expanded SCED pilot as one physical station is using multiple fuel types (domestic gas, RLNG, liquid fuels) and therefore, there is an added complexity due to unit commitment/open or closed cycle operation to be factored in real time.
- 3.6 This Procedure shall apply to CTU, SLDCs, RLDCs, NLDC and RPCs.
- 3.7 Any generator, after providing one-time consent, unwilling to participate in expanded SCED pilot shall inform NLDC at least one week (7 working days) before starting of the month on one time basis clearly indicating the reasons. 'SCED

generators' except as above shall be considered as 'participating' by NLDC for optimization under expanded SCED pilot.

- 3.8 The expanded SCED Pilot envisages optimization for a despatch period of one time-block of 15 minutes at a time repeated every 15-minutes over the day for 96 time- blocks. Multi-period optimization runs could also be carried out to provide indicative / pilot schedules to facilitate look-ahead for the participating generators.

#### **4. Role of National Load Despatch Centre (NLDC)**

- 4.1 NLDC would develop and implement requisite software applications for the SCED Pilot and update it from time to time for all the SCED Generators honouring the existing scheduling practices prescribed in the Indian Electricity Grid Code (IEGC).
- 4.2 NLDC would run the SCED software application to generate the SCED schedules (up/down) for the SCED Generators and communicate the same to the RLDCs and SLDCs (through the RLDCs) for regional entity generators and intra-state generators respectively for incorporation in the schedules.
- 4.3 NLDC would maintain and operate a separate bank account in the name of "National Pool Account (SCED)" for settlement of payments to/from the participating SCED Generators and disbursement of savings
- 4.4 NLDC would prepare a consolidated all India Monthly statement indicating the SCED schedules.
- 4.5 NLDC would issue a consolidated "National SCED Monthly Statement" indicating the payment and receipts to/from all participating SCED generators which would be made available to the stakeholders through the NLDC website.
- 4.6 NLDC would issue a consolidated "National Statement of compensation due to part load operation on account of SCED" indicating the payment to all eligible SCED generators, based on the monthly statement issued by respective RPCs, which would be made available to the stakeholders through the NLDC website.

- 4.7 NLDC shall issue a Monthly statement “National net SCED Benefits Distribution statement” detailing disbursement for different utilities in the net accrued amount due to reduction in total variable charge through SCED mechanism in “National Pool Account SCED”. This statement would be made available to the stakeholders through the NLDC website.

## **5. Role of Regional Load Despatch Centres (RLDCs)**

- 5.1 The respective RLDCs would incorporate the SCED schedules as received from NLDC and maintain the relevant scheduling data during the operation of the expanded SCED pilot (including but not limited to generating station-wise installed capacity, declared capacity, schedule, Un-Requisitioned Surplus (URS), generator wise Variable cost, RRAS, SCED schedules for up/down and requisitions from the generating stations).
- 5.2 The reconciliation of SCED schedules would be done by RLDCs with the data provided by NLDC before forwarding implemented schedule to RPCs.

## **6. Role of Regional Power Committees (RPCs)**

- 6.1 Based on the data provided by the participating SCED generators in the expanded SCED Pilot, the concerned RPCs shall publish the information of variable charge of all participating generations as per Format-SCED1 on their respective websites on a monthly basis by the 12<sup>th</sup> day of current month (if 12<sup>th</sup> day is a holiday, then next working day). The above information will be used for despatch of SCED from the 16<sup>th</sup> day of the current month till the 15<sup>th</sup> day of the next month.
- 6.2 The RPCs shall use the above-mentioned details of variable charge for preparation of monthly SCED account on the data for SCED schedules provided to them by the RLDCs. Any post-facto revision in rates/charges by participating SCED generator shall not be permitted.

6.3 The RPCs would issue Monthly SCED account based on the data provided to them by the RLDCs.

6.4 The RPCs would issue monthly "Statement of Compensation due to Part Load Operation due to SCED" separately in its accounts for participating SCED generators along with monthly REA except for merchant generators with no tied-up capacity in LTA and MTOA.

## 7. Role of SCED Generators

7.1 The SCED generator shall provide, on monthly basis, technical data such as variable charge (VC), technical minimum, maximum possible generation i.e. Pmax, Ramp up and Ramp down rates and other details as per AS-III format (as given in Detailed Procedure for RRAS) or **Format SCED1** to the concerned RLDC/NLDC through respective RPC.

7.2 Declaration of Variable Charges to be used for SCED and Settlement

7.2.1 Variable charge of SCED generator which are also participating under RRAS shall be considered as per the Format AS3 published by respective RPCs.

7.2.2 SCED generator, other than those participating in the RRAS mechanism, shall provide the variable charges (in the prescribed **Format SCED1**) by 8th day of the current month (if 8th day is holiday, then next working day) to respective RPC as follows:

7.2.2.1 For generators having full capacity tied in multiple PPAs, variable charge shall be considered as the weighted average of the variable charges, as determined or adopted by the Appropriate Commission.

