WELCOME TO

KCP SOLAR POWER PLANT

Mr. K.C.SRINIVASA RAO
GENERAL MANAGER (E&I)
9491296011, kcsao@kcp.co.in

THE KCP LIMITED
KCP CEMENT – UNIT-II
RAMAKRISHNAPURAM-521457

KCP Group of Companies
CEMENT DIVISION

CEMENT UNIT-I- 0.80 MTPA

CEMENT UNIT-II – 1.52 MTPA

KCP Group of Companies

RENEWABLE ENERGY DIVISION(14.95 MW)

8.25 MW

3.25 MW

1.15 MW

2.30 MW WHR

KCP CEMENT
CONCRETE CEMENT

kcp

Green power zone

KCP SOLAR

VISION IN ACTION

Capacity : 1.15 MWp DC with single Axis Tracker

CAPTIVE SOLAR PHOTOVOLTIC POWER PLANT

THE KCP LIMITED,RAMAKRISHNAPURAM

PROJECT DETAILS

Location: Muktyala, Jaggayyapet(m), Krishna(D), AP

- Capacity: 1.15 MWp
- Scheme: REC Mechanism
  - Embedded connection with cement plant
- Single axis tracker
- Poly Crystalline SPV 240 Wp
- Land Occupied: 5.50 Acres
- Module Area : 8217 m2

PROJECT DETAILS

- Energy guaranted:19,08,000 kwh/yr
- First 2 years O&M Inclusive
- SPV Panels 25 years warranty
- BOS 5 years warranty
- Solar Fencing Inclusive
- Solar LED Street lights
- CCTV : IR PTZ Camera
- Lightening Arrestors – 3 no

•Year wise Generation Guarantee for 25 Years

Year #	Annual Energy Output guarantee(KWh)	Max. YoYDegradation
1	1908016	0
2	1892752	0.8%
3	1877610	0.8%
4	1862589	0.8%
5	1847688	0.8%
6	1832907	0.8%
7	1818244	0.8%
8	1803698	0.8%
9	1789268	0.8%
10	1774954	0.8%
11	1760754	0.8%
12	1746668	0.8%
13	1732695	0.8%
14	1718833	0.8%
15	1705083	0.8%
16	1691442	0.8%
17	1677910	0.8%
18	1664487	0.8%
19	1651171	0.8%
20	1637962	0.8%
21	1624858	0.8%
22	1611859	0.8%
23	1598964	0.8%
24	1586173	0.8%
25	1573483	0.8%

TECHNICAL EVEALUATION

Grid-Connected System: Simulation parameters

Project : Jaggayyapet

Geographical Site Jaggayyapet Country India

Situation Latitude 16.1°N Longitude 80.0°E
Time defined as Legal Time Time zone UT+6 Altitude 107 m
Monthly albedo values

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Albedo	0.16	0.16	0.16	0.16	0.15	0.16	0.16	0.17	0.16	0.16	0.16	0.16

Meteo data : Jaggayyapet_New, Synthetic Hourly data

Simulation variant : **KCP_1.15MW_Tracker_Bonfiglioli RPS 1110**
Simulation date 18/09/12 13h44

Simulation parameters

Tracking plane, tilted Axis Axis Tilt 0° Axis Azimuth 0°
Rotation Limitations Minimum Phi -45° Maximum Phi 45°

Backtracking strategy Tracker Spacing 4.80 m Collector width 1.66 m
Inactive band Left 0.02 m Right 0.02 m

Horizon Free Horizon

Near Shadings No Shadings

PV Array Characteristics

PV module Si-poly Model **SSI-M6-230**
Manufacturer Solar Semiconductor
Number of PV modules In series 25 modules In parallel 200 strings
Total number of PV modules Nb. modules 5000 Unit Nom. Power 230 Wp
Array global power Nominal (STC) **1150 kWp** At operating cond. 1026 kWp (50°C)
Array operating characteristics (50°C) U mpp 653 V I mpp 1572 A
Total area Module area **8217 m²** Cell area 7302 m²

Inverter Model **RPS 1110 Multi MPPT**
Manufacturer Bonfiglioli Vectron
Characteristics Operating Voltage 460-875 V Unit Nom. Power 1000 kW AC

PV Array loss factors
Thermal Loss factor Uc (const) 26.7 W/m²K Uv (wind) 0.0 W/m²K / m/s
-> Nominal Oper. Coll. Temp. (G=800 W/m², Tamb=20°C, Wind=1 m/s.) NOCT 47 °C
Wiring Ohmic Loss Global array res. 13 mOhm Loss Fraction 2.8 % at STC
Array Soiling Losses Loss Fraction 3.0 %
Module Quality Loss Loss Fraction 1.5 %
Module Mismatch Losses Loss Fraction 2.0 % at MPP
Incidence effect, ASHRAE parametrization IAM = 1 - bo (1/cos i - 1) bo Parameter 0.05

TECHNICAL EVEALUATION

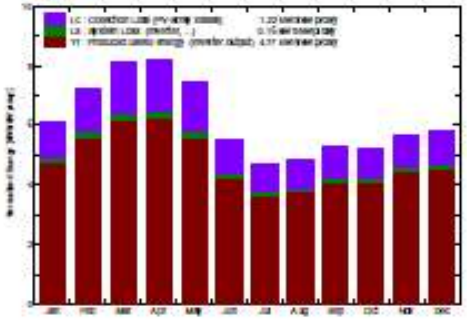
Grid-Connected System: Main results

Project : Jaggayyapet
Simulation variant : KCP_1.15MW_Tracker_Bonfiglioli RPS 1110

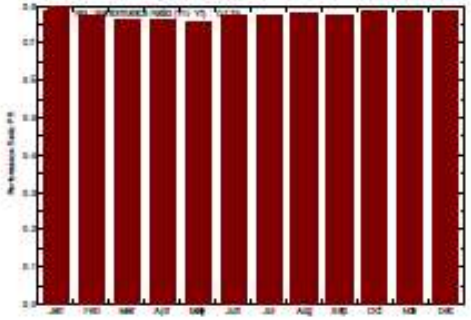
Main system parameters	System type	**Grid-Connected**		
PV Field Orientation	tracking, tilted axis, Axis Tilt	0°	Axis Azimuth	0°
PV modules	Model	SSI-M6-230	Pnom	230 Wp
PV Array	Nb. of modules	5000	Pnom total	**1150 kWp**
Inverter	Model	RPS 1110 Multi MPPT	Pnom	1000 kW ac
User's needs	Unlimited load (grid)			

Main simulation results
System Production — **Produced Energy** **2002 MWh/year** — Specific prod. 1741 kWh/kWp/year
Performance Ratio PR 77.5 %

