Green Growth Background Paper

Draft Final Report

Green Growth and Renewable Energy in Punjab

Prepared for

Department of Science, Technology and Environment
Government of Punjab

Supported by

Global Green Growth Institute

The Energy and Resources Institute

...towards global sustainable development

Suggested format for citation

T E R I. 2015
Green Growth and Renewable Energy in Punjab
New Delhi: The Energy and Resources Institute.

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1 Current Status

As of March 2015, Punjab's installed capacity of renewable energy consists of solar power (200 MW), biomass power (63 MW), small hydro (135 MW), waste to energy (1 MW), and cogeneration power (410 MW). It has also been given an award by the MNRE for being one of the best performing states in terms of capacity addition of renewables.

Punjab has also set a target of increasing the percentage of renewable energy in the total energy mix to 15% by 2022. It targets an installed capacity of 5,400 MW renewable capacities by 2022 which includes 300 MW from biomass, 680 MW from co-generation, 4,200 MW from solar, 200 MW from small hydro and 20 MW from waste to energy. Punjab has large solar and biomass potential as shown in Figure 1 below

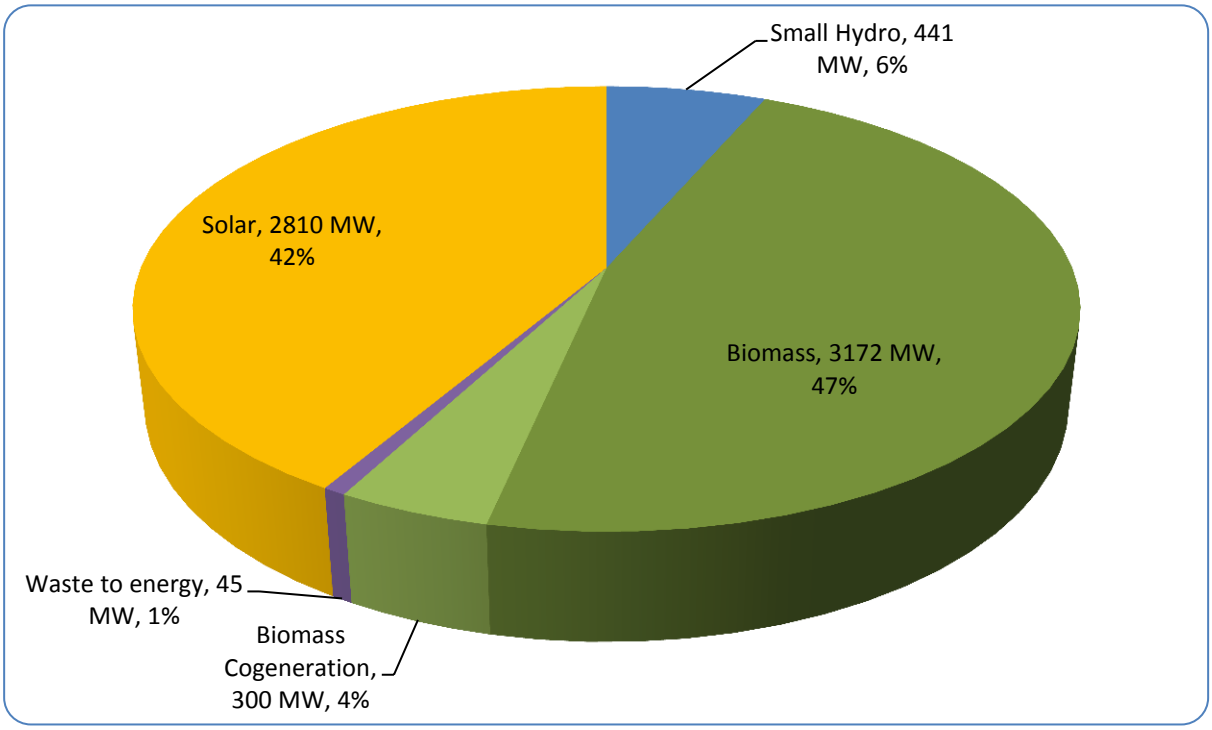

Figure 1: Renewable Energy Potential in Punjab

Source: MNRE Annual Report 2014

2 Institutional setup of the power sector in Punjab

Punjab Energy Development Agency (PEDA) was formed in Sept. 1991 as a state nodal agency for promotion and development of renewable energy programmes/projects and energy conservation programme in the state of Punjab. The government of Punjab unbundled Punjab State Electricity Board into two companies -Punjab State Power Corporation Ltd. (PSPCL) that looks at generation and distribution of power and Punjab State Transmission Corporation Ltd. (PSTCL) that manages power transmission.

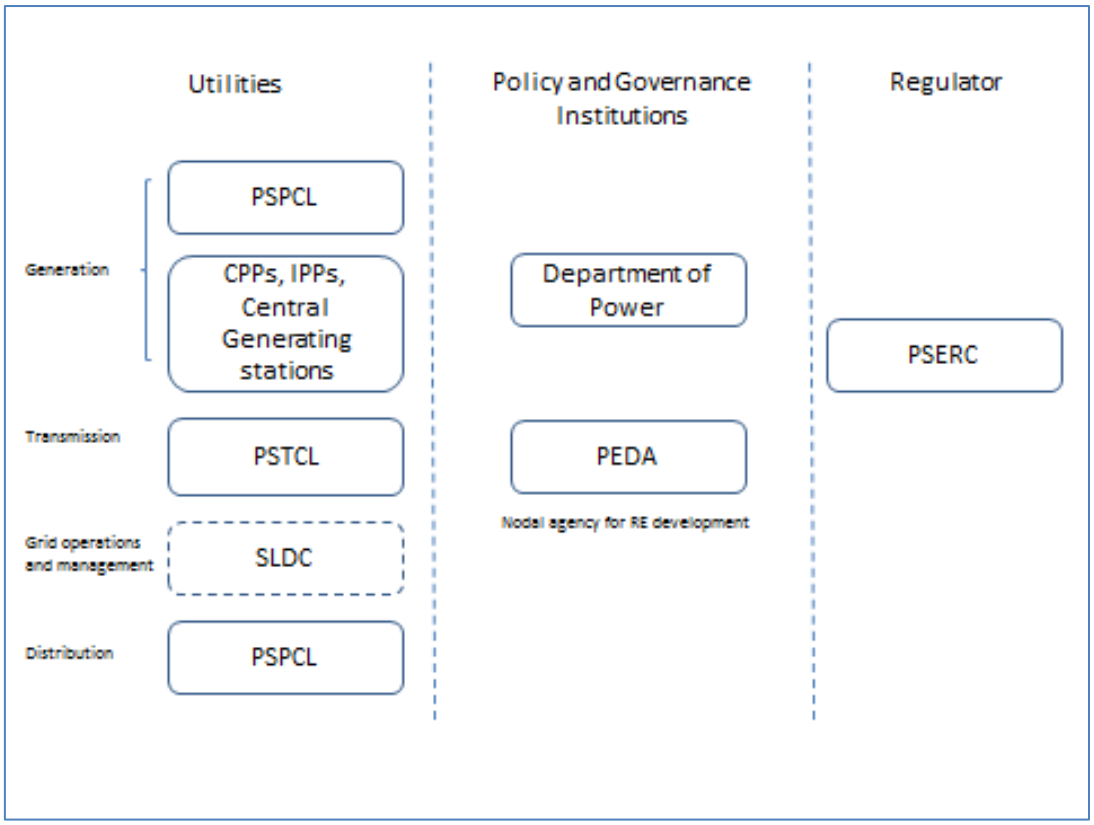

Figure 2: Institutional setup of power sector in Punjab

Source: TERI compilation

Notes: CGS – Central Generation Stations, CPP - Captive Power Producer, PSPCL – Punjab State Power Corporation Limited, PSTCL – Punjab State Transmission Corporation Limited, IPP – Independent Power Producer, SLDC – State Load Despatch Centre, PEDA – Punjab Energy Development Agency, PSERC – Punjab State Electricity Regulatory Commission.

