Natural Group

Driving Green Value

SOLAR – FUTURE POSSIBILITIES, THE LALIT, NEW DELHI

28th May 2013

Solar Renewable Energy Certificates (Solar RECs) – Today and the way ahead for Solar Power

About Us

A Safer, Better and Healthier Planet

Delivering Green Value

Innovative, Sustainable, Enhanced

- India focused Renewable Energy Advisory
- NG sustainable value added business models are in Solar, Biomass and Green projects
- Concept to Commissioning - Consulting, Technology, PPA, EPC, Finance….
- Largest India focused renewable and solar energy forums on LinkedIn
  - Renewable Energy and Cleantech – India
  - Solar Energy Professionals – India
- Our articles on Renewable Energy and Solar are published across varied Industry leading journals, websites and magazines – Energy Next, Solar Business Focus, Renewable Energy Magazine….
- www.natgrp.org is the most read blog on Solar and Renewable Energy in India

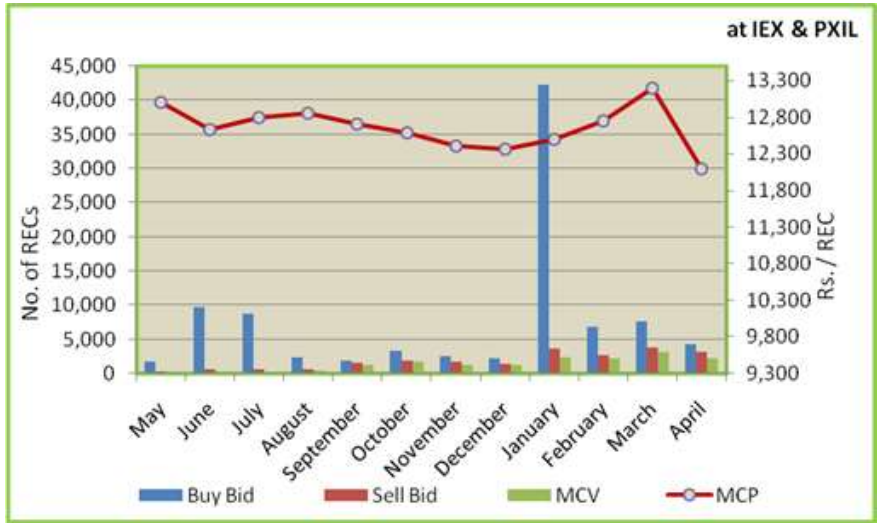
Today

- 1.5 GW+ grid based projects (~400MW Conventional)
- AT&C Losses in excess of 40% (Rs. 75K+ Crores)
- No CSP power on the ground
- Land is expensive, grid connectivity poor and solar generation is far away from urban centers
- Generation only during peak hours
- Coal shortage, peak power unable to meet demand (Gap ~18GW = ~60GW Solar)
- Grid too expensive for low density locations
- Growing rural needs
- Abnormalities resulting in grid failure
- Poor Discom infrastructure and health unable to support the growing needs of the nation
- RECs future is hazy without enforcement

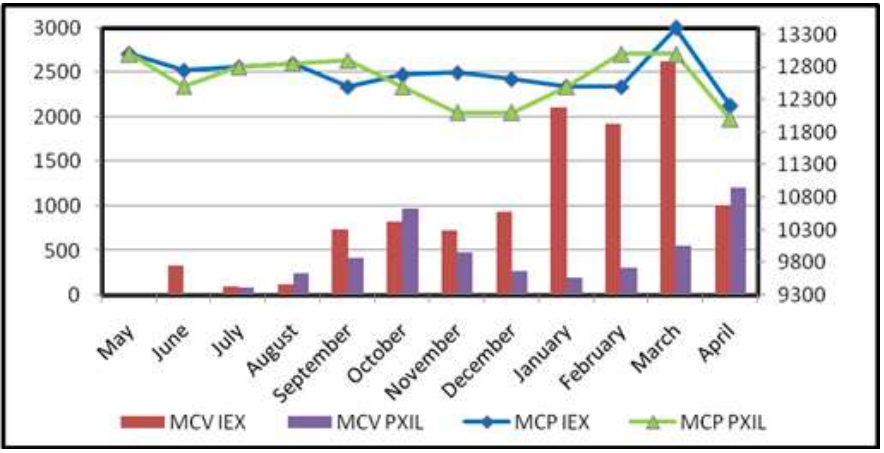
Lifecycle greenhouse gas emission estimates for electricity generators[1]

