

Solar Power Projects : “REC way”

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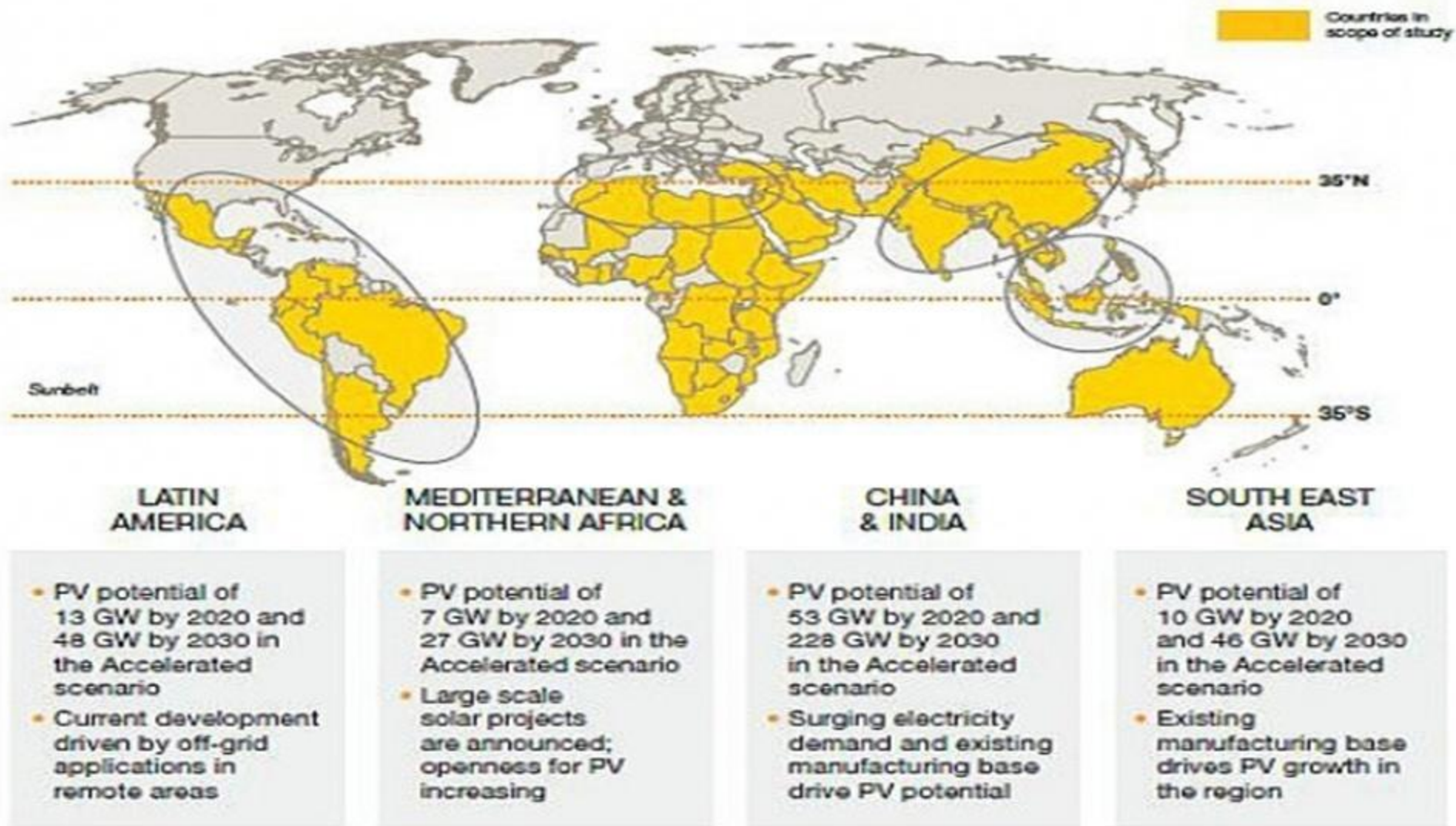
Presentation Highlights :

- ✓ Global Scenario;
- ✓ Indian Scenario;
- ✓ Estimation of Project Cost based on various technologies;
- ✓ Business Proposition;
- ✓ Summary of Key Recommendations.