Normalized productions (per installed kWp): Nominal power 1150 kWp



Performance Ratio PR



KCP_1.15MW_Tracker_Bonfiglioli RPS 1110
Balances and main results

	GlobHor kWh/m²	T Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray MWh	E_Grid MWh	EffArrR %	EffSysR %
January	145.7	21.20	188.1	184.0	175.7	169.9	11.37	10.99
February	155.1	22.50	201.7	198.6	189.7	173.5	11.20	10.83
March	194.7	24.60	251.5	247.6	228.7	220.9	11.07	10.69
April	195.9	25.50	246.5	243.0	223.5	215.9	11.03	10.66
May	187.5	27.30	229.5	225.7	207.1	200.2	10.99	10.62
June	144.0	27.50	166.1	162.5	152.5	147.6	11.18	10.82
July	129.3	26.60	146.5	142.1	134.4	130.0	11.24	10.87
August	132.1	26.50	150.1	146.8	139.2	134.6	11.28	10.91
September	135.9	25.70	158.0	154.8	145.6	140.8	11.21	10.84
October	134.5	24.00	161.0	157.7	150.8	146.0	11.40	11.03
November	135.9	22.40	170.2	166.5	159.4	154.2	11.39	11.02
December	138.6	21.10	179.6	175.3	168.3	162.8	11.40	11.03
Year	1829.2	24.59	2247.5	2203.3	2071.0	2002.1	11.21	10.84

Legends: GlobHor Horizontal global irradiation — EArray Effective energy at the output of the array
T Amb Ambient Temperature — E_Grid Energy injected into grid
GlobInc Global incident in coll. plane — EffArrR Effic. Eout array / rough area
GlobEff Effective Global, corr. for IAM and shadings — EffSysR Effic. Eout system / rough area

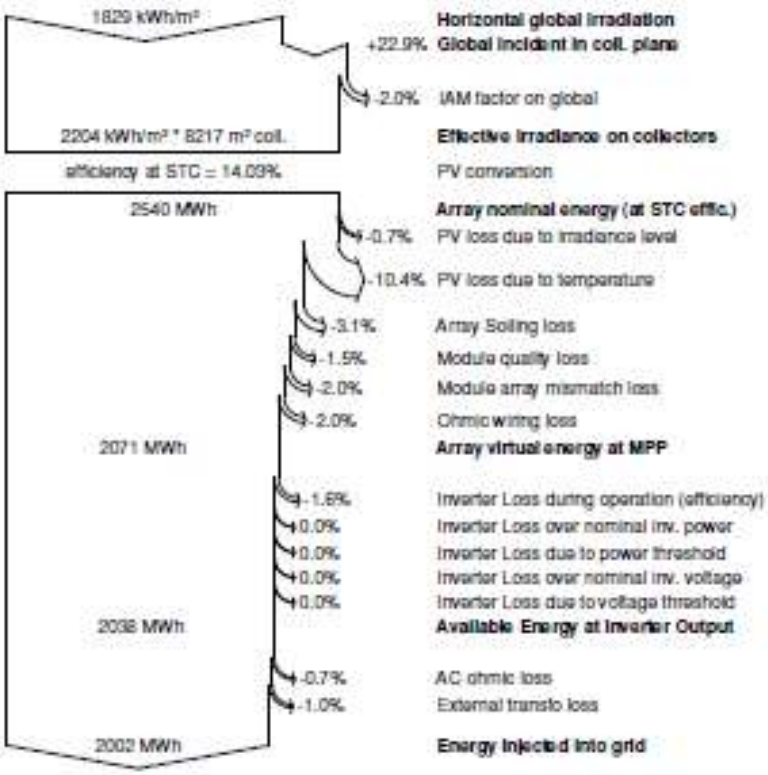
TECHNICAL EVEALUATION

Grid-Connected System: Loss diagram

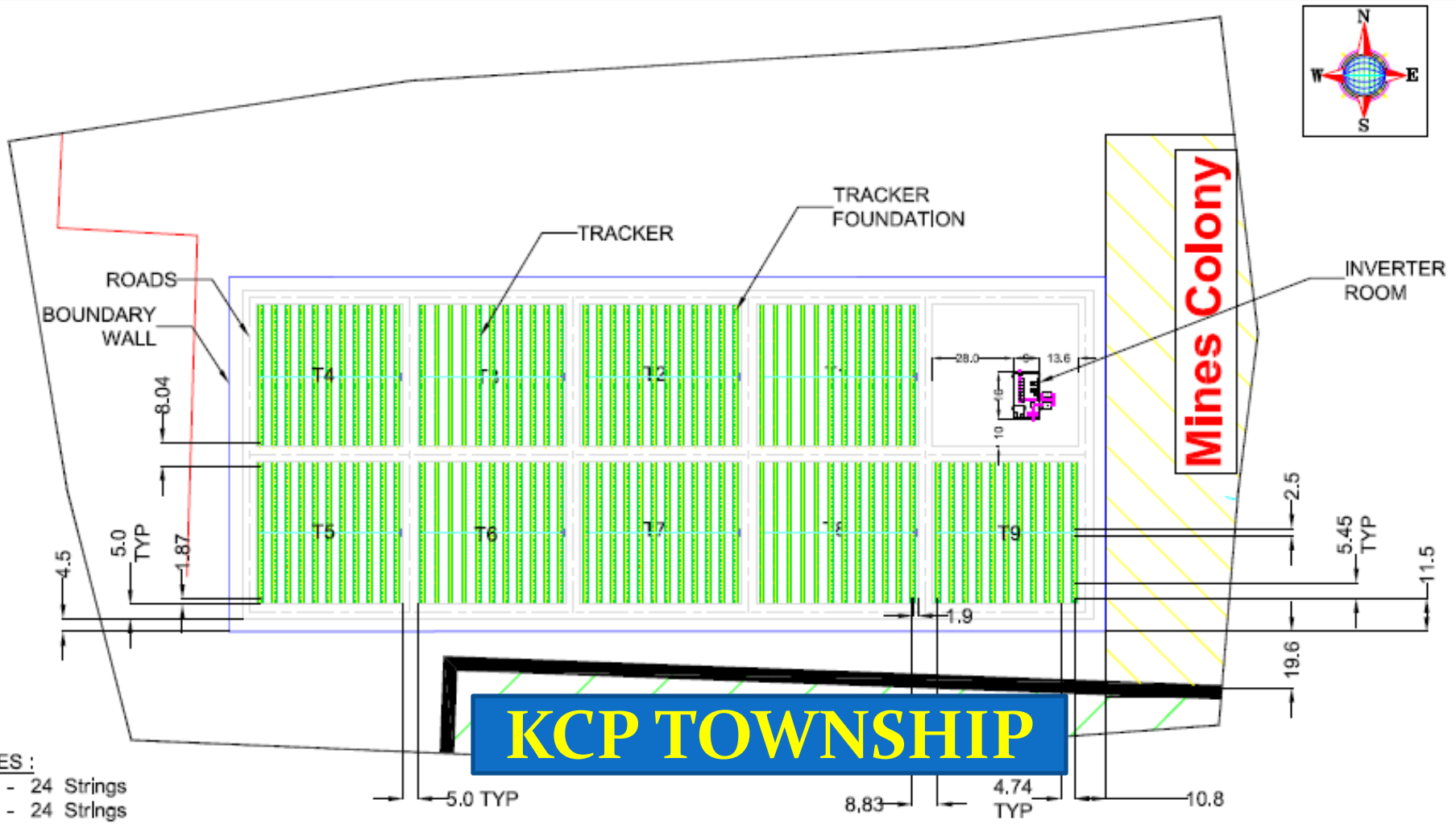
Project : Jaggayyapet
Simulation variant : KCP_1.15MW_Tracker_Bonfiglioli RPS 1110