Technology	Description	Estimate (g CO_2/kWh$_e$)
Wind	2.5 MW offshore	9
Hydroelectric	3.1 MW reservoir	10
Wind	1.5 MW onshore	10
Biogas	Anaerobic digestion	11
Hydroelectric	300 kW run-of-river	13
Solar thermal	80 MW parabolic trough	13
Biomass	various	14-35
Solar PV	Polycrystaline silicon	32
Geothermal	80 MW hot dry rock	38
Nuclear	various reactor types	66
Natural gas	various combined cycle turbines	443
Diesel	various generator and turbine types	778
Heavy oil	various generator and turbine types	778
Coal	various generator types with scrubbing	960
Coal	various generator types without scrubbing	1050

REC Sale - Solar



Graph:1 - Market overall performance. (Solar)



Graph : 2 – Market Comparison (Solar)

Graph and Data Courtesy: Atlanta Energy

Year	Month	Power Exchange	Buy Bid(REC)	Sell Bid(REC)	MCV	MCP
2012-13	May	IEX	1,637	149	5	13,000
		PXIL	5	100	5	13,000
	June	IEX	9,489	541	336	12,750
		PXIL	130	22	6	12,506
	July	IEX	8,554	419	93	12,800
		PXIL	200	130	86	12,800
	August	IEX	1,728	310	129	12,850
		PXIL	603	250	250	12,850
	September	IEX	1,317	1,094	735	12,500
		PXIL	525	527	425	12,900
	October	IEX	1,263	864	820	12,680
		PXIL	2,100	1,012	971	12,500
	November	IEX	1,458	758	733	12,720
		PXIL	1,120	930	486	12,100
	December	IEX	1,608	977	931	12,620
		PXIL	583	484	277	12,100
	January	IEX	40,138	3,356	2,105	12,500
		PXIL	2,017	203	203	12,500
	February	IEX	4,574	2,416	1,924	12,500
		PXIL	2,203	310	310	13,000
	March	IEX	5,238	3,192	2,632	13,400
		PXIL	2,372	624	551	13,000
213-14	April	IEX	2,711	1,478	1,005	12,206
		PXIL	1,528	1,609	1,212	12,000

REC RPO FY 2012 - 2013

State	Projected Demand* (MU)	Solar RPO Target (2012-13)	Solar RPO Target (2012-13)	Capacity required for meeting Solar RPO	Total Capacity Tied Up as on 09.03.2013*	Installed capacity as on 09.03.2013	Gap to be fulfilled in 2012-13
	2012-13	%	(MU)	(MW)	(MW)	MW	(MW)
Andhra Pradesh	98,956	0.25%	247.39	148.6	77.7	23.35	70.94
Arunachal Pradesh	631	0.10%	0.63	0.4	0.025	0.03	0.35
Assam	6,810	0.15%	10.21	6.1	5	-	1.14
Bihar	15,272	0.75%	114.54	68.8	0	-	68.82
Chhattisgarh	21,174	0.50%	105.87	63.6	29	4.00	34.61
Delhi	28,598	0.15%	42.90	25.8	2.525	2.53	23.25
JERC (Goa & UT)	12,860	0.40%	51.44	30.9	1.685	1.69	29.22
Gujarat	79,919	1.00%	799.19	480.2	968.5	824.09	-488.33
Haryana	40,167	0.75%	301.25	181.0	8.8	7.80	172.20
Himachal Pradesh	8,647	0.25%	21.62	13.0	0	-	12.99
Jammu and Kashmir	14,573	0.25%	36.43	21.9	0	-	21.89
Jharkhand	6,696	1.00%	66.96	40.2	36	16.00	4.23
Karnataka	65,152	0.25%	162.88	97.9	159	14.00	-61.14
Kerala	21,060	0.25%	52.65	31.6	0.025	0.03	31.61
Madhya Pradesh	53,358	0.60%	320.15	192.3	211.75	11.75	-19.40
Maharashtra	1,50,987	0.25%	377.47	226.8	75.5	34.50	151.29
Manipur	608	0.25%	1.52	0.9	0	-	0.91
Mizoram	418	0.25%	1.04	0.6	0	-	0.63
Meghalaya	2,154	0.40%	8.62	5.2	0	-	5.18
Nagaland	596	0.25%	1.49	0.9	0	-	0.90
Orissa	24,284	0.15%	36.43	21.9	78	13.00	-56.11
Punjab	48,089	0.07%	33.66	20.2	51.825	9.33	-31.60
Rajasthan	55,057	0.75%	412.93	248.1	331.15	442.25	-83.05
Sikkim	436	0.00%	-	-	0	-	0.00
Tamil Nadu	91,441	0.05%	45.72	27.5	20.105	17.06	7.36
Tripura	1,010	0.10%	1.01	0.6	0	-	0.61
Uttarakhand	11,541	0.05%	5.77	3.5	5.05	5.05	-1.58
Uttar Pradesh	85,902	1.00%	859.02	516.1	93.375	12.38	422.74
West Bengal	41,896	0.00%	-	-	52.05	2.00	-52.05
		Total		2,474.6	2,207.07	1,440.81	267.58