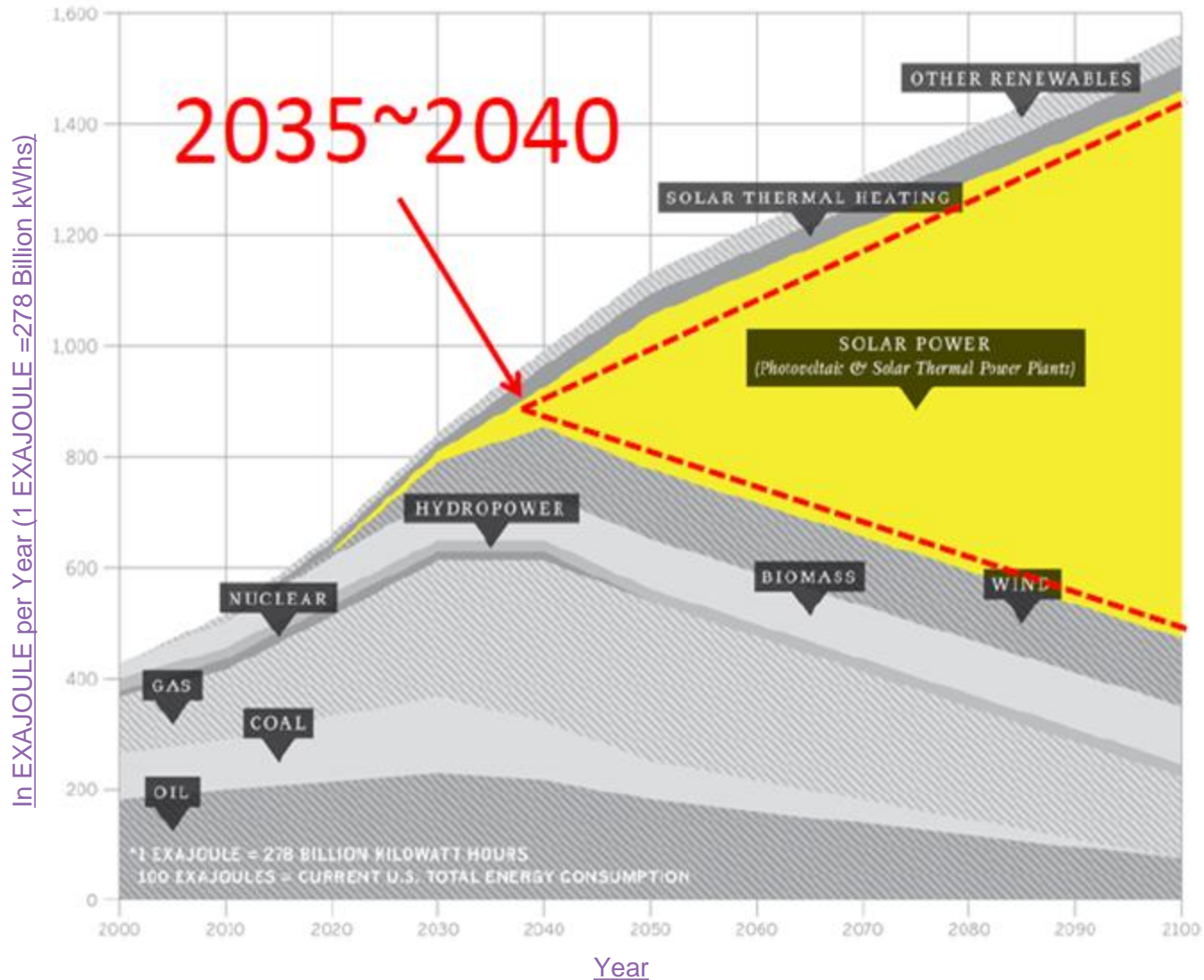
GLOBAL SCENARIO



Installed Solar Power capacity (PV): 67.4 GW out of which is around 78% (52.57 GW) is based on C-Si Technology.



Projected Share by Global Source of Energy Production :