7.2.2.2 For generators having only part capacity tied in PPA(s), variable charge shall be considered as the weighted average of the variable charges, as determined or adopted by the Appropriate Commission for the contracted portion of the capacity. This variable charge determined for the contracted capacity shall be considered for the untied portion of the capacity as well.



7.2.2.3 For generators with no tied capacity (merchant generator), variable charge shall be considered as intimated by such generator to concerned RLDC/NLDC through RPC.

Provided that for the purpose of declaration of variable charges as specified in para 7.2.2, "tied capacity" shall mean the capacity of the concerned generator tied up in long-term and medium-term contracts.

7.3 The participating SCED generators shall also communicate the details of constituent-wise share in generating station, requisition (day-ahead and last revision) from the generating station to respective RLDC and RPCs.

7.4 The participating SCED generator with no tied capacity (merchant generator) shall inform about contracts for power sale entered in LTA/MTOA and shall submit revised information of variable charge in format SCED-1 at least 7 working days in advance before the commencement of scheduling of the same to the concerned RLDC and RPCs.

7.5 The participating SCED generator with part tied capacity shall inform about any change in status of the tied up capacity and shall submit revised information of variable charge in format SCED-1 at least 7 working days in advance before the commencement/termination of scheduling due to such change in status to the concerned RLDC and RPCs.

7.6 The participating SCED generators shall reconcile the amount paid and received due to participation in SCED and benefits accrued in National Pool Account (SCED) with NLDC on quarterly basis based on the RPCs and NLDC statement.

## **8. Role of Beneficiary of SCED Generators**

8.1 Beneficiary(ies) of SCED Generators shall provide the Bank account details to NLDC to facilitate payments to/from the beneficiary of participating SCED generator due to net benefits accrued in National Pool Account (SCED).

- 8.2 Beneficiary shall reconcile the amount received due to benefits accrued in National Pool Account (SCED) with NLDC on quarterly basis based on the RPCs and NLDC statement.
- 8.3 The reconciliation statements shall be uploaded in the NLDC website within 15 days from closing of each financial quarter.
- 8.4 Beneficiary shall reconcile the SCED payment details with NLDC within 15 days of issuance of reconciliation statement, else it shall be treated as deemed reconciled.

## 9. Scheduling & Despatch under SCED

- 9.1 The existing schedule & despatch procedure in accordance with IEGC (Part 6 - Scheduling and Despatch Code) would continue for all entities.
- 9.2 NLDC would prepare the SCED schedules based on the following data:
- 9.2.1 Generator Parameter
    - 9.2.1.1 Normative On bar declared capability or maximum possible generation (Pmax) as the case may be
    - 9.2.1.2 Injection schedule (latest revision)
    - 9.2.1.3 Ramp Rates (as declared in RRAS and /or in format SCED-1)
    - 9.2.1.4 Variable Charges (as declared in RRAS and /or in format SCED-1)
    - 9.2.1.5 Technical Minimum (as per IEGC provisions) or Pmin as the case may be
  - 9.2.2 Transmission Capability Constraint
  - 9.2.3 Inter-Regional Transfer Margins as assessed by RLDCs/NLDC
- 9.3 The Mathematical Formulation of the Economic Despatch Model used for SCED procedure is enclosed at **Annexure - I**.
- 9.4 A schematic of scheduling under SCED Procedure is placed at **Annexure – II** for better clarity and understanding.
- 9.5 The SCED software program would consider only the units on-bar. Further, SCED would run after all schedule revisions as per the allowable time lines have been

incorporated by the RLDCs and RRAS despatched by NLDC. NLDC would run SCED after gate closure and scheduling of RTM transactions.

- 9.6 The SCED schedules, with the increment (up)/decrement values (down), for each SCED Generator in a particular time block would be intimated by NLDC to respective RLDCs, normally about one-time block in advance.
- 9.7 Triggering in of the SCED optimization (smooth take-off) and reverting to normal schedules (smooth landing) in case of any interruption of SCED algorithm due to any reason are issues that need to be taken care of by NLDC and SCED generators.
- 9.8 The triggering in of the SCED optimization algorithm shall have least impact on the total schedules if at the time of triggering in, the schedules of the generators are close to optimized schedules. This would generally be the situation during peak hours. Likewise, in the case of an interruption, the impact of safe landing would be minimized with the generators reverting gradually to the base schedules (without SCED) as per the ramp rates. NLDC would attempt multi period optimization runs in this pilot project to assess its impact on ramp constraints.

In case of failure or interruption of the SCED software program or a communication failure for any reason, the schedules without SCED shall become applicable for the SCED generators. NLDC/RLDCs shall notify the same to the SCED generators. In such a case, the SCED Generators shall come back to their schedules without SCED schedule as per their respective ramp rate. The mismatch in schedules after accounting for the generating station's ramp rate shall be taken care in the SCED implemented schedules by RLDCs in consultation with NLDC for the affected generators. After resolving the issues leading to interruption, SCED optimization algorithm shall be triggered in again.

- 9.9 Diversity in the regional load-generation patterns has given rise to the present scope of generation optimization through SCED. However, opposing ramping requirements of different regions also impose constraints in terms of overall

ramping that is required for the optimization process. This may sometimes lead to an infeasible/non-converged solution while solving the SCED optimization problem.

