

Suggestions for the Fourteenth Finance Commission on Renewable Energy

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Context

The Terms of Reference (ToR) of the Fourteenth Finance Commission (FFC) includes that the Commission shall take into consideration “the need to manage ecology, environment and climate change that will be consistent with sustainable development” while making its recommendations.

Taking into account the need for managing ecology, environment and climate change, the Thirteenth Finance Commission had recommended incentive grants of Rs. 5000 crore each for – Water Sector Management, Forest Protection, and Promotion of Renewable Energy. As regards Renewable Energy (RE), the Thirteenth Finance Commission had recommended the incentive grant of Rs. 5000 crore for grid-connected RE based on the States' achievement in RE capacity addition over the first four years of the Commission's recommendation period, i.e. from 1st April 2010 to 31st March 2014. This performance based incentive grant was supposed to be released by the Union Finance Ministry to the deserving States in 2014-15 based on States' achievement in RE capacity addition during the four years 2010-11 to 2013-14. This incentive grant comprised two components, where the first component was to be provided for achievement in installed capacity addition in a State relative to its unachieved potential with a weightage of 25 percent and the second component of grant was to be provided for achievement in installed capacity addition in the State relative to the aggregate of installed capacity addition across all States with a weightage of 75 percent.

This was indeed a welcome step, given the fact that power sector is a major contributor to GHG emissions in the country (with 43 percent share)¹ and hence encouraging faster infusion of RE into the sector can be expected to have a significant impact in terms of promoting sustainable development. The Union Budget 2014-15 was expected, therefore, to set aside some resources (if not the entire Rs. 5000 crore) to be shared with the deserving States this year; but no such allocations have been reported in the Union Budget papers though the main budget for 2014-15 was presented in July only and hence there was some time (i.e. during April to June this year) with the Union Ministry of Finance to take stock of the situation. The Thirteenth Finance Commission recommended grants-in-aid for Environment and Forest sector have been provided for in the Union Budget, while there is no provision for the grants-in-aid meant for RE.²

In this context, the current note makes a few suggestions pertaining to encouraging faster infusion of RE into the power sector in the country, which could be considered by the FFC.

¹ Power sector contributes 43 percent in total GHG emissions in India. Source: Indian Network for Climate Change Assessment (INCCA) Report: India's GHG Emissions 2007, May 2010.

² Union Budget 2014-15, Expenditure Budget Volume –II, Ministry of Finance, Demand No. 36.

Suggestions for the Fourteenth Finance Commission

1. Need to release at least a part of the Renewable Energy incentive grants to States upfront

The recommendation of the Thirteenth Finance Commission on RE was a performance based incentive grant to be released to deserving States in 2014-15 after installation of RE capacity by them. This could have proven to be a deterrent for power utilities in the States, many of which have been in poor financial health. A detailed analysis of budgetary spending by States on Renewable Energy during 2010-11 to 2012-13 shows that several of the States with high levels of unachieved RE potential (such as, Jammu and Kashmir, Odisha, Assam, Haryana and Punjab) have spent small amounts on this sector (Please see Table 2 in the Background Information on Issues and Priorities Relating to Renewable Energy). Given this scenario of inadequate spending by States on RE, it could have been difficult for cash strapped power utilities to accelerate development of RE capacity (which requires high capital investment).

Hence, the Fourteenth Finance Commission should consider releasing at least a part of the incentive grant upfront for enabling the power utilities in the States to meet the financial requirement for installation of RE capacity; States could be asked to submit Work Plans for the release of a part of the grants in the first year of the Commission's recommendation period (i.e. 2015-16).

2. Including Off-Grid Applications of Renewable Energy with installation of Micro-Grids

Inequities in terms of energy access have been widening across States as well as between urban and rural areas within States. As on 31st of August 2013, out of the 29 States in the country, only nine States had achieved 100 percent 'village electrification'³ (Please see Table 3 in the Background Note). However, as per the new definition of 'electrified villages', a village is deemed electrified if at least 10 percent of all the households of the village have electricity access and electricity is provided to public buildings such as schools, panchayat offices, health centres, community centres and dispensaries. Clearly, the new definition of 'electrified villages' is not comprehensive. Moreover, a large proportion of the country's population living in remote areas does not have access to grids and faces deficiency of electricity for economic activities.