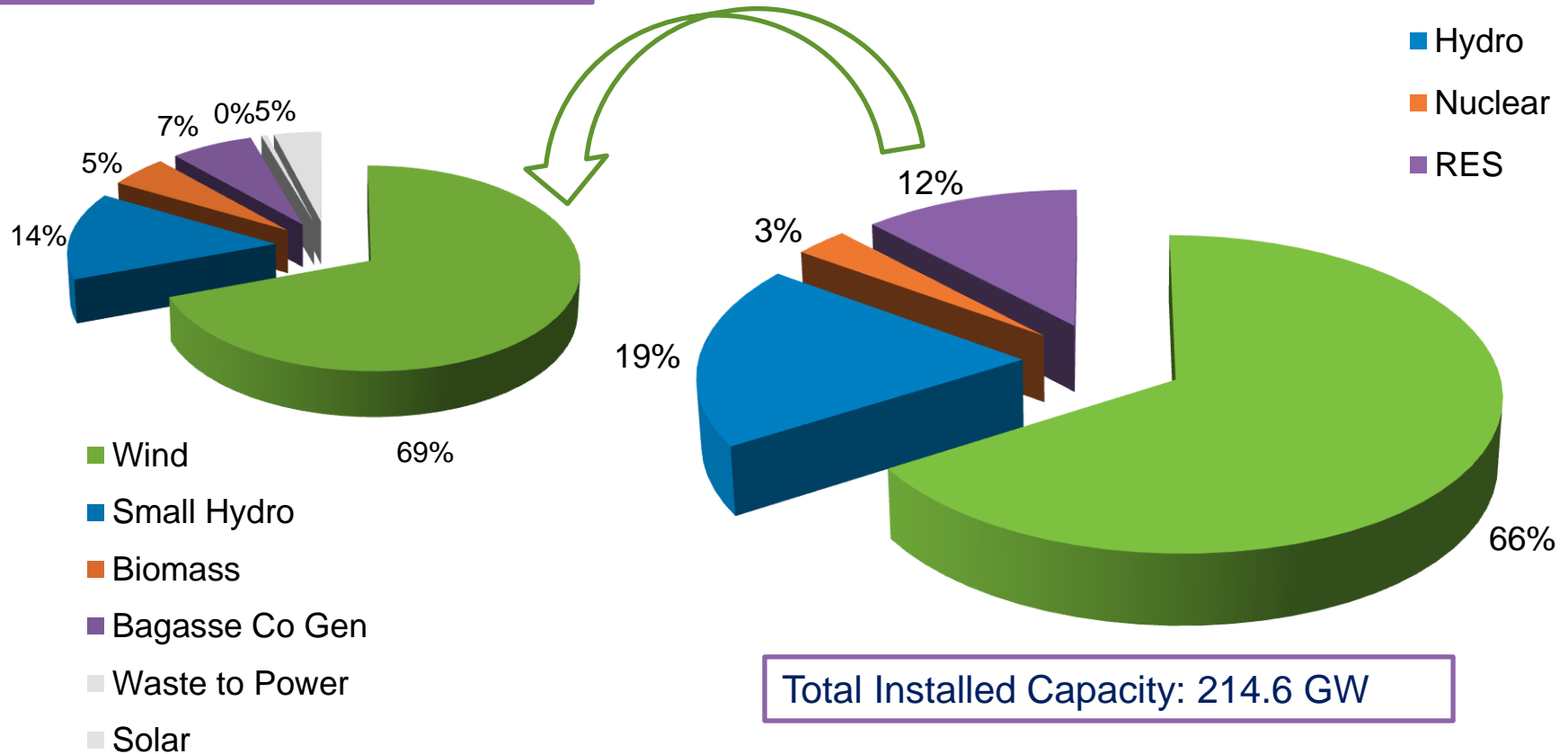


INDIAN SCENARIO



Installed Power Capacity India as on March 31st 2013:

Total RES Installed Capacity: 26 GW



Policy & Regulatory Framework for Solar Power Generation :

- ✓ The Electricity Act, 2003 : RPO (Section 86-1.e & 61-h);
- ✓ National Tariff Policy : Separate RPO for Solar Power;
- ✓ State Wise RPO Orders by Regulators;
- ✓ Announcement of Solar Policies by various States;
- ✓ Jawaharlal Nehru National Solar Mission (JNNSM);
- ✓ Preferential Tariff for Solar PV and Solar Thermal;
- ✓ Renewable Energy Certificate (REC) Mechanism.

Renewable Purchase Obligation:

- ❖ Most of the states have announced their RPO in the range of 0.25% to 0.75% of the total annual energy requirement.
- ❖ As per the RPO announced by various SERCs for 2012-13, Solar Capacity required (@ 19% CUF) shall be 1837 MW.
- ❖ Requirement of Annual Solar Capacity Generation considering the RPO mandate:

	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Energy Consumption (MU) as per 18th EPS	861189	938893	1022854	1117997	1202097	1291860	1388816	1493457	1607141
(Assuming constant solar RPO of 0.25% up to 2022)									
Solar Energy requirement (MU)	2153	2347	2557	2795	3005	3230	3472	3734	4018
Solar Capacity required (MW) @19% CUF	1294	1410	1536	1679	1805	1940	2086	2243	2414
(Assuming increase in solar RPO from 0.25% in 2012-13 to 2.5% by 2021-22 @ 0.25% increase/annum)									
Solar Energy requirement (MU)	4306	7042	10228	13975	18031	22608	27776	33603	40178
Solar Capacity required (MW) @19% CUF	2587	4231	6145	8396	10834	13583	16688	20189	24140