- 9.10 In the event of an infeasible/non-converged solution by the SCED optimization algorithm within the given set of constraints, the classical method of relaxation of the constraints, incrementally in steps, and/or penalizing the objective function shall be attempted in order to find an optimal solution. The lessons learnt during the pilot phase would help in improving the optimization process nuances. Such small incremental relaxation of constraint(s), required to obtain an optimal solution, shall automatically be accounted for in the SCED implemented schedules and through the National Pool Account. Higher ramping capability of the participating generators will help in improving the optimization and the above-mentioned issues.
- 9.11 RLDCs would incorporate the SCED schedule in the respective participating SCED Generator's schedule to provide a net injection schedule.
- 9.12 SCED schedules of the participating generators would be treated as deemed delivered. There would be no retrospective changes in the SCED schedules except in situations as mentioned in Para 9.8 and 9.9 above.
- 9.13 The schedules of the states/beneficiaries, would not be changed under SCED and the beneficiaries would continue to be scheduled based on their requisitions from different power plants as per the existing practices.
- 9.14 A virtual SCED entity, VSCED-[Region] would be created in the scheduling process of the RLDCs which shall act as a counter-party to the SCED schedules for the SCED generators. For example, in the Northern Region, VSCED-NR shall be created. The virtual SCED entity, by its very nature, is not a physical entity bounded by meters and hence, shall not form a part of the Regional DSM Pool
- 9.15 A virtual SCED entity, VSCED-[State] would be created in the scheduling process of the SLDCs which shall act as a counter-party to the SCED schedules for the SCED intra-state generators. For example, in the State- A, VSCED-State (A) shall

be created. The virtual SCED entity, by its very nature, is not a physical entity bounded by meters and hence, shall not form a part of the State DSM Pool.

- 9.16 Loss will be applied to SCED schedules as per the existing extant regulations and scheduling practice.
- 9.17 The URS available due to Regulation of Power Supply provisions as per the CERC Regulations would also be used for SCED procedure similar to RRAS.
- 9.18 The participating SCED Generator whose scheduling has been restricted due to transmission constraints or any other reason viz. testing purpose can also be considered in the SCED optimization algorithm with revised constraints (maximum/minimum generation limits) for despatch. The concerned RLDC shall inform NLDC about such generators.

## **10. Data and Voice Communication**

- 10.1 All participating SCED Generators would ensure the availability of real time updated data to the RLDCs/SLDCs. CTU would ensure reliable communication between the respective SCED Generators and RLDCs and also between RLDCs and NLDC. STU would ensure reliable communication between the respective state SCED Generators and SLDC and also between SLDCs and RLDCs.
- 10.2 RLDCs would provide information related to SCED schedules of SCED Generators on their websites. The data display on RLDCs Website (for each SCED Generator) would be as per **Format SCED2**.

## **11. Energy Accounting & Settlement**

- 11.1 Energy Accounting for SCED optimized schedules shall be done by the respective RPCs for regional entity generators and SLDC for intra-state generators on monthly basis with day wise resolution figure made available in the SCED account based on the data provided to them by RLDCs.

- 11.2 SCED schedules are also required to be incorporated in the inter-regional schedules for each region and accordingly, NLDC shall compute the impact of SCED schedules on the inter-regional schedules for all regions. The incremental change in the inter-regional schedules shall be communicated by NLDC to the respective RLDCs for incorporation in the net inter-regional schedules being given to the RPCs for the purpose of accounting.
- 11.3 NLDC would prepare a consolidated all India statement, monthly indicating the SCED schedules
- 11.4 NLDC would maintain and operate a separate bank account in the name of "National Pool Account (SCED)" for payments to/receipts from the SCED Generators. The details of the bank account would be displayed on the NLDC website.
- 11.5 For any decrement in schedule of SCED Generator due to SCED, the SCED Generator shall pay to the 'National Pool Account (SCED)' for the decrement in generation at the rate of its variable charges.
- 11.6 For any increment in schedule of SCED Generator due to SCED procedure, the SCED generator would be paid from the 'National Pool Account (SCED)' for the incremental generation at the rate of its variable charges.
- 11.7 The payments/receipts by/to the SCED Generators would be based on the "Regional SCED Monthly Statement" (**Format SCED3**) issued by RPCs, "State SCED Monthly Statement" (**Format SCED3A**) issued by SLDCs and consolidated "National SCED Monthly Statement" (**Format SCED4**) issued by NLDC.
- 11.8 Day wise details for SCED Generators shall also be made available in the SCED account by RPCs/SLDCs as per Format SCED7.
- 11.9 NLDC would issue a consolidated "National SCED Monthly Statement" comprising of payment and receipts to/from all SCED Generators based on the "Regional SCED Monthly Statements" issued by all the RPCs/SLDCs.
- 11.10 The concerned SCED Generator would pay the indicated charges for SCED decrement within seven (07) working days of the issue of statement of SCED by

the RPCs/SLDCs to the 'National Pool Account (SCED)'. Payments against SCED shall not be adjusted against any other payments by the SCED Generator.

