

The similar situation happens when large HT Motors of Bulk Consumers started for the sake of being connected to the Grid.

In isolated condition, the CGP would have either tripped or operated in "islanded mode" if Grid Support were not there.

Conclusion form transient Study

- (a) Starting of HT Motors below 02MW is possible under house load conditions.
 - (b) The clearing time and recovery is more than 12 cycles whereas Breakers work much within the time limit which shows that, the system is stable for all Single-Phase and Three-Phase faults.(Para-14.4,Page-56 of the Report)
 - (c) As long as CGPs are connected to strong Grid, during fault conditions parameters of the connected CGP is definitely disturbed but the voltage and frequency at the PCC (Point of Connection) remains steady. As islanding is based on change of voltage and frequency, the possibility of islanding is minimized at the CGP end.
40. That, the consultant has taken several snapshots of varieties of situations arising out of Loss of generation/ load throw-off and similar emergency/ contingency situation and studied the impact on the Grid and the support supplied by the robust grid. The same is a part of the report submitted by the Consultant.

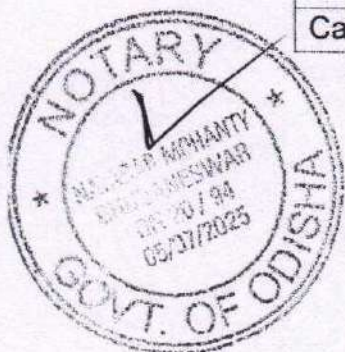
The same are depicted in Graphical Form which shall be explained at the time of presentation of the same during hearing proceeding before OERC. The graphs generally depict that, in transient situation, the voltage and frequency dip is nominal and recovery time is fast which prevents the CGP generators from tripping and preventing the consequential loss of CGP owners.

That copies of the said study report is attached with the petition for kind appreciation of Hon'ble Commission and its Officers.

41. That the Consultant has divided the CGPs into three categories namely, A B & C based on the installed capacity as depicted at TABLE-2.

TABLE-2

TYPE OF CGP	UNIT SIZE	Installed Capacity
Category-A	> 100 MW	> 500 MW
Category-B	> 50	> .100 < 500 MW
Category-C	> 10 <50 MW	< 50MW.



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42. That in case of the **Category—A-** type CGPs, Dependence on Grid is moderate, have in built provisions for islanding operation, contribute to fault current and take start up power from Grid. Own provisions of VAR compensation, harmonic filter etc. These are Generators which use state of the art technology and moderately dependent on the Grid.

Category-B :- CGPs of this Category need frequent support of Grid, poor VAR compensation and inject harmonics into the system, normally Connected at 132kv. These CGPs are the **main beneficiaries of the Grid Support extended by the OPTCL system.**

Category-C :-These small CGPs can be treated as small HT Commercial Loads. Normally inject power to Grid. They may be treated as in floating condition.

Quantification of the Grid Support charges.

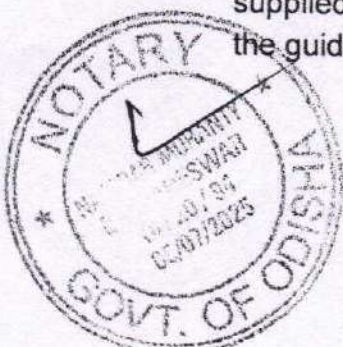
43. That the GSC is universally decided based on following Methods

- (i) Minimum Support method or Spinning Reserve method.
- (ii) Base MVA Support Method

That, in Minimum Support Method (**Spinning Reserve Method**), 05% of the installed capacity of the CGP or 25% of the largest generating unit of the CGPs whichever is higher, is taken as the basis for determination of GSC. The Consultant have evaluated the Grid Support Charges in this System and found the rate to be Rs 5.11 lakh/Month/MVA at the Minimum or more based on their installed capacity and Contract Demand(CD) which is beyond the imagination of CGP owners and is bound to be objected to vehemently by the targeted CGPs. We, therefore deliberately ignore the contention of Charging the GSC in Spinning Reserve Method.

The other Method, called as "**Base MVA Support Method**" is universally accepted being more scientific and logical. In this method, the contribution of short circuit MVA by the Grid at PCC (Point of Common Coupling) is taken as the basis for determination of GSC charges to be paid by CGPs.

44. The net cost that OPTCL bears for providing the Grid Support is the summation of annuity of the installed cost of established OPTCL network with the concerned CGP and the depreciation cost of the equipment involved in the above installation. The difference of the cost of yearly power purchase based on the rated power supplied from the OPTCL network from the net cost that OPTCL bears determines, the guiding principles of Concept of Support Charge.