Main system parameters		System type	**Grid-Connected**		
PV Field Orientation		tracking, tilted axis, Axis Tilt	0°	Axis Azimuth	0°
PV modules		Model	SSI-M6-230	Pnom	230 Wp
PV Array		Nb. of modules	5000	Pnom total	**1150 kWp**
Inverter		Model	RPS 1110 Multi MPPT	Pnom	1000 kW ac
User's needs		Unlimited load (grid)			

Loss diagram over the whole year



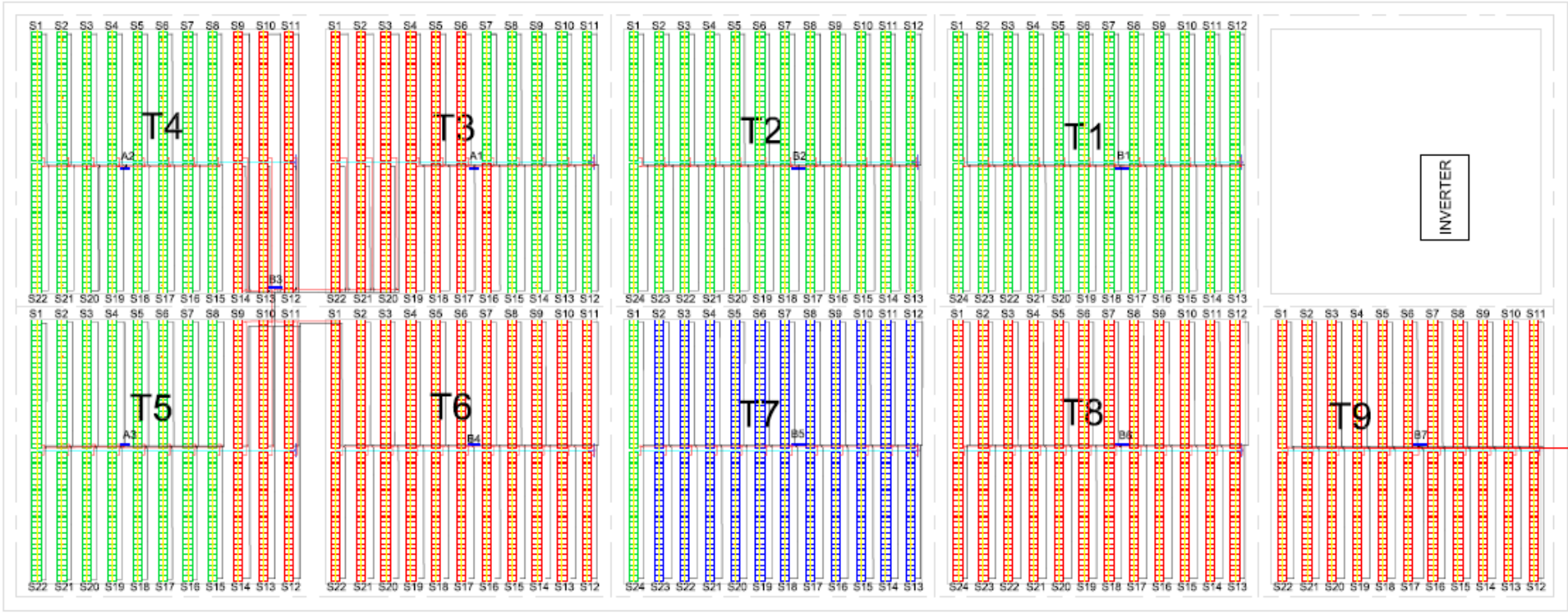
KCP SOLAR PLANT 1.15 MWp LAYOUT



NOTES :

T-01 - 24 Strings
T-02 - 24 Strings
T-03 - 22 Strings
T-04 - 22 Strings
T-05 - 22 Strings
T-06 - 22 Strings
T-07 - 24 Strings
T-08 - 24 Strings
Modules/String = 24
Total No of Strings = 206
Total No of Modules = 4944

TRACKER / STRING LAYOUT



NOTE:

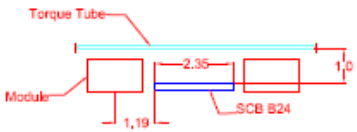
+ve Cu EBXL-XLPO 4Sqmm Cable

-ve Cu EBXL-XLPO 4Sqmm Cable

230Wp Modules

235Wp Modules

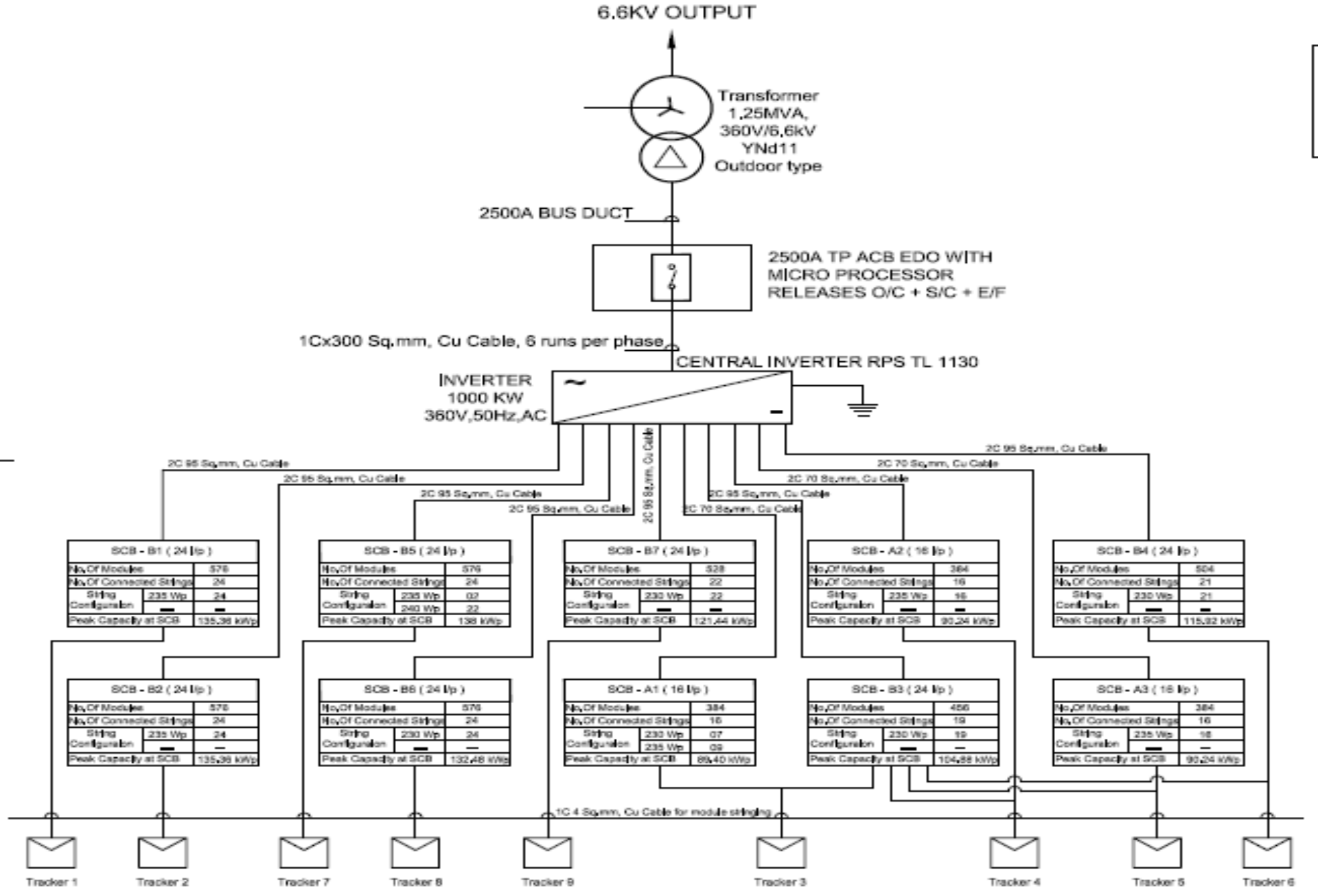
240Wp Modules

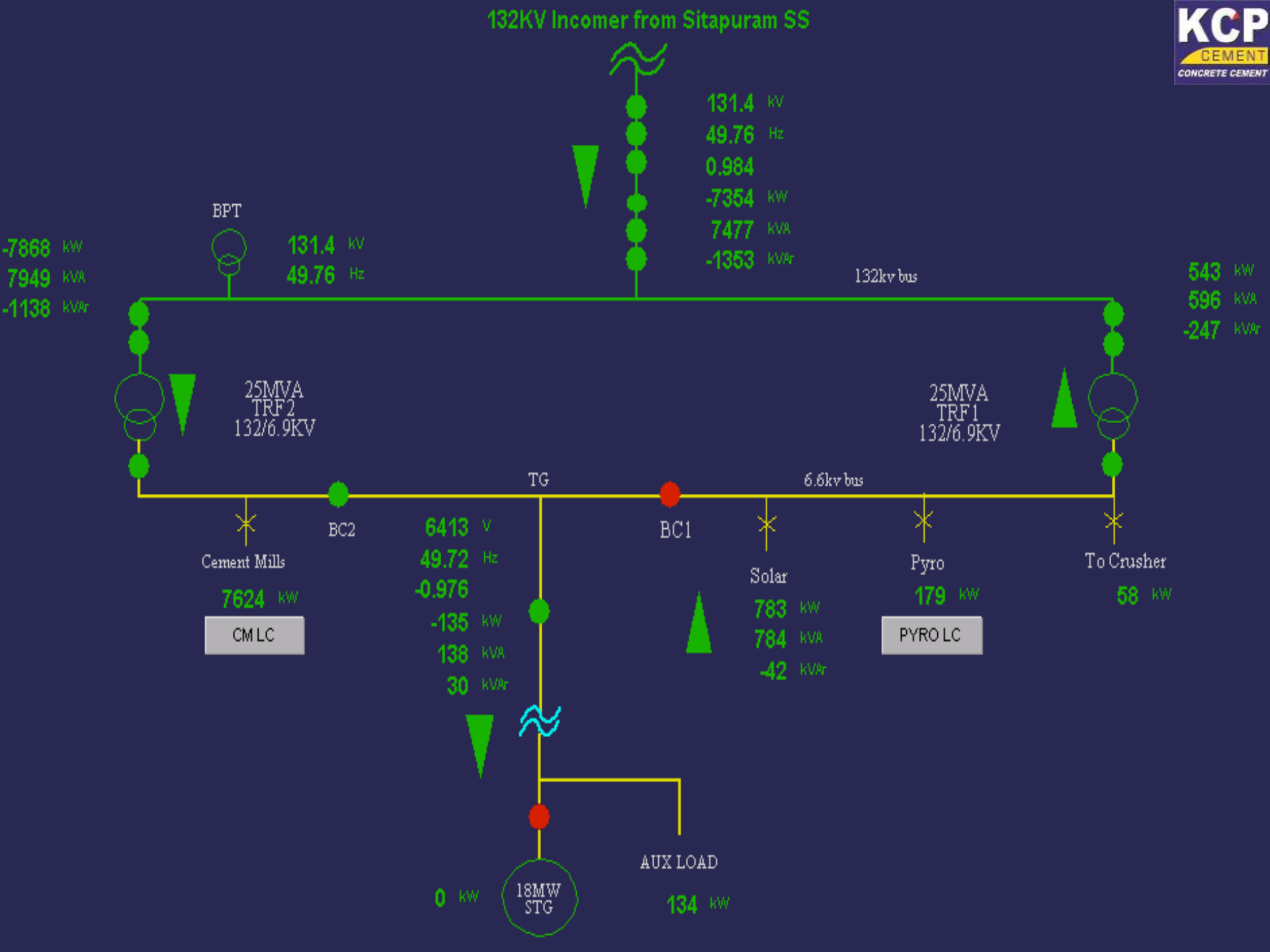


SCB B 24 I/P Location Details

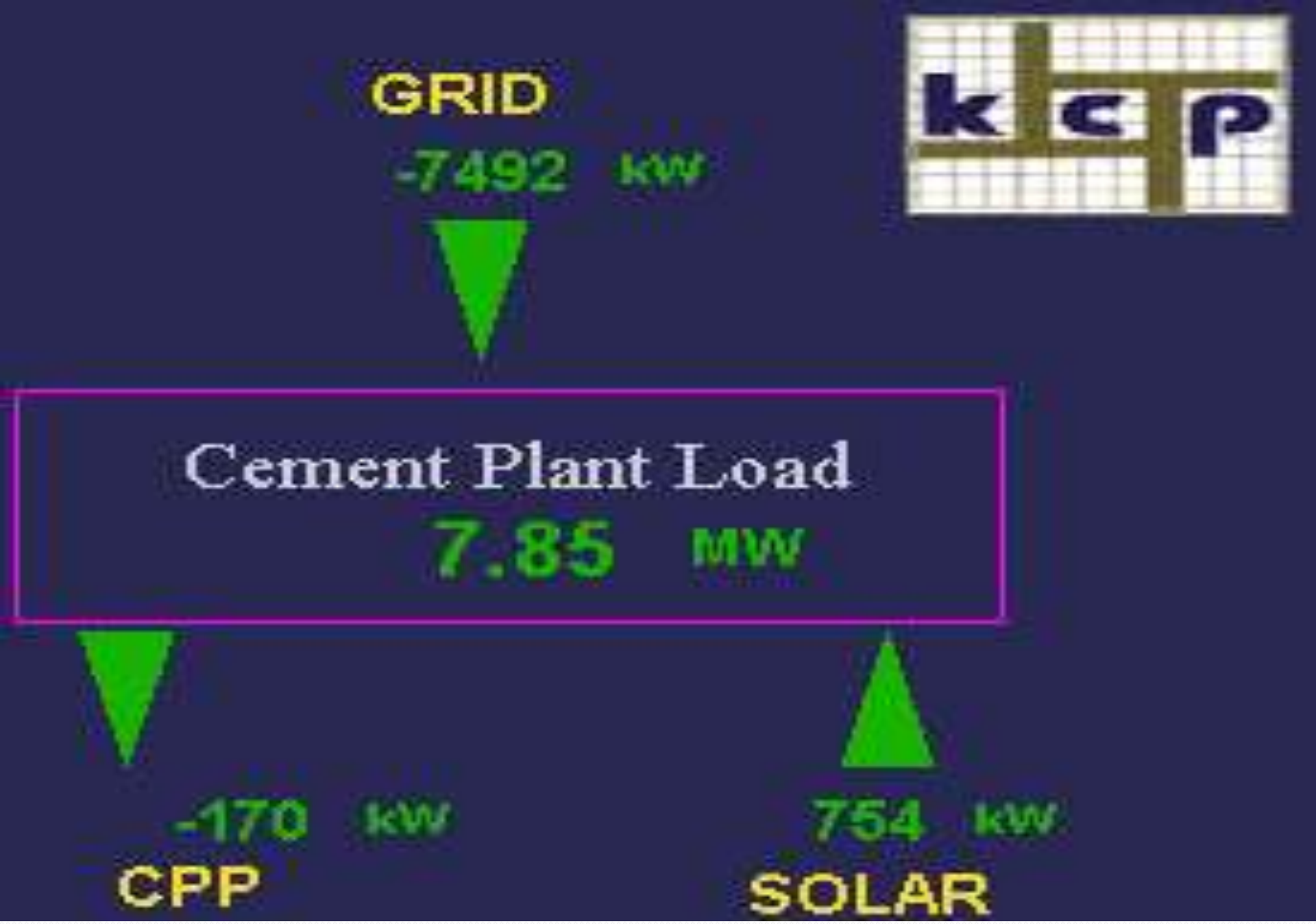
REV. NO.	DATE.	DCR#	PAGE AFFECTED	REASON FOR CHANGE	PREPARE
01	30.11.12	29	01	SCB Location has been changed	Jayacha

DC SCHEMATIC




132KV Incomer from Sitapuram SS
131.4 kV
49.76 Hz
0.984
-7354 kW
7477 kVA
-1353 kVAr
BPT
-7868 kW
7949 kVA
-1138 kVAr
131.4 kV
49.76 Hz
132kv bus
543 kW
596 kVA
-247 kVAr
25MVA
TRF2
132/6.9KV
25MVA
TRF1
132/6.9KV
TG
6.6kv bus
BC2
BC1
Cement Mills
7624 kW
CM LC
6413 V
49.72 Hz
-0.976
-135 kW
138 kVA
30 kVAr
Solar
783 kW
784 kVA
-42 kVAr
Pyro
179 kW
PYRO LC
To Crusher
58 kW
AUX LOAD
134 kW
0 kW
18MW
STG

Total Plant - Power Over view



PROJECT COMPLETION


KCP
CEMENT
CONCRETE CEMENT


KCP
CEMENT
CONCRETE CEMENT
09/05/2013 10:26


KCP
CEMENT
CONCRETE CEMENT


KCP
CEMENT
CONCRETE CEMENT
09/05/2013 10:33


SOLAR PLANT CONTROL ROOM
KCP
CEMENT
CONCRETE CEMENT
09/05/2013 10:27

Solar Inverter 5 x 200 KWp - MPP
Input: 700 VDC & Output 360 VAC

6.6 KV HT VCB, ABB Unigear ZS


KCP
CEMENT
CONCRETE CEMENT
09/05/2013 10:24
STATUTORY ABT METERING SYSTEM


6.6KV / 360 V TRANSFORMER
NANI
TRANSFORMERS
DANGER
Aux Transformer

UPS AND BATTERY CHARGER

DATA LOGGER (HMI)