11.11 The concerned SCED Generator shall be paid the indicated charges for SCED increment within ten (10) working days of the issue of consolidated "National SCED Monthly Statement" by the NLDC from the 'National Pool Account (SCED)'.

11.12 If payments by the SCED Generator, due under the SCED, are delayed beyond seven (7) working days from the date of issue of the "Regional SCED Monthly Statement" by the RPCs, the defaulting SCED Generator shall pay simple interest @ 0.04% for each day of delay on the payable amount.

11.13 If payments to the SCED generator, due under the SCED are delayed beyond ten (10) working days from the date of issue of the consolidated "National SCED Monthly Statement" by NLDC, the SCED Generator shall be paid simple interest @ 0.04% for each day of delay on the receivable amount

11.14 The RPCs would issue monthly "Statement of Compensation due to Part Load Operation due to SCED" (**Format SCED5**), subject to yearly computation as the heat rate computation is being done on annual cumulative basis.

11.14.1 For Inter State Generating Stations (ISGS) that are regional entities and whose tariff is determined or adopted by the Commission, the heat rate compensation for part load operation shall be provided as per CERC (Indian Electricity Grid Code) Regulations, 2010 as amended from time to time.

11.14.2 For generators (with part capacity tied (whose PPAs have been approved by the Appropriate Commission), the heat rate compensation for part load operation shall be provided as per CERC (Indian Electricity Grid Code) Regulations, 2010 as amended from time to time. The Station Heat Rate (SHR) to be used as reference for this purpose shall be according to the provisions in the respective PPA(s) read with the relevant regulations of the Appropriate Commission.

11.14.3 Generators with no tied capacities (merchant generators) shall not be eligible for any heat rate compensation for part load operation.

- 11.15 NLDC would issue monthly "National Statement of Compensation due to Part Load Operation due to SCED" (**Format SCED6**) on the compensation to be paid to the SCED Generator for heat rate degradation, from National Pool Account (SCED) based on Format SCED4 statement issued by respective RPCs.
- 11.16 The concerned SCED Generator shall be paid the indicated charges of compensation for heat rate degradation as per the statement issued by "National Statement of Compensation due to Part Load Operation due to SCED" by the NLDC from the National Pool Account (SCED) within seven (07) working days of the issue of the monthly statement subject to yearly computation, as the heat rate computation is being done on annual cumulative basis.
- 11.17 If payments are delayed beyond seven (7) working days from the date of issue of the "National Statement of Compensation due to Part Load Operation due to SCED" by the NLDC, the SCED Generator shall be paid simple interest @ 0.04% for each day of delay.
- 11.18 In case of any recovery on account of Heat rate compensation due to part load operation from SCED generator, the concerned SCED Generator would pay back to the 'National Pool Account (SCED)' the indicated charges within seven (07) working days of the issue of "National Statement of Compensation due to Part Load Operation due to SCED" by the NLDC.
- 11.19 If payments are delayed beyond seven (7) working days from the date of issue of the "National Statement of Compensation due to Part Load Operation due to SCED" by the NLDC, the defaulting SCED Generator shall pay simple interest @ 0.04% for each day of delay.
- 11.20 NLDC shall maintain a record of all savings on accrual basis in the 'National Pool Account (SCED)'.
- 11.21 NLDC shall issue the statement of interest due to delay in payment on quarterly basis.
- 11.22 The concerned SCED Generator would pay back to the 'National Pool Account (SCED)' the indicated charges within seven (07) working days from the issue of



"National Statement of Interest due to delay in payments". NLDC shall disburse the interest amount from the 'National Pool Account (SCED)' to the eligible SCED Generators due to delay in receipt of Monthly SCED payment for net SCED down.

11.23 If the concerned SCED generator fails to pay the interest amount within the stipulated period as mentioned in para 11.22, NLDC shall adjust that amount from the amount receivable by the particular generator either in "Monthly SCED statement" and /or "Monthly SCED statement due to part load operation due to SCED" and / or "Monthly benefit sharing statement"

## **12. Distribution of Benefits due to SCED**

Beneficiary(ies) of SCED Generators shall provide the Bank account details to NLDC as per format given on POSOCO website to facilitate payments to/from the beneficiary of participating SCED generator due to net benefits accrued in National Pool Account (SCED). The net benefits as a result of SCED optimization after adjusting heat rate compensation for part load operation of the generators shall be shared in the following manner:

12.1 The share towards the 'untied capacity' of merchant generators (100% untied capacity) as well as generators with part capacity tied shall be segregated from the net benefits, in the ratio of contribution of such generators to SCED, for every time block energy accumulated on monthly basis.

12.2 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.

12.3 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).

12.4 RPCs/SLDCs shall issue the "Detail of Beneficiary schedule energy from SCED generator" (**Format SCED7**) and "SCED Generator Monthly Statement" (**Format**

**SCED8).** RPCs/SLDCs would provide soft copy of both these statements to NLDC on monthly basis.

12.5 The benefits corresponding to the SCED generator out of the total Net SCED benefits shall be distributed in the ratio of 60 and 40 between the SCED generators receiving SCED Up and SCED Down respectively. This shall be based on the block wise SCED Up and SCED Down energy aggregated on monthly basis.