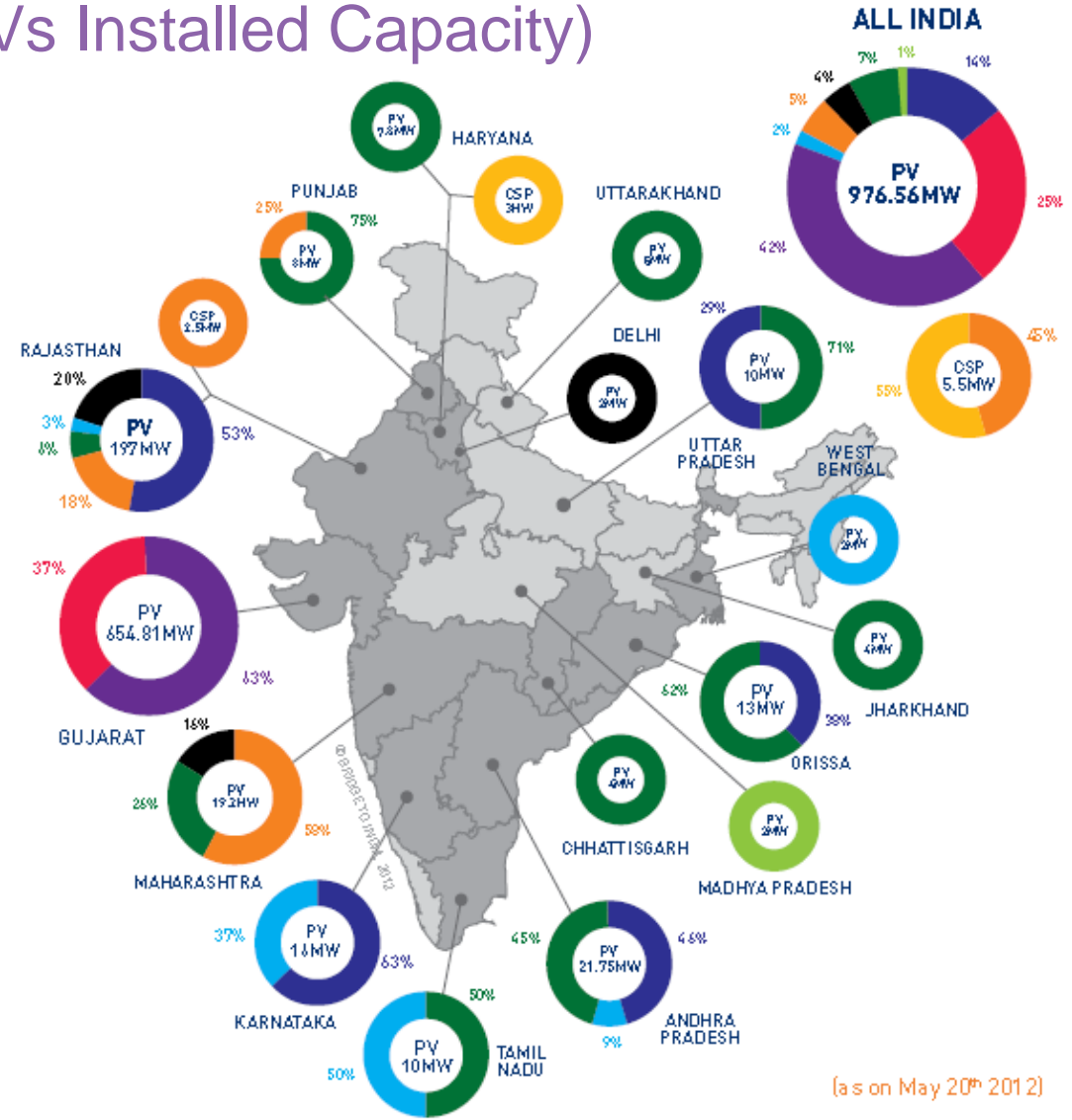
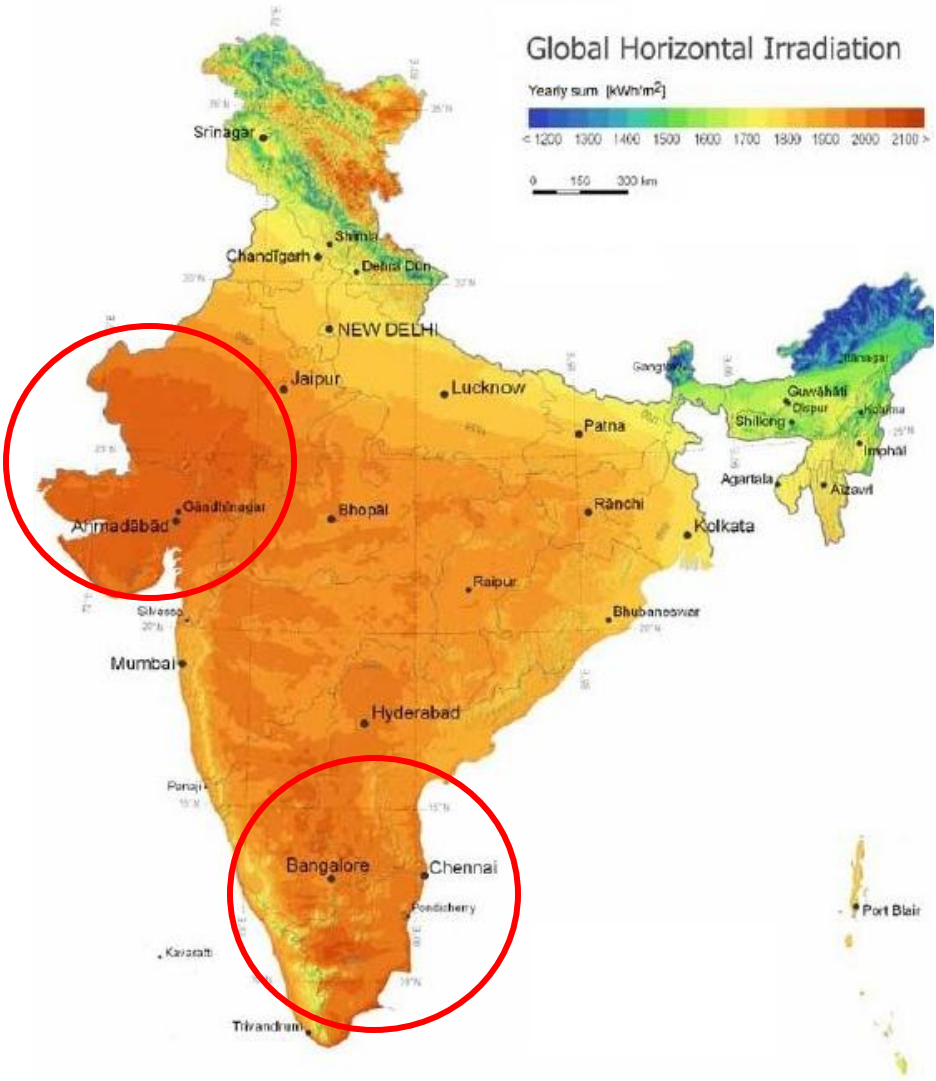
Solar Map of India (Insolation Vs Installed Capacity)