SOLAR LIGHT
09/05/2013 10:26

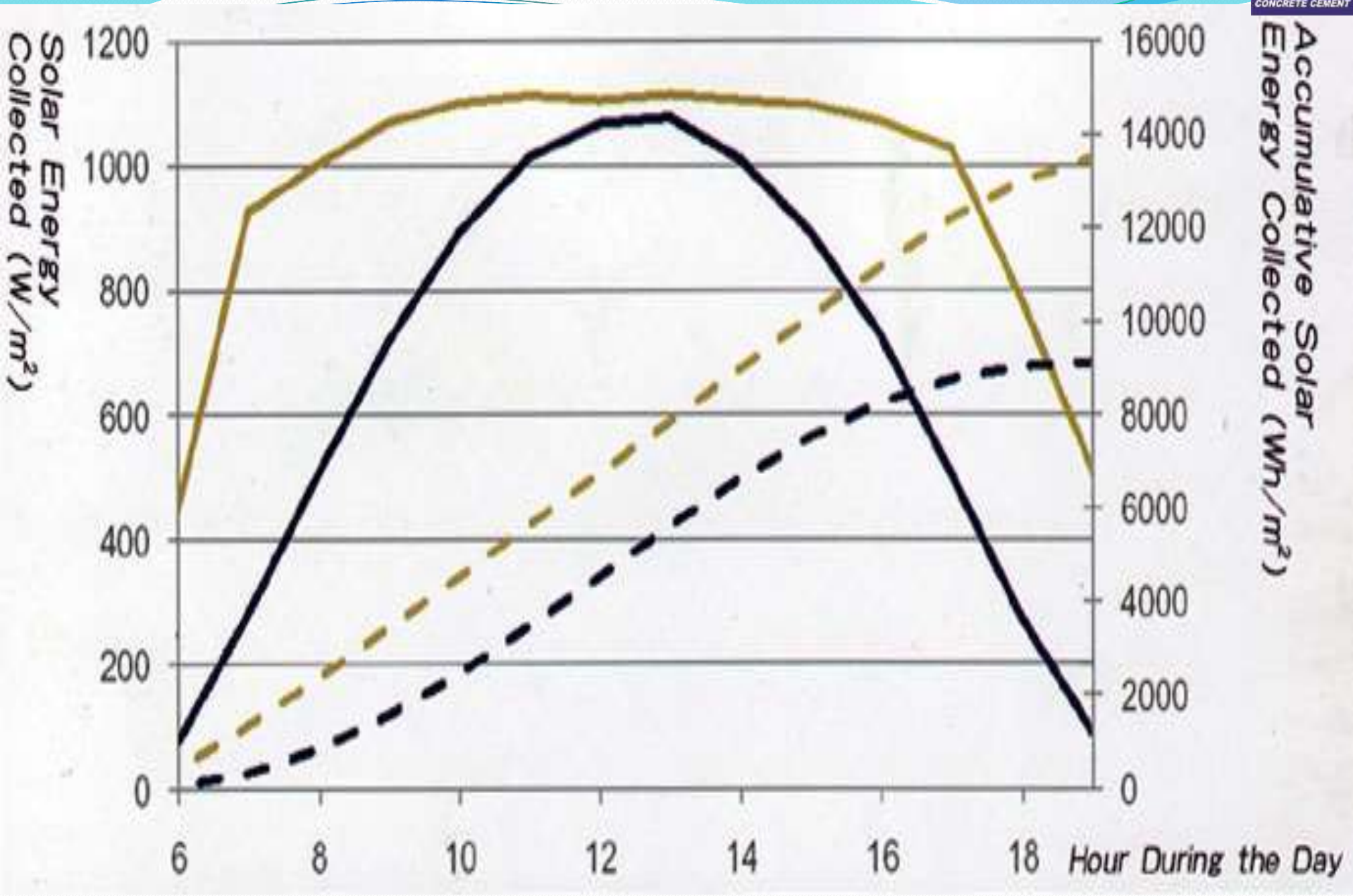

SOLAR POWER FENCE
SOLAR FENCE
09/05/2013 10:22

SOLAR STREET LIGHT


KCP
CEMENT
CONCRETE CEMENT
12/05/2013 18:13


KCP
CEMENT
CONCRETE CEMENT
12/05/2013 17:59


KCP
CEMENT
CONCRETE CEMENT
Single Axis Tracker based on
NASA data for given longitude and latitude


Solar Energy Collected (W/m²)
1200
1000
800
600
400
200
0
Accumulative Solar Energy Collected (Wh/m²)
16000
14000
12000
10000
8000
6000
4000
2000
0
6
8
10
12
14
16
18
Hour During the Day

PERFORMANCE DATA

Year	Guaranteed Yield (kwh)	Actual Yield (kwh)
2013	1908	1917
2014	1893	1901
2015	1063 up to Jun	1017 up to Jun

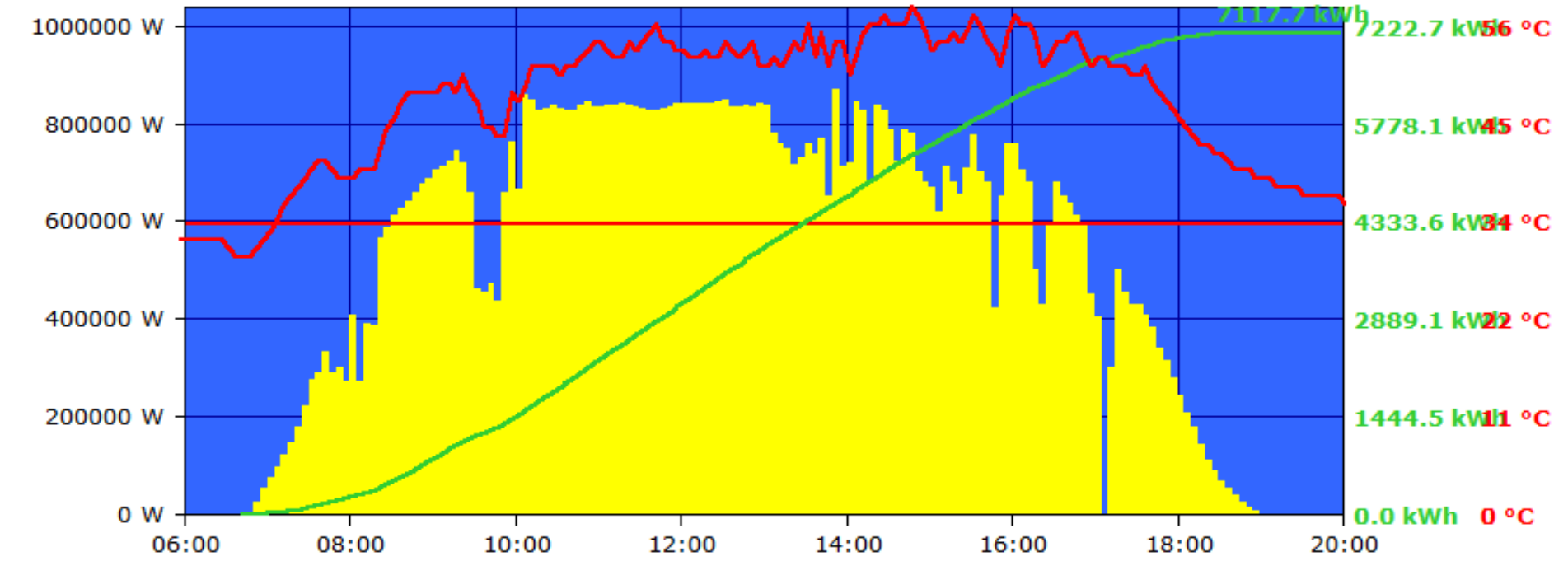
overview daily

12.07.15

Production
✓

yield	kWp	24h	Values	Solar	Mod-T	Env-T	Wind
✓					✓		

ALL	A1	A2	A3	A4	A5
✓					



current		
feeding power Pac	726900	W
generator power Pdc	734380	W
inverter efficiency η	>98	%
status	5xMPP, DATA	
error	----	

day		
yield	7117,68	kWh
	3327,51	€
specific yield	6,17	kWh/kWp
maximum value	870160	W
set value	4291,84	kWh
actual	165,8	%