Based on the above, if a generator's benefit including SCED Up and SCED Down exceeds ₹ 7 paise/kWh the same shall be restricted to 7 paise/kWh and the gains over and above ₹ 7 paise/kWh shall be shared among the Beneficiary of the respective SCED generator in the same manner as above.

The cap of ₹ 7 paise/kWh shall, however, not be applicable in respect of 'untied capacity' of merchant generators as well as generators with part capacity tied, for its untied capacity.

12.6 The allocations for merchant generators as segregated as above, shall accrue to such generators as their share.

12.7 The share of savings from SCED for generators with part capacity tied, shall be first settled in proportion to their contribution from tied capacity and then from untied capacities.

12.8 The share in savings as segregated in respect of such generators shall be the same for SCED up and SCED down on the ratio of 50:50.

12.9 Benefits as computed above for the SCED generators would then be summed up for the month.

12.10 The benefits for merchant generators as segregated in 12.1 shall accrue to such generators as their final share.

12.11 Similarly, the benefits for generators with part capacity tied segregated in 12.1, shall accrue to such generators as their final share for the untied capacity.

12.12 NLDC would issue Monthly "National net SCED Benefits Distribution Statement" (after adjusting the heat rate compensation) indicating the payment to SCED

generators (**Format SCED9**) and Beneficiary of SCED generator (**Format SCED10**) based on statements issued by respective RPCs. This would be made available to the stakeholders through the NLDC website.

- 12.13 The payment to the SCED Generator and Beneficiary shall be paid within ten (10) working days of the issue of monthly "National net SCED Benefits Distribution Statement" by the NLDC from the 'National Pool Account (SCED)'.
- 12.14 The payment of Net SCED benefits to the SCED Generator will be made by NLDC after deducting any pending interest on delay payment of variable fuel charges from the respective SCED generator.
- 12.15 NLDC shall transfer interest accrued on SCED Pool a/c & interest received from SCED Providers on delay payment to SCED Providers & beneficiaries in the ratio of 50:50 in the same manner of SCED benefits at the end of financial year after adjusting incidental charges if any.

### **13. Settlement of Bank Interest**

- 13.1 SCED payment credited in bank account may earn some bank interest. NLDC (POSOCO) shall keep the record of the interest earned for each financial year in the National SCED Pool Account.
- 13.2 Interest payable on account of late payment of charges by SCED Generator shall be first adjusted before settlement of interest from National Pool account (SCED).
- 13.3 The interest accumulated as per 13.1 and 13.2 shall be first utilized for any costs or expenses or other charges incurred on recovery of amount mentioned in National SCED monthly statement or any applicable banking/finance charges for maintaining National Pool Account (SCED).
- 13.4 The interest accumulated in National Pool Account (SCED) after settlement as per clause 13.1 and 13.3 shall be disbursed between the SCED generator and SCED Beneficiaries after the end of each financial year in following manner:

- 13.4.1 The interest accumulated in the pool after clause 13.1 and 13.3, shall be shared between in the ratio of 50:50 between the generators participating in SCED and the concerned beneficiaries / Discoms, on financial year basis.
- 13.4.2 The share of 50% of the net interest accrued in the pool corresponding to the beneficiaries would be shared in proportion to their final schedule from the generating stations covered under SCED pilot in a Financial year basis as per the Regional Energy Account (REA)/ State Energy Account (SEA).
- 13.4.3 The share of 50% of the net interest accrued in the pool corresponding to the SCED generator would be shared in proportion to their total SCED schedule on mileage (SCED Up plus SCED down) in a Financial year basis as per the National SCED Monthly Statement prepared by NLDC (POSOCO).

## **14. Removal of Difficulties**

- 14.1 Notwithstanding anything contained in this Procedure, NLDC/RLDCs may take appropriate decisions in the interest of System Operation. Such decisions shall be taken under intimation to CERC and the procedure shall be modified/amended, as necessary.
- 14.2 In case of any difficulty in implementation of this procedure, this procedure shall be reviewed or revised by POSOCO and submitted to the CERC for information.

## Annexure I - Mathematical Formulation of Security Constrained Economic Despatch

### Objective Function

- Minimize Pan India ISGS Variable Cost

### Subject to Constraints

- Meeting Total Requisition by States from ISGS
- Transmission Constraints (ATC)
- Technical Minimum of Plants
- Maximum Generation (DC-on-bar)
- Ramp up/down rates

$$\text{Minimise } \sum_{i=1}^k C_i P_i + \sum(\text{Violation Penalties}) \dots \dots \dots (1)$$

- $k$  = total number of Plants
- Where  $C_i$  is the variable per unit cost of the  $i^{\text{th}}$  Plant
- $P_i$  is the optimised scheduled power of the  $i^{\text{th}}$  Plant
- Violation Penalties are computed based on constraint violations