Source: CEA base data for 2011-12 and escalated for 2012-13 based on 18th EPS escalation rates for the same period

** Based on the data provided by NVVN, State Agencies & Project developers*

REC RPO FY 2013 - 2014

State	Projected Demand* (MU)	Solar RPO Target (2013-14)	Solar RPO Target (2013-14)	Capacity required for meeting Solar RPO (2013-14)	Total Capacity Tied Up as on 09.03.2013*	Installed capacity as on 09.03.2013	Gap to be fulfilled in 2013-14
	2013-14	%	(MU)	(MW)	(MW)	MW	(MW)
Andhra Pradesh	1,06,752	0.25%	266.88	160.3	77.7	23.35	82.65
Arunachal Pradesh	664	0.15%	1.00	0.6	0.025	0.03	0.57
Assam	7,685	0.20%	15.37	9.2	5	-	4.23
Bihar	16,298	0.50%	81.49	49.0	0	-	48.96
Chhattisgarh	22,410	0.75%	168.07	101.0	29	4.00	71.98
Delhi	30,572	0.20%	61.14	36.7	2.525	2.53	34.21
JERC (Goa & UT)	13,790	0.50%	68.95	41.4	1.685	1.69	39.74
Gujarat	85,508	1.50%	1,282.61	770.6	968.5	824.09	-197.88
Haryana	43,754	0.75%	328.15	197.2	8.8	7.80	188.36
Himachal Pradesh	9,162	0.25%	22.91	13.8	0	-	13.76
Jammu and Kashmir	14,904	0.25%	37.26	22.4	0	-	22.39
Jharkhand	7,140	1.00%	71.40	42.9	36	16.00	6.90
Karnataka	69,782	0.25%	174.45	104.8	159	14.00	-54.19
Kerala	22,300	0.25%	55.75	33.5	0.025	0.03	33.47
Madhya Pradesh	57,187	0.80%	457.49	274.9	211.75	11.75	63.12
Maharashtra	1,61,244	0.50%	806.22	484.4	75.5	34.50	408.89
Manipur	680	0.25%	1.70	1.0	0	-	1.02
Mizoram	440	0.25%	1.10	0.7	0	-	0.66
Meghalaya	2,409	0.50%	12.04	7.2	0	-	7.24
Nagaland	635	0.25%	1.59	1.0	0	-	0.95
Orissa	25,599	0.20%	51.20	30.8	78	13.00	-47.24
Punjab	51,173	0.13%	66.52	40.0	51.825	9.33	-11.86
Rajasthan	58,890	1.00%	588.90	353.8	331.15	442.25	22.67
Sikkim	487	0.00%	-	-	0	-	0.00
Tamil Nadu	97,584	0.05%	48.79	29.3	20.105	17.06	9.21
Tripura	1,076	0.10%	1.08	0.6	0	-	0.65
Uttarakhand	12,669	0.05%	6.33	3.8	5.05	5.05	-1.24
Uttar Pradesh	90,720	1.00%	907.20	545.1	93.375	12.38	451.69
West Bengal	45,381	0.25%	113.45	68.2	52.05	2.00	16.11
		Total			2,207.07	1,440.81	1217.03

