

Low Cost Financial Models for
Renewable Energy Projects and
Promotion of financing

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PREFACE

I am pursuing my post graduation in Economics from Gokhale Institute of Politics and Economics. Being an economics student, I have always had keen interest in public policy and social issues, owing to the quantitative and qualitative rationale that this subject equips one with. Issues related to the public sector and the economics involved in it has always intrigued me thus I decided to pursue my internship in a similar sphere and Rakshak Foundation provides a great platform for public policy research. This foundation has a unique internship structure which caters to one's intellectual development by providing one with an eminent mentor and a diverse group of peer interns to work with. The internship programme has a rigorous framework which keeps us motivated to work regularly and manage time effectively. During these two months of internship, I have had various worthwhile experiences ranging from interaction with dignitaries to on field experiences. The research methodology we follow here is embedded with necessary guidelines which make this internship more primary research oriented and thus makes it feasible to come up with original and feasible solutions by the end of the research.

My research topic demands a low cost financial model for renewable energy projects to promote their financing so that more incumbents take interest in this sector. Thus my basic aim is to focus on low cost technologies in the renewable sector. I hope to do a fair job in proposing certain feasible solutions taking into consideration the social as well as environmental impact of the same.

By the end of this internship, I hope to gain experience on primary research focused on the analysis of the ground realities that hamper development of the renewable sector. The objective of this project is to try to propose a long/short term power supply solutions at grid as well as off grid levels to cater to the problems at micro and macro level of power deficit and fuel deficiency for other purposes. Even after numerous policies by the government and concerned ministries, there is still major scope for tapping the future potential of these natural imperishable sources of energy. Thus through my research, I aim to come up with ways to increase the technical and financial viabilities of RE projects (with special emphasis on Solar technology).

Acknowledgement

I would like to express my gratitude and regards to my mentor Shri Alok Srivastava (IAS officer, Joint Sec. , MNRE) for his valuable guidance and supervision. It is because of my mentor's help to provide me with a far sighted insight for my research and at the same time helped me to focus on important issues to streamline the research and make it more feasible given the time constraint.

I also take this opportunity to thank the executives of IREDA who have guided my throughout and provided with suggestions to make suitable changes in the task line to make it more feasible. My special thanks to Mr. Rakesh Bhalla (financial advisor, IREDA) for his constant guidance on the project and helping me to meet with the right people for further guidance

I am obliged to the Rakshak Foundation to have provided me with the best research environment with supportive coordinators and helpful fellow interns who have make this internship a worthwhile experience.

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Contents

LIST OF FIGURES.....	5
LIST OF TABLES	6
EXECUTIVE SUMMARY	7
1. INTRODUCTION	9
1.1.1 Why do we need renewable energy resources?.....	9
1.1.2 Policy Initiatives in India	11
1.1.3 Need of efficient project financing for RE projects	12
1.3 GOALS AND OBJECTIVES	16
2. METHODOLOGY	18
2.1 LITERATURE SEARCH	18
3. MEETINGS AND INTERVIEWS	23
3.1 MENTOR MINUTES	23
3.2 OTHER INTERVIEWS	25
4. GOVERNMENT EFFORTS	27
4.1 COMMON POLICIES	27
4.2 SOLAR DEVELOPMENT SCHEMES	29
5. RESULTS AND DISCUSSIONS	31
5.1 FINDINGS FROM THE LITERATURE.....	31
5.2 FINDING FROM THE FIELDS AND IMPACT ON THE THEORETICAL FOCUS OF THE PROJECT	33
5.2 GAP ANALYSIS.....	35
5.2.1 Government Policies.....	35
5.2.2 Gaps/Barriers:.....	36
6. RECOMMENDATIONS	37
6.1 SOLAR OFF GRID ENERGY SYSTEMS:.....	37
6.2 GRID CONNECTED SOLAR PROJECTS:.....	39
6.2.1 Appraisal for loans for grid connected solutions:	40
6.3 RECOMMENDATIONS: REASON, SCOPE AND STRATEGY.....	50
6.3.1 Introducing Energy Micro financing as a financial alternative for Renewable Energy projects	51
6.3.1 Public Private Partnerships in the Renewable Sector	53
6.3.3 Making contribution towards RE projects a part of Corporate Social Responsibility (CSR)	55
6.3.4 Proper Appropriation of National Clean Energy Fund	57
6.3.5 Encouraging Interest Subsidies	59
6.3.6 Appraisal mechanism to be followed by financial institutions for RE projects	61
6.3.7 Improving the Renewable Energy Certificates Market through policy amendments	63
6.3.8 Categorizing incentives and subsidies	65
7. CONCLUSION	67
8. REFERENCES.....	68

APPENDIX A.....	69
MENTOR MEETINGS.....	69
1. Discussion in the first Mentor Meeting.....	69
2. Discussion in the Second Mentor Meeting.....	72
3. Discussion in the Third Mentor Meeting.....	73
FIELD VISITS.....	73
1 Discussion Details of First Field Visit.....	73
2.Discussion Details of Second Field Visit.....	75
3.Discussion Details of Third Field Visit.....	75
4.Discussion Details of Fourth Field Visit.....	76
5.Discussion Details of Fifth Field Visit.....	77
6.Discussion Details of Sixth Field Visit.....	78

List of figures

Figure 1 : Project Financing (Source: www.wsgr.com)	13
Figure 2: Air Emissions in 2008 (Source: Report by “Western Resource Advocates”)	15
Figure 3: Refinancing.....	16
Figure 4: Appraisal Mechanism of IREDA for solar projects	17
Figure 5: Fuel Wise Capacity (Source: MNRE).....	20
Figure 6: Jawaharlal Nehru National Solar Mission Timeline (Source: Wikimedia Commons)	28
Figure 7: SELCO Business Model for rural lightening.....	32
Figure 8: Energy Import Division (Source: Report by International Energy Agency)	33
Figure 9: Potential Capacity and Installed Capacity (Source: MNRE)	34
Figure 10: Solar Photovoltaic System (Source: www.greenenergytimes.net)	38
Figure 11: Solar Lamps without Photovoltaic cells (Source: Report at ETSAP meeting, Lisbon, Dec 10, 2012).....	38
Figure 12: Solar Lamps with PV Cells (Source: Report at ETSAP meeting, Lisbon, Dec 10, 2012).....	39
Figure 13: Grid-Tiered Solar Electric System (Source: Website of “Enlighten Power Solutions”)	40
Figure 14: Sample Project Appraisal Form of IREDA (Source: IREDA)	49
Figure 15: Framework for Recommendation #1	52
Figure 16: Framework for Recommendation #2	53
Figure 17: Framework for Recommendation #3	55
Figure 18: Framework for Recommendation #4	57
Figure 19: Framework for Recommendation #5	59
Figure 20: Framework for Recommendation #6	62
Figure 21: Framework for Recommendation #7	64
Figure 22: Framework for Recommendation #8	65

List of Tables

Table 1 : Plan Wise Capacity Installed (Source: MNRE)	20
Table 2: Off Grid Deployment (Source: MNRE)	21
Table 3: Stipulated Renewable Capacity (Source: MNRE)	22
Table 4: Goals for off grid deployment of RE till 2022 (Source: MNRE)	22
Table 5 : Interview Details	25

Executive Summary

The use of renewable energy sources is the need of the hour despite of the uncertainties they face. The environmental concerns and shortage faced in the supply of conventional sources of power like coal and fossil fuels as against the ever increasing demand for power has put forward major emphasis on the adoption of renewable energy projects for a sustainable future. But even the renewable sector is not free from blockages; the major bottleneck is concerned with the technical and financial viability. For instance, per unit production of electricity is much lesser in case of conventional sources than that of renewable sources (except hydro). Also the capital investment required also surpasses the feasible limits, thus financing of these projects becomes the major deciding factor when one thinks of entering the renewable market.

Project financing in itself is a major task which takes into consideration all the factors that directly or indirectly affect the **risk to return ratio of the project**. Thus the main aim of my project is to provide with low cost solutions for renewable energy projects. The renewable sources include energy from water (up to 25 MW), sunlight, wind, tides, solid waste, and biomass. Since the ambit of this sector is too wide and a single financial model cannot cater to the diversity of these technologies, it is more feasible to focus on one single renewable source which has the potential to provide a long term solution to the power crisis and prove as a sustainable source of energy for varied purposes.

In a country like India which experiences tropical climate has great potential for tapping solar energy and its usage thereafter. Thus the Ministry of New and Renewable Energy published **Jawaharlal Nehru National Solar Mission in 2008**. The objective of the Jawaharlal Nehru National Solar Mission (JNNSM) under the brand 'Solar India' is to establish India as a global leader in solar energy, by creating the policy conditions for its diffusion across the country as quickly as possible. The Mission has set a target of 20,000 MW and stipulates implementation and achievement of the target in 3 phases (first phase up to 2012-13, second phase from 2013 to 2017 and the third phase from 2017 to 2022) for various components, including grid connected solar power. The successful implementation of the JNNSM requires the identification of resources to overcome the financial, investment, technology, institutional and other related barriers which confront solar power development in India. The penetration of solar power, therefore, requires substantial support. The policy framework of the Mission will facilitate the process of achieving grid parity by 2022.

The aim of this project is a long term goal which will only be achieved once the financial blockages are removed totally and availing low cost finance becomes a viable option. Thus through this report my sole aim is to provide an insight into the

long term goal of attaining grid parity through use of renewable energy as source of power. Due to time constraints, focus would be on proposing low cost solutions to solar energy projects and will cater to both grid and off grid energy systems with special reference to rural electrification and environmental concerns.

Through this report certain recommendations have been suggested which aim to make the renewable energy projects more viable in implementation and at the same time more cost effective. There are eight recommendations:

- Introducing **Energy Micro financing** as a financial alternative for Renewable Energy projects.
- **Public Private Partnerships** in the Renewable Energy Projects
- Making contribution towards RE projects, a part of **Corporate Social Responsibility**.
- Proper Appropriation of **National Clean Energy Fund**
- Encouraging **Interest Subsidies**
- **Improved appraisal mechanism** to be followed by financial institutions for RE projects.
- Improving the **Renewable Energy Certificates Market** through policy amendments
- **Categorizing Interests and Subsidies**.

Thus through these suggestive recommendations, the report aims to make the renewable energy market more efficient through providing the framework for all recommendations which if applied would make financing of these projects more viable and cost effective and thus help renewable energy sources penetrate deeper into the power sector with sustainable solutions to the problem of power deficit and oil/fuel scarcity.

1. Introduction

1.1 Background Information

1.1.1 Why do we need renewable energy resources?

India has great potential to accelerate the use of its endowed renewable resources to power its growing economy with a secure and affordable energy supply. The Government of India recognizes that development of local, renewable resources is critical to ensure that it is able to meet both its economic and environmental objectives, and it has promoted this development through policy action.

The Indian economy has experienced tremendous growth over the past several years. Energy, in all its forms, underpins both past and future growth. For the Indian economy to continue this trajectory, India needs to address its energy challenges, which cross all sectors and impact all citizens. Electricity—both in terms of quality and access—is a key challenge.

The quality of the current electricity supply is impeding India's economic growth. Issues such as voltage fluctuation, frequency variation, spikes, black-outs, brown-outs, and other disruptions impact industrial, commercial, and residential consumers. The addition of grid tied renewable power can help address these issues. The gap between the demand of customers connected to the grid and the available electricity supply reported by the Central Electricity Authority for 2009–2010 was almost 10% of the total requirement. The peak demand deficit was more than 15 GW, corresponding to a shortage of 12.7%. Closing this gap will be critical for India to achieve its growth targets, and renewable energy has the potential to improve energy security and reduce dependence on imported fuels and electricity while striving to meet those goals. Much of India's population is not experiencing the benefits of economic growth. The Government of India sees the provision of electricity to all as critical to inclusive growth. It recognizes off-grid renewable energy as a practical, cost-effective alternative to an expansion of grid systems in remote areas of the country. To be able to provide adequate electricity to its population, India needs to more than double its current installed capacity to over 300 GW by 2017. Also, India's demand for oil in 2015 is expected to be 41% higher than in 2007 and almost 150% higher in 2030—needed primarily to feed a growing transportation sector. The Indian government is aware of the size and importance of the challenges and that success will depend on structural changes in the industry and on new technologies and business models.

Renewable energy is well positioned to play a critical role in addressing this growing energy demand for the following reasons:

- Indian natural resource abundance. India has abundant, untapped renewable energy resources, including a large land mass that receives among the highest solar irradiation in the world, a long coastline and high wind velocities that provide ample opportunities for both land-based and offshore wind farms, significant annual production of biomass, and numerous rivers and waterways that have potential for hydropower.
- Renewable energy provides a buffer against energy security concerns. India's use of its indigenous renewable resources will reduce its dependence on imported, expensive fossil fuels.
- Renewable energy offers a hedge against fossil fuel price hikes and volatility. Increased competition for limited fossil resources is projected to push prices up, while increased deployment of renewable technologies pushes prices down in line with technology improvements and economies of scale. For example, oil prices in 2030 are projected to be 46% higher than in 2010 while the investment costs for photovoltaic (PV) systems are expected to decrease to less than half of their 2007 levels over the same time period.
- Off-grid renewable power can meet demand in un-served rural areas. As a distributed and scalable resource, renewable energy technologies are well suited to meet the need for power in remote areas that lack grid and road infrastructure.
- Renewable energy can be supplied to both urban and rural poor. Renewable energy technologies offer the possibility of providing electricity services to the energy poor while addressing India's greenhouse gas (GHG) concerns and goals.
- Renewable energy can support attainment of India's climate change goals. Through its National Action Plan on Climate Change (NAPCC) and through its recently announced carbon intensity goal, India has made a commitment to its carbon emissions.
- India aims to be a global leader in renewable energy. India's intention to play a leadership role in the emergent global green economy is driving investment in renewable energy technologies. Recognizing the magnitude of the potential demand for renewable energy, India is attracting significant investment in renewable energy.

1.1.2 Policy Initiatives in India¹

In 1992, the Government of India established MNRE, the world's first ministry committed to renewable energy. MNRE is dedicated to expanding contributions of renewable energy in all of India's end-use sectors and undertakes policy and planning activities to that end. MNRE also supervises national-level renewable energy institutes such as the Solar Energy Centre and the Centre for Wind Energy Technology.

The Indian Renewable Energy Development Agency (IREDA) provides financial support and innovative financing for renewable energy and energy efficiency projects with funds from the Indian government and multilateral lending agencies. IREDA also administers the central government's renewable energy incentive programs. Other government institutions with direct responsibilities that extend into renewable energy include several units under **the Ministry of Power, the Planning Commission, and the Prime Minister's Council on Climate Change**.

