

**REFER ANNEXURE-3A1-3**

**Work Order and Completion Certificate from M/S. Green Power  
International Pvt. Ltd. towards CO2 Capture Plant**

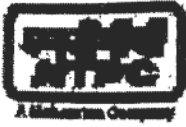


# Green Power International Pvt. Ltd.

(An ISO 9001:2015 Certified Company)

Corporate Office : E-12 / A, Sector - 63, Noida - 201 301, U.P. Tel. : +91 120 4655400 / 444 Fax No. : +91 120 4655499  
E-mail : materials@greenpowerintl.com Website : www.greenpowerintl.com

Work Order								
<b>M/s CARBONCAPTURE TECHNOLOGIES PRIVATE LIMITED</b>  1st Floor, Jivan Silk Mills, Andheri Kurla Road, Andheri, Mumbai, Maharashtra - 400072  Mr. Prateek Bumb - Director (Mob-9167555141) E-mail : prateek.bumb@carbonclean.com			WO No :	GPIPL/W/0789/20-21	Date :	20-02-2021		
			Indent No :		Date :			
			Reference :	Technical & Commercial Agreement dtd.06.10.2020				
			GPIPL GST No :	07AABCG8829R1ZT	Amd No :	0		
			GPIPL PAN No :	AABCG8829R	Amd Dt :			
Supplier GST No.	27AAFCC8191E1ZJ	Project Code :	NTPC-294					
Supplier PAN No.	AAFCC8191E							
Sr. No.	Description	Service Code	SAC Code	Uom	Qty.	Rate (INR)	Total Value (INR)	
1	Providing Process Design Package & Support for Erection, Testing & Commissioning of 20 TPD CO2 Capture Plant at NTPC Vindhyachal	SR0443CO2CAP	0	JOB	1.00			
						Total (INR)		
Amount In Words : (INR)						Net Total Value (INR)		
Billing Address:- <b>Green Power International Pvt. Ltd.</b> Kh. No. 15/9, E-Block, Gali No- 9, Burari Road , Saroop Nagar, Delhi - 110042, Tel:-011-27812309			Site Address:- <b>NTPC Limited</b> Vindhyachal Super Thermal Power Station, Singrauli, Madhya Pradesh					
<b>As per terms and conditions:</b> 1. Vendor has to raise invoice as per GST Rules enabling us to take ITC (input Tax Credit under GST) 2. Vendor GST Number as well as our GST Number should be printed on the Vendor Invoice. 3. HSN Code for Goods / SAC for Services along with item code must be appear on Vendor invoice. 4. You will upload Accurately & Timely your Sale / Service data on GST PORTAL (GSTR -1 Form ).In case of any delay in updating of data on GST Portal, any disallowance of Input Tax Credit, penalty, interest or GST liability arising to Green Power will be recovered from you. 5. Timely Delivery / Quality is an important part of this contract. 6. You must acknowledge the receipt of this order and send formal order acceptance. 7. The Work Order number must appear on all papers and correspondence pertaining to this order. 8. GST : Extra @ 18% or as applicable at the time of billing. 9. PAYMENT TERMS : The payment terms shall be as per the commercial agreement signed between GREEN POWER and CTPL dtd. 06.10.2020.  10. OTHER DOCUMENTS TO BE REFERRED TO :- a) Technology Licence Agreement signed between GREEN POWER and CTPL dtd. 06.10.2020. b) Performance Guarantee Agreement signed between GREEN POWER and CTPL dtd. 06.10.2020. c) Commercial Agreement signed between GREEN POWER and CTPL dtd. 06.10.2020. d) Deed of Joint Undertaking signed between GREEN POWER and CTPL dtd. 10.10.2020 11. SCOPE : The Scope shall be as per the above referred agreements signed between GREEN POWER and CTPL.								
Prepared By			Checked By			For Green Power International Pvt. Ltd. (Authorized Signatory)		



## NTPC Limited

(A Government of India Enterprise)