Source: CEA base data for 2011-12 and escalated for 2012-13 based on 18th EPS escalation rates for the same period

** Based on the data provided by NVVN, State Agencies & Project developers*

REC – CERC Suggestions – Jointly with Solar Energy Association of Gujarat

1. Life of RECs to be a minimum of 10 years in order to make it Bankable.

2. Connectivity to Grid for REC eligibility should not be insisted upon. There are many companies with large captive consumption. If such organizations invest to generate solar energy and consume the same – grid connectivity involving open access and other charges should not be insisted up on.

3. There should be total transparency on Open Access and other charges whenever Third Party Sale is involved.

4. Open Access charges in case of Third Party Sale should not exceed Re.1/kwh. The inefficiency of Discom's in terms of Losses etc. should not be passed on to the Solar investor – or at least it should be pegged to Re. 1/kwh throughout the country.

5. The very purpose of the new Electricity Act, 2003 will be defeated if Third Party Sale is being thwarted in the name of ambiguous Open Access Charges.

6. RECs should be traded on the exchange on a preferential basis, those registered earlier should be given preference over others at the similar rates.

7. Forward sale and trading of RECs permitted for up to 10 years

8. Energy Generated in the form of steam through solar concentrators – i.e. steam augmentation through solar resulting in saving/displacement of fossil fuels like coal in an existing conventional power plant should be eligible for RECs. A suitable mechanism needs to be worked out for this purpose.

9. RE Cess of Rs. 1/- all inclusive per KWh charged by DISCOM, in place of RPOs. No cross subsidy and lower duties to be charged to the developer / consumer for green power. This will allow for DISCOMs to promote green power projects without burdening them and free developers from extra costs especially in states like Maharashtra.

10. All states including power surplus states should be mandated to sign solar PPAs at variable APPC rates as determined by the state regulator to enable REC generation. This is justified by the fact that any surplus power can be traded at the Power Exchanges at higher rates.

11. SEB's to proportionate Wheeling, Banking and Storage charges based on PLFs not MW. E.g. 1 MW of Coal should be treated equivalent to 3-4 MW of Solar / Wind.

12. Rates of solar RECs to be capped at Rs. 12/- with a floor price of Rs. 8/- making this affordable for all RPO entities. This is keeping in mind the current reduced Capex prices of Rs. 70/- per Wp.

13. Current term of REC extended from 2017 to 2020 with visibility to extend beyond 2020

14. Off grid plants with internet metering should be allowed RECs and developers should include 100KW+ by combining installations.

15. Special Funding mechanism with low interest rate funds from National Clean Energy Fund for Solar REC projects should be set up – monitored by MNRE.

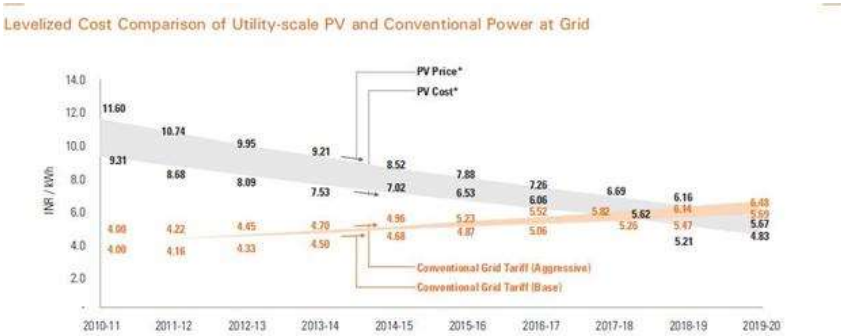
16. 6% of all power for commercial and industrial plants to come from Solar RECs i.e. TN by 2017 with an increase of 1% yearly (capped at 20% of consumed power).