In such a scenario, off-grid application of RE offers a scalable solution. However, some of the major barriers to the development of off-grid RE applications are the relatively low rate of return for project developers and lack of grid connectivity. These barriers can be overcome by installation of micro-grids⁴ over a cluster of un-electrified, under-electrified and even electrified villages or hamlets with high demand for electricity, where energy can be generated by various sources of RE (depending on the abundance of

³ Central Electricity Authority, Progress Report of Village Electrification as on 31.01.2014. See link http://www.cea.nic.in/reports/monthly/dpd_div_rep/village_electrification.pdf

⁴ Micro-grid refers to mini-power plants that supply 220 volts 50 Hz three-phase AC electricity through low-tension distribution networks to households for domestic use, commercial activities (such as shops, cycle repair shops, flour mills etc.), and community requirements such as drinking water supply and street lighting. For details, please see the Chapter on Electrification and Bio Energy Options in Rural India, India Infrastructure Report, 2007.

specific RE type in a State) through off-grid applications. Installation of micro-grids can provide adequate grid connectivity to the RE generated through off-grid applications.

Analysis of budgetary spending by States on Renewable Energy during 2010-11 to 2012-13 shows that States with large numbers of un-electrified houses, such as Arunachal Pradesh, Nagaland, Odisha and Tripura, have spent less than Rs. 10 crore in the these three years (Please see Table 4 in Background Note).

States can lead the investments in off-grid applications as part of meeting their electrification targets; however, the grant recommended by the Thirteenth Finance Commission was meant only for grid interactive RE. The Fourteenth Finance Commission should consider incentivisation of off-grid applications of RE with installation of micro-grids.

3. Incentive for Creation of Renewable Energy Evacuation Infrastructure

Presently, the responsibility of distribution of the power generated lies mainly with the State Governments. Although the private sector developers currently own as much as 86 percent of the installed RE capacity in the country, they depend on the State Governments for adequate evacuation infrastructure and grid connectivity for the RE generated.⁵

The development of evacuation infrastructure and provisioning of measures for grid connectivity for RE sources is considered the responsibility of the State Transmission Utility (STU) or State Electricity Board (SEB). It has been observed that barring few of the State utilities, such as Maharashtra State Electricity Transmission Company Ltd., Rajasthan Vidyut Prasaran Nigam, and Himachal Pradesh State Electricity Board, the utilities in other States have not included evacuation infrastructure for RE as part of their overall transmission or distribution capital expenditure plans.⁶ Even for those State utilities that have better capital expenditure plans, lack of funds was found to be a major challenge in realization of their plans. Some of the critical challenges faced by STUs in integrating RE with grid are – lack of evacuation infrastructure, need for reserves/energy storage to deal with intermittency in RE generation, and need for robust communication systems to transmit real time RE generation data.⁷ Capital expenditure, therefore, is a prerequisite for the required infrastructure for RE. However, the analysis of budgetary spending by States on Renewable Energy during 2010-11 to 2012-13 shows that merely three States, viz. Andhra Pradesh, Assam and Arunachal Pradesh, showed some amounts of Capital Expenditure on RE (See Table 5 in the Background Note).

Given that RE generation requires large amounts of capital expenditure; the FFC could consider prioritizing the grants for the capital expenditure plans of State Transmission Utilities for installing evacuation infrastructure and grid connectivity for the RE generated.

⁵ Annual Report of CEA, 2012-13. Installed Renewable Energy includes Wind, Small Hydro Project, Biomass Gasifier, Biomass Power, Urban & Industrial Waste Power & Solar Power.

⁶ A Discussion Paper on barriers to development of renewable energy in India, IDFC Ltd., February 2010. Available at <http://www.idfc.com/pdf/publications/Discussion-paper-on-Renewable-Energy.pdf>

⁷ Integrating renewable energy and energy efficiency in the transmission and distribution grids of Tamil Nadu and Karnataka by New Venture India , 2013.