### Vindhyachal Super Thermal Power Station

P.O. Vindhyachal

Vindhyachal District Singrauli

Madhya Pradesh- 486885, India

Telephone No. : 07805-247685/247928 Fax No. : 07805-247728

#### Service Purchase Order

PAN No. : AAACN0255D

CIN No. : L40101DL1975GOI007966

Purchase Order No. : 5500039061-151-1018 Date : 14.09.2021 ( version : 0 )

To

Vendor Code : 1130893

GREEN POWER INTERNATIONAL PVT LTD

KHASRA NO. 15/9.E-BLOCK, GALI.NO. 9

BURARI ROAD, SAROOP NAGAR

NEW DELHI

Delhi

India - 110042

Tel: 011-27812309

Fax: 0120-4655499

E-Mail : vipul.gupta@greenpowerintl.com

Subject: : Set Up of 20 TPD CO2 Capture Plant at NTPC Vindhyachal on turnkey basis including engineering, procurement, construction, testing and 6 months O&M.

NIT NO. : Dated

Your Offer No. :

Your Reference :

Dear Sir,

This has reference to our above mentioned NIT, Your offer and subsequent discussions. We are pleased to accept your offer opened on and confirm having awarded on you the work of Set Up of 20 TPD CO2 Capture Plant at NTPC Vindhyachal on turnkey basis including engineering, procurement, construction, testing and 6 months O & M. of total value [REDACTED]

mentioned in the scope of works, special terms & conditions, Bill of quantities etc.

The duration of the service period shall be from 15.02.2021 to 14.04.2022. Though the duration of contract shall remain same, the actual date of commencement of the contract shall be as per the direction of EIC. Sh Subrata Sarka (AGM-NETRA) shall be EIC for this work.

This service purchase order along with its annexure is being issued to you in duplicate. We request you to return the duplicate copy of this service purchase order, duly signed on each page by your authorised signatory in token of your unequivocal acknowledgment of the same within 15 days from the date of this service purchase order. If no communication is received within 15 days of receipt of Purchase Order, it will be treated that order has been accepted in entirety.

We thank you for the interest shown by you in our project and the cooperation extended to us. We expect to receive your continued cooperation in future also.

Thanking You,

For & on behalf of NTPC Limited.

*Subrata Sarka*

Enclosures :

Registered Office: NTPC Bhawan, Core-7, Scope Complex, Institutional Area, Lodhi Road, New Delhi-110003

Phone No. -(011)24360100, Fax No. -(011)24361018. Website: www.ntpc.co.in

*1*  
*Set*






## Functional Test and Performance Guarantee Test Completion Certificate

Project: 20TPD CO2 CAPTURE PLANT AT NTPC – VINDHYACHAL (VSTPS)


Contract No: CM-NETRA-9-40088108-FC/SC-COA, Dated: 04.03.2021.

This is in reference to the above referred contract for set up of 20TPD CO2 Capture Plant at NTPC, Vindhyachal. The Functional and Performance Guarantee Test of 20TPD CO2 Capture plant was carried out successfully from 16.01.2023 to 22.01.2023. Functional and Performance tests were carried out as per the approved test procedure vide NTPC-294-VS-Q-DOC-6002-R01.

The Functional and Performance Guarantee test reports are submitted and accepted by NTPC.

  
29/5/2023




Sr. Manager- Green Chemical

  
29.5.23

GM- Green Chemical & EIC


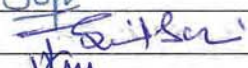
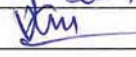
**विजय कुमार**  
**VIJAY KUMAR**  
वरिष्ठ प्रबंधक (हरित रसायन)  
Sr. Manager (Green Chemical)  
VINDHYACHAL SUPER THERMAL POWER STATION  
P.O. Vindhyanagar, Distt. Singrauli (M.P.) 486 885




**सुजय कर्मकार**  
**SUJAY KARMAKAR**  
महाप्रबन्धक (हरित रसायन)  
General Manager (Green Chemical)  
एनटीपीसी लि. विंध्याचल  
NTPC Ltd. Vindhyachal

<b>CUSTOMER</b> 	<b>EPC</b> 	<b>FUNCTIONAL AND PERFORMANCE GUARANTEE TESTS</b>	<b>LICENSOR</b> 	<b>PAGE</b> 1 of 7
			<b>PROJECT</b>	20 TPD CO <sub>2</sub> CAPTURE PLANT
			<b>DOC. NO.</b>	