Renewable Energy Policy Overview

The New and Renewable Sources of Energy Policy (NRSE 2012) was launched by the state of Punjab in order to develop and promote renewable energy based technologies. Punjab Energy Development Agency (PEDA) has been appointed as the nodal agency and also as a single window facility for the implementation of the policy. The policy focuses on attracting private sector investment, provision of decentralized renewable energy particularly in rural areas (to improve quality of power and reduce T&D Losses), and to support R&D, demonstration and commercialization of new technologies in renewable sector.

It includes range of incentives such as:

- 100% electricity duty exemption for power consumed from state licensee during construction and testing of the project.
- 100% VAT exemption for manufacturing & sale of renewable systems and equipment for renewable power projects

- 100% exemption from entry tax for supplies for setting up and trial operations of the projects
- 100% exemption from payment of fee and stamp duty for registration/lease deed charges for the land required for the project.
- 100% exemption from payment of Change of Land Use (CLU) fee and External Development Charges (EDC) for the land required for renewable projects
- Solar PV power projects to be exempted from obtaining any NOC/consent under Pollution control laws from the PPCB.

Punjab also released a **Policy on net metering for Grid Interactive Roof-Top Solar Photo Voltaic Power Plants** (it currently has rooftop solar projects amounting to approximately 8.52 MW of installed capacity). The policy requires grid interconnectivity of rooftop solar systems by deploying net metering through which power can be sold to Punjab State Power Corporation Limited (PSPCL). The policy applies to the distribution licensee and consumers of distribution licensee in Punjab. The Punjab government has fixed a **target of 100 MW** under net metering policy for the next one year.

Renewable Purchase Obligations

The Punjab State Electricity Regulatory Commission (PSERC) has brought out the Renewable Purchase Obligation and its Compliance Regulations, 2011 that specifies the quantum of Renewable Purchase Obligations (RPO) from solar and non-solar sources. The obligated entities include the distribution licensee, captive and open access consumers. Table 1 below specifies the RPO obligations for the state.

Table 1: RPO for Punjab

Year	Minimum Purchase from renewable sources	
	Total RPO (%)	Solar RPO (%)
2011-12	2.37	0.03
2012-13	2.83	0.07
2013-14	3.37	0.13
2014-15	3.81	0.19
2015-16	3.9	1.0
2016-17	4.1	1.3
2017-18	4.2	1.8
2018-19	4.3	2.2
2019-20	4.5	2.5

Source: PSERC RPO Regulations 2011

Focus areas

Some of the major focus areas identified by PEDA for the state of Punjab are:

- Small Hydel Projects on Canal falls.
- Biomass/Agro Residue based power projects.

- Cogeneration power project in Sugar Mills and Paper industry.
- Solar Photovoltaic based technologies.
- Solar Thermal Systems.
- Biogas Development Program
- Energy Conservation in agriculture, industrial, commercial and domestic sector.
- Promotion of Renewable Energy Devices for daily use.

Solar

Punjab receives an estimated at 4-7 units/m2 of solar insulation levels indicating that it has high potential for solar power. Punjab government is targeting solar power generation of 1,000 MW by 2017 and is targeting to operationalize 500 MW solar power projects by March, 2016. It has currently operationalized 117 MW of solar power projects.

Punjab floated a tender in December 2014 for the second phase of allocations in the state for 250 MW of solar PV projects. Projects were divided into three categories: category one was for a total of 50 MW with project sizes between 1 MW and 4 MW, category two was for 100 MW with project sizes between 5 MW and 24 MW and category three was for 100 MW with project sizes between 25 MW and 100 MW. It was noted that developers preferred larger projects (as category three projects were heavily oversubscribed) with comparatively lower transaction costs and more options for financial engineering.