### Subject to

$$\text{➤ } \sum_{i=1}^k P_i = \sum_{i=1}^k S_i - \text{Schedule violation} \dots \dots \dots (2)$$

$$\text{➤ } P_i \leq (\text{DC on bar}) \dots \dots \dots (3)$$

$$\text{➤ } P_i \geq P_{i,\text{min}} \dots \dots \dots (4)$$

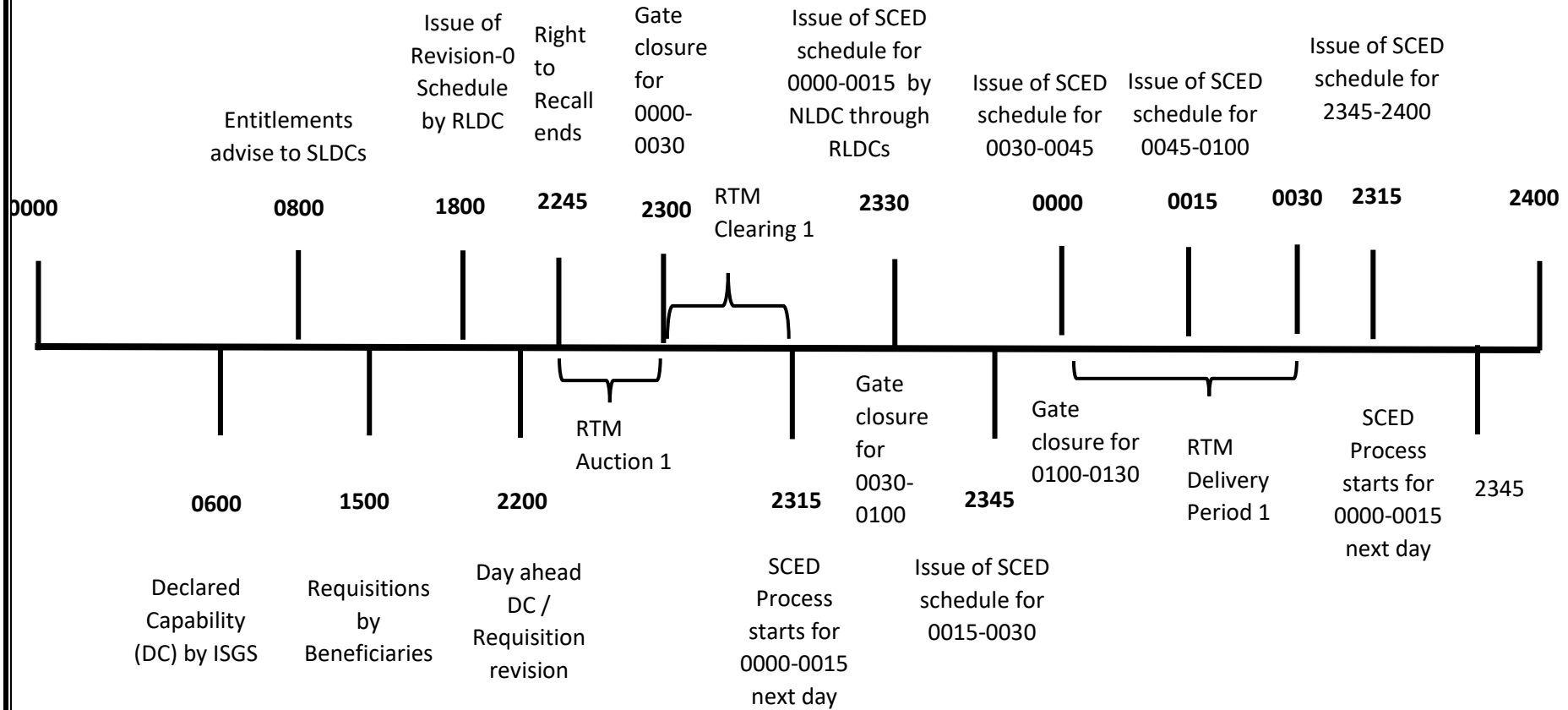
$$\text{➤ } P_{i,t} \leq P_{i,t-1} + \text{Ramp up rate} + \text{Ramp up violation} \dots \dots \dots (5)$$

$$\text{➤ } P_{i,t} \geq P_{i,t-1} - \text{Ramp down rate} - \text{Ramp down violation} \dots \dots \dots (6)$$

$$\text{➤ } \forall r \in R, \sum_r (P_{i,r} - S_{i,r}) \geq \text{SCHIR}_r - \min(\text{ImpOpATC}_r, \text{ImpATC}_r) - \text{ATC violation} \dots \dots (7)$$

- $S$  -is the scheduled power
- $t$  -represents current time of execution
- $R$  -represents each of the regions viz., North, East, West, South and North East
- $\text{ImpATC}$  -is the import Available Transmission Capability (ATC) of each region  $R$ , always positive
- $\text{ImpOpATC}$  -is the operator fed import ATC value entered during grid contingencies / line trippings, always positive
- $\text{SCHIR}$  -is the Scheduled Net Interchange of the region  $R$ , import positive
- $P_{i,\text{min}}$  is the technical minimum for thermal power plants considered at 55% of normative DC on bar or schedule whichever is less