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	Company	Person	Signature	Date
Prepared	CTPL	Gopi Kiran Neeliesetty		17.04.2023
Reviewed	GPI	Sunil Soni		12.05.2023
Approved	NTPC	Vijay Kumar		12.05.2023

CUSTOMER	EPC	FUNCTIONAL AND PERFORMANCE GUANRANTEE TESTS	LICENSOR		PAGE 2 of 7	
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## 1.0 INTRODUCTION

This document describes the Functional and Performance Guarantee Tests performed for capture of 20TPD CO<sub>2</sub> from unit-13 flue gas at NTPC-Vindhyachal Super Thermal Power station, Madhya Pradesh.

### Abbreviations:

Plant Owner/ End User:	NTPC-VSTPS
NTPC	: National Thermal Power Corporation
NETRA	: NTPC Energy Technology and Research Alliance
GPI	: Green Power International Private Limited
CTPL	: Carbon capture Technologies Private Limited
CCP	: CO <sub>2</sub> Capture Plant
FGD	: Flue gas Desulphurization
MTPD	: METRIC TONNES PER DAY
FT	: Functional Test
PGT	: Performance Guarantee Test
BLs	: Battery Limits


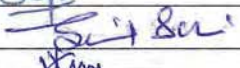
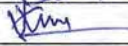
## 2.0 FUNCTIONAL TEST

Based on the procedures outlined in the "Functional and Performance Guarantee Test" document numbered NTPC-294-VS-Q-DOC-6002, CTPL/GPI initiated the FT at 10:00am on 16/01/2023 till 09.00 am of 19/01/23.




### 2.1 FUNCTIONAL TEST PROCEDURE

The CCP Plant shall be operated continuously for a minimum of 72 hours and an average of 24 hours operating data shall be considered for the functional test. The following parameters in the below table shall be considered for the result of the functional test.

Continuous CO<sub>2</sub> production for 24 hours and meeting all the functional parameters within a range of  $\pm 10\%$  as mentioned in the table below is considered as completion of the functional test.

	Company	Person	Signature	Date
Prepared	CTPL	Gopi Kiran Neeliesetty		17.04.2023
Reviewed	GPI	Sunil Soni		12.05.2023
Approved	NTPC	Vijay Kumar		18.05.2023



<b>CUSTOMER</b> 	<b>EPC</b> 	<b>FUNCTIONAL AND PERFORMANCE GUARANTEE TESTS</b>	<b>LICENSOR</b> <b>PROJECT</b> <b>DOC. NO.</b>	 20 TPD CO <sub>2</sub> CAPTURE PLANT	<b>PAGE</b> 3 of 7
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S.No.	Description	Value
1	Quality of CO <sub>2</sub> Captured	> 99.4 (Mole % - Dry basis) > 96.4 (Mole % - Wet basis)
2	CO <sub>2</sub> Captured from Flue Gas	> 80% (Mole %)
3	Steam Consumption	< 1.4 Ton/Ton of CO <sub>2</sub>
4	Solvent Consumption	< 0.35 kg/Ton of CO <sub>2</sub>

## 2.2 PARAMETER MONITORING DURING FUNCTIONAL TEST

Parameters were tabulated at 01hour interval for a period of 72 hours in the attached document as Annexure-1. Flue Gas flow rate data (FIT-101) is incorporated in a handwritten log sheet from a system generated report.

## 2.3 RESULTS SUMMARY

The results of each FT parameter are summarized below.

### 2.3.1 CO<sub>2</sub> PRODUCT QUALITY


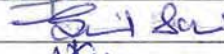

The CO<sub>2</sub> product quality (Dry Basis) was monitored using the tag number AIT-401 directly. Average reading of 24hrs from 17:00hrs of 16/01/23 to 17:00hrs of 17/01/23 is 99.95% (Dry Basis).