The Government of India has enacted several policies to support the expansion of renewable energy. Those that apply to more than one renewable technology include the following:

- **Electricity Act 2003:** Mandates that each State Electricity Regulatory Commission (SERC) establish minimum renewable power purchases; allows for the Central Electricity Regulatory Commission (CERC) to set a preferential tariff for electricity generated from renewable energy technologies; provides open access of the transmission and distribution system to licensed renewable power generators.
- **National Electricity Policy 2005:** Allows SERCs to establish preferential tariffs for electricity generated from renewable sources.
- **National Tariff Policy 2006:** Mandates that each SERC specify a renewable purchase obligation (RPO) with distribution companies in a time-bound manner with purchases to be made through a competitive bidding process.
- **Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) 2005:** Supports extension of electricity to all rural and below poverty line households through a 90% subsidy of capital equipment costs for renewable and non-renewable energy systems.
- **12th Plan 2012-17:** The government emphasizes on the need of sustainable development and adoption of clean fuel and cost effective technologies. India has been actively involved in international forum relating to environmental protection, and has been part of 94 Multilaterals

¹ Extracts from recent policies adopted by the government of India for better access to power and distribution of the same

Environmental Agreements such as the Ramsar Convention on Wetlands, Convention on International Trade in Endangered Species of Fauna and Flora (CITES), Convention on Biological Diversity (CBD), among many others. India has also signed the United Nations Framework Convention on Climate Change, and has acceded to the Kyoto Protocol in 2002. India has communicated its voluntary mitigation goal of reducing the emissions intensity of its Gross Domestic Product (GDP) by 20–25 per cent, over 2005 levels, by 2020.

- **Integrated Energy Policy:** The Integrated Energy Plan prepared by the Planning Commission is an important document for it lays down estimates for our energy and electricity needs for the next 25 years making explicit its basis, assumptions and methodologies. It also lists possible supply options, giving several scenarios, and emphasizes the importance of Demand Side Management and energy efficiency.

Apart from common policies there have been sector specific policies aiming to encourage the renewable sector through diverted approach in sectors respectively. For instance, in order to make the solar technologies more efficient and user friendly. **Jawaharlal Nehru National Solar Mission**, officially launched in November 2009 aims to incentivize the installation of 22,000 MW of on- and off-grid solar power using both PV and CSP technologies by 2022 as well as a large number of other solar applications such as solar lighting, heating, and water pumps. As the power trading arm of the National Thermal Power Corporation (NTPC), **NTPC Vidyut Vyapar Nigam Ltd (NVVN)** has been designated as the nodal agency to ensure the execution of Phase 1 of the mission. JNNSM aims to address the shortcomings of prior schemes through revised and more attractive feed-in tariffs, a single-window application process, and RPOs that include a solar purchase obligation.

1.1.3 Need of efficient project financing for RE projects

Apart from the government initiatives and the dire need of a successful renewable market in our country and worldwide, the basic requirement for the success of the renewable energy projects is a properly channelled project financing mechanism which needs to go through a long way owing to the inherent uncertainties of these projects since they are dependent on nature which does not promise any certain amount of sunlight or wind for a particular period of time. Thus in order to get these projects financed, efforts have to be made to work on the appraisal mechanism of these projects on the other hand the funding of these projects should be done so as to make them less costly for borrowers by charging lesser rates of interest. Government has made efforts to encourage these projects by introducing schemes like **Accelerated Depreciation** or making **NVVN** (subsidiary of NTPC) enter into PPA with every IPP and then supplies the collected power from

all sources to the state electricity boards (SEB). But there exists major untapped potential in our country when it comes to renewable sources.

Appraisal mechanism involves analyzing the economic, financial, and technical viability of the project and simultaneously weighing its environmental impacts on the society. Thus appraisal of these projects is the major deciding factor when lending funds. Therefore more scrutinized appraisal leads to better viability of the project.

Typical Project Finance Structure

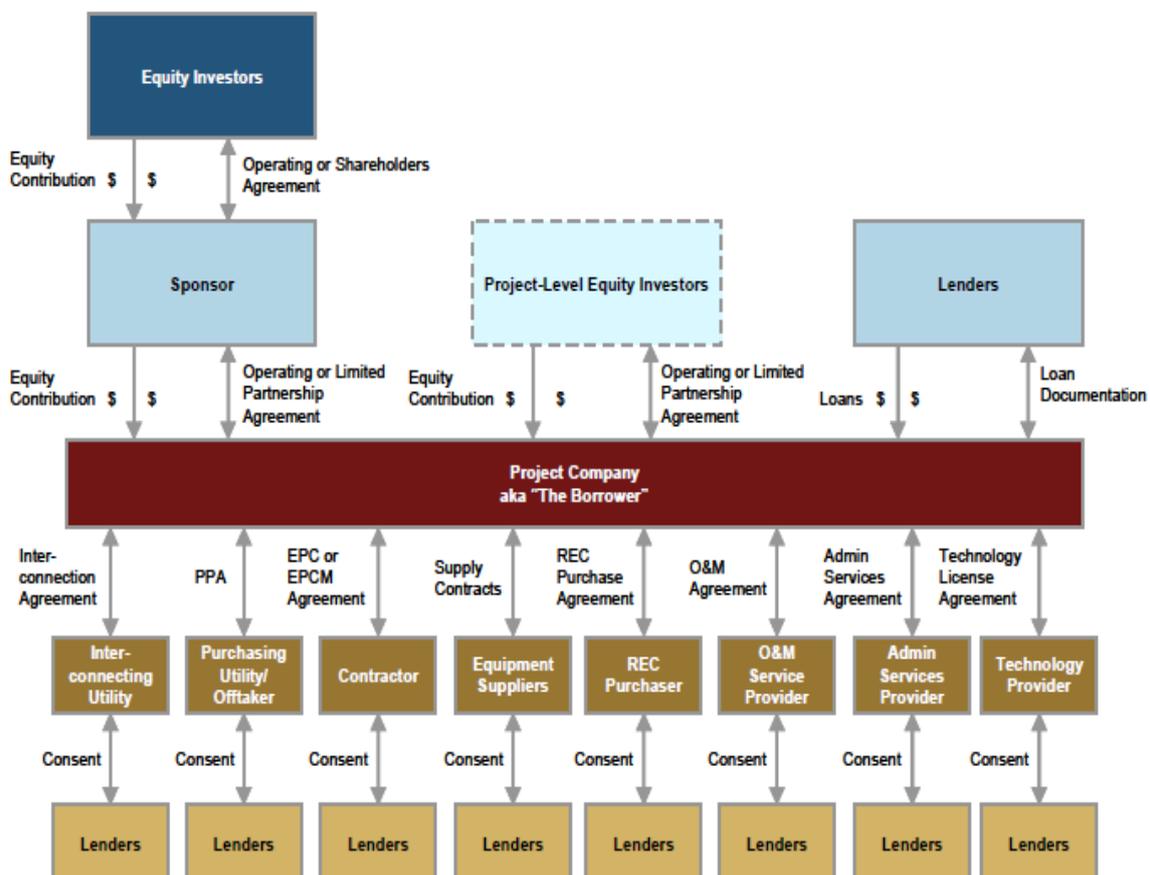


Figure 1 : Project Financing (Source: www.wsgr.com)

The above figure explains the proper channel followed in project financing in renewable energy projects.

1.2 Main Problems, their scope and impact on the society

The main problems can be identified as follows:

- **Power deficit in the country:** “India witnessed a peak power shortage of over 9,000 MW in April this year as scarcity of coal continued to haunt electricity generation. Peak power deficit or shortage in electricity supply when the demand is at its highest, stood at 6.9 per cent or 9,020 MW in the month of April, according to latest data by the Central Electricity Authority (CEA).” Thus the above information gives us a fair idea of the acute power deficit that India is in due to incessant surge in demand of electricity and scarcity of fossil fuels. This calls for a need for a source of power that can be replenished at a faster pace than they are utilized in production of electricity. And the sustainable solution to this is usage of renewable sources for producing electricity or using them for other applications like heating, cooling, cooking etc. Since the society as a whole suffers badly from power shortage due to transmission losses, lesser supply and wastage, prudent measures are required to address the same.
- **Reaching the poor:** It is a well known fact that the basic suffers of our country are the poor who are even devoid of the basic amenities of life and electricity is one such amenity which is very scarcely available in rural areas due to laxative policies and internal corruption. Rural Electrification (RE) is viewed as the key for accelerating rural development. Provision of electricity is essential to cater for requirements of agriculture and other important activities including small and medium industries, khaki and village industries, cold chains, health care, education, and information technology. The policy aimed at providing electricity to all in the rural areas by 2009 but it still lacks in implementation and still we can see many people spending their nights under the sky. Renewable come up with solutions to this problem where in poor people can avail off grid electricity solutions through small solar panels at their roof tops or indigenous biomass plants which can cater to a small community and work towards solving the major bottleneck o inaccessibility to electricity for the poor.
- **Depletion of fossil fuels:** The conventional sources of energy are on a fast decline due to their perishable nature thus sustainable solutions are required to solve the resultant power shortage. Thus renewable energy projects if taken on a larger scale for power production and other uses then

it can provide with a solution which would not put the future generations in to dangers of facing acute scarcity of resources.

- Environmental Degradation:** Owing to the ecological imbalances that is caused by appliances such as generators, cars, other appliances and vehicles using petrol, diesel and other fuels, there has been a greater realization to shift to alternative green technologies using renewable and sustainable sources of energy. The air pollution levels in metro cities, example being New Delhi has always been around critical levels thus the efforts of propagating use of fuel like CNG, but it alone does not solve the issue since it is too a compressed form of fuel. Thus renewable sources such as solar, wind and hydro comes to the rescue. Photovoltaics do not emit any pollutants into the atmosphere in contrast to coal- or gas-fired power plants. Average air emissions per gigawatt-hour (GWh) generated from natural gas-fired and coal-fired power plants and from PV projects in Arizona, New Mexico, Nevada, and Colorado in 2008 are shown in the table below:

Air emissions rates for power plants in 2008: AZ, CO, NM, and NV

RESOURCE TYPE	CO ₂ METRIC TONS PER GWH	SO ₂ METRIC TONS PER GWH	NOX METRIC TONS PER GWH
Gas-fired power plants	421	0.002	0.262
Coal-fired power plants	996	1.122	1.745
Photovoltaics	0	0	0

Figure 2: Air Emissions in 2008 (Source: Report by “Western Resource Advocates”)

By reducing air emissions, the impacts of power generation on human health, plants, and wildlife, and the contribution of power generation to climate change are all reduced. Thus, a major benefit of PV projects (as well as of many other

renewable energy technologies and energy efficiency) is improved environmental quality.

1.3 Goals and Objectives

The project is basically focuses on providing low cost solutions to Renewable Energy Projects using financial and non financial channels.

- **Financial alternatives** include ways to reduce the rate of interest charged on loans for these projects or use of indirect subsidies such as **capital subsidies** or schemes like **accelerated depreciation** to lower the cost of starting the project to the incumbent. In order to increase the rate of return of the project and diversify risk, refinancing can be used as an option which will distribute risk between the lender, equity shareholders and any government body like IREDA which finances RE projects.

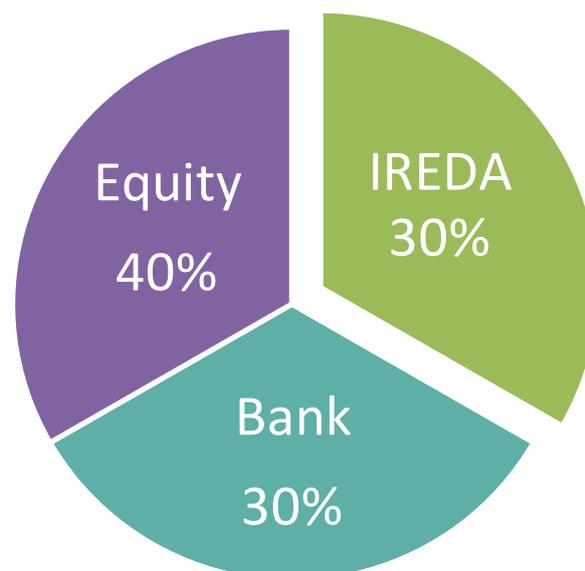


Figure 3: Refinancing

Represented above is the refinancing model for diverting risk in granting loans. With such an approach, any risk associated with the repayment default can be divided amongst the three parties equally and risk to return ratio improves which attracts more investors to finance these projects.

- Non financial Alternatives:** This basically refers to the appraisal mechanism that financial institutions follow in deciding to lend the projects. From my experience gained through interaction with the executives of IREDA, it has been realized that each project is scrutinized on its technical and financial viabilities very thoroughly. Also the projects for different technologies have a different appraisal mechanism, thus awareness of all technologies is required to understand the mechanism followed for different projects. This report would thus focus on projects of solar technologies since it is not feasible to focus on all renewable technologies and provide with a single solution for all. For instance for Solar PV technology, factors such as payback period, lifecycle cost, plant load factor, target buyers, state policies, risk appetite, substation analysis are taken into consideration during the viability analysis and any project which comes at par with all these requirements gains confidence from the investors and is thus provided with finance without facing any reluctance owing to presence of uncertainties since this appraisal is designed in a way to minimize the risk involved in the project.



Figure 4: Appraisal Mechanism of IREDA for solar projects

2. Methodology

2.1 Literature Search

Annual reports of MNRE, Integrated Energy Policy, Jawaharlal Nehru National Solar Mission (grid and off grid), Strategic Plan for New and Renewable Sector for the period 2011-17, papers on project financing for RE projects, solar energy potential in India form the background reading references for the research.

- Under the **annual reports of MNRE**, information regarding the current scenario of the solar, wind and hydro related projects and policies are given. It gives us an overview of the recent developments and the implementations so far in the renewable sector.
- **Integrated Energy Policy:** The integrated energy policy of India which was approved by the Cabinet in 2008, deals with energy strategy for the country which works at various levels to provide an integrated approach to this entire sector:
 - Consistent data collection and compilation.
 - Defining both the short and long-term energy demand scenarios.
 - Understanding the linkages between development choices in other sectors of the economy (eg. urbanisation, transport and agriculture) and the energy sector.
 - Pricing energy resources in a consistent manner as well as for ensuring consistency in the regulatory frameworks.

A key proposal of the policy that needs to be supported is that of **tax neutrality** across energy sources. This combined with full cost pricing should remove the grouse of the renewable energy industries regarding the absence of a level playing field to a large extent and give us a true estimate of cost difference between renewable energy and conventional energy forms. Having said that, and in support of the energy strategy of the country, the government should also ensure that the fiscal structure governing energy intensive appliances/equipments results in the economy moving to a more efficient, environmentally benign path. India has recognised the need to promote energy efficiency and to reduce energy demand for several decades, albeit without too much success in implementation. A serious exercise must be undertaken to determine the incentives required to move the economy in this direction and to compare the costs of these efficiency-led incentives against the real subsidies provided to various energy forms. The scale of India's energy challenge is

huge and the future quite uncertain. A large part of this uncertainty arises from factors that are beyond our control:

- The global demand/supply for energy that would impact availability and prices for India
- The technological progress that we might see internationally both in energy supply and consumption arising out of climate considerations as well as the discovery of newer energy forms.

It is, therefore, imperative for us to revisit this policy at periodic interval and be able to dovetail short-term requirements into a longer-term strategic vision.