4. Incentives to States for achieving their targets on Renewable Energy Purchase Obligation

The State Governments have mandatory targets for meeting Renewable Energy Purchase Obligation (RPO). Section 86 (1) (e) of the Electricity Act, 2003 initiated the practice of RPO at the State level, which mandates the power distributing authorities to purchase a fixed percentage of power from RE sources.⁸ In terms of the progress made by various States in meeting their respective RPO targets, it has been reported that 22 out of 29 States have failed to meet their RPO targets as of 2012.⁹

The incentives proposed by the Thirteenth Finance Commission were focused on RE capacity addition across all States without any reference either to the RPOs set by the SERCs or to the national targets set by the National Action Plan on Climate Change. The Fourteenth Finance Commission can help accelerate RE capacity addition by States by incentivizing those States that meet their RPO targets; this could facilitate revenue generation by States by selling the RE generated under the existing mechanism of Renewable Energy Certificates.

5. Strengthening of the State Nodal Agencies for Renewable Energy

Since the actual implementation of the programmes of the Union Ministry of New and Renewable Energy is taking place through the State nodal agencies, it is important that these agencies are strengthened adequately in terms of human resources and skills. There is a need to facilitate the strengthening of the State nodal agencies for RE in the areas of – assessment of RE sources, database management, their local administrative setup and getting local self-government institutions (such as local Panchayats and Municipalities) involved in planning and implementation of RE projects.

The FFC could consider incentivising the strengthening of the State nodal agencies for RE in terms of their human resources and technical skills.

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⁸ Subsequent to the Electricity Act (EA) 2003, the National Action Plan on Climate Change (NAPCC) aims to derive 15 percent of India's energy requirements from renewable energy sources (non-solar) by the year 2020. The National Solar Mission requires SERCs to set solar RPO targets requirement increasing from 0.25 percent in the beginning of 2012-13 to 3 percent by 2022.

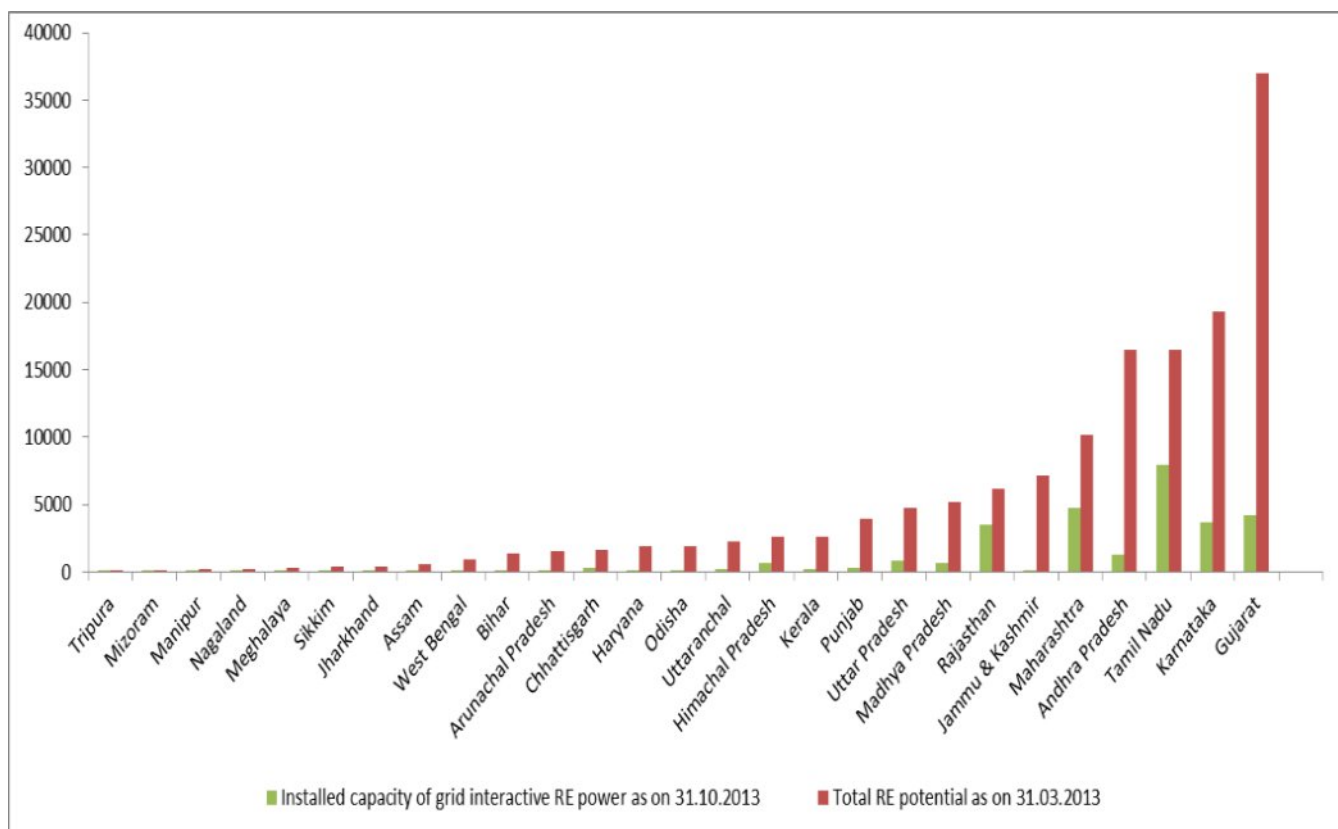
⁹ "Indian States miss renewable energy targets: Greenpeace". Article available at: <http://www.thehindu.com/news/national/indian-states-miss-renewable-energy-targets-greenpeace/article4666827.ece>