Global Horizontal Irradiation

Yearly sum [kWh/m²]



0 150 300 km



(as on May 20th 2012)

- Gujarat Solar Policy Phase 1
- Gujarat Solar Policy Phase 2
- Generation Based Incentive
- Migration
- Direct RP0 Project
- NSM Batch 1, Phase 1
- Demo Project
- RPSSGP
- REC Mechanism

PROJECT COSTING



Sr. No.	Description	50 MW - Poly C-Si Power Project (Most Likely)		50 MW - Poly C-Si Power Project (Optimistic)	
		Total Cost (in Crore)	Per MW Cost (in Crore)	Total Cost (in Crore)	Per MW Cost (in Crore)
1	Module	220.00	4.40	198.00	3.96
2	Solar Inverters	35.00	0.70	35.00	0.70
3	Mounting Structures	38.90	0.78	38.90	0.78
4	EPDM Rubber & Clamps (for C-Si, only Clamps required)	1.00	0.02	1.00	0.02
	DC Cable	13.57	0.27	13.57	0.27
6	AC Cable	2.31	0.05	2.31	0.05
7	Switchyard & other Electrical Equipment	21.01	0.42	21.01	0.42
8	Array Junction Boxes, SCADA & AC/Ventilation system	9.46	0.19	9.46	0.19
9	Reinforcement Steel	6.88	0.14	6.88	0.14
10	Civil Works (Foundation, Boundary Wall, Roads & Drains, Bldgs)	28.99	0.58	27.61	0.55
11	Erection Testing & Commissioning	6.74	0.13	6.74	0.13
12	Port Clearance & Logistics	1.50	0.03	1.50	0.03
13	Contingency	5.00	0.10	5.00	0.10
14	Total EPC Cost :	390.34	7.81	366.96	7.34
15	Land Cost	0.19	0.01	0.19	0.01
16	Pre-Operative Expenses	8.23	0.25	8.23	0.25
17	Insurance Charges	1.00	0.03	1.00	0.03
18	Import Duties	3.27	0.10	3.27	0.10
19	Cement	3.68	0.11	3.68	0.11
20	Contingency	1.25	0.04	1.25	0.04
21	IDC and Financial Charges	20.33	0.62	19.24	0.58
22	Statutory Charges	1.49	0.05	1.49	0.05
23	Total Non EPC Cost:	39.43	1.19	38.34	1.16
24	Total Project Cost:	429.78	9.00	405.30	8.50

Note:

1. Most Likely Option: Solar PV Modules cost has been taken 0.79 USD/Watt Peak for 240 Watt Peak Poly C-Si Module. (1USD= 55 INR)

2. Optimistic Option: Solar PV Modules cost has been taken 0.70 USD/Watt Peak for 240 Watt Peak Poly C-Si Module. (1USD= 55 INR)

3. Inverter cost (Central Inverter) : It has been taken @ 7 INR/Watt + Customs Duty @ 9.36%

4. Land Cost: Security deposite @ 10 % of DLC rate at Kuchhari which is Rs. 25000/Beegha

5. IDC for has been taken @ 10% for Debt part of Project Cost considering the 8 months execution time of the Project. Also, 1.5 Crore included as Financial Charges.



BUSINESS PROPOSITIONS



II. REC Route

Renewable Energy Certificates

- ✓ REC's are regulated by CERC.
- ✓ 1 REC = 1 MWh of Renewable Energy Generated
- ✓ Validity of RE Certificates : 730 days
- ✓ IEX & PXIL has already introduced REC Trading

There are two categories of certificates –

- ✓ Solar Certificates
- ✓ Non Solar Certificates

The floor and forbearance price as determined by CERC are as follows –

Particulars	Non Solar RECs	Solar RECs
Floor Price (Rs./MWh)	1500	9300
Forbearance Price (Rs./MWh)	3300	13400

Solar REC traded on Exchange:

Exchange	Month	Buy Bid (REC)	Sell Bid (REC)	MCP (Rs./REC)	MCV (REC)
PXIL	Feb	5	100	13,000	5
	March	130	22	12,506	6
IEX	Feb	1,637	149	13,000	5
	March	9,489	541	12,750	336

Solar PV Projects registered for RECs:

Total Capacity (MW) = 23.16

Sr. No.	State	RE Generator	Capacity (MW)	Date of Registration
1	Madhya Pradesh	M & B Switchgears Ltd.	2	4/4/2012
2	Tamil Nadu	Numeric Power Systems Ltd.	1.055	10/4/2012
3	Rajasthan	Kanoria Chemicals & Industries Ltd.	5	20/04/2012
4	Madhya Pradesh	M/s Gupta Sons	0.5	22/05/2012
5	Maharashtra	Jain Irrigation Systems Ltd.,	8.5	22/05/2012
6	Madhya Pradesh	Omega Renk Bearings Pvt. Ltd	0.105	14/06/2012
7	Maharashtra	Jaibalaji Business Corporation Pvt. Ltd.	1	25/06/2012
8	Maharashtra	Enrich Energy Pvt. Ltd	1	N/A