- **Jawaharlal Nehru National Solar Mission:** It basically lays out the targets for the next decade or so to make India a major producer of energy through solar power. It is divided into three phases with different energy capacities to be installed during that period. After its inception, India Solar Market has faced tremendous progress in the last two years and has encouraged many rural projects to enhance the status of rural electrification.
- **Strategic Plan for New and Renewable Sector for the period 2011-17:** The imbalance in supply and demand in energy sources calls for serious efforts from the policy makers to augment energy supplies. The large dependence of India on imports for oil and other fuels has also put immense pressure on energy security of India. Difficulties of large hydro are increasing and nuclear power is also beset with problems. The country thus faces possible severe energy supply constraints. Renewable energy can make a substantial contribution in curtailing the Energy crisis. It is no longer “alternate energy”, but will increasingly become a key part of the solution to the nation’s energy need.

Below is the fuel wise installed capacity

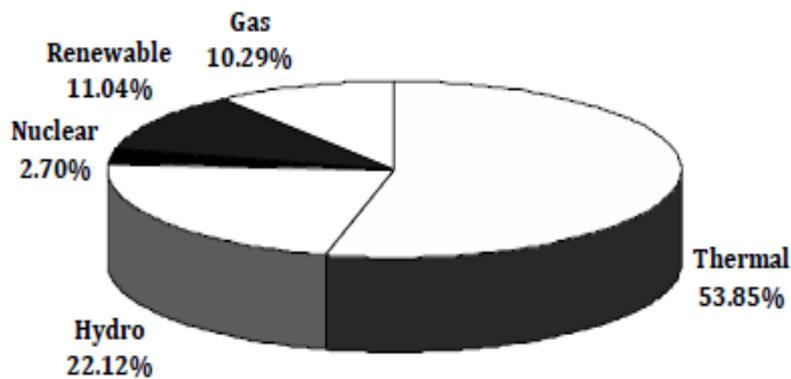


Figure 5: Fuel Wise Capacity (Source: MNRE)

Table 1 : Plan Wise Capacity Installed (Source: MNRE)

Resource	Estimated Potential (MW)	Capacity Addition (in MW)				Total capacity as on 31.12.2010
		Upto 9 th Plan	During 10 th Plan	Targets for 11 th Plan	During 11 th Plan upto 31.12.2010	
Wind power	48,500	1,667	5,427	9,000	5,973	13,066
Small Hydropower	15,000	1,438	538	1,400	963	2,939
Bio power*	23,700	390	795	1,780	1,427	2,632
Solar power	20-30MW/sq.km	2	1	50	14	18
Total		3,475	6,761	12,230	8,377	18,655

Table 2: Off Grid Deployment (Source: MNRE)

S.No	Resources	Cumulative Achievements (in MW) (upto 31.12.2010)
Off-Grid/Distributed Renewable Power (including Captive/Cogeneration Plants)		
1.	Biomass Power / Cogen.(non-bagasse)	274 MW
2.	Biomass Gasifier	128 MWeq
3.	Waste-to- Energy	68 MWeq
4.	Solar PV Power Plants	3 MWp
5.	Aero-Generators/Hybrid Systems	1 MW
	Total	460 MWeq
Decentralized Energy Systems		
1.	Family Type Biogas Plants	42.70 lakh
2.	SPV Home Lighting System	6,19,428 nos.
3.	Solar Lantern	8,13,380 nos.
4.	SPV Street Lighting System	1,21,227 nos.
5.	SPV Pumps	7,495 nos.
6.	Solar Water Heating - Collector Area	3.77 mln. sq.m.

MNRE has prepared this Strategic Plan for the period 2011-17 (covering the last year of the 11th plan and the next 5 years period of the 12th plan) and perspective till 2022, which seeks to articulate the goals of the Ministry, the strategy to be adopted by it during this period to achieve these goals and the corresponding action plan.

The key components of this Strategic Plan cover the following aspects:

- Vision, Mission and Objectives.
- Priority list for sources and technologies to be promoted.
- Important External and Internal factors which would impact the sector.
- Opportunities and threats for the sector.
- Key stakeholders; Government support needed for achieving the objectives / targets.
- Strategy for promotion of the sector and achieving the desired outcomes.
- Implementation Plan outlining the timelines, resources required and tools for tracking and measuring success.

Thus this plan gives an overview of the planned actions that the ministry plans to undertake in the next five years as similar to the five year plans put forth by the planning commission in every five years. The existing deployment of energy systems has been shown in the tables above while the stipulated capacity according to the plan can be shown as under:

Table 3: Stipulated Renewable Capacity (Source: MNRE)

Technologies	Biomass/ Agri waste	Bagasse Cogen.	U&I Energy	SHP	Solar	Wind	Total
SMART Targets for 2022 (MW)	2,500	4,000	800	6,600	20,000	38,500	72,400
Aspirational Goals (MW)	5,000	4,000	800	8,000	20,000	45,000	82,800

For off Grid Systems, the plan mentions various decentralized ways including decentralized solar systems, rural electrification, green buildings and cooking systems through off grid installations as summarized in the table below:

1.	Decentralised /Off-grid SPV systems	2000 MW-under Solar Mission 4000 MW- aspiration
2.	Solar Lighting	20 mln. households as under the Solar Mission
3.	Solar Thermal collectors	20 mln. sqm.- as under Solar mission
4.	Solar Concentrating Systems for heating / cooling applications	100-200 - on routine basis 1000 -aspiration
5.	Rural Electrification (New Initiatives) - Through Solar - Through Biomass	Reach 1,000 villages/ hamlets Reach 10,000 villages/ hamlets
6.	Improved Biomass Cook-stoves - Family - Community	10 million 0.5 million
7.	Green Buildings	200 mln. sqm.

Table 4: Goals for off grid deployment of RE till 2022 (Source: MNRE)

3. Meetings and Interviews

3.1 Mentor Minutes

The task line prepared for this project was -

- Understanding the concept of renewable resources and taking a look into various renewable energy resources and their viability. Then a study has to be made of the financial sector for such RE projects and who are engaged in to financing these projects. And at the end we look at the viability of low cost financing and why would these institutions be interested in such form of financing. Also we would look at the major blockages that come under the financing and how the whole market of finance works
- After looking into the different sources of renewable resources we focus on the financing of these projects. These projects are either financed by banks or financial institutions. The Ministry of new and renewable resources has set up a financial institution IREDA which was the first ever organization to initiate in renewable project financing and take all the risks and market for getting finance for these projects through other investors in the market , now as a result in present , though IREDA looks after the financial regulations and also financing , it is just some other player in the market as now we have big investors for large scale projects in the renewable sector.

Financing of these projects is an uphill task owing to the large manufacture infrastructure costs. Power is either provided through grid or off grid. In off grid , it refers to no infrastructural requirement and this is done through small indigenous plants like the aforesaid example of biomass plant but such production hardly counts at the macro level thus when we talk about the power generation even at a district level , we require grids . Now since the power supply in our country is ruled by the state governments thus all the various producers will have to sell electric power to the government. In our country the rate at which the electricity is provided to the public is highly subsidized , in lame terms it can be put if the buyer buys it at Rs10 per unit , the public gets it at Rs4 per unit . Thus it creates a monopoly in reverse where in high losses are suffered by the providers of electricity. This mismatch in the cost price and selling price proves as a biggest disincentive for the investors to provide finance because it leads it a reverse return to risk ratio where in risk of default is higher than the return. Thus subsidy in electricity becomes a blessing in disguise which puts growth of the power sector in a vulnerable state.

Talking internationally, China is the biggest solar panel manufacturing base in the world; it alone stands for the 50% of total production for the manufacture of the same. Countries like USA, UK have invested heavily in the renewable sector but the recent euro-zone crisis has led to withdrawals in such investments but it is regarded as a temporary setback and will see recovery soon enough. Thus now through this project we will aim to study the renewable sector and the financing of its projects deeply. Analyze the current scenario, decipher the blockages in the growth of the sector, look for low cost alternatives, attempt to design solutions to make financing much more lucrative and thus aim to increase the returns and reduce the risk on the RE projects. The risks remain high due to high subsidy in the power sector and also higher per unit cost of power from renewable sources than from conventional sources like fossils or coal.

The second meeting was concerned with financial aspect of the topic dealing with project financing. In order to start a project, these are the following basic factors, one looks at:

1. Capital required in the initial stage.
2. Cost of technology per mega watt of production
3. Financing alternatives
4. The target buyers of the production

My basic aim is to focus on the third factor and that is financing alternatives which invariably depend on all other factors, since capital requirements and cost implies the level of viability of the project. Under financing

1. There is a big mismatch in lending of funds in the renewable sector, this prevails due to the fact that the banks normally provide funds at the maturity periods from 8 to 10 yrs while the requirement of the RE projects is 15 to 20 years which this makes it difficult to avail full financial cover for these projects.
2. Another risk relates to the vulnerability of the RE projects due to their reliance on nature, thus increasing the uncertainty factor of these projects.

In order to explore more in to these problems I would narrow my report to study about the solar, wind and waste to energy related RE projects and will try to analyze their financial mechanism and viability factors.

Now the basic two parties in contact here are

1. Financial intermediaries or banks
2. Enterprises or companies engaged in RE projects.

The basic factors affecting both will be relevant for the study. For instance, from the viewpoint of the company, deeper scrutiny is required on the viability of the project and the cost of their techniques but main focus here will be on financial institutions which provide finance for they are the basic providers. For banks, the two factors play important role in the decision of lending, broadly financial and non financial factors. The high interest rates form a part of the financial blockages while bad appraisal of the RE projects is the non financial blockage.

Thus my basic aim is to address these blockages and this can be done by refinancing of the RE projects which would divide the risk among investors and thus improve the risk to return ratio and finding certain ways to improve the appraisal mechanisms of banks for these projects which can be done through making banks realize it is a socially desirable project and helpful in the long run.

3.2 Other Interviews

Table 5 : Interview Details

Date	Name	Designation	Institution	Topic of Discussion
31st May, 2013	Mr. R. Bhalla	Financial advisor	IREDA	Introduction to the renewable sector, role of project financing, financing procedure by IREDA, indirect and direct subsidies for RE projects.
3rd June, 2013	Mr. K. Yeptho	AGM(PTS)	IREDA	Project appraisal mechanism followed by solar department of IREDA with reference to all the technical details taken into consideration.
4th June, 2013	Mr K.B.K Reddy	AGM(PTS)	IREDA	Discussed the new task line with a narrowed approach focussing on the solar sector and the viable incentives' combination for low cost financing.
5th June, 2013	Ms. Debjani Bhatia	AGM(PTS)	IREDA	The meeting did not last for long since she was working in the wind sector and I wanted information about solar sector, thus the result of this meeting was just receiving a draft of the appraisal form of IREDA

29th June 2013	Mr. Rakesh Bhalla	Financial Advisor	IREDA	The discussion was regarding the scope of NCEF in refinancing or using in other activities, micro financing as a solution.
1st July 2013	Mr.K Yeptho	AGM	IREDA	Discussed about the recommendations of the report.

***Refer to Appendix A for more details on mentor discussions and field visits.**

4. Government Efforts

4.1 Common policies²

The Government of India has enacted several policies to support the expansion of renewable energy. Those that apply to more than one renewable technology include the following (technology-specific policies are discussed in the relevant chapters):

- **Electricity Act 2003:** Mandates that each State Electricity Regulatory Commission (SERC) establish minimum renewable power purchases; allows for the Central Electricity Regulatory Commission (CERC) to set a preferential tariff for electricity generated from renewable energy technologies; provides open access of the transmission and distribution system to licensed renewable power generators.
- **National Electricity Policy 2005:** Allows SERCs to establish preferential tariffs for electricity generated from renewable sources.
- **National Tariff Policy 2006:** Mandates that each SERC specify a renewable purchase obligation (RPO) with distribution companies in a time-bound manner with purchases to be made through a competitive bidding process.
- **Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) 2005:** Supports extension of electricity to all rural and below poverty line households through a 90% subsidy of capital equipment costs for renewable and non-renewable energy systems.
- **Eleventh Plan 2007–2012:** Establishes a target that 10% of power generating capacity shall be from renewable sources by 2012 (a goal that has already been reached); supports phasing out of investment-related subsidies in favour of performance-measured incentives. As of April 2010, 18 states had established RPOs or had draft regulations under consideration with RPO requirements ranging from 1% to 15% of total electricity generation. In January 2010, CERC announced the terms of a tradable Renewable Energy Certificate (REC) program. Under this program, generators choose between selling the renewable electricity generated at a preferential tariff and selling the electricity generated separately from the environmental benefits.

²Schemes/Policies by the government for power sector

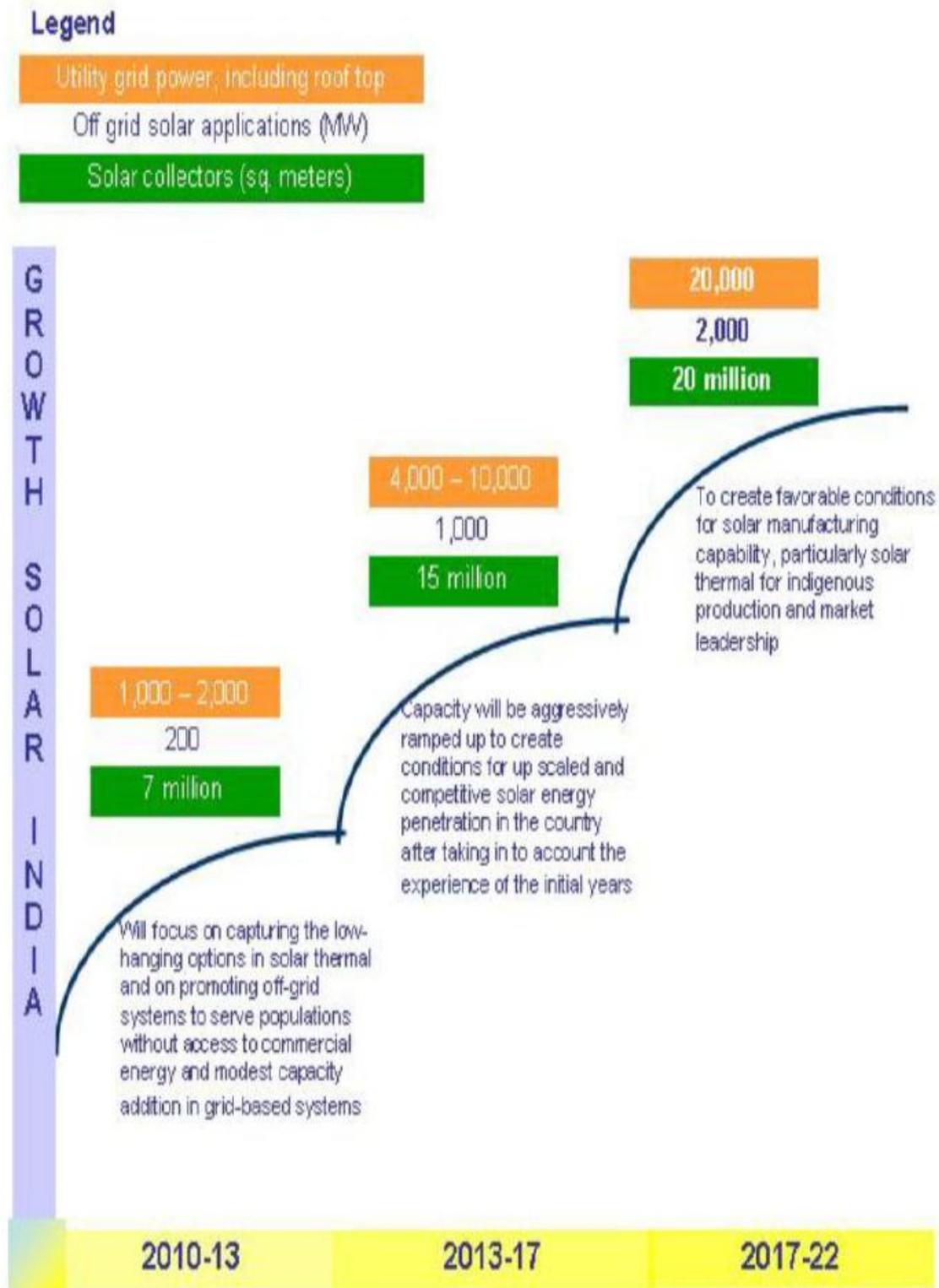


Figure 6: Jawaharlal Nehru National Solar Mission Timeline (Source: Wikimedia Commons)

4.2 Solar development schemes:

The power deficient regions with regular blackouts of 8-10 hours and large power demand from India's fast Growing Economy triggered government's attention to invest considerable time and money in this sector. There is a list of some of the existing MNRE schemes for solar energy development:

- Generation based incentive for grid interactive solar power generation projects (PV and Thermal both).
- Programme on "Accelerated development and deployment of solar water heating systems in domestic, industrial and commercial sectors".
- Revised Scheme on "Demonstration and Promotion of Solar Photovoltaic Devices/Systems in Urban Areas and Industry".
- Continuation of the Scheme on "Promotion of Solar Thermal Systems for air Heating/Steam generating applications, solar buildings and Akshay Urja Shops".
- Implementation of the programme on "Development of Solar Cities" during 11th Plan period including 2010-11.