Solar – Structures

Type	On Grid / Open Access	Commercial / Industrial	Residential / Habitat	Off Grid / Mini Grid
Size	1MWp+	250KWp+	0.3 – 5 KWp	10 KWp+
PPA	PPA Rs. 6.5+	PPA Rs. 7+	Net Metering / FIT Rs. 6+	Dist. Access ~Rs.10-15
Tenure	20+ Yrs	10+ Yrs	10+ Yrs	10+ Yrs
Escalation	Fixed	Escalated with Discom	Escalated with Discom	Fixed
Incentive	AD / REC	AD / REC / Subsidy	Capital / Interest Subsidy	Capital / Interest Subsidy
States	Gujarat / MP / Rajasthan / TN / AP	TN / AP / Kerala / MP	Primarily Urban and Rural	NE / Rural Areas
Storage	Hydro / Grid	Battery	Battery	Battery

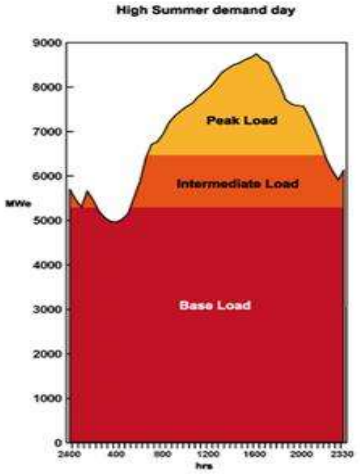
Grid

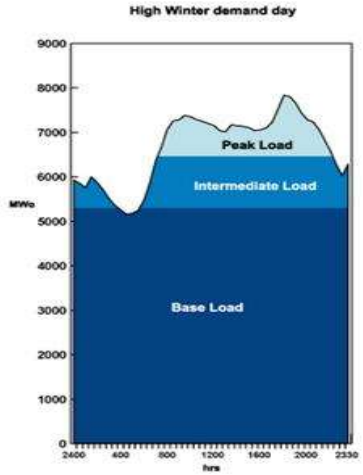
- Improve efficiencies and breadth of generation
- Promote banking and storage
- Professional Approach
- Local distribution and Rural model adoption
- Avoid land concentrations
- Facilitate access for solar to international finance
- Developers need to move up the ladder to partner for local grid distribution management
- Proper planning for states, dedicated solar zones close to high density population centers
- Allow REC forward purchases for group companies
- Combine Solar with Hydro as storage
  - Conserves water and is complementary
  - Reduces evaporation losses



Grid Parity Year	Aggressive Case	Base-Case
Utility PV Price	2017-18	2019-20

Source: KPMG's Solar Grid Parity Model
*Note that the CDM benefit of INR 0.60 / KWH has been factored in the Solar Costs





Rooftops – Commercial

- Clear Policy and tax rules for private / group use
- Municipal mandate for solar thermal and power for commercial establishments
- Incentivize Commercial rooftop private PPAs
- Allow excess power to be sold to the grid under REC scheme with feed in Tariff based on hourly / zone input
- RPOs for commercial / industrial
- RE Cess in Corporate Tax
- Standardization of state based policies
- No regulatory compliance required for commercial rooftops, especially from Discoms for post meter usage
- Incentives to Discoms on the RE component
- RE on commercial to count towards RPO of Discoms

Residential and Off-grid

- Residential / Agricultural capital costs with storage subsidized up to 80% of the cost especially for solar pumps
- Hybrid, Smart grids and normalization in a cluster
- Delivery system to be privatized
- Private prepaid style delivery i.e. Simpa
- Mix of technology and delivery
- Government funding for such private programs (entrepreneurs)
- Innovative Solar based devices with higher subsidies i.e. Solar Cookers (<Rs. 1500), Dryers, Pumps)
- No Discom expensive infra required

End State

- Balanced National Energy Security
- Solar as a mainstay for the next stage of growth
- Grid losses reduced to manageable levels
- Better living conditions and stronger economy
- Lower subsidies on fossil fuel
- Lower impact of grid failures
- Higher grid availability
- Reduced load on the grid
- More efficient technologies given preference
- **Government restricted to policy**
- Increased commercial activity resulting in high standards of living
- Local employment generation
- Rural progress
- Discom partnership

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Thanks

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