The CO<sub>2</sub> product quality (Wet Basis) needs to be calculated based on the below formula.  
CO<sub>2</sub> product quality (Wet basis) = (100 - (water concentration % in product CO<sub>2</sub> at the average temperature)) \* CO<sub>2</sub> product quality (dry basis).

CO<sub>2</sub> product Quality (Wet Basis) is 96.40% (Wet Basis).

Refer to Annexure-1 for the complete dataset values.

S. No	Description	Required Value	Actual Average Value
1	Quality of CO <sub>2</sub> Captured	> 99.4 (Mole % - Dry basis)	99.95 (Mole % - Dry basis)
2		> 96.4 (Mole % - Wet basis)	96.40 (Mole % - Wet basis)

	Company	Person	Signature	Date
Prepared	CTPL	Gopi Kiran Neeliesetty		17.04.2023
Reviewed	GPI	Sunil Soni		12.05.2023
Approved	NTPC	Vijay Kumar		18.05.2023

<b>CUSTOMER</b> 	<b>EPC</b> 	<b>FUNCTIONAL AND PERFORMANCE GUARANTEE TESTS</b>	<b>LICENSOR</b> <b>PROJECT</b> <b>DOC. NO.</b>	 20 TPD CO <sub>2</sub> CAPTURE PLANT	<b>PAGE</b> 4 of 7
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### 2.3.2 CO<sub>2</sub> CAPTURE %

The CO<sub>2</sub> capture % estimation is done based on the below calculation. The tag numbers monitored are AIT-105A and AIT-201.

$$CO_2 \text{ capture \%} = [(AIT-105A) - (AIT-201)] / (AIT-105A) * 100$$

AIT-105A: refers to CO<sub>2</sub> concentration in the flue gas at Absorber inlet.

AIT-201: refers to CO<sub>2</sub> concentration in the flue gas at Absorber outlet.

Average of readings from 17:00hrs of 16/01/23 to 17:00hrs of 17/01/23 is 86.9 % (mol).

Refer to Annexure-1 for the complete dataset values.

S. No.	Description	Required Value	Actual Average Value
2	CO <sub>2</sub> Captured from Flue Gas	> 80% (Mole %)	86.9 % (mol%)

The CO<sub>2</sub> is transferred from the flue gas to the CDRMax solvent in the Absorber and is liberated from the Stripper top using LP steam. Once the solvent reaches saturation, the CO<sub>2</sub> transfer from flue gas to solvent and into the Product CO<sub>2</sub> attains an almost steady state which is observed in the constant product CO<sub>2</sub> flow rate.

### 2.3.3 STEAM DEMAND

The steam demand is calculated based on the below formula. The tag numbers monitored for this parameter are FIT-401 and FIT-402.

$$Steam \text{ Demand} = (FIT-402) / (FIT-401)$$



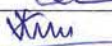
FIT-402: refers to Steam flow rate.

FIT-401: refers to CO<sub>2</sub> production flow rate.




From Annexure-1 at 17:00 of 16/01/23 to 17:00 of 17/01/23 average reading of steam demand is 1.42 Ton/Ton of CO<sub>2</sub>. The average value is within the range of +/-10%.

Refer to Annexure-1 for the complete dataset values.

S. No.	Description	Required Value	Actual Average Value
3	Steam Consumption	< 1.4 Ton/Ton of CO <sub>2</sub>	1.42 (within a range of +/-10%)

	Company	Person	Signature	Date
Prepared	CTPL	Gopi Kiran Neeliesetty		17.04.2023
Reviewed	GPI	Sunil Soni		12.05.2023
Approved	NTPC	Vijay Kumar		18.05.2023



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#### 2.3.4 SOLVENT CONSUMPTION

There was no solvent makeup done during the complete phase of the project from Commissioning to Continuous trial to FT and PGT completion. But there will be some amount of solvent loss from the system which is determined based on the solvent analysis results. Refer attached solvent analysis results.





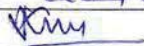
Total CO<sub>2</sub> produced till date: 474.03 Tons




Solvent loss: [REDACTED] = 0.285 kgs/Ton CO<sub>2</sub>

S. No.	Description	Required Value	Actual Average Value
4	Solvent Consumption	< 0.35 kg/Ton of CO <sub>2</sub>	0.285

#### 2.4 CONCLUSION

Based on the above summary and the results tabulated, we confirm the completion of the Functional Test as per the procedures laid down in the reference document.