Total Installed capacity under REC mechanism would reach 100 MW by 2013-14

Average Power Purchase Cost (APPC) of States:

State	APPC (Rs/kWh) 2009-10 2010-11	Remarks	APPC 2011-12 #
Gujarat	2.53	Tariff Order 2010-11	2.70
HP	1.60	HPERC Order dated 10/6/2010	1.70
Uttaranchal	2.14	UERC Letter 84/UERC/CERC Dtaed 19/4/2011	2.46
Karnataka	2.61	KERC Letter Y/04/09/9933, Dated 6/4/2011	2.78
Maharashtra	2.51	MERC Tariff Order 2009-10	2.85
Chattisgarh	2.11	CSERC Tariff Order 2010-11	2.15
Punjab	2.69	PERC APPC Order 2010-11 Dated 2/6/2011	2.87
Uttar Pradesh	2.43	UPERC Tariff Order 2009-10	2.75
Haryana	2.60	HERC ARR Order of UHBVNL & DHBVNL Dated 13/9/2010	2.77
Kerala	1.68	KSERC Tariff Order 2009-10	1.91
West Bengal	1.86	Tariff Order 2010-11	1.98
Rajasthan	2.60	Tariff Order 2010-11	2.60
Andhra Pradesh	2.52	Tariff Order 2010-11	2.50
Tamil Nadu	2.37	TNERC APPC Order: M.O.4/E/RPO dated 28-12-2010: Rs.2.37/kWh	2.69
Madhya Pradesh	1.74	MPERC letter :MPERC/D(RE)/2011/1138 Dtaed 13/4/2011	1.85
Assam	2.40	AERC: APDCL No. GM (Com-T)/AERC/MISC/2008/175 27/4/2011	2.55
Bihar	2.32	MYT Tariff Order 2010-11	2.47
Delhi	2.62	MYT Tariff Order 2010-11	2.79
# Latest Available data on APPC are considered and same is escalated with the CAGR of power purchase cost data of previous years as per PFC Report to arrive APPC for 2011-12			

Scenario Analysis For REC Route

Input

Useful Life	25	Years
Debt:Equity	70:30	
Repayment Period	12	Years
O&M Expenses	11	Lakhs/MW
Escalation of O&M Expense	5.72%	
Depreciation rate	5.28%	As per Companies Act
Interest on working capital	13.50%	
CUF	19%	
Tariff (Rs./kWh)	11.9	For First Five year Floor REC price of 9.3 Rs./kWh APPC price of 2.6 Rs./kWh (Rajasthan)
Discount Rate for NPV	10.72%	

Conclusion:

Feasible scenarios – Equity IRR>16%
@ Rs.4/kWh – Not feasible



Represents feasible scenarios

Tariff of 4 Rs./kWh for rest of the project life

Capital Cost (Rs.Cr./MW)	8.5		
Interest rate (%)	13	10	8
NPV (Rs. Cr.)	-45.05	-10.62	11.72
Equity IRR (%)	4.86	9.07	12.76

Tariff of 5 Rs/kWh for rest of the project life

Capital Cost (Rs.Cr./MW)	8.5		
Interest rate (%)	13	10	8
NPV (Rs. Cr.)	-10.19	24.08	46.54
Equity IRR (%)	9.59	13.81	17.25

Tariff of 6 Rs/kWh for rest of the project life

Capital Cost (Rs.Cr./MW)	8.5			9		
Interest rate (%)	13	10	8	13	10	8
NPV (Rs. Cr.)	24.45	58.36	79.89	10.34	36.27	59.59
Equity IRR (%)	13.11	17.2	20.29	10.75	14.38	17.24

Tariff of 7 Rs/kWh for rest of the project life

Capital Cost (Rs.Cr./MW)	8.5			9			9.5		
Interest rate (%)	13	10	8	13	10	8	13	10	8
NPV (Rs. Cr.)	81.23	112.24	132.44	34.25	69.19	91.94	10.07	47.65	71.67
Equity IRR (%)	18.61	22.87	26.03	13.47	16.96	19.65	11.46	14.67	17.14

Summary of Key Recommendations :

- Contribution of Solar Energy is set to increase in the total energy portfolio worldwide.
- India has charted out ambitious plans for Solar Energy & is promoting the same.
- Government of Bihar should float a PPP model for solar power plant with REC mechanism in which it should stake claim of 26% equity portion. It would benefit the government in following way:
 1. It will enhance the bankability of the project and hence more investment, local job creation etc.
 2. Profit shared out of the model can be passed on to the local community for development.
- After analyzing various options it is recommended to go for REC route. However, Following are the concerns associated with it:
 1. RPO has not been enforced effectively.
 2. Mismatch in demand (RPO compliance) & supply (REC validity) regulations.
 3. Lack of a long-term predictability of REC pricing.
 4. Lack of Bankability of such projects due to uncertainty in revenue beyond 2017 (Control Period).