Background Note on Issues and Priorities relating to Renewable Energy

I. Gaps between the Renewable Energy Potential and the Capacity Installed by States

There is a significant gap between the Renewable Energy (RE) potential and the capacity installed by the States¹⁰ (see Figure 1 below). The State-wise distribution of the estimated potential of RE shows that Gujarat has the highest share in total RE potential of the country at 25 percent followed by Karnataka at 13.1 percent, Tamil Nadu at 11.3 percent and Andhra Pradesh at 11.2 percent. There is a need for giving higher policy priority to the development of RE for harnessing the untapped RE potential across States.

Graph 1: Installed Capacity for RE vs. Total Estimated Potential of RE across States (in MW)



Note: States arranged in ascending order of their share in Total RE potential of the country.

Source: Ministry of New and Renewable Energy, Govt. of India, 2013

¹⁰ Annexure-I referred to in reply by MNRE to part (c) of Lok Sabha Starred Question No.31 for 06.12.2013 regarding Power Generation from various Renewable Energy Sources. Available at <http://164.100.47.132/Annexure/lcq15/15/as31.htm>

II. Low Budgetary Priorities for Development of Renewable Energy

Currently, the budget allocation for the Union Ministry of New and Renewable Energy (MNRE), which amounts to a little over 0.1 percent of the total allocations of the Union Budget 2014-15, is considered grossly inadequate vis-à-vis the need for harnessing RE potential in the country¹¹.

Table 1: Union Budget Allocation for MNRE (in Rs. Crore)

Year (BE Figures)	Gross Budgetary Support for MNRE#	Internal and External Budgetary support	Total Budgetary Expenditure (BE)	Budget Allocation for MNRE as a percent of Total Budget Estimate (BE)*
2007-08	632.9	384	680520.51	0.093
2008-09	624.1	647	750883.53	0.083
2009-10	628.0	727	1020837.68	0.062
2010-11	1008.5	950	1108749.24	0.091
2011-12	1212.4	950	1304364.98	0.093
2012-13	1397.8	1970	1430825.24	0.098
2013-14	1533.6	2394	1665297.32	0.092
2014-15	2443.9	3000	1763213.96	0.14

Notes:

Figures include the funds made available from the National Clean Energy Fund;

* Does not include the Internal and External Budgetary support Component.