	Company	Person	Signature	Date
Prepared	CTPL	Gopi Kiran Neeliesetty		17.04.2023
Reviewed	GPI	Sunil Soni		12.05.2023
Approved	NTPC	Vijay Kumar		18.05.2023

<b>CUSTOMER</b> 	<b>EPC</b> 	<b>FUNCTIONAL AND PERFORMANCE GUANRANTEE TESTS</b>	<b>LICENSOR</b>		<b>PAGE</b> 6 of 7
			<b>PROJECT</b>	20 TPD CO <sub>2</sub> CAPTURE PLANT	
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### 3.0 PERFORMANCE GUARANTEE TEST

PG test was carried out after the completion of Functional Tests. Based on the procedures outlined in the "Functional and Performance Guarantee Test" document numbered NTPC-294-VS-Q-DOC-6002, CTPL/GPI initiated the PGT at 10:00am on 19/01/2023 till 12.30pm of 22/01/23

### 3.1 PERFORMANCE GUARANTEE TEST PROCEDURE

The CCP Plant shall be operated continuously for a minimum of 72 hours and an average of 24 hours operating data shall be considered for the performance guarantee test. The following parameters in the below table shall be considered for the result of the performance guarantee test.

Continuous CO<sub>2</sub> production for 24 hours period from 10:00am of 21/01/23 to 10:00am of 22/01/23 meeting all the performance guarantee parameters as mentioned in the table below is considered as completion of the performance guarantee test.

S. No.	Description	Required Value
1	Quality of CO <sub>2</sub> Captured	> 99.4 (Mole % - Dry basis),
2	CO <sub>2</sub> Production	20 TPD

### 3.2 PARAMETER MONITORING DURING PERFORMANCE GUARANTEE TEST




Parameters were tabulated at 01hour interval for a period of 72 hours in the attached document as Annexure-2.




### 3.3 RESULTS SUMMARY

The results of each PGT parameter are summarized below.

#### 3.3.1 CO<sub>2</sub> PRODUCT QUALITY

The CO<sub>2</sub> product quality was monitored using the tag number AIT-401 directly.

	Company	Person	Signature	Date
Prepared	CTPL	Gopi Kiran Neeliesetty		17.04.2023
Reviewed	GPI	Sunil Soni		12.05.2023
Approved	NTPC	Vijay Kumar		18.05.2023

<b>CUSTOMER</b> 	<b>EPC</b> 	<b>FUNCTIONAL AND PERFORMANCE GUANRANTEE TESTS</b>	<b>LICENSOR</b>		<b>PAGE</b> 7 of 7
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			<b>DOC. NO.</b>		

From Annexure-2 at 10:00am of 21/01/23 to 10:00am of 22/01/23 average value of CO<sub>2</sub> product quality is 99.96 (Mole% - Dry basis).

Refer to Annexure-2 for the complete dataset values.

S. No.	Description	Required Value	Actual Average Value
1	Quality of CO <sub>2</sub> Captured	> 99.4 (Mole % - Dry basis)	99.96 (Mole % - Dry basis)

### 3.3.2 CO<sub>2</sub> PRODUCTION

The tag number monitored for this parameter is FIT-401.




From Annexure-2 at 10:00am of 21/01/23 to 10:00am of 22/01/23 average value of CO<sub>2</sub> production is 20.9 TPD.

Refer to Annexure-2 for the complete dataset values.

S. No.	Description	Required Value	Actual Average Value
2	CO <sub>2</sub> Production	20 TPD	20.9 TPD

### 3.4 CONCLUSION

Based on the above summary and the results tabulated, we confirm the completion of the Performance Guarantee Test as per the procedures laid down in the reference document.

	Company	Person	Signature	Date
Prepared	CTPL	Gopi Kiran Neeliesetty		17.04.2023
Reviewed	GPI	Sunil Soni		12.05.2023
Approved	NTPC	Vijay Kumar		18.05.2023