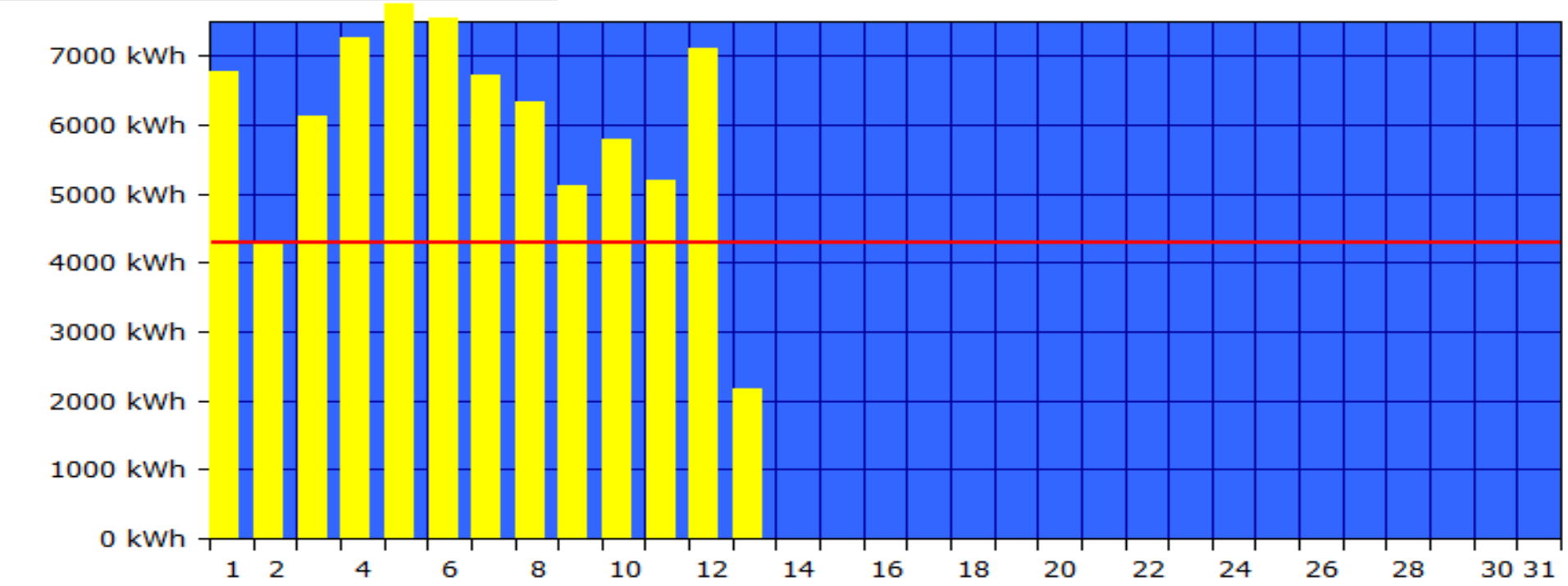
avoided CO_2-emission total: 3353,04 to

overview monthly

July
2015

Values

ALL | A1 | A2 | A3 | A4 | A5

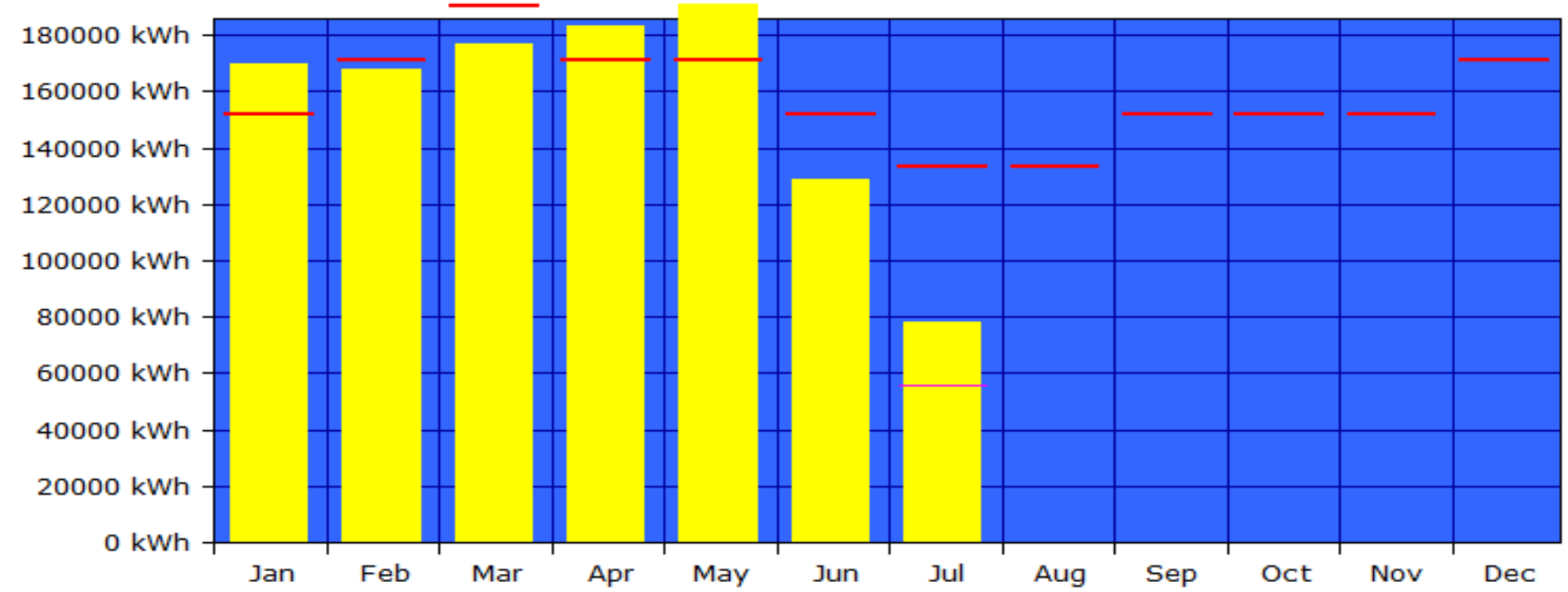


current			month		
feeding power Pac	794060	W	yield	78234,83	kWh
generator power Pdc	802830	W		36574,78	€
inverter efficiency η	>98	%	specific yield	67,83	kWh/kWp
status	5xMPP, DATA		maximum value	7761,1	kWh
error	----		set value (cumulative)	55793,90	kWh
			actual	140,2	%

overview yearly
2015

Values

ALL | A1 | A2 | A3 | A4 | A5



current		
feeding power Pac	787500	W
generator power Pdc	796310	W
inverter efficiency η	>98	%
status	5xMPP, DATA	
error	----	

year		
yield	1095081,48	kWh
	511950,59	€
specific yield	949,50	kWh/kWp
maximum value	190787,0	kWh
set value (cumulative)	1063149,72	kWh
actual (forecast : 1675 kWh/kWp)	103,0	%

SOLAR PROJECT TECHNO-ECONOMICS

Annual Generation	**19.08 LKwh/Year**
Unit Rate	Rs 8.65 Rs/Kwh (Rs. 5.15 – Supply to Cement plant. Rs. 3.50 from REC - till Mar 2017)
Sale Value of Energy	Rs. 164 Lacs/Year
Less Annual O&M	Rs. - 6.00 Lacs/ Year
Capital Investment	Rs. 800 Lacs
Simple pay back period	5 years
Life of the SPV Module	25 years

APPROVALS

KCP SOLAR POWER- 1.15 MWp

- Connectivity Approval
- Metering Scheme approval
- CEIG Approval
- Grid Synchronization Approval
- REC Accreditation
- REC Registration
- Plan approval from Fact. Dept
- **MoEF Approval not required**