Source: Expenditure Budget Vol. 1 and 2, Union Budget various years, GoI

Total budgetary expenditure on RE in the States, shown in Table 2 below, has been compiled by taking into account both the expenditures made through the State Budgets and the direct transfers of Central resources for RE to State-level agencies that bypassed the State Budgets.

It is observed that that several of the States with high levels of unachieved RE potential, such as, Jammu and Kashmir, Odisha, Assam, Haryana and Punjab, have spent small amounts on this sector during 2010-11 to 2012-13 (the period over which the States were being incentivised by the Thirteenth Finance Commission to step up their efforts for RE capacity installation).

Table 2: Total Budgetary Expenditure on RE vis-à-vis Unachieved RE Potential across States

S. No.	State	2010-11	2011-12	2012-13	Unachieved RE Potential in the State (in %)
		(in Rs. Crore)			
1	Rajasthan	14.9	79.0	62.1	43.9
2	Tamil Nadu	2.1	2.0	0.0	51.8

¹¹ Committee on Estimate (2011-202) for Ministries of Power, Coal, And New & Renewable Energy for Power Generation – demand and supply; Lok Sabha secretariat, GOI, December 2011

S. No.	State	2010-11	2011-12	2012-13	Unachieved RE Potential in the State (in %)
		(in Rs. Crore)			
3	Maharashtra	85.9	132.6	--	53.0
4	Tripura	7.0	2.5	1.5	69.2
5	Himachal Pradesh	1.4	8.2	--	76.0
6	Mizoram	0.5	0.5	--	78.8
7	Karnataka	11.6	21.8	16.1	80.8
8	Chhattisgarh	50.9	70.2	--	81.6
9	Uttar Pradesh	39.6	51.9	0.0	82.2
10	Sikkim	31.9	11.5	6.8	85.8
11	West Bengal	28.9	0.0	--	86.3
12	Nagaland	2.9	2.4	--	87.1
13	Madhya Pradesh	39.2	20.1	35.0	87.6
14	Gujarat	32.6	22.8	0.0	88.6
15	Meghalaya	3.8	14.0	--	90.5
16	Bihar	6.1	16.4	12.4	91.6
17	Uttarakhand	38.7	26.9	31.0	91.6
18	Andhra Pradesh	21.4	30.0	0.0	92.1
19	Punjab	1.4	0.8	0.0	92.5
20	Kerala	36.7	49.3	29.4	92.6
21	Arunachal Pradesh	72.4	74.0	--	93.4
22	Haryana	12.3	11.2	--	93.5
23	Assam	1.8	1.4	0.7	94.6
24	Odisha	17.0	13.2	9.7	94.9
25	Jharkhand	21.1	38.5	102.1	95.0
26	Manipur	8.9	34.5	--	97.0
27	Jammu and Kashmir	0.0	0.0	0.0	97.9

Notes:

-- indicates that the Finance Accounts 2012-13 are not available yet for the State concerned.

Unachieved potential is estimated based on figures of total estimated RE potential of States and installed capacity of RE as on 31.02.2013.

States are arranged in ascending order of their unachieved percentage of RE Potential; Jammu & Kashmir is the State with the highest percentage of unachieved potential.

Source for Budgetary Expenditure Data: State Finance Accounts for various years, Comptroller and Auditor General of India, GoI

Source for Data on Unachieved Potential of RE: Annexure-I referred to in reply by MNRE to part (c) of Lok Sabha Starred Question No.31 for 06.12.2013 regarding Power Generation from various Renewable Energy Sources. Available at <http://164.100.47.132/Annexure/lsg15/15/as31.htm>

III. Poor Spending on Off- Grid Applications of Renewable Energy

As per the Census 2011 figures on Household Amenities, the total number of households in the country without electricity has decreased marginally from 78 million to 75 million. Even after the launch of the Rajiv Gandhi Grameen Viduytikaran Yojana, only nine States have achieved 100 percent village electrification (see Table 3) even on the basis of the new definition of 'electrified villages', which is far from being comprehensive (a village is deemed electrified if at least 10 percent of all the households of the village have electricity access and electricity is provided to public buildings such as schools, panchayat offices, health centres, community centres and dispensaries).