That, based on the study by M/s PRDC has prepared a rate-chart for individual CGPs which varies from Rs 12/KVA/Month to Rs 31.20/KVA/Month based on the relevant data available pertaining to the year 2018-19, installed capacity of CGPs and other relevant data.

45. That, OPTCL has made a fresh calculation of GSC taking the relevant informations for the year 2019-20 submitted to Hon'ble Commission for Tariff determination for the F/Y-2020-21 as mentioned hereunder :-

- (a) Total ARR for the F/Y-2020-21 – Rupees in Crores (INR).
- (b) Total Generation Capacity connected to OPTCL System in MW.
- (c) Total MUs Approved in ARR for OPTCL for the F/Y-20-21.
- (d) Contract Demand of the CGP in MVA with the concerned DISCOM
- (e) Installed Capacity of Individual CGP in MW/MVA.
- (f) Short-Circuit MVA Contribution by Grid.
- (g) Short-Circuit MVA Contribution by CGP.
- (h) No load loss of equivalent transformer / Transformation Loss
- (i) Export of power from the CGP.
- (j) The cost of power purchased by CGPs from Discom.

Details of calculation:

The below calculation is based on the approved ARR and Energy to be wheeled through the OPTCL network during the F/Y-2020-21.

Total ARR Approved for the F/Y-2020-21 in INR.—925.54 Crores

Total Generation Capacity connected to OPTCL System in MW – 14830MW

(Including state generation from Hydro, Thermal, Solar, RE and ISGS Share of Odisha)

Total Transformation Capacity- 20376 in MVA. (As on 30.11.2019)

Total MUs approved for F/Y 2020-21----28550 MUs

Synchronous Reactance of CGP Generator- 0.23 PU to 0.35(As collected from CGPs)

Average Cost of Supply to CGP---Rs 5.75 (INR)

Power factor for MVA /MU Calculation—0.9

Power Factor for transformer No Load Loss Calculation-- 0.1

3-Phase to Ground fault in MVA at PCC—Taken from Short Ckt study individually.

Average cost of Generation in Rs/KVA/Month is calculated based on approved ARR(20-21) and Transformation Capacity for the year F/Y-2020-21.

That the formula for GSC in Base MVA Support Method is as explained below.



Grid Support Charges=Total MVA Support received by the CGP (From Grid) – Total Fault MVA support by CGP(To Grid) – Export of power + No load Loss (in Rs/KVA/Month)

47. That, the consultant has carried out of Study of all the 34 Nos of CGPs of the state connected to OPTCL system.

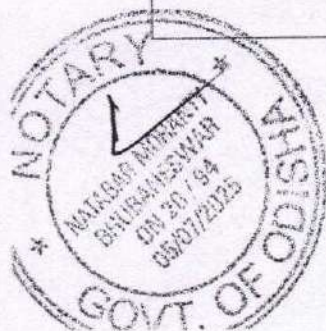
For the purpose of clarity and explanation, he has determined the rate of GSC varying from Rs 12/KVA/Month to Rs 37/KVA/month which cover all categories of CGPs as categorized as Type-A,B & C as explained at para-42 considering the data available during 2018-19.

48. That for the sake of kind appreciation of Hon'ble Commission, the sample exercise for determination of GSC for one CGP, say, M/s IFFCO, Paradeep is explained as below.

IFFCO,PARADEEP:

Details of informations as explained in earlier para is given in a Tabular Form, say Table-3.

NAME OF THE CGP	RELEVANT INFORMATIONS
Installed capacity as on 26.05.2018	110MW / 122.22MVA(At 0.90 PF)
Connectivity at Voltage Level	132Kv
Synchronous Reactance of Generator	0.31 (Generator Data)
Contract Demand	11.0 MVA
Total Short Ckt Current(3ph to Ground fault) by IFFCO at PCC	5425.455 Amperes or say 5.425 KA
Total S/C MVA= (S/C Current x 132kV x 1.732) at PCC	1238.96 MVA
S/Ckt MVA Contribution by Grid	925.03MVA
S/Ckt MVA Contribution by CGP	313.927 MVA
Equivalent Support by CGP to Grid	=Installed Capacity in MVA x S/Ckt MVA of CGP/ Total S/Ckt MVA at PCC =122.22x 313.93 /1238.96= 30.963 MVA



Pradyuman Kumar