Eligibility Criteria

Self Consumption / Captive Use

- No Promotion al Wheeling*
- No Promotional Banking**

- **Eligible if all three condition mentioned above are met**

Third Party Sale/Open Access

- Sale at Mutually Agreed Price
  - **Eligible**

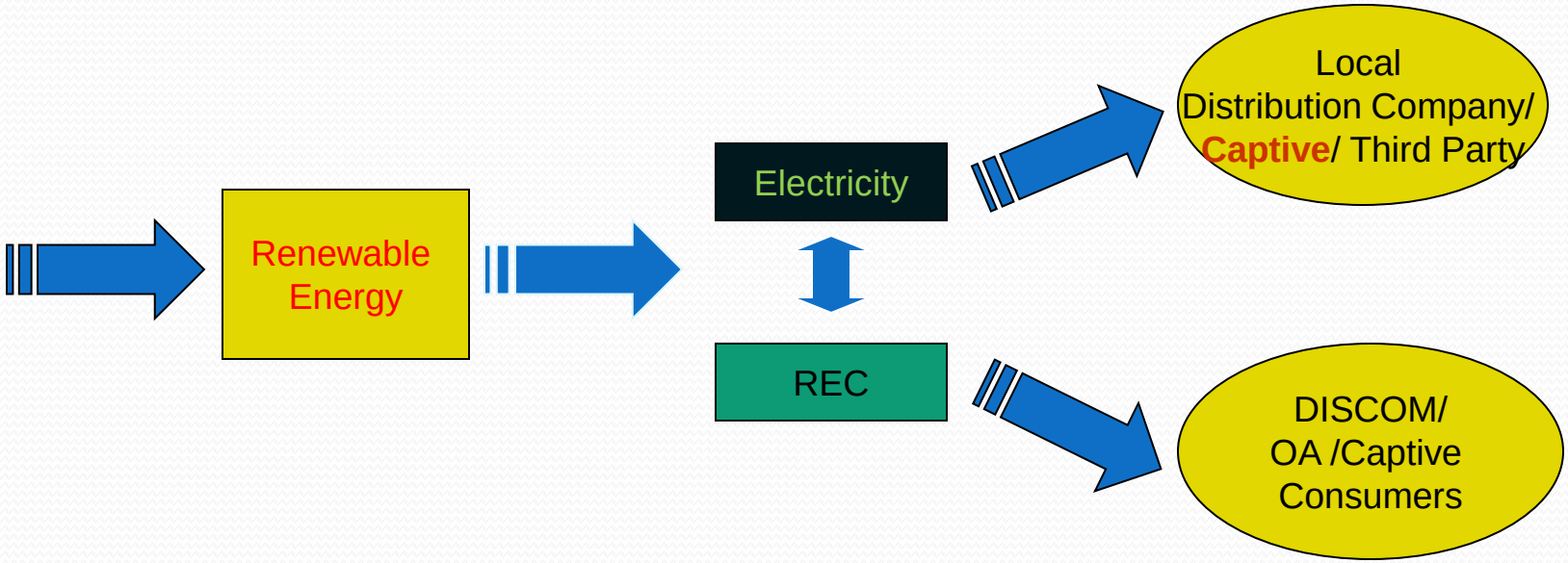
Sale Through Bilateral Contracts

- Sale at Mutually Agreed Price
  - **Eligible**

PPAs with Distribution Licensee

- PPA at Average Power Purchase Cost
  - **Eligible**
- PPA at State Regulated Tariff
  - **Not Eligible**

Renewable Energy Certificate



- Sale of Renewable Energy under REC Scheme
  - Consume Electricity with in our cement Plant
  - Sale REC Component to Obligated entities through IEX / PXIL

REC Buyers

- Obligated Entities (RPO)
  - Distribution Companies
  - Open Access Consumers
  - Captive Power Consumers

- Voluntary Entities
  - Corporates under CSR
  - Individuals

REC Revised Price as per CERC

The Commission decided to retain the proposed amendment in the final Order. The following forbearance price and floor price are prescribed for dealing in Solar Certificates under the REC Regulations:

	Solar REC (INR/ MWh)
Forbearance Price	5800
Floor Price	3500

The above stated forbearance and floor prices shall remain valid for the control period upto financial year 2016-17 from the date of notification of this Order.

As per CERC Amendment -3

Practical Challenges faced during Execution - The KCP Limited

- Approvals took 6 months after project ready
- Proper guidelines were not in place at state agencies.
- Lack of clarity on roles & responsibility of various wings in E.B. for solar projects.
- Absence of metering protocols for in-house captive solar projects.

REC ACCREDITATION

CERTIFICATE OF ACCREDITATION

This is to certify that **THE KCP LIMITED** having/proposing to install its RE Generating station at **"KCP LTD Muktayal Village Jaggayapet Krishna dt A.P "** with capacity **5.75MW**, utilising **Solar PV (Solar)** has been granted Accrediation for its said RE Generating Station with effect from **08-04-2013**

This Accreditation is granted subject to fulfilling the Rules, Regulations and Procedures specified by the State Agency from time to time.

The validity of this certificate is mandated through ongoing surveillance.

Issue Date	Expiration Date	Certificate Number
08-04-2013	07-04-2018	AP0SLKCPLS001A080413

Date : 08-04-2013

Place : Andhra Pradesh

Authorised Signatory of the Accreditation Agency

Chief Engineer/SLDC
Andhra Pradesh State Load Dispatch Centre
APTRANSCO, Vidyut Soudha,
HYDERABAD - 500 082.
Room No. 611, 6th Floor, Vidyut Soudha APTRANSCO, khairtabad

REC REGISTRATION

This is to certify that **THE KCP LIMITED** having/proposing to install its RE Generating station at **"KCP LTD Muktayal Village Jaggayapet Krishna dt A.P " Andhra Pradesh** with installed capacity **5.75 MW**,availing **5.75 MW** under REC Mechanisim, utilising **Solar PV (Solar)** has been registered with Central Agency as 'Eligible Entity' for its said RE Generating Station with effect from **10-05-2013**

This Registration is granted subject to fulfilling the Rules, Regulations and Procedures specified by the Central Agency from time to time.

The validity of this certificate is mandated through ongoing surveillance.

Issue Date	Expiration Date	Certificate Number
10-05-2013	09-05-2018	AP0SLKCPLS001R100513

Date : 10-05-2013

Authorised Signatory of the Central Agency

Place : New Delhi

National Load Despatch Centre

National Load Despatch Centre, B - 9
Qutab Institutional Area, Katwaria Sarai
New Delhi - 110016

SOLAR WATER PUMP

SOLAR STREET LIGHT

BEFORE

AFTER

SOLAR WATER HEATER

TOTAL TOWNSHIP EQUIPPED WITH SOLAR WATER HEATERS

ROOFTOP SOLAR SYSTEM, CORPORATE OFFICE, CHENNAI, TN

Let us contribute towards a Clean and Green Power

Mr. K.C.S. RAO
9491296011, kcsrao@kcp.co.in

THANK YOU