Table 3: Status of Rural Electrification in India as on 31.01.2014

Percentage of Electrified Villages	Total Number of States	Names of the States
100 %	09	Andhra Pradesh, Delhi, Goa, Haryana, Karnataka, Kerala, Punjab, Sikkim and Tamil Nadu
90-99 %	12	Assam, Bihar, Gujarat, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Chattisgarh, Maharashtra, Mizoram, Rajasthan, Uttaranchal and West Bengal
81-90 %	04	Jharkhand, Manipur, Meghalaya, Uttar Pradesh
71-80%	04	Arunachal Pradesh, Nagaland, Odisha, Tripura

Source: Central Electricity Authority, Progress Report of Village Electrification as on 31.01.2014.

A close look at the budgetary expenditure made by States on off grid applications, during 2010-11 to 2012-13, shows that States with poor coverage of village electrification (such as Arunachal Pradesh, Nagaland, Odisha and Tripura) have spent less than Rs. 10 crore on Rural Applications of RE in the last three years (see Table 4).

Table 4: State-wise Expenditure on Rural Applications of RE
(in Rs. crores)

State	2010-11	2011-12	2012-13
Arunachal Pradesh	2	3	--
Sikkim	1	11	3
Maharashtra	6	3	--
Jharkhand	4	19	72
Gujarat	10	0	0
Manipur	3	4	--
Bihar	3	6	6
Punjab	1	0	0
Madhya Pradesh	20	7	10
Nagaland	2	10	--

State	2010-11	2011-12	2012-13
Uttarakhand	24	11	11
Andhra Pradesh	13	18	0
Karnataka	9	22	16
West Bengal	23	0	--
Kerala	29	49	29
Orissa	14	11	7
Tripura	6	1	0
Haryana	11	10	--
Chhattisgarh	51	70	--
Uttar Pradesh	40	52	0
Himachal Pradesh	1	5	--
Tamil Nadu	2	2	0
Assam	0	0	--
Jammu and Kashmir	0	0	0
Meghalaya	0	1	--
Mizoram	0	0	--
Rajasthan	0	0	0

Notes: -- indicates that the Finance Accounts 2012-13 are not available yet for the State concerned.

Figures for Budgetary Expenditure on Rural Application also include expenditure for off-grid applications and other benefits programs such as Choolahs, Cookstoves etc.

Source: State Finance Accounts of various years, Comptroller and Auditor General of India, GoI

IV. Low Magnitudes of Capital Expenditure on Renewable Energy

A comparison of the figures for capital and revenue expenditure on RE reported in the State Budgets, during 2010-11 to 2012-13, reveals that merely three States, viz. Andhra Pradesh, Assam and Arunachal Pradesh, undertook some small amounts of capital expenditure on renewable energy¹². On the other hand wide variations have been observed in terms of revenue expenditure on RE across States. While Maharashtra shows a sudden increase in both revenue and capital expenditure on RE in 2012-13, Jharkhand shows very high revenue expenditure on RE for 2011-12.

Adequate capital expenditure on the sector is a necessary prerequisite for RE infrastructure development; the inadequacy of capital expenditure is likely to constrain – the creation of evacuation infrastructure, transmission and distribution infrastructure, RE transmission networks, development of storage technologies, and RE sector's grid parity with the conventional sources of energy.

¹² Capital Expenditure is usually meant for creation of assets while Revenue Expenditure bears all subsequent charges for maintenance of assets. Once the government decides to spend for the creation of an asset, Capital Expenditure bears all charges for the first construction of the asset, while Revenue Expenditure bears all subsequent charges for its maintenance and operation or salary of employees.