As a developing country, India does not have binding emissions reduction targets, but voluntarily declared a reduction of 20-25 percent in missions intensity by 2020 compared to 2005, at the Copenhagen talks. India has been promoting renewable energy through its Ministry of New and Renewable Energy (MNRE) since the 1980s. Under **the Electricity Act (2003) and the National Tariff Policy (2006)**, the Central Electricity Regulatory Commission sets indicative preferential feed-in tariffs (FITs) for different grid-connected renewable energy technologies including solar, while individual state electricity commissions are free to adopt these tariffs or set their own norms.

The big push for solar came in 2010, when the Central Government of India launched the **Jawaharlal Nehru National Solar Mission (JNNSM)³**, which set a target of developing 22,000 MW of solar installed capacity by 2022.

- The mission stated the following deployment objectives – clean energy, energy security, environmental awareness and, most importantly, access to energy, given that a large section of the population is deprived of it.
- The mission also has domestic value addition objectives of job creation, economic development (by developing the domestic industry), and strategic support for R&D. Given the high interest in setting up large-scale grid

³Jawaharlal Nehru National Solar Mission was the national mission launched by the central government in 2010 which divided the solar energy growth in to three phases and attempts to maximize the utilization of solar power as renewable source of energy.

connected solar plants (1000 MW target for Phase I), the Indian government selected projects through the reverse auction mechanism. Auction of the first 150 MW of solar PV and 470 MW of CSP yielded tariffs that were on an average 30 percent lower than the Central Electricity Regulatory Commission's cost-plus-based tariffs.

- The first 1000 MW of solar power from large-scale plants will be 'bundled' with 1000 MW of cheap coal power from the government-owned National Thermal Power Corporation, and sold at a bundled rate to the distribution utilities. This cheap coal power is highly valued by state utilities and its bundled price with solar is also expected to be attractive compared to market prices in power-deficit India. However, this arrangement is limited to Phase I of the JNNSM, following which the demand for solar is expected to be driven through solar-specific RPOs. In 2011, the National Tariff Policy was amended to prescribe a solar specific RPO, starting from 0.25 percent in 2012-13 to 3 percent by 2022. However, given the poor financial health of electric utilities, it remains to be seen whether individual states (where state electricity regulatory commissions are independent and free to set their own RPO targets) will set and enforce solar-specific RPOs that are aligned to national targets.
- In addition to expanding deployment, India aspires to develop its domestic solar manufacturing industry. The Indian government is providing a 20-25 percent capital subsidy through the Special Incentive Package Scheme of the Department of Information Technology for different parts of the PV manufacturing supply chain.
- To encourage the development of its domestic PV manufacturing industry and avoid potential imports from lower cost suppliers from other countries, the government of India has imposed some mandates for domestic content for its utility-scale solar power projects under the JNNSM. Forty percent of India's households (approximately 70 million) have no access to electricity, and have to rely on subsidized kerosene for lighting. Many more households that are connected to the grid do not get reliable electricity, especially in the rural areas, where power cuts are frequent. Solar home lighting systems and solar system micro-grids are being looked upon as an option to provide clean lighting to rural households.

5. Results and Discussions

5.1 Findings from the literature

The basic findings from the literature review are the following:

- An efficient energy mix model has to be followed to meet the increasing demands of power and fuel. It is true that the renewable energy is a sustainable solution but until all the technical blockages and financial risks are overcome, it is not feasible to have renewable market as a leading player in catering to the energy demands. Thus it is imperative to focus on solutions that are viable. After going through the energy policies and different reports, it has become more evident that though potential is there but there is not an efficient mechanism to tap the same for maximum results. Also, it is not possible to remove complete reliance from coal and other fuels because they are inevitably the major driving force behind energy generation and other applications such as fuel for vehicles, appliances etc. So the common crux from all the background readings is creation of such a solution that is both feasible and sustainable, in other words, states should try their best to focus their attention on propagating the use of renewable energy in every sphere possible but at the same time, the fossils should not be ignored.
- Government has proposed many policies for the renewable sector and many incentives for improving the financing of these projects. In the wind sector, there is a scheme of Accelerated Depreciation which proves as an indirect subsidy, helping incumbents to evade taxes. For solar off grid energy systems, capital subsidies have been provided up to 90% for projects undertaken in the special category states and 30% elsewhere. For grid energy systems, NRVN has been assigned the responsibility to distribute power to different state boards after buying it from different IPPS. States have RPOs(renewable purchase obligations) to buy a particular percentage of power produced from renewable sources, for states not having access to renewable energy sources have an option to buy RECs(renewable energy certificates) from the states having surplus. Thus there have been schemes introduced by the ministry and the government to foster the growth of the renewable sector but still more policies are required to make the sector prosper more through sector specific policies

which focus on the intricacies of each sector and thus create policies catering to the diverse interests.

- Solar energy has the maximum potential in the renewable sector as per the tropical climatic conditions owing to which India receives a considerable amount of sunlight throughout the year. Solar technologies can provide solutions both for grid and off grid energy systems. Off grid energy systems are of great importance for rural electrification and remote areas where there is very less accessibility to grid connected power supply. The figure below gives a view of a business model of a company named SELCO⁴ for rural lightening using solar charging stations.

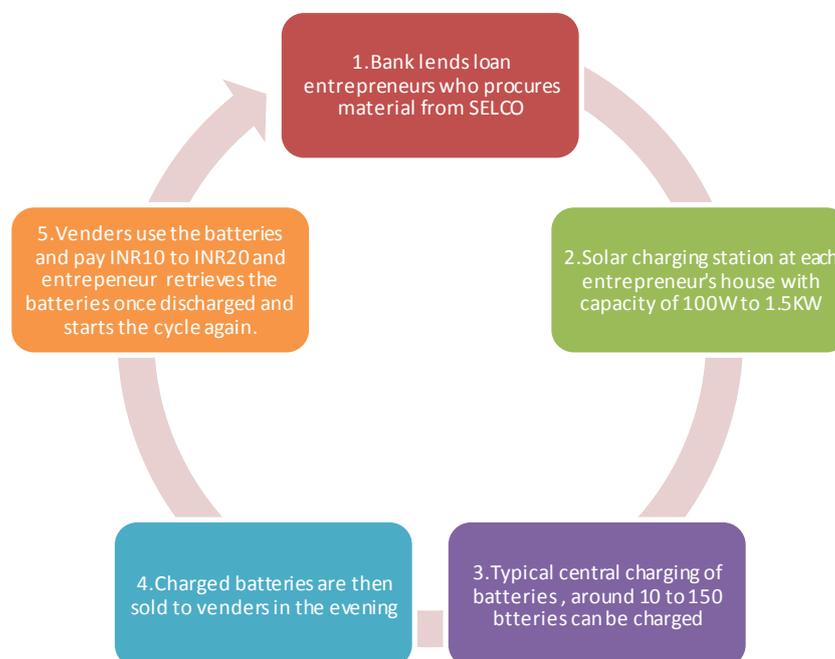


Figure 7: SELCO Business Model for rural lightening

⁴ This business model of SELCO is being provided as a case study to highlight the possibility of providing low cost solutions to the rural areas

5.2 Finding from the fields and impact on the theoretical focus of the project

The white picture which the theory suggests is very pleasing to hear and think about, it gives us the foresight of a sustainable future with non perishable sources of energy as a solution to all blockages that conventional sources face in the present scenario. Basically the major deterrents are:

- The imbalances in supply and demand of power resulting in huge power deficit
- The inequitable distribution of electricity throughout the country
- Shortage of fossil fuels, gas and oil, thus the inability to meet the demand.

Apart from these three broad categories that affect the efficiency of the energy sector, there are many manufacturing constraints which lead to major import dependence of India for fuels like diesel, natural gas and petroleum. As the growth in energy demand outpaced domestic energy production, India's dependence on imported energy intensified. From 1990 to 2009, India's import dependence increased from 11% to 35%. The largest source of import increase was crude oil, representing 70% of the total increase. The availability and affordability of imported energy has become a key factor in determining India's energy demand growth.

Energy imports and import dependence

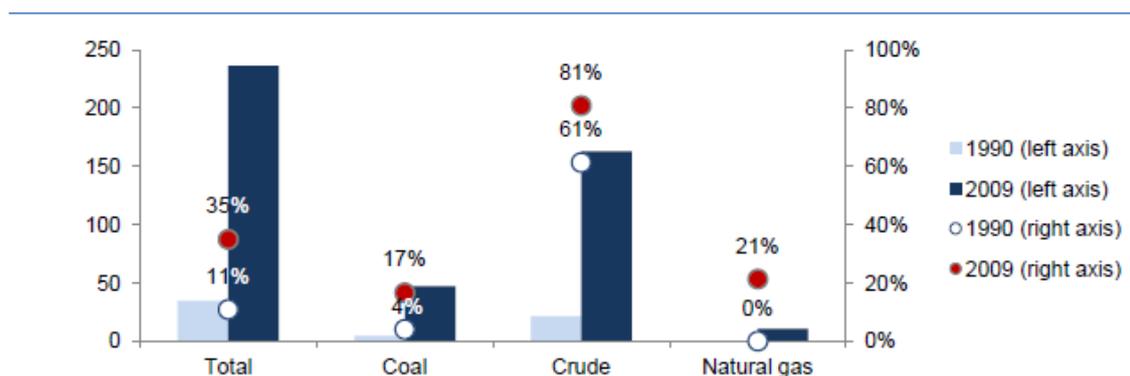
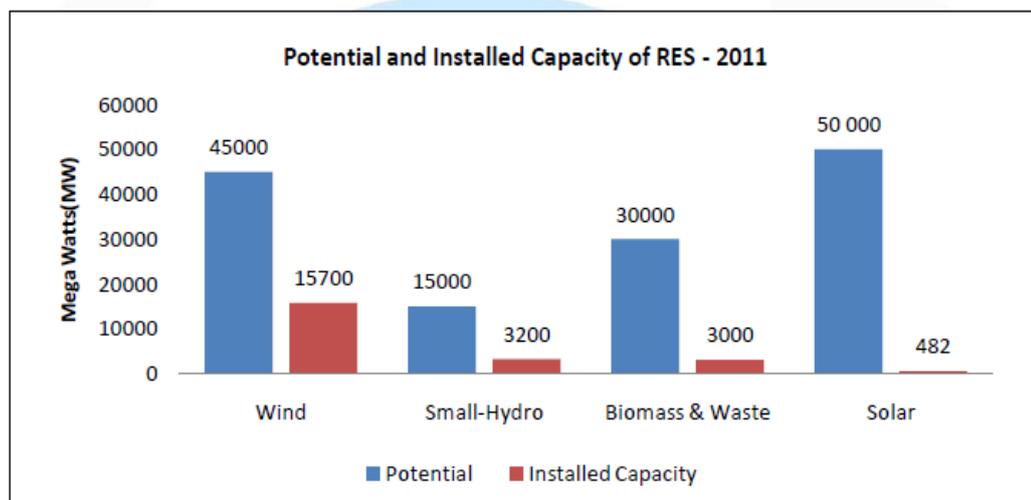


Figure 8: Energy Import Division (Source: Report by International Energy Agency)

Thus this picture of the energy sector calls for a major change in the supply side factors as well as better reach for the poor is called for. In order to reach a viable solution for this problem, renewable energy is looked as a solution

owing to its non perishable and environment friendly nature. Theory suggests that India has huge renewable energy potential owing to its natural abundance in sunlight, water and also good wind currents in certain states. Below is the potential and installed capacity of renewable sources in the year 2011.



Source: MNRE Website

Figure 9: Potential Capacity and Installed Capacity (Source: MNRE)

Potential of solar energy is 50,000 MW which is the most in all other renewable sources. Thus solar energy promises great potential for becoming the leader in the renewable market owing to the recent developments in the sector and recent schemes such as **Jawaharlal Nehru National Solar Mission**. The objective of the National Solar Mission is to establish India as a global leader in solar energy, by creating the policy conditions for its diffusion across the country as quickly as possible. The immediate aim of the Mission is to focus on setting up an enabling environment for solar technology penetration in the country both at a centralized and decentralized level. The first phase (up to 2013) will focus on capturing of the low hanging options in solar thermal on promoting off-grid systems to serve populations without access to commercial energy and modest capacity addition in grid-based systems. In the second phase, after taking into account the experience of the initial years, capacity will be aggressively ramped up to create conditions for up scaled and competitive solar energy penetration in the country.

5.2 Gap analysis

India as a country is not devoid of natural resources, what is lacking is the realization of its potential due to the absence of better implementation of existing policies and lack of technological expertise in the renewable sector. There have been enough innovations with respect to technologies utilizing solar or wind or hydro or hybrid technologies for that matter, but there still a large gap between the installed capacity and the potential that our country has in power production.