Solar PV projects in the state are primarily of three types

1. Ground Mounted

2. Rooftop

    a. Gross Metering

    b. Net Metering

3. Canal mounted

Solar power PPAs in the state are for 25 years with payment security mechanisms. The discom PSPCL has been given B+ credit rating by ICRA.

Punjab has also installed 6,500 solar street lights, 1,950 solar water pumps so far. Currently the rooftop solar projects in the state amount to approximately 8.52 MW of installed capacity. Punjab also has the world's largest single rooftop solar power project of 7.52 MW (L&T Constructions) consisting more than 30,000 panels spread over an area of 94,000 m2. The energy generated from the plant is being fed to the local grid through PPA with the state distribution company.

Small Hydro

The potential power generation capacity of the state from its extensive canal systems is about 250 MW at Canal falls, out of which 133 MW capacity projects are in operation. Canal systems are being harnessed to generate electricity through building small, mini and micro hydel units across these canals. Another 23 MW capacities are under execution including hydel projects undertaken by Punjab State Power Corporation Limited (PSPCL). The State Government is targeting to exploit the total potential by the year 2022. In addition to the sites already identified by PEDA in association with Punjab Irrigation Department (PID) and PSPCL, private investors can also apply for self-identified sites in case of small/mini hydel projects, which are not included in the list of projects identified by PEDA.

Wind

As per an earlier Wind Resource Assessment carried out in Punjab, there was insufficient wind speed at lower heights (25 Mtrs.). However, there is a possibility of higher wind speeds at heights close to 100 meters, which can be harnessed with the improvement in low speed wind power technology. PEDA has recently signed MoUs with two major wind power companies for wind resource assessment and on completion of the wind speed assessments.

Biomass

Punjab is primarily an agrarian economy and holds large potential for energy generation from agro- residues (cotton stalks, paddy husk, paddy straw etc). It is proposed to achieve a target of 600 MW power generation in this sector by 2022. Also the existing industries like Sugar, Paper and others have still an estimated unexploited potential of about 500 MW of co-generation.

Large Biogas plants: A 1 MW High rate Biomethanation Projects (biogas) based on anaerobic digestion technology for Recovery of Energy from Dairy Waste has been operational at Haibowal, Ludhiana since 2004. There are plans are on to increase the capacity of energy generation from 1MW to 10 MW. Another project of similar capacity ~ 1MW has been approved in Jalandhar. It will also be Cattle Dung based Power Project.

Small biogas plants: Numerous biogas plants of about 6m3 size have been installed across the villages in Punjab. The individual families in the villages have been beneficiary as PEDA has provided financialsubsidies for setting up the same.

Co-generation: Co-generation technologies are used for converting dry biomass (crop residues) for cogeneration in sugar, paper, fertilizer chemical, textile and other industries. These industries together have an estimated co-generation potential of 500 MW. As of December 2013, about 382 MW of power was commissioned through co-generation. It is proposed to encourage the industry to set up co-gen plants and achieve capacity addition of 500 MW by 2022.

Power generation from Biomass/Agro-residue and waste: It is estimated that surplus agro residues (including rice straw) and agro industrial/processing waste produced annually can

generate 1500 MW of power. PEDA has so far allocated a total of 200 MW capacity Biomass Power Plants in the state and, seven projects of total capacity 62.5 MW have been commissioned. The State Government targets harnessing total potential by the year 2022. One Independent Power Producer (IPP) Biomass project is to be allocated in a tehsil in the state so as to provide for a sufficient command area for biomass resource as fuel for the project.

Urban Municipal and Industrial Liquid and Solid Waste

At present about 5,000 MT of municipal, urban and industrial solid waste is being produced every day in the urban areas of the State. Introducing scientific processing and treatment of this quantity of waste would add to power generation besides being environmentally benign. Punjab intends to launch 5 such projects in the state. PEDA is to be the facilitator for waste to energy projects, where department of Local Government is directly involved in project allotment. (PEDA will allot waste to energy projects to private developers based on cattle dung, vegetable waste, poultry waste and so on for power generation through bio-methanation process on first come first serve basis as self-identified projects.