Table 5: State-wise Capital and Revenue Expenditure on Renewable Energy
(in Rs. Crore)

States	Revenue Expenditure			Capital Expenditure		
	2010-11	2011-12	2012-13	2010-11	2011-12	2012-13
Tripura	1.02	1.00	1.12	0.00	0.00	0.00
Mizoram	0.50	0.50	--	0.00	0.00	--
Manipur	5.50	4.50	--	0.00	0.00	--
Nagaland	2.87	2.35	--	0.00	0.00	--
Meghalaya	1.82	2.44	--	0.00	0.00	--
Sikkim	0.85	0.61	1.00	0.00	0.00	0.00
Jharkhand	20.00	35.00	100.00	0.00	0.00	0.00
Assam	0.37	0.35	0.00	1.40	1.09	0.66
West Bengal	9.23	0.00	--	0.00	0.00	--
Bihar	3.28	10.51	6.55	0.00	0.00	0.00
Arunachal Pradesh	2.80	6.38	--	1.90	2.06	--
Chhattisgarh	15.70	15.80	--	0.00	0.00	--
Haryana	12.33	11.18	--	0.00	0.00	--
Orissa	8.93	6.45	6.96	0.00	0.00	0.00
Uttarakhand	10.63	9.74	13.86	0.00	0.00	0.00
Himachal Pradesh	1.26	7.97	--	0.00	0.00	--
Kerala	28.92	43.26	23.48	0.00	0.00	0.00
Punjab	1.37	0.83	0.00	0.00	0.00	0.00
Uttar Pradesh	39.61	51.92	0.00	0.00	0.00	0.00
Madhya Pradesh	21.28	12.62	24.92	0.00	0.00	0.00
Rajasthan	0.48	0.54	0.56	0.00	0.00	0.00
Jammu and Kashmir	0.00	0.00	0.00	0.00	0.00	0.00
Maharashtra	52.56	106.51	--	0.00	0.00	--
Andhra Pradesh	7.72	8.44	0.00	0.50	3.09	0.00
Tamil Nadu	2.13	2.04	0.00	0.00	0.00	0.00
Karnataka	11.60	16.71	16.13	0.00	0.00	0.00
Gujarat	14.15	19.00	0.00	0.00	0.00	0.00

Notes: -- indicates that the Finance Accounts 2012-13 are not available yet for the State concerned.

Source: State Finance Accounts of various years, Comptroller and Auditor General of India, GoI

V. State-wise Ownership of Installed RE Capacity: Private vs. Public

Currently, the private sector developers own as much as 86 percent of the installed RE capacity in the country; however, they depend on the State Governments for adequate evacuation infrastructure and grid connectivity for the RE generated.

Table 6 presents the State-wise installed capacity of RE in terms of its private sector, Central Government and State Government level ownership status. States with high levels of unachieved RE potential, such as Punjab, Kerala, Arunachal Pradesh, Jharkhand, Uttar Pradesh, Madhya Pradesh, Rajasthan, and Andhra Pradesh, show relatively lower levels of participation by the private sector as of now. It is understood that there is a relatively low rate of return for the investor, which discourages them from investing in RE; the State Governments can address this challenge by supporting the creation of adequate evacuation infrastructure for RE. It has also been observed that RE project developers expect a clear policy from State Government on land clearance for installation of RE capacity.

Table 6: State-wise Ownership of Installed RE Capacity (in MW) as on 31.3.2013

States	State	Private	Central
Andhra Pradesh	223	885	0
Arunachal Pradesh	104	0	0
Assam	31	0	0
Bihar	71	43	0
Chhattisgarh	52	254	0
Gujarat	33	3935	0
Haryana	70	53	0
Himachal Pradesh	588	0	0
Jammu and Kashmir	131	0	0
Jharkhand	4	16	0
Karnataka	901	2610	0
Kerala	175	0	0
Madhya Pradesh	86	440	0
Maharashtra	304	3853	0
Manipur	5	0	0
Meghalaya	31	0	0
Mizoram	36	0	0
Nagaland	29	0	0
Orissa	64	33	0
Punjab	245	143	0
Rajasthan	30	3297	0
Sikkim	52	0	0
Tamil Nadu	119	7339	0
Tripura	16	0	0