The gap analysis can be divided into two parts:

- Government initiatives
- Gaps/Barriers in implementation

5.2.1 Government Policies

The milestones in the RE sector in India can be summarized as follows:

- Establishing the Commission for Additional Sources of Energy in 1981 for promoting research and development in renewable energy.
- Establishing the Department of Non-conventional Energy Sources (DNES) in 1982 in the Ministry of Energy
- Wind-resource assessment and publication of a data-book in the early 1980s
- Research and development, capacity building and demonstration programs in the areas of biogas, cooking stoves and solar energy in the 1980s
- Installing the first grid-connected wind turbine in 1985 and beginning of the demonstration program by DNES in 1986
- Establishing the Indian Renewable Energy Development Agency (IREDA) in 1987 to finance renewable energy projects.
- Upgrading DNES into a full-fledged Ministry of Non-conventional Energy Sources (MNES; now MNRE) in 1992.
- Recognition of renewable technologies for power generation in 1992, by their inclusion in the Eighth Five Year Plan (1992-97)
- Policy to encourage private sector investment in renewable energy and guidelines for renewable energy tariffs by MNES in 1993.
- The enactment of the Electricity Act 2003 (EA 03) has radically changed the legal and regulatory framework for this sector by providing for policy formulation by the Government of India and making it mandatory for state electricity regulatory commissions (SERCs) to take steps to promote renewable and non-conventional sources of energy within their area of

jurisdiction. Section 3 of EA 03 clearly mandates that the formulation of the National Electricity Policy (NEP), Tariff Policy and Plan thereof for development of power systems shall be based on optimal utilization of all resources including renewable sources of energy.

5.2.2 Gaps/Barriers:

- India still lacks a strong technical base when it comes to manufacturing of the solar panels, photovoltaic cells and other advanced installations, designing software like SCADA. Thus no policy can reach its desired objective until India has its own technically advanced base to manufacture such items.
- Imports in solar technologies leads to fall in foreign exchange reserve and also dependence on other countries. Though absence of import duties do make it less costly but still imports dependence should be made less by promoting domestic production for renewable infrastructure.
- Indian Renewable market does not have the proper supply demand match since there is lack of demand due to lack of awareness, untapped potential is a major reason between huge differences in installed and potential capacity. Thus major gap between supply and demand still continues.
- In financing rates charged are high due to uncertainties therefore, more incentives are required.
- Renewable Energy Certificate Market has failed due to lack of incentives in state policies, absence of penultimate measures and lack of efficiency in the market.
- Capital Subsidy has been increased from 30% to 40% which will increase the fiscal burden on the government.

6. Recommendations

By the end of this report, would be to reach at a low cost solution for solar energy projects with special focus on solar PV technologies. Thus the scope of my recommendations would be two pronged where in I would focus on grid and off grid energy systems separately.

6.1 Solar Off Grid Energy Systems:

When there is a need for off grid energy systems, solar technologies do provide us with some low cost reliable solutions. Owing to the restricted discussions about solar photovoltaic technologies, I focus on solar PV solutions for off grid energy systems. Solar Photovoltaic systems can be used for individual home, communities or for a bigger population. This technology works by tapping sunlight and converting it directly into current and thus supplying to the households. The initial costs are high but they have decreased with time. The favourable feature of this technology is that it is environment friendly, a 3.5kW power system can generate around 3,000 kilowatt hours of electricity a year – about three quarters of a typical household's electricity needs. It will save over a tonne of carbon dioxide every year. There is low maintenance for these systems and the only precaution required is to keep them away from dust. Thus if such systems are put in place they will provide a feasible solution for rural electrification problem. Below given is the image of the Solar PV home system for a single household which works through the process of conversion of Direct Current (DC) to Alternating Current (AC) by an inverter which then can be used to make other appliances work. Also if there is any surplus then it can be exported outside as well as shown below in the figure. The main objective behind such power alternatives is to provide electricity to remote areas where there is no access of grid energy systems, thus for such conditions, it is a better option to have individual or community projects for households.

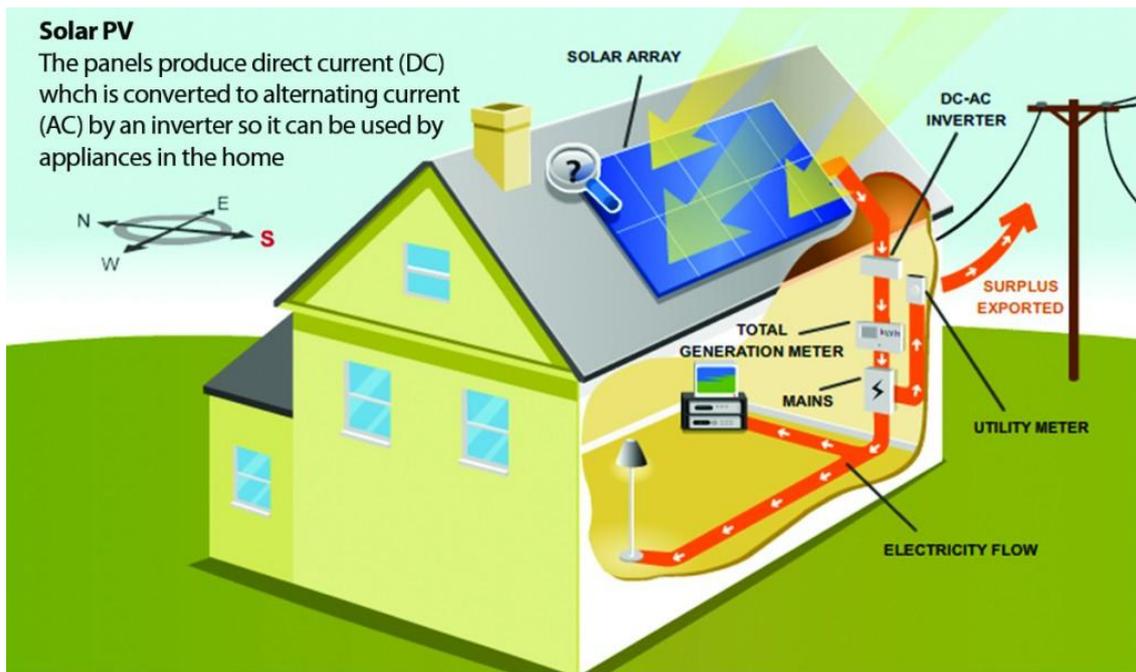


Figure 10: Solar Photovoltaic System (Source: www.greenenergytimes.net)



Figure 11: Solar Lamps without Photovoltaic cells (Source: Report at ETSAP meeting, Lisbon, Dec 10, 2012)



Figure 12: Solar Lamps with PV Cells (Source: Report at ETSAP meeting, Lisbon, Dec 10, 2012)

The images above provides a picture how rural areas can be lightened up by solar lamps which provide 4 to 5 hours of back up and the whole of the household can also be lit through solar light by having a small panel on the roof top (mini grid) and thus provide power to one house or more households depending upon the size of the plant. Thus to have low cost solar solutions, mini grids are formed which work on solar PV technology to provide electricity rural households.

6.2 Grid connected Solar Projects:

For such projects major factor is availing of finance for the capital investment and other initial start up costs. Thus it becomes very necessary that the investors are attracted towards these projects while at the same time borrowers too are willing to take up such projects willingly. The solar market is filled with potential with the availability of various available technologies for power supply or for heating and other related applications. But such potential can be realized if all the projects taken up are viable and reliable for future returns and to confirm that a proper scrutinized appraisal mechanism is followed. Thus the basic recommendation for grid connected solar projects is to have a thorough appraisal which will make sure its lifecycle cost decreases and risk to return ratio is not adverse. Apart from that government should try more schemes to propagate solar energy use, a policy mix of indirect subsidies, capital subsidies, tariffs and tax exemptions should be tried to make more IPPs procure PPAs. Refinancing can also help in dividing risk factor of the projects, hybrid technologies can also be tried according to the given local

conditions which might just be small community oriented but if provided through grid can prove to be very beneficial.

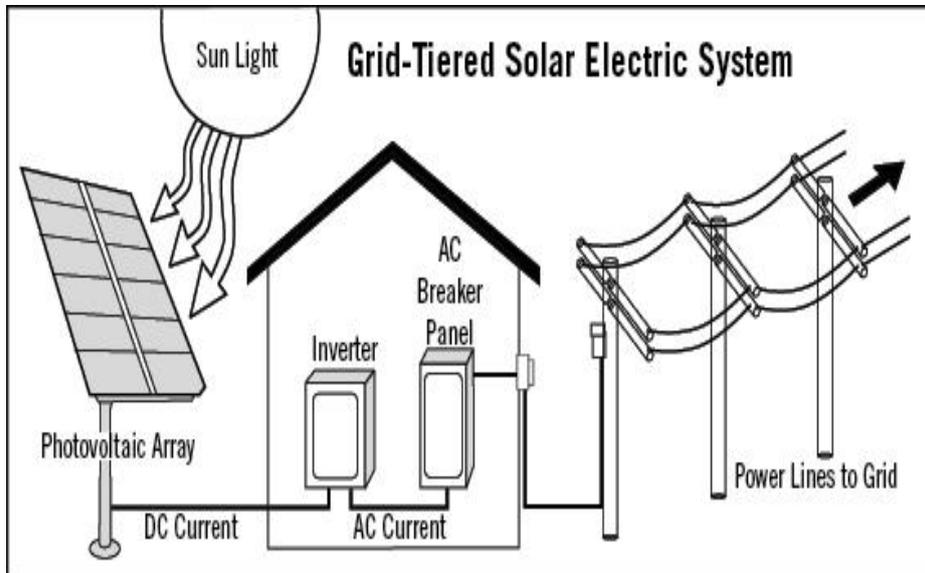


Figure 13: Grid-Tiered Solar Electric System (Source: Website of “Enlighten Power Solutions”)

6.2.1 Appraisal for loans for grid connected solutions:

In the above recommendations, the report aims at two way solutions catering to both grid and off grid energy systems. During my visit to IREDA, there was an interaction with the manager of the solar department to understand the appraisal for the solar projects. During the discussion, it was felt that all the factors they consider are very specific to the technology and energy source that is being used in the project. Thus it is very important that every bank or financial institution that enters the RE market for lending funds is well aware of the technical and financial aspects that need to be considered in the appraisal for a particular project, since with change in energy source, the method of scrutiny changes as well. In India so far, IREDA is one of those rare institution which has specific departments with mainly engineers as employees who can understand the technical factors more deeply and hence provide with ways to make the process of appraisal better by including guidelines which work towards reducing **the lifecycle cost of the project** and improving the **risk to return ratio of the project**. Below is an appraisal form from IREDA which I was given during my visit to IREDA. This form will provide a fair idea as to how these projects should be tested before lending any money.

Given below is the form for appraisal which IREDA gives its borrowers to fill to have the necessary information.

Appraisal Note to Consider Sanction of a Loan of Rs. _____ Lakhs to M/s _____ for their _____ MW (___ x ___ kW Wind Electric Generator) Wind Farm Project to be set up at _____

A. GENERAL

1	Name of the Applicant		
2	Address of the Applicant	❖ Registered office: ❖ Address for Communication (i.e. Admn. Office) Same as above ❖ Delhi Branch Office Address : ❖ Others (Factory Address) :	
3	Name & Designation of the Chief Executive	Name: Designation:	
4	Name & Designation of the contact person	Name: Designation:	
5	Name of the group company(ies) to which it belongs		
6	Existing shareholding pattern of the Applicant		
SI No	Name of shareholder	Share equity (Rs.)	% to total paid up share capital (equity)
	Promoters		
	Total		
7	Legal Status		
8	Legal Eligibility to take up the project and/or borrow loan		
9	Date of incorporation		
10	Applicant Profile (Present Business)		
11	Industry Type		
12	Special category – Borrower		
13	Special category – Installation location.		
14	Location of the proposed project		

15	Management Structure (with comments)			
S. No.	Name of the Director	Qualification	Age	Experience
A)				

16	Information on Promoter Directors / Companies / Directors (1Euro = Rs. 66.37607 approx.) (As per Audited Balance Sheet of 2008)					
Sl. No.	Promoter	Networth (Rs. In Lakhs)	Available liquid cash (Rs. In Lakhs)	Equity (Rs. In Lakhs)	Unsecured Loans (Rs. In Lakhs)	Total taxable income (Rs. In Lakhs)
17	Comments on Managerial Capability					
18	If the applicant is a NBFC, whether it is registered with RBI (Give Regn. No.) and the registration is valid as on date.					
19	Whether the shares are listed on Stock Exchange.					
20	Names of Associate Companies					
21	Proposed shareholding pattern of the company in case of a new company.					
	Name of Share Holder of applicant company	Share Equity (Rs. In Lakhs)		% to total paid up share capital		
	Total					

22	Assessment of Applicant's main line of business/proposed business over the tenure of IREDA Loan	
23	Documents referred to make the above assessment:	

B. FINANCIAL PERFORMANCE OF THE COMPANY

1	Financial Parameters of the firm		
	a) Equity		
	b) Reserve and Surplus		
	c) Miscellaneous expenditure		
	d) Net Worth		
	e) Capital Employed		
	f) Sales Turnover		
	g) PBDT *		
	h) Net Profit after Tax		
	i) % of Net Profit to Capital Employed		
	j) % of Net Profit to Networth		
	k) Term Loans		
	l) Other Loans (Including WC Loan)		
	m) Fixed Assets		
	n) Dividend (%)		
o) Existing Debt-Equity Ratio			
* The applicant is a new company and has not yet started its operations. The negative PBDT is on account of the expenditure due to bank charges, auditor's fees, which are preliminary expenses.			
2	Credit Rating from CRISIL/CARE, if any	Rating Agency: Rating: Date: Rated for:	
3	Any qualifying remarks by Auditors in the Annual Report regarding litigation/contingent liabilities in respect where disputes with SEB/Income Tax Department/Machinery Suppliers and other creditors are pending		
4	Total sums of such contingent liabilities involved	Litigation/Contingent Liability	
		Income Tax Demands against which the applicant has gone on appeal	
		Sales Tax Demands against which the applicant has gone on appeal	
		Customs / Excise demands under dispute, not provided for	
		Others	