## Annexure II: Schematic of Scheduling Process under SCED Procedure



**Format SCED1: Data to be provided by participating SCED generator  
(not participating in RRAS) to RLDCs/NLDC through respective RPCs**

(Name of Generating Station)		
(Name of Owner Organization)		
Validity of the Information		<b>From:</b> 16/mm/yyyy <b>To:</b> 15/mm/yyyy
<b>Date:</b> dd/mm/yyyy		
<b>S.No.</b>	<b>Title/Parameters</b>	<b>Values/Data</b>
a)	Number of Generating Units (e.g. 1 x 210 MW...)	
b)	Total Installed Capacity (MW)	
c)	Maximum possible Ex-bus injection (MW) (including overload if any)	
d)	Technical Minimum (MW)	
e)	Type of Fuel	
f)	Region	
g)	Bid area	
h)	Fixed Cost (paise / kWh upto one decimal place)	
i)	Variable Cost (paise / kWh upto one decimal place)	
j)	Ramp-Up Rate (MW/Min) for each unit	
k)	Ramp-Down Rate (MW/Min) for each unit	
l)	Start-up Time from Cold Start (in Min) & Warm Start of each unit	
m)	Any other information	
Signature of Authorized Signatory (with Stamp)		
		Name:
		Designation:



## Format SCED2: Data Display on RLDCs Website (for each SCED Generator)

**SCED Generator Name: xxxxxxxxxx**

Schedule Time Block	ISGS	MTOA	STOA	LTA	Power Exchange	URS	RRAS	SCED	Net Total
1									
2									
.									
.									
96									
<b>Average</b>									
<b>Maximum</b>									
<b>Minimum</b>									
<b>MWHR</b>									



## Format SCED3: ...RPC "Regional SCED Monthly Statement"

*(To be issued by concerned RPC)*

**SCED Account For Month <<from date>> <<to date>>**

**\*(+)** means payable from the 'National Pool Account (SCED)' to SCED Generator

**/ (-)** means receivable by 'National Pool Account (SCED)' from SCED Generator

S.N.	SCED Generator	Increment due to SCED scheduled to VSCED [Region] (MWHr) (A)	Decrement due to SCED scheduled to VSCED [Region] (MWHr) (B)	Charges To be Paid to SCED Generator from National Pool (SCED) (in ₹) (C) = (A) x V.C.	Charges To be Refunded by SCED Generator to National Pool (SCED) (in ₹) (D) = (B) x V.C.	Net Charges Payable (+) / Receivable (-) (in ₹) (E)* = (C) – (D)
1	SCED Generator 1					
2	SCED Generator 2					
....	.....					
	<b>Total</b>	Total of (A)	Total of (B)	Total of (C)	Total of (D)	Total of (E)

## Format SCED4: NLDC "National SCED Monthly Statement"

For Month <<from date>> <<to date>>

\* (+) means payable from the National Pool Account (SCED) to SCED Generator

/ (-) means receivable by National Pool Account (SCED) from SCED Generator

S.N.	SCED Generator	Region	Increment due to SCED scheduled to VSCED (MWHr) (A)	Decrement due to SCED scheduled to VSCED (MWHr) (B)	Charges To be Paid to SCED Generator from National Pool (SCED) (in ₹) (C) = (A) x V.C.	Charges To be Refunded by SCED Generator to National Pool (SCED) (in ₹) (D) = (B) x V.C.	Net Charges Payable (+) / Receivable (-) (in ₹) (E)* = (C) - (D)	Average Untied capacity of Generator during the month (%) (F)
1	SCED Generator 1	NR						
2	SCED Generator 2	WR						
....	.....	.....						
	Total		Total of (A)	Total of (B)	Total of (C)	Total of (D)	Total of (E)	



## Format SCED5: ...RPC "Statement of Compensation due to Part Load Operation due to SCED"

*(To be issued by concerned RPC)*

**\*(+) means payable from the National Pool Account (SCED) to SCED Generator**

**/ (-) means receivable by National Pool Account (SCED) from SCED Generator**

**For Month:**

SCED Generator	Decrement due to SCED <b>(MWHr)</b>	Compensation Amount Payable due to SCED from National Pool Account (SCED) to SCED Generator <b>(in ₹)*</b>
SCED Generator 1		
SCED Generator 2		
.....		
<b>Total</b>		



## Format SCED6: NLDC "National Statement of Compensation due to Part Load Operation due to SCED"

\*(+) means payable from the National Pool Account (SCED) to SCED Generator

/ (-) means receivable by National Pool Account (SCED) from SCED Generator

**For Month:**

SCED Generator	Region	Decrement due to SCED <b>(MWHr)</b>	Compensation Amount Payable due to SCED from National Pool Account (SCED) to SCED Generator <b>(in ₹)</b>
SCED Generator 1	NR		
SCED Generator 2	WR		
.....	.....		
<b>Total</b>			

## Format SCED7: ...RPC "Details of Beneficiary schedule energy from SCED generator"

Details from REA\* <<Month>>

Entity	Beneficiary 1	Beneficiary 2	Beneficiary 3	Beneficiary ...	Total
Plant	Schedule energy(MWh)	Schedule energy(MWh)	Schedule energy(MWh)	Schedule energy(MWh)	Schedule energy(MWh)
SCED Gen1					
SCED Gen2					
SCED Gen3					
SCED Gen...					