However, If Government of Bihar agrees to buy all the un sold REC at the end of its valid period even at floor price, it would give then the lending would become easier that would optimize the prifitability

REC

Eligibility Criteria for REC mechanism



Pricing

RECs Floor/Forbearance Price

2012-2017	Floor Price	Forbearance Price
Solar	9300/REC	13400/REC
Non Solar	1500/REC	3300/REC

1 REC is equivalent to 1 MWh

Reference : CERC Order in matter of Petition no. 99/2010, dated March 23, 2010

REC Mechanism

Procedure for ACCREDITATION (Through State nodal Agency)



Procedure for REGISTRATION (Through Central Agency NLDC)



Procedure for ISSUANCE (Through Central Agency NLDC)

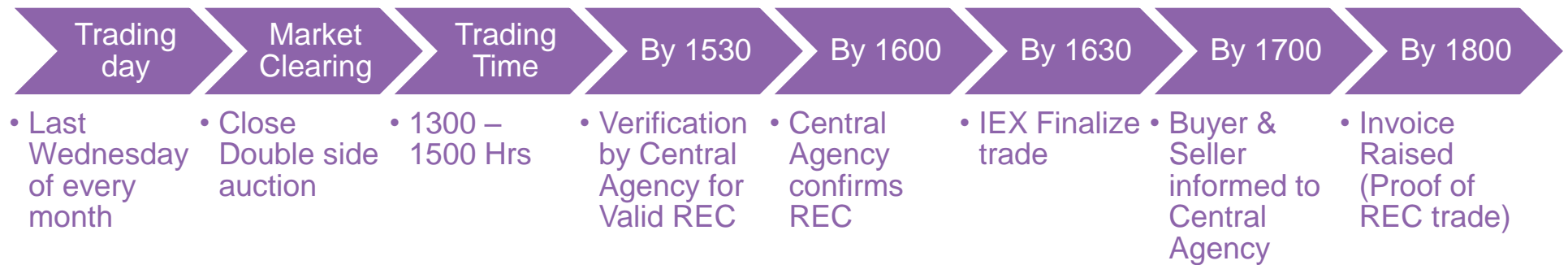


Procedure for TRADING & REDEMPTION (Through PXs)