	Whether any provision has been made to meet the contingent liabilities.																									
	IREDA's perception	There are no adverse remarks on the audited balance sheet of the Company.																								
5	Comments on Income Tax Assessments/Wealth Tax Assessments & Sales tax Assessments of Promoter Companies/Promoters/Directors as on																									
		<table border="1"> <thead> <tr> <th colspan="2">Income Tax Assessment</th> <th colspan="2">Wealth Tax Assessment</th> <th colspan="2">Sales Tax Assessment</th> </tr> <tr> <th>Assessed Taxable Income</th> <th>Tax Paid</th> <th>Wealth Assessed</th> <th>Wealth Tax Paid</th> <th>Sales Tax Assessed</th> <th>Sales Tax Paid</th> </tr> </thead> <tbody> <tr> <td colspan="6">Promoters</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Income Tax Assessment		Wealth Tax Assessment		Sales Tax Assessment		Assessed Taxable Income	Tax Paid	Wealth Assessed	Wealth Tax Paid	Sales Tax Assessed	Sales Tax Paid	Promoters											
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Assessed Taxable Income	Tax Paid	Wealth Assessed	Wealth Tax Paid	Sales Tax Assessed	Sales Tax Paid																					
Promoters																										
6	Whether the applicant has given any guarantee for the loans raised by other companies/others and if so, provide details thereof.																									
7	Major legal cases against the applicant, which may have impact on financial position of the applicant.																									
8	Status of Accounts with existing Banks/Financial Institutions and applicant's track record with them The Company has availed loans from the following Banks/FIs:																									
	Name of Institution/Bank	<table border="1"> <thead> <tr> <th>Purpose of Loan</th> <th colspan="3">Details of the Loan</th> <th>Security</th> <th>Repayment Status</th> </tr> <tr> <th></th> <th>Interest %</th> <th>Maturity (yrs)</th> <th>Repayment (yrs)</th> <th>Outstanding Amount (Rs. Lakhs)</th> <th></th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Purpose of Loan	Details of the Loan			Security	Repayment Status		Interest %	Maturity (yrs)	Repayment (yrs)	Outstanding Amount (Rs. Lakhs)													
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9	Details of earlier loans from IREDA to this Company/Group Company																									
	Capacity Sanctioned	<table border="1"> <thead> <tr> <th>Date of sanction</th> <th>Sanction amount (Rs. in Lakhs)</th> <th>Present outstanding (Rs. In Lakhs)</th> <th>Over dues, if any (Rs. In Lakhs)</th> <th>Remarks</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Date of sanction	Sanction amount (Rs. in Lakhs)	Present outstanding (Rs. In Lakhs)	Over dues, if any (Rs. In Lakhs)	Remarks																			
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10.	Financial performance of Promoter/ Companies																									
	Company Name	Rs Lakhs																								
	Financial Year																									
	PBDT																									
	Net Profit																									
	Total Net Worth																									
	Sales Turnover																									
	Debt Equity Ratio																									

	Term Loans (excl. IREDA loan)		
	IREDA Loan Outstanding		
	IREDA Overdues		
11	Overall Observation of IREDA :		
	If pre-sanction inspection is carried out give details.	Site	
		Office	

C. TECHNICAL ASSESSMENT

1	Financing Scheme	
2	Classification	
3	Purpose of the Project	
4	Project Category	
5	Project Description	
6	Raw material Resource Reference	
7(A)	Capacity	
7(B)	Name of WEG Model & type certification	
8	Capacity in terms of MTCR	
9	Envisaged Energy Generation (Annual)	
10	Annual Power Consumption (for captive units)	
11	Technical Process	
12	Status of Technology (Is it proven)	
13	Procedure for selection of Equipment	
14	Comments on Inputs of project - Raw Materials - Labour - Power - Others	

15	Assessment and status of land acquisition for the project	Composition of the land : Complications envisaged in acquiring : Estimated time required to acquire :	
16	Statutory Clearances		
17	Implementation Schedule		
		Event	Expected date of Completion
		Finalization of procurement contract / Placement of Purchase Order	
		Completion of Civil Works	
		Delivery of Equipment	
		Completion of Electromechanical Instrumentation / Installation of Equipment	
		Testing & Commissioning	
18	Disbursement Plan		
		Amount	
	1	Rs. 93.00 Crore	
	2	Rs. 93.00 crores	

D. MARKET ASSESSMENT

Demand – Supply outlook in the State	
Selling Arrangements made	
Selling Prices	
Regulations and Policies affecting supply	

E. FINANCIAL ASSESSMENT

1. Project Cost Breakup

(Rs. in Lakhs)

Particulars	Cost indicated as in application	Cost as appraised
a) Land (3 to 4 acres)		
b) Site Development		
c) Plant & Machinery: <ul style="list-style-type: none"> • Blades, Nacelle, Hub and Generators • Tower • Electrical Items • SCADA • Transportation • Installation, testing & commissioning • Civil works for Foundation • Any other (please specify) 		
Other Civil works not included in the cost of Plant & Machinery		
Other Electrical items not included at in the cost of Plant & machinery		
Evacuation charges payable to DISCOM/SNA/SEB, if any and not included in the cost o Plant & Machinery		
Statutory expenses service Tax etc., if any and not included in the cost of Plant & machinery		
d) Preliminary & Pre-operative expenses such as (Registration & Front-end fee, Other misc. charges, traveling, legal counsel etc., Stamp duty charges, IDC, etc.)		
e) Margin Money for Bank Guarantee/ Fixed Deposit Receipt (FDR)		
f) Others, if any (please Specify)		
Total		
Cost per MW		
Variations in % in the cost requested and cost computed by IREDA		

2. Reasonability of Project with respect to similar projects sanctioned recently

a. In Karnataka

Name of Company	Proj. No.	Year of Sanction	Capital Cost (Rs. in lacs)	Installed Capacity (MW)	Cost per MW (Rs. Lacs)	Supplier

b. Enercon machines

Name of Company	Proj. No.	Year of Sanction	Capital Cost (Rs. in lacs)	Installed Capacity (MW)	Cost per MW (Rs.)	Supplier	State

					Lacs)		

3. Means of Financing (With break-up)

	Particulars	Amount (Rs. in lacs)	Percentage
	Promoter's Contribution		
a.	Equity Share Capital		
b.	Internal Accruals		
c.	Unsecured /Subordinate Loans (repayment after payment of proposed IREDA's loan)		
d.	Total promoter contribution		
e.	Subsidy, if any		
f.	Term Loans Proposed		
	From IREDA		
	From Others		
	Total Project Cost		
4	Total Loan for the company including proposed loan		
	Overall Debt Equity Ratio including proposed loan		
	Asset coverage ratio		

F. IREDA'S EXPOSURE

No .	Exposure Limit	Board approved ceiling in percentage	Applicable ceiling in Amt. (Rs in Lacs) / percent	Compliance of proposed loan along with Amt. (Rs in Lacs)	Deviations if any
1	Single Borrower Exposure	20 % of IREDA's network			
2	Group borrower exposure	35 % of IREDA's network			

G. CREDIT RATING AND GRADE ASSIGNED:

Rating	Category	Applicable Interest Rate
	Grade _____	

H. FINANCIAL PARAMETERS/ASSUMPTIONS TAKEN INTO ACCOUNT FOR THE PROJECT

1	Fiscal Incentives available for the project :	
	Depreciation rate for equipment's	
	Sales Tax benefit, if any.	
	Income tax holiday	
2	Project Parameters for Consideration	Value
	Capacity	
	Project cost	
	Interest rate	

Dealing Official	
Sectoral Head	
Group. Head	
Technical Services Dept.	
Financial Services Deptt.	
Chairman and Managing Director	

Figure 14: Sample Project Appraisal Form of IREDA (Source: IREDA)

Above is the sample project appraisal form of IREDA, which is a financial institution for RE projects financing. This form seeks information ranging from technical assessment to financial viability of the project. It has sections for market assessment and credit rating analysis to test the long term returns of the project. In simpler words, this form is highly extensive in terms of details it seeks for, for the project, but at the same time such scrutiny is necessary to validate the viability of the project for the long run. Thus if all independent producers do well in the appraisals and follow the guidelines then they increase their chances for getting approved by banks for getting finance for their projects.

IREDA has different departments for wind, hydro and solar projects, having specialized workforce in each department which scrutinizes every project through the nature specific mechanism of appraisal. My major emphasis lies in this aspect, owing to the reason that though there might be different policies and incentive combinations for RE projects but when the time comes to reach out a lender for seeking loans, it is necessary for a project to fair with properly with the guidelines of the appraisal. Each project will face different appraisals according to the nature of the renewable energy source it uses.

This report aims at providing low cost solutions to solar energy projects, thus my recommendations aim at enhancing this mechanism in such a way that the reach of finance is much deeper in the market and more and more projects get approved and work thereafter.

6.3 Recommendations: Reason, Scope and Strategy

After a detailed discussion with the executives of IREDA about the problems faced in renewable energy market, the recommendations have been summed up in eight major categories:

- Introducing Energy Micro financing as a financial alternative for Renewable Energy projects.
- Public Private Partnerships in the Renewable Energy Projects
- Making contribution towards RE projects, a part of Corporate Social Responsibility.
- Proper Appropriation of National Clean Energy Fund
- Encouraging Interest Subsidies
- Improved appraisal mechanism to be followed by financial institutions for RE projects.
- Improving the Renewable Energy Certificates Market through policy amendments
- Categorizing Interests and Subsidies.

Although all these recommendations can work for both grid and off grid projects in the solar sector or any other renewable energy sector but in order to reach the remote areas where accessibility to grid is minimal, it is necessary to implement these recommendations, for which the proposed framework is as under.

6.3.1 Introducing Energy Micro financing as a financial alternative for Renewable Energy projects

Reason

Microfinance is the provision of a broad range of financial services such as deposits, loans, payment services, money transfers and insurance products to the poor and low-income households, for their micro enterprises and small businesses, to enable them to raise their income levels and improve their living standards. Microfinance institutions can provide solutions to the problem of rural electrification since it can be used as a tool to finance Solar Photovoltaic power systems for rural households.

Scope

The basic idea behind this recommendation is to make it feasible for rural households to afford solar energy house systems or a single solar PV panel. The low income households find it difficult to afford solar panels or any off grid energy system and their nights are spent in dark due to inaccessibility to power, thus there is a need for a financial solution to facilitate them with financial assistance with affordable payback options. Micro financing is one such alternative where in loans are being given with an option to repay that loan in small installments on daily basis or in any small intervals of time. Although the interest rate is usually around 20% to 25% but the number of installments is large enough to not make this interest worrisome. Thus it is possible to use microfinance to give loans to people in rural and remote areas for solar PV home systems and reach as many households as possible to electrify them.

Strategy

Micro finance providers can be provided into three categories:

- **Formal:** The organizations like NABARD, SIDBI and regional rural banks which provide assistance for agriculture and micro enterprise developments come under formal category in micro finance lending.
- **Semi Formal:** Micro Financing Institutions (MFIs) registered under some legal act come under the semi formal section of micro financing. Most of the micro financing is done in semi formal category.
- **Informal:** This category includes friends, family, moneylenders and traders.

To achieve rural electrification through installing off grid solar energy home systems, the following strategy can be followed to make micro financing a successful option.

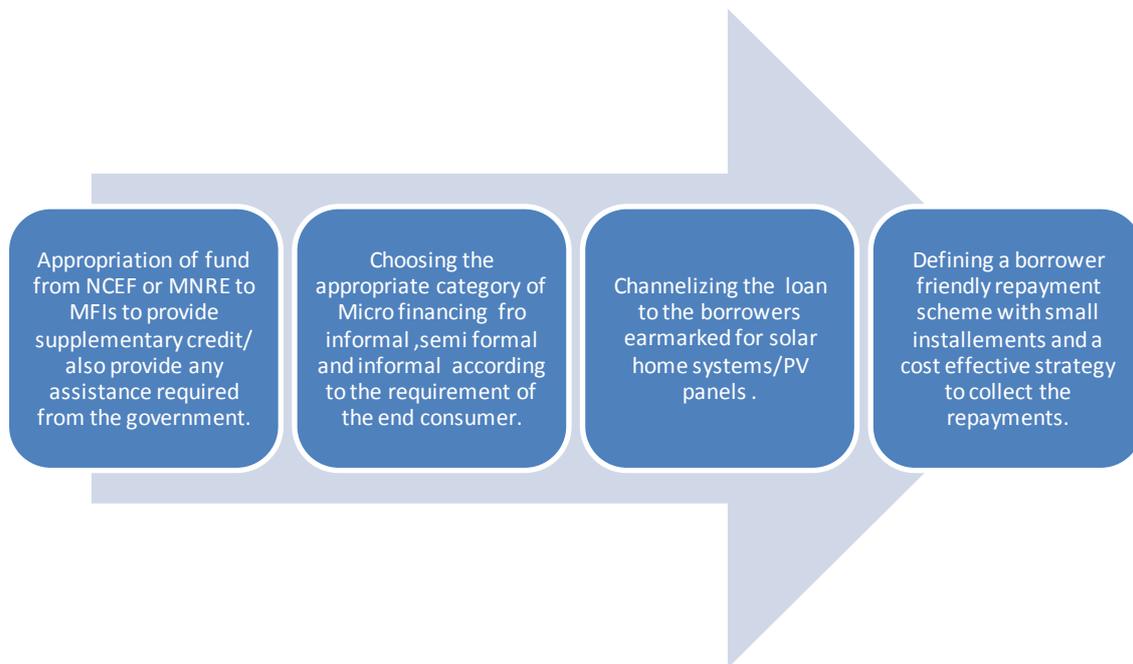


Figure 15: Framework for Recommendation #1

In order to make micro financing feasible and cost effective, the government might have to intervene to provide with assistance required to motivate the MFIs to lend for renewable projects. For promoting use of solar PV models in houses, the loans should be given specifically to buy these panels. If the repayment is done efficiently and government provides with required assistance then micro financing can be very successful in providing low cost finance to individuals or communities.

6.3.1 Public Private Partnerships in the Renewable Sector

Reason

There is a great need to introduce public private partnerships in off grid energy projects due to the lack of initiatives and inefficiency of the implementation of the government policies. Government does provide with subsidies and other incentives for solar projects but these is still scope for more participation which can be done through the promotion of public private partnerships in the renewable sector which will provide with efficient business models to reach the poor through efficient solar energy solutions.

Scope

In the off grid projects there are major blockages in the implementation of these projects due to lack of financial or technical assistance thus the idea of PPP in the renewable energy sector will cater to the provision of a network which will provide technical, financial, managerial assistance and make these projects cost effective. Through the participation of the private sector with the public sector, the coordination between the policies and their implementation would become better. There would be provision energy systems at concessional rates due to economies of scale that occur due to its technical efficiency.

Strategy

For any off grid project, it is possible to engage PPP in the same. One strategy for the same can be as below



Figure 16: Framework for Recommendation #2

Shown above is the simple PPP model with IPPs and a licensed distribution unit for distribution of electricity through solar PV panels the basic advantage of PPP in off grid is the availability of skills, technology and finance under one roof. Due to this advantage, a PPP model is attractive for off grid. In Gujarat, the government is in the way of making Gandhinagar, the model solar city of India through such PPP

models. The government here has the role of giving subsidies to these ventures and other policy initiatives to motivate them. One incentive can be **green incentive** which refers to the policy to paying a amount of money per KW of energy production through SPV method. Apart from this, these PPP can work with banks to provide low cost finance through **interest subsidies**.

6.3.3 Making contribution towards RE projects a part of Corporate Social Responsibility (CSR)

Reason

A percentage of profit of every registered company should be earmarked for activities which are environment friendly and affects the society positively. Since renewable energy projects reduce the carbon footprints and do not affect the environment adversely like other fossils do, companies can thus make contribution towards these projects as a part of their CSR activity.

Scope

All those companies which have any relation with energy should make use of renewable energy as a mandated part of their CSR activities. Such obligations could either come through independent policies from the companies or from the government. Companies like NTPC, BHEL, TATA etc have already stepped into this idea and are investing in renewable energy projects, for instance NTPC has installed solar PV systems rural areas like one in Dadri, Uttar Pradesh.