*\* Each RPC will furnish beneficiary data for the SCED generators under the respective RLDC Control Area.*

## Format SCED8: ...RPC "SCED Generator Monthly Statement"

SCED Account For Month <<.....> Name of SCED

Generator: SCED Generator1

\*(+) means payable from the 'National Pool Account (SCED)' to SCED Generator

/ (-) means receivable by 'National Pool Account (SCED)' from SCED Generator

Date	Increment due to SCED scheduled to VSCED [Region] (MWHr) (A)	Decrement due to SCED scheduled to VSCED [Region] (MWHr) (B)	V.C. (Variable cost) Paisa/Unit	Charges To be Paid to SCED Generator from National Pool (SCED) (in ₹) (C) = (A) x V.C.	Charges To be Refunded by SCED Generator to National Pool (SCED) (in ₹) (D) = (B) x V.C.	Net Charges Payable (+) / Receivable (-) (in ₹) (E)* = (C) - (D)
01/mm/yy						
02/mm/yy						
03/mm/yy						
dd/mm/yy						
<b>Total</b>	Total of (A)	Total of (B)		Total of (C)	Total of (D)	Total of (E)

## Format SCED9: NLDC " National net SCED Benefits Distribution

### Statement"" - SCED Generator

For the Month <<Month>>

**Table 1: System Savings**

Total Saving for the month (Rs.) (A)	Heat Rate Compensation (Rs.) (B)	Net Saving for the month (Rs.) (C)	SCED UP + DOWN in MW (D)

**Table 2: Share of System Savings for Merchant Generators**

Sl.No.	SCED Generator	Region	SCED Schedule MW (A)	Contribution in SCED (%) (B)	Benefit accrued to Generator (Rs.) (C)	Estimated benefit Rs. per KWH (D)= (C)/(A)	Final Benefit to Generator (E) (Rs.)
1	SCED Gen1						
2	SCED Gen2						
3	SCED Gen3						
n	SCED Gen.....						
<b>All India Total</b>							

**Table 3: Share of System Savings for generators with part capacity Untied-Computation for untied portion**

Sl.No.	SCED Generator	Region	SCED Schedule MW (A)	Contribution in SCED (%) (B)	Benefit accrued to Generator (Rs.) (C)	Estimated benefits Rs. per KWH (D)= (C)/(A)	Final Benefit to Generator for Untied Capacity (E) (Rs.)
1	SCED Gen1						
2	SCED Gen2						
3	SCED Gen3						
n	SCED Gen.....						
<b>All India Total</b>							

**Table 4: Share of System Savings between generators with tied capacity & Beneficiaries**

System Savings (Rs.) (A)	Benefits to Merchant Generator (Rs.) (B)	Benefit to Untied portion of generator with part tied capacity (Rs.) (C)	Net System Savings (Rs.) (D)= (A)-{(B)+(C)}	Generators Share in Rs. (E)=50% * D)	Discoms Share in Rs. (F =50% * D)	SCED UP Generators Contribution (Rs.) (G = 60%*E)	SCED UP Generators Contribution (Rs.) (H = 40%*E)

**Table 4A: Share of System Savings for tied capacity for SCED UP & DOWN**

Sl. No.	SCED UP Generators	SCED Schedule (A)	Generator's Contribution (%) (B)	Generator's Contribution in Share of Savings (Rs.) (C)	Estimated benefits to Generator Rs. per KWH (D)= (C)/(A)	Generator's Benefit subject to Cap of 7 Paise /KWH (D)=(A)* 7*10	Final Benefit to Generator for tied Capacity (E) (Rs.)	Additional benefit to Discoms (F)=(C) - (E)
1	SCED Gen1							
2	SCED Gen2							
3	SCED Gen3							
n	SCED Gen.....							
<b>All India Total</b>								

Sl. No.	SCED DOWN Generators	SCED Schedule (A)	Generator's Contribution (%) (B)	Generator's Contribution in Share of Savings (Rs.) (C)	Estimated benefits to Generator Rs. per KWH (D)= (C)/(A)	Generator's Benefit subject to Cap of 7 Paise /KWH (D)=(A)* 7*10	Final Benefit to Generator for tied Capacity (E) (Rs.)	Additional benefit to Discoms (F)=(C) - (E)
1	SCED Gen1							
2	SCED Gen2							
3	SCED Gen3							
n	SCED Gen.....							
<b>All India Total</b>								





## Format SCED10: NLDC " National net SCED Benefits Distribution

### Statement"" - Beneficiary

Sl no	Beneficiary	REGION	Total schedule Energy(Mwh) as per REA	Share in 50% of System Savings in (Rs)	Additional Benefit Share in (Rs.)	Total Benefit in (Rs.)
1	Beneficiary 1					
2	Beneficiary 2					
3	Beneficiary 3					
n	Beneficiary ...n					
	All India					