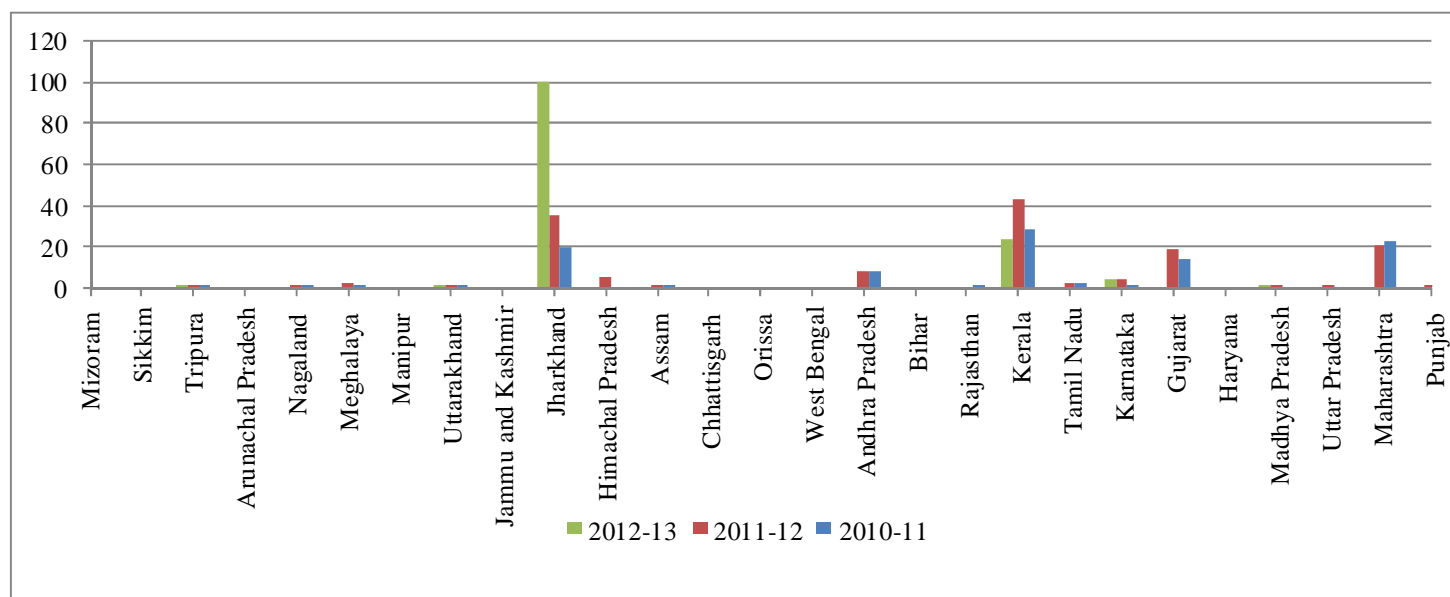
States	State	Private	Central
Uttar Pradesh	25	799	0
West Bengal	143	28	0

Source: Central Electricity Authority Annual Report 2012-13

VI. State-wise Budgetary Expenditure on Various Types of Renewable Energy

An analysis of States' budgetary expenditure on various types of RE reveals that States are not spending in accordance with the abundance of the specific RE types. States, which are rich in Bio energy resources such as Punjab, Uttar Pradesh, Madhya Pradesh and Haryana, are spending negligible amounts on Bio energy (See Figure 2).

Figure 2: State-wise Budgetary Expenditure on Bio Energy (in Rs. Crore)



Note: States are arranged in ascending order of their share in total Bioenergy potential of the country.

Source: State Finance Accounts of Various States Audited by CAG for year 2010-11, 2011-12, 2012-13

Similar mismatches have also been found for wind and other types of Renewable Energy. It has been observed that only Madhya Pradesh is incurring budgetary expenditure on wind energy. Similarly, only few States, such as Assam, Uttar Pradesh and Rajasthan, are spending on others sources of Renewable Energy. Installation of micro-grids over a cluster of un-electrified, under-electrified and even electrified villages or hamlets with high demand for electricity, where energy can be generated by various sources of RE (depending on the abundance of specific RE type in a State) through off-grid applications needs to be pursued seriously. This would provide solution for meeting energy requirement of commercial activities of villages along with other residential usage of electricity.

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