Strategy

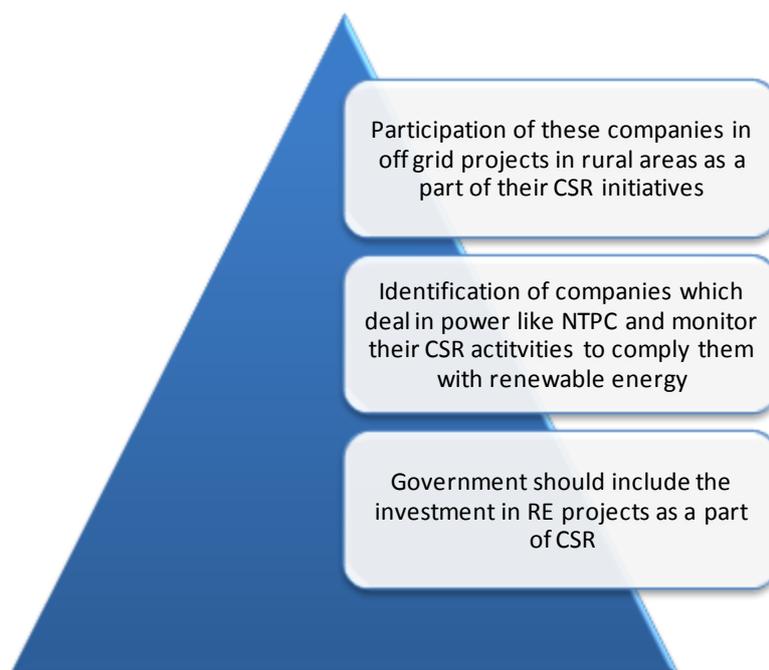


Figure 17: Framework for Recommendation #3

The government should propose an obligation of inclusion of investment in RE projects as a part of CSR at least for those public/private sector companies which deal with energy. After identifying these organizations, they should be encouraged to take up CSR initiatives in the rural areas through investing in various off grid

projects like installing solar energy systems in households, communities, schools and so on. **NTPC, Bharti, TATA** are some of the examples of organizations who have initiated investments in renewable energy projects. The basic aim behind this recommendation is to identify the fact that

6.3.4 Proper Appropriation of National Clean Energy Fund

Reason

National Clean Energy Fund is being created to finance the innovations and other important technological experiments in the renewable sector. It has been provide properly in the guideline as to where the entire fund will be used. It is basically made to provide with the required financial support to the renewable sector to take its risks. Thus it is required properly define the appropriation of this fund to make the sector more resourceful.

Scope

NCEF is formed from the electricity cess charged at the rate of 5% from the production of coal. It goes to the Consolidated Fund of India and there is no mechanism to appropriate the fund to the MNRE. The amount in the fund was around 3684 cr. as on March 2012 and it expected to touch 10000 cr. by 2015. But the government has still not decided about the use of this fund. Thus a proper policy is required to specify the use of this fund and the government should be simultaneously proactive in implementing these guidelines and also monitoring the possibilities of efficient use of this fund.

Strategy

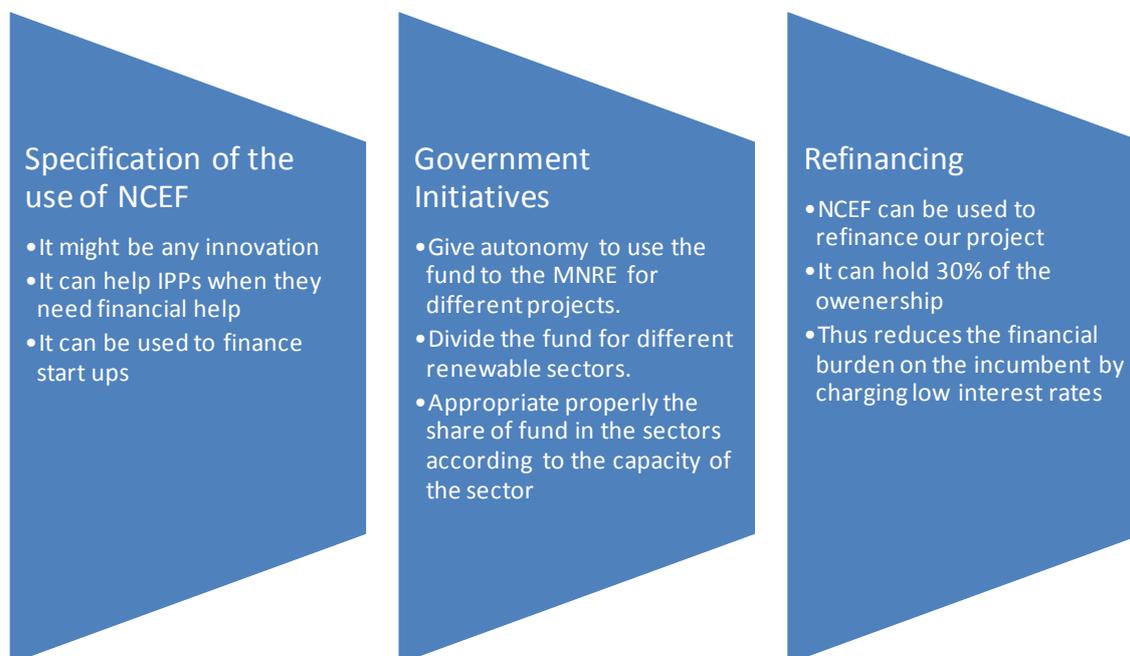


Figure 18: Framework for Recommendation #4

The threefold recommendation provides with the framework to make the appropriation of NCEF more inclusive and effective. It lays down the different uses to which the fund can be put and how the government can be financed through this fund to finance the projects/innovations in the renewable sector. In project financing too, this fund can be used by financing a percentage of loan finance required in the project which will help in diversifying the risk from lenders such as banks/financial institutions indirectly to the government. If this fund is appropriated as recommended then there would be more availability of funds for these projects and one more viable option of refinancing for these projects would be available.

6.3.5 Encouraging Interest Subsidies

Reason

MNRE has increased the capital subsidies for solar off grid projects from 30% to 40% and has waived off the policies for interest subsidies. Capital subsidies do act as a cushion in the incubation period of the projects but does not guarantee implementation of the project.

Scope

The main objective of giving the interest subsidies is making the financing of these projects cost effective through the provision of loans at a lesser interest rate than the prevailing market interest rates. Since the main problem with Solar PV projects is the high cost involved in the installation of the panels, there is need to introduce ways to make the financing accessible and cost effective which can either be achieved through subsidizing the capital expenditures which the government is doing presently or subsidizing the interest rate. At first, increase of capital subsidies does provide a positive picture for incumbents but capital subsidies do not guarantee implementation of the projects since the government subsidizes the capital in the very beginning with no obligation on the producer to pay back or perform better but if the same financial support is provided through the combination of interest and capital subsidies then it will cater to better implementation of the projects.

Strategy

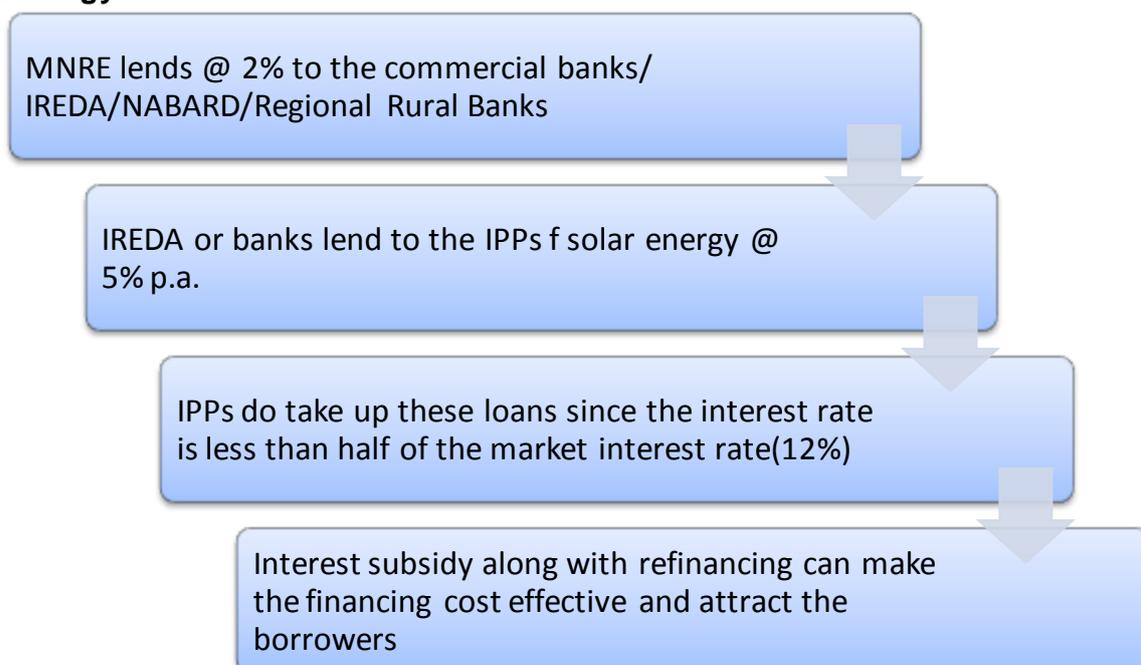


Figure 19: Framework for Recommendation #5

Thus the government, IREDA and banks can use interest subsidies to make the project financing of RE projects low cost. In this case the government has to give loans at very low interest rates of around 2% to attract the financial institutions and these intermediaries can further loan this at higher interest rate which would still be lower than the market interest rate and thus make RE project financing cost effective.

6.3.6 Appraisal mechanism to be followed by financial institutions for RE projects

Reason

In the above recommendations, the report aims at two way solutions catering to both grid and off grid energy systems. During my visit to IREDA, I interacted with the manager of the solar department to understand the **appraisal for the solar projects**. During the discussion, it was felt that all the factors they consider are very specific to the technology and energy source that is being used in the project. Thus it is very important that every bank or financial institution that enters the RE market for lending funds is well aware of the technical and financial aspects that need to be considered in the appraisal for a particular project, since with change in energy source, the method of scrutiny changes as well. In India so far, IREDA is one of those rare institution which has specific departments with mainly engineers as employees who can understand the technical factors more deeply and hence provide with ways to make the process of appraisal better by including guidelines which work towards reducing **the lifecycle cost of the project** and improving the **risk to return ratio of the project**.

Scope

Although project appraisal mechanism is a non financial aspect of project financing but it is the most important factor which has to be considered when one is looking for the viability of the project since it is through a proper scrutinized appraisal mechanism that the lenders can judge the credibility of the borrowers and their project proposals. Thus this recommendation aims at providing with the strategy through which banks maintain a proper appraisal mechanism specifically for RE projects with required diversifications in the appraisal with the change in renewable energy source and technology.

Strategy

Below is the appraisal mechanism that IREDA follows for solar energy projects.



Figure 20: Framework for Recommendation #6

Since IREDA has mostly engineers as its employees therefore it is feasible for this organization to have a strong technical team to appraise each project with its technical intricacies but this is not feasible for every bank or other financial intermediary to follow such a regressive mechanism owing to the lack technical expertise. Thus in order to have better mechanisms, **there should be recruitments of such employees who have expertise in the renewable energy projects' financing.**

6.3.7 Improving the Renewable Energy Certificates Market through policy amendments

Reason

The renewable market has failed to be successful in India owing to lack of policies which have penultimate repercussions on failure of obligating to the REC provisions. Thus there is a need for policy amendments in renewable energy certificates which will reduce the incidence of non compliance with renewable purchase obligations.

Scope

The National Tariff Policy (NTP) 2006 requires the State Electricity Regulatory Commissions (SERCs) to fix a minimum percentage of Renewable Purchase Obligation (RPO) from such sources taking into account availability of such resources in the region and its impact on retail tariffs and procurement by distribution companies at preferential tariffs determined by the SERCs. NTP has further elaborated on the role of regulatory commission; mechanism for promoting renewable energy and timeframe for implementation, etc. The policy was amended in January 2011 to prescribe solar-specific RPO be increased from a minimum of 0.25 per cent in 2012 to 3 per cent by 2022. Renewable Energy Certificates are traded when it is not possible to have direct access to power from renewable sources owing to unavailability of these sources in the vicinity, thus these certificates mandates the certain amount of power (through renewable energy) that has to be purchased from some other state. But the REC market has been unsuccessful; the actual performance of REC market trading shows that the number of certificates issued in the first year of operations is less than 4.0% of the technical REC demand potential, indicating that the full potential of REC markets is far from being realized. Further, according to financial institutions, investors cannot rely upon revenues from the REC mechanism beyond the first few years of projects that have up to 20-year lives. As a result, the REC mechanism has had virtually no impact on bringing new renewable energy projects on line. Thus there is scope for changes in the REC policies to make the market work efficiently.

Strategy

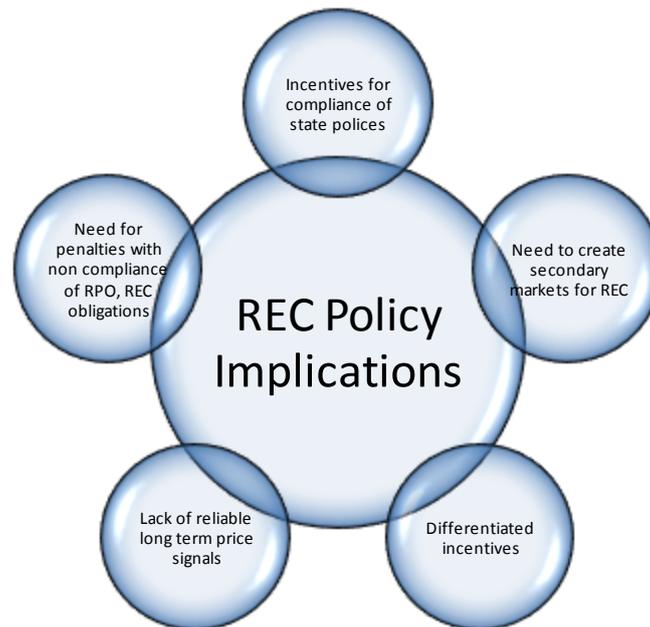


Figure 21: Framework for Recommendation #7

Above is the list of policy implications of the energy certificates. If there are provisions charge the state or any entity by cancelling the government incentives to them like not giving the capital subsidies for the solar energy projects in those states which fail to oblige with the REC/RPO obligations, include long term price signals, create secondary markets for REC trading and thus make provisions to make this market efficient because it has the potential to encourage use of renewable energy.

6.3.8 Categorizing incentives and subsidies

Reason

Although the government has given subsidies up to 40% to off grid solar projects but these benefits should not accrue equally to all income groups because the affluent private companies which can afford such projects should receive lesser incentives than those who are the poorest of the poor. Thus there is a need to revamp the policy structure of subsidies and other incentives.

Scope

This recommendation is sought to reach the poor section of the society. If the government prioritizes the or in making the policies then the rural areas would be benefitted in a more efficient way.