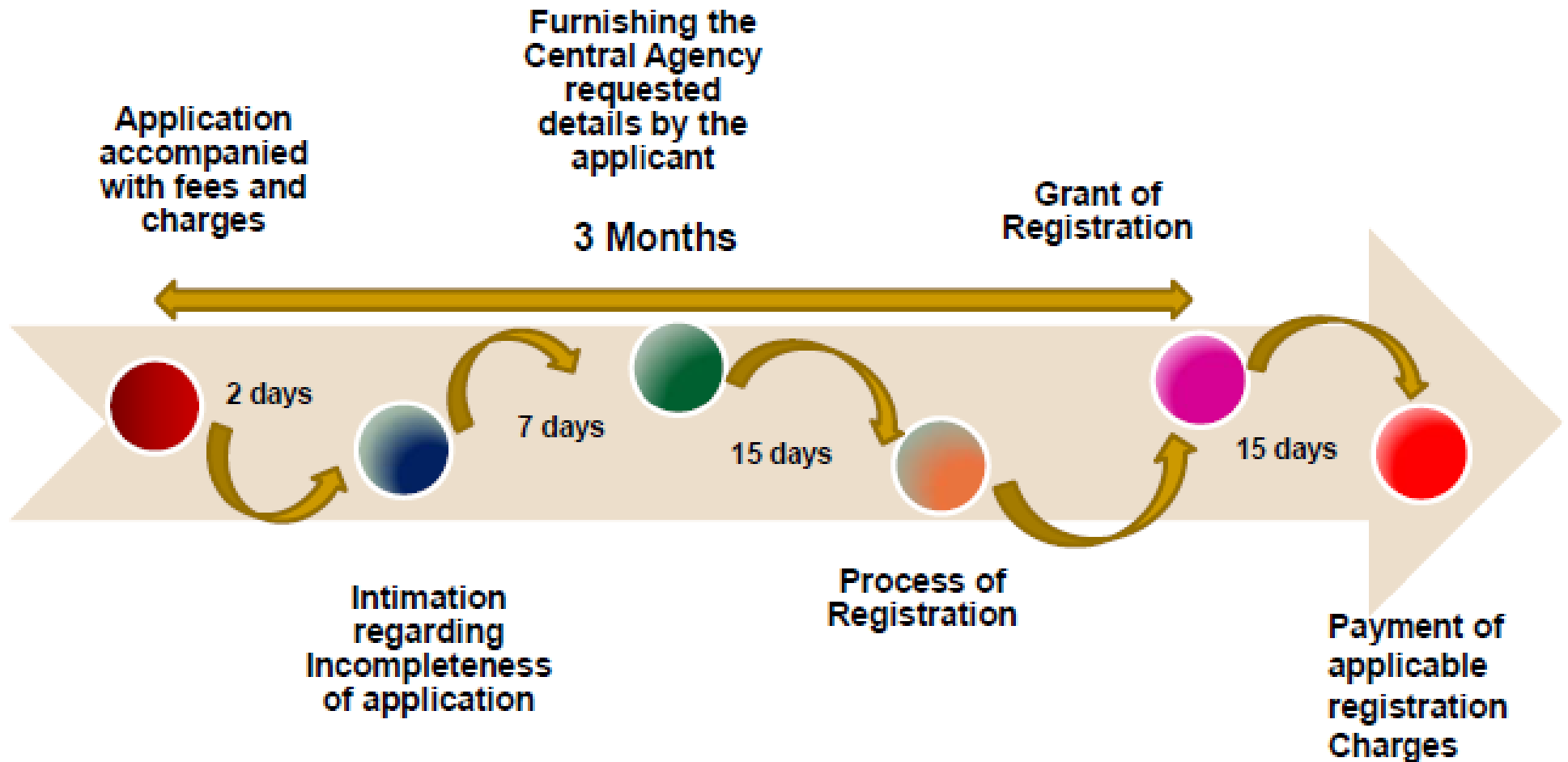
Facts – REC Mechanism

Salient features	
Accreditation	State Agency
Registration	Central Agency
Revocation of Registration	Central Agency
Categories of REC	Solar REC & Non-Solar REC
Issuance of REC	By Central Agency only based on injection certificate
REC Denomination	1 MWh = 1 REC
Time limit for claiming REC	3 Months from injection
Validity of REC	365 days after issuance
Dealing in Certificates	Power Exchanges only
REC Price Guarantee	Between 'Floor' Price and 'Forbearance' Price
Monitoring Mechanisms	Compliance Auditor

Exchange Trading time line

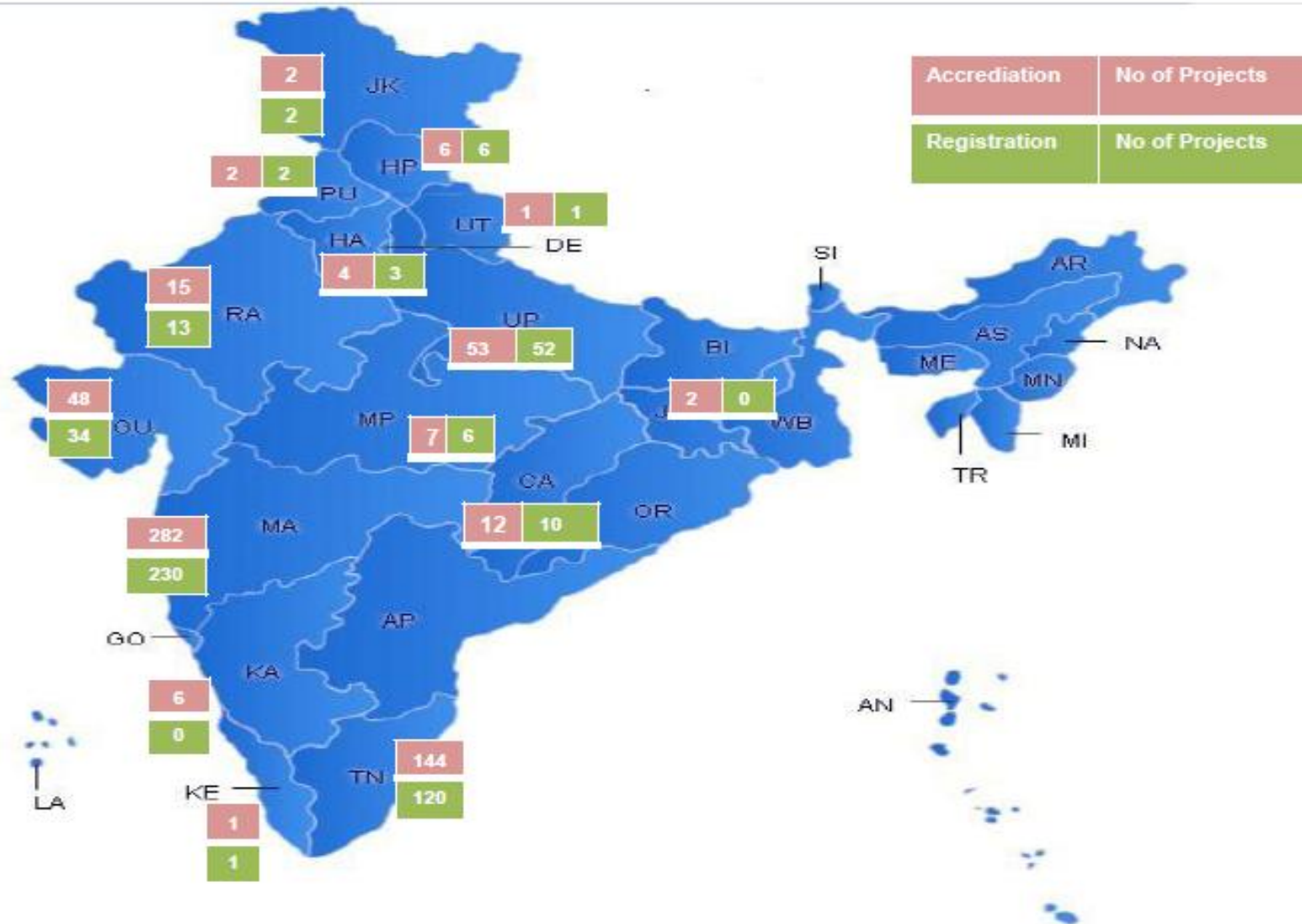


REC - Registration time line



State wise Accredited & Registered No. of Projects

As on 26th June'12



Thank You