Barriers

Lack of enforcement of RPOs: The RPO is the biggest driver for the uptake of renewable energy by state utilities and captive users (obligated entities). The RPO regime is an instrument for stimulating renewable energy investments. However lack of RPO enforcement has led to concerns about the final purchase of renewable power. The state discoms will have to start taking RPOs seriously and state regulatory authorities would have to hold the discoms responsible and penalize them for failing to comply on purchase obligations. Instead of forcing defaulters to buy RECs (Renewable Energy Certificates) to cover shortfall in power purchase, states are allowing the obligated entities (such as DISCOMs and captive consumers) to 'carry forward' deficits to the next financial year. There also needs to be harmonization of the state-level RPO targets with the national targets.

Off taker risk: The creditworthiness of the distribution companies is a critical issue and plays a key role in determining the bankability of a PPA (Power Purchase Agreement). Very few discoms are in good financial health. When discoms have poor financial health, the risk of off-taker default and delayed payments is high. Weak financials of discoms will keep them from meeting commitments and affects the effectiveness of instruments that have been put in place for deployment of renewables. Recently the Electricity Regulatory Commission of Uttarakhand imposed a penalty on its discom for not complying with its renewable power obligation (RPO) target. Such actions are important for proper functioning the renewables sector.

Permits and Land acquisition: There is a need to streamline, accelerate, and standardize the acquisition of permits, clearances, and other administrative hurdles that the developer must cross. These relate particularly to land acquisition and environmental permitting. Acquisition of land is a critical aspect for infrastructure development and the approval processes and inability of the state governments to provide an effective single-window clearance to developers has caused considerable challenges. Lack of coordination among

key organization like revenue department, state pollution control board, grid operators has led to time and cost overruns resulting in high transaction costs. A robust system setting a time bound target for getting all approvals without having to follow up with different state government departments needs to be put in place for renewable energy developers.

3 Punjab Roadmap

Short Term Plan: By 2020

- Maximize and improve the share of new and renewable sources of energy to 10% of the total installed power capacity in the state by 2022.
- Exploit the potential power generation capacity of the state from its extensive canal systems (about 250 MW)
- Use unproductive land to promote development of Solar Parks by Private Sector Developers (by purchasing of agricultural land or acquiring government land). A 1000 MW Solar part can be developed under PPP model. All possible incentives should be extended to companies setting up solar parks under the state's industrial policy and under investment promotion schemes.
- Encourage solar power generation and promote Stand Alone, Rooftop and IPP projects to achieve installed capacity of 1000 MW with net-metering agreement between consumers and Discoms.
- Mega Solar Power Projects of capacity greater than 500 MW should be encouraged and also be eligible for incentives under the state's Industrial policy and Investment Promotion Schemes. Two solar parks of 500 MW each should be targeted.
- Promote 'farm level solar power generation' where land-owing farmers can install solar power projects of 2-3 MW capacity. Such projects can have multiple purposes of generating clean energy, tackling the issues of land scarcity, result in additional income for the farmer as well as foster skill development. Up 500-1000 MW power generation can being targeted.
- Energy generation from agro-residues like cotton stalks, paddy straw, paddy husk etc: A target of 600 MW power generation should be set in this sector. Additionally the existing industries like sugar, paper and others have an estimated unexploited potential of 500 MW of co-generation.
- Introduce scientific processing and treatment of Municipal, Urban and Industrial solid waste. Such waste to energy projects can be developed to target an additional 50 MW power generation.
- Increase coverage of solar street lighting in rural areas putting 3000 solar lighting systems each year.

Medium Term Plan: By 2030

- Promote renewable energy initiatives for meeting energy / lighting needs in rural areas and supplementing energy needs in urban, industrial and commercial sectors.
- Create conducive conditions for attracting private sector investment in NRSE projects along with broader participation by public community/civil society.
- Provide decentralized renewable energy for agriculture, industry, commercial and household sector particularly in rural areas thereby improving the quality of power and reducing transmission & distribution losses.
- Give support to specific NRSE projects and schemes for generating energy and conserving energy through energy efficiency.
- Support research and development, demonstration and commercialization of new and emerging technologies in renewable energy sector such as fuel cell, hydrogen and chemical energy, alternate fuels for transportation etc.
- The State should promote and incentivize decentralized and off-grid solar applications, including hybrid system to meet electrical and thermal energy requirements for domestic and commercial use.
- Punjab produces a large amount of paddy straw and its burning results in serious environmental damage. Punjab has an opportunity to set up second generation bio-ethanol refineries using paddy straw as feedstock. Such plants would also be able to generate co-products of biogas, pellets and compost; result in additional income for farmers for supply of paddy straw; creation of a number of direct/indirect jobs; and lower petrol/diesel usage.
- Energy Plantations, Rice mills integrated small capacity Biomass Plants: Land in areas that are degraded/waste land in Punjab can be used for raising dedicated plantations of fast growing high yielding plant species such as Bambusabalcooa, Meliadubia, etc. for generating decentralized energy needs on sustainable basis in rural areas. Small capacity biomass plants in IPP mode up to 5 MW capacities only based on dedicated energy plantations or integrated in rice mills can be setup with the condition that 50% of the biomass used has to be rice straw. These projects cannot infringe upon the command area of the allocated Taluka based biomass IPP projects. These small capacity projects can be set up in technology neutral mode i.e. Rankin cycle, Gasification cycle or Otto cycle.

Long Term Plan: By 2047

- Creation of conducive conditions for attracting private sector investment along with broader participation by public community/civil society.

- Provision of decentralized renewable energy for agriculture, industry, commercial and household sector particularly in rural areas thereby improving the quality of power and reducing transmission & distribution losses.
- Supporting specific projects and schemes for generating energy and conserving energy through energy efficiency.
- Support research and development, demonstration and commercialization of new and emerging technologies in renewable energy sector such chemical energy, geothermal energy, and bio fuels
- Support research and development, demonstration and commercialization of Hydrogen production, storage and distribution.
- Promote research and commercialization of storage technologies including fuel cells
- Initiate move to electrify automotive transportation or develop electric vehicles — plug-in hybrids.

About TERI

A unique developing country institution, TERI is deeply committed to every aspect of sustainable development. From providing environment-friendly solutions to rural energy problems to helping shape the development of the Indian oil and gas sector; from tackling global climate change issues across many continents to enhancing forest conservation efforts among local communities; from advancing solutions to growing urban transport and air pollution problems to promoting energy efficiency in the Indian industry, the emphasis has always been on finding innovative solutions to make the world a better place to live in. However, while TERI's vision is global, its roots are firmly entrenched in Indian soil. All activities in TERI move from formulating local- and national-level strategies to suggesting global solutions to critical energy and environment-related issues. TERI has grown to establish a presence in not only different corners and regions of India, but is perhaps the only developing country institution to have established a presence in North America and Europe and on the Asian continent in Japan, Malaysia, and the Gulf.

TERI possesses rich and varied experience in the electricity/energy sector in India and abroad, and has been providing assistance on a range of activities to public, private, and international clients. It offers invaluable expertise in the fields of power, coal and hydrocarbons and has extensive experience on regulatory and tariff issues, policy and institutional issues. TERI has been at the forefront in providing expertise and professional services to national and international clients. TERI has been closely working with utilities, regulatory commissions, government, bilateral and multilateral organizations (The World Bank, ADB, JBIC, DFID, and USAID, among many others) in the past. This has been possible since TERI has multidisciplinary expertise comprising of economist, technical, social, environmental, and management.

The Energy and Resources Institute
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