Strategy

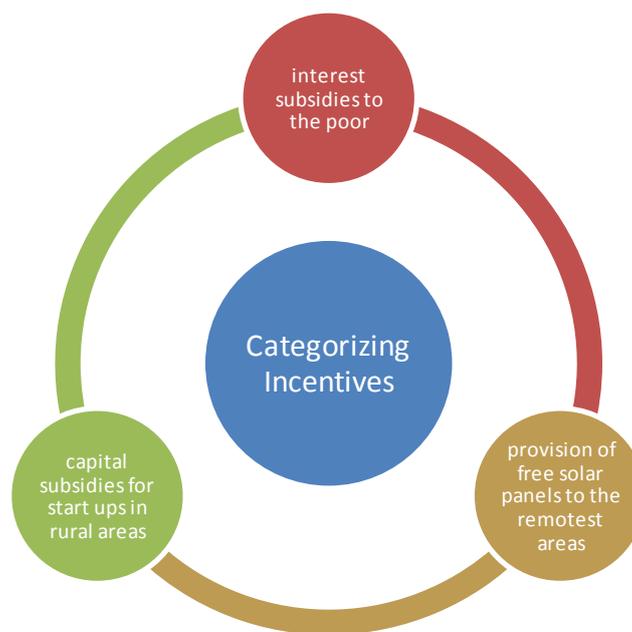


Figure 22: Framework for Recommendation #8

This recommendation aims at proposing poor specific policies. The government provides interest and capital subsidies for renewable energy projects and its policies differ on the basis of connection to the grid and thus everyone gets equal benefits but since the problem of less access to power is in rural areas, there is a need for certain special provisions to be included in the subsidy schemes. There should be different interest rate bands which are lower than the normal interest

subsidies as per the policies. Differentiated capital subsidy schemes on the basis of the financial status of the developer should be encouraged.

7. Conclusion

The aim of this report is to find low cost solutions for renewable energy projects. The potential of solar energy in India is the most amongst other sources of energy and thus more focus on the solar sector is required to make it prosper and help in overcoming the acute power deficit in our country. Depletion of fossil fuels, population explosion, increased demand of power, environmental degradation due to excessive use of fossils are some of the reasons which justify the use of a sustainable source of power.

Jawaharlal Nehru National Solar Mission and provisions like capital subsidies, solar renewable certificates, feed in tariffs, interest subsidies, viability grid fund and many other such government initiatives have been taken up by the government to increase the use of solar energy. But still the installed capacity is far behind the potential capacity thus more inclusive policies are required to realize the potential.

The basic problem faced in the renewable sector is in availing finance for these projects owing to high installation costs for solar panels and uncertainty due to reliance on the natural source. Thus low cost alternatives have to be discovered for making the implementation of these projects feasible. Thus through this report an effort has been made to suggest ways to diversify the incidence of risk and cost of capital of renewable energy projects through change in government policies, banks and public/private sector companies.

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Appendix A

Mentor Meetings

1. Discussion in the first Mentor Meeting

Meeting with the mentor

I was called at 3 pm in his office for the meeting and it lasted for around half hour after which I was being sent to IREDA, the financial institution administered by the MNRE for financing RE projects, there I had the meeting with its CMD and their financial advisor who is an ex RBI and gave me very insightful advise about the project and thus made the topic more clear.

We have framed our own task line to which we will adhere, which is as follows

Understanding the concept of renewable resources and taking a look into various renewable energy resources and their viability.

Then a study has to be made of the financial sector for such RE projects and who are engaged in to financing these projects

And at the end we look at the viability of low cost financing and why would these institutions be interested in such form of financing

Also we would look at the major blockages that come under the financing and how the whole market of finance works.

The renewable resource sector gets the resource from various sources mentioned as below:

- Nuclear power: This resource has the ability to solve all the scarcities in the power and the energy sector as also proved by Japan whose power sector is ruled by nuclear power but at the same time this use is highly vulnerable to destructive usage thus our government does not favor reliance on nuclear power as an energy source but yes it has an amazing potential to give lifetime warranty if it's used.
- Hydro power: Water one of the most widely used natural resource for power generation because of the abundance of its quantity available. But apart from this fact India does not regard it as a fully renewable resource i.e. any usage below 25 MW is regarded as renewable and as this limit is surpassed water becomes a non-renewable resource. Still we have large dams all across the country which generates hydro power.
- Wind energy: This energy is processed from natural wind through windmills.
- Solar energy: The energy which we get from sunlight can be used for power generation. A fact emphasizes that the amount of solar energy that hits the earth per day if used properly can amount the whole power consumption for the next 100 years but yet again the major bottleneck is the

infrastructural constraint where in the cost of infrastructure required for solar power generation is very high which make large scale projects less viable .

- Tidal Energy: This energy comes from high tides which again is not much reliable as high tides have a particular time on which they occur so not a permanent solution.
- Geothermal Energy: Earth has a lot of heat underneath which can be used and thus geothermal energy is the energy which we get from earth.
- Waste to energy: Under this any sort of waste is turned into gas through combustion and filtration and thus used. This waste can be of any form and can be collected from houses, hospitals etc. One example is of energy from biomass. There is a case study of a village in Bihar where a small plant was constructed to generate gas from rice husk and other kinds of waste materials like tree leaves, other waste from fruits and vegetables. This waste is then burned and the gas thus formed is purified. The purified gas is combusted and thus sent through underground channels to different households. One such plant can cater to 200-300 households for their cooking and related usage. So therefore waste to energy is one of the lucrative areas where in if investment is done properly, a lot can be achieved.

After looking into the different sources of renewable resources we focus on the financing of these projects. These projects are either financed by banks or financial institutions. The Ministry of new and renewable resources has set up a financial institution IREDA which was the first ever organization to initiate in renewable project financing and take all the risks and market for getting finance for these projects through other investors in the market , now as a result in present , though IREDA looks after the financial regulations and also financing , it is just some other player in the market as now we have big investors for large scale projects in the renewable sector.

Financing of these projects is an uphill task owing to the large manufacturing and infrastructural costs. Power is either provided through grid or off grid. In off grid , it refers to no infrastructural requirement and this is done through small indigenous plants like the aforesaid example of biomass plant but such production hardly counts at the macro level thus when we talk about the power generation even at a district level , we require grids . Now since the power supply in our country is ruled by the state governments thus all the various producers will have to sell electric power to the government. In our country the rate at which the electricity is provided to the public is highly subsidized , in lame terms it can be put if the buyer buys it at Rs10 per unit , the public gets it at Rs4 per unit . Thus it creates a monopoly in reverse where in high losses are suffered by the providers of electricity. This mismatch in the cost price and selling price proves as a biggest

disincentive for the investors to provide finance because it leads to a reverse return to risk ratio where the risk of default is higher than the return. Thus a subsidy in electricity becomes a blessing in disguise which puts the growth of the power sector in a vulnerable state.

Talking internationally, China is the biggest solar panel manufacturing base in the world; it alone stands for 50% of total production for the manufacture of the same. Countries like USA, UK have invested heavily in the renewable sector but the recent euro-zone crisis has led to withdrawals in such investments but it is regarded as a temporary setback and will see recovery soon enough.

Thus now through this project we will aim to study the renewable sector and the financing of its projects deeply. Analyze the current scenario, decipher the blockages in the growth of the sector, look for low cost alternatives, attempt to design solutions to make financing much more lucrative and thus aim to increase the returns and reduce the risks of the RE projects. The risks remain high due to high subsidy in the power sector and also higher per unit cost of power from renewable sources than from conventional sources like fossils or coal.

Action Items before Next Discussion

- Read the 12th five year plan (section on sustainable development)
- Read the recent two years action plans of the Ministry of New and Renewable Resources.
- Read the draft on Integrated Energy Policy by the Planning Commission.
- To make oneself aware about the power sector and the need of renewable energy projects
- To understand the financing of these projects and identify the critical factors in financing.
- To make a report on the following aforementioned subjects.

References (People to meet, research report or papers to read)

- Mr. D. Majumdar, CMD , IREDA
- Mr. R. Bhalla, Financial advisor , IREDA
- Annual Report of MNRE
- 12th five year plan
- Integrated Energy Policy
- One document provide by the mentor on the IREDA financing.

2. Discussion in the Second Mentor Meeting

In order to start a project, these are the following basic factors, one looks at:

1. Capital required in the initial stage.
2. Cost of technology per mega watt of production
3. Financing alternatives
4. The target buyers of the production

My basic aim is to focus on the third factor and that is financing alternatives which invariably depend on all other factors, since capital requirements and cost implies the level of viability of the project. Under financing,

1. There is a big mismatch in lending of funds in the renewable sector, this prevails due to the fact that the banks normally provide funds at the maturity periods from 8 to 10 yrs while the requirement of the RE projects is 15 to 20 years which this makes it difficult to avail full financial cover for these projects.
2. Another risk relates to the vulnerability of the RE projects due to their reliance on nature, thus increasing the uncertainty factor of these projects.

In order to explore more in to these problems I would narrow my report to study about the solar, wind and waste to energy related RE projects and will try to analyze their financial mechanism and viability factors.

Now the basic two parties in contact here are

1. Financial intermediaries or banks
2. Enterprises or companies engaged in RE projects

The basic factors affecting both will be relevant for the study. For instance , from the viewpoint of the company, deeper scrutiny is required on the viability of the project and the cost of their techniques but main focus here will be on financial institutions which provide finance for they are the basic providers. For banks, the two factors play important role in the decision of lending, broadly financial and non financial factors. The high interest rates form a part of the financial blockages while bad appraisal of the RE projects is the non financial blockage.

Thus my basic aim is to address these blockages and this can be done by refinancing of the RE projects which would divide the risk among investors and thus improve the risk to return ratio and finding certain ways to improve the appraisal mechanisms of banks for these projects which can be done through making banks realize it is a socially desirable project and helpful in the long run.

Action Items before Next Discussion

- Field visits to financial institutions like IREDA and meeting sector specific experts
- Plan field visits to IPPs for case studies.
- Meeting with the mentor on Thursday.
- Third visit to IREDA.

References

- Mr. Rakesh Bhalla, financial advisor, IREDA
- Mr. D. Majumdar , CMD , IREDA
- RE Project Experts in IREDA (in the following week)

3. Discussion in the Third Mentor Meeting

The meeting was concerned to discuss the status of the report. It was an informal conversation about the work done till date.

Field Visits

1. Discussion Details of First Field Visit

S. No.	Mr. Rakesh Bhalla Financial Advisor, IREDA
1.	Project financing through banks: There is a major misconception that banks do not indulge in project financing but such is not the case. Although majorly the maturity of deposits banks have are in forms of savings, current accounts, fixed/recurring deposits etc which have a shorter maturity period making it difficult for banks to provide long term project financing, but due to the existence of core deposits, they are capable of providing long term project finance. But there still exists an interest rate risk if the rate of interest is fixed till the maturity period but banks overcome this risk by lending at floating rates thus transferring the same risk to consumers
2.	IREDA's financing policy: IREDA does project financing for RE projects but it lends at fixed interest rate with a reset option where in they change the interest rate in every two years with an option for the borrower to pay back the loan without any penalty if he is not comfortable with the change.

3.	<p>Wind Sector Specifics: In the wind energy sector, in order to improve the market, government has introduced Accelerated Depreciation which gives the right to all the wind sector entrepreneurs to charge 80 percent of the depreciation in the first year which helps them in tax evasion and the loss that occurs due to charging this depreciation can be divided within a span of 3 to 5 years which further helps in reduction of tax payments. This scheme was basically introduced to provide an indirect subsidy in the wind renewable sector.</p>
4.	<p>Solar Sector Specifics: The solar sector has not done well as compared to the wind sector but for this sector too certain incentives have been undertaken by the government. It is called capital subsidy, this subsidy differs for grid and off grid installations. The off grid installations in the special zone areas get 90% capital subsidy while the off grid installations in other areas get 30% subsidy.</p> <p>For grid installations, there are Power Purchase Agreements (PPAs). The IPP enters into PPA with the government for 25 years at fixed rate. NVVN (subsidiary of NTPC) enters into PPA with every IPP and then supplies the collected power from all sources to the state electricity boards (SEB). The Central Electricity Board (CEB) determines a price band for buying electricity within states is allowed to vary.</p>
5.	<p>Initiatives: There is a system of Reverse bidding where in the lowest bidder gets the deal. Thus cost cuts are sought through cutting down costs, technological breakthroughs and recently global recession has affected the prices abroad which have also led to a temporary decrease in the price levels globally. This phenomenon has narrowed the difference in prices between conventional and renewable sources but there is still time till we reach parity and until then subsidies and alike policies are required.</p> <p>State Electricity Regulatory Commission (SERC) dictates Renewable Purchase Obligation (RPO), which implies that some part of electricity to every utility should come from renewable sources.</p> <p>There is Renewable Energy Certificates (REC), which obligates the states having surplus energy production from renewable sources to sell the surplus in form of these certificates to the states that have scanty to such resources.</p>

2. Discussion Details of Second Field Visit

S.No.	Mr.Khekiho Yeptho AGM, IREDA
1.	After the introduction of JNNSM in 2010 the capacity of Solar PV technology has increased from being below 5 MW to reaching to 1.7 GW which implies that from last two years the potential of solar PV has increased manifold thus this sector becomes the major player in the renewable market when it comes to tapping the future potential. Before 2010, the projects hardly had full financial and technical viability but after the inception of JNNSM, the condition has improved due to targeted policies and better improved technologies.
2.	IREDA has its unique project appraisal mechanism where in it takes into account factors such as payback period, lifecycle cost, plant load factor, target buyers, state policies, risk appetite, substation analysis. All these factors combined make a comprehensive mechanism for appraisals of these projects which as a results in the increased investor and borrower confidence in the project because if the aforementioned features are met by the project then the projects' viability on the technical front increases tremendously because IREDA's main motive is to cater to the long term perspective of the returns from the project both financially and in productivity. Thus , though cumbersome such an appraisal helps to reach at the final result which is reliable and most viable owing to the competency of the project which is gained through the process.

3. Discussion Details of Third Field Visit

S.No.	Mr. K.B.K Reddy AGM, IREDA
1.	<p>The scope of the project should be divided in to two sections :</p> <ul style="list-style-type: none"> • Grid Connected Energy Systems. • Off Grid Energy Systems. <p>These systems should be provided with solutions differently because the nature of grid and off grid projects is totally different. For instance, it is not possible to have successful grid energy systems</p>

	in the remote areas where there is no proper access to grids. Thus it is important to properly demarcate the recommendations considering the various differing factors in the two categories.
2.	It is not possible to provide with a generalized low cost solution in the RE sector for all projects since all energy sources have different characteristics and thus it is important to focus on each sector individually, which in turn has various technologies from one energy source itself. For instance, for solar, power can be directly produced through solar PV technology or indirectly using thermal process, thus both technologies will have different cost specifications and different technical requirements.
3.	India has the potential of 50000 MW of energy production form solar power and installed is less than 500 MW, thus solar power has the biggest potential in our country in the renewable energy sector to be tapped. Thus by the end of the discussion it was decided that it is better to focus on solar projects and try to come up with viable low cost solutions for these projects to increase their implementation and reach in the whole country with special focus on low cost power solutions to the remote and rural areas who have lack of infrastructure and finance to have access to electricity.
4.	Solutions can also focus on the policy framework and recommendations for change in the same

4. Discussion Details of Fourth Field Visit

S.No.	Miss. Debjani Bhatia AGM, IREDA
1.	As mentioned earlier, IREDA has a very comprehensive appraisal mechanism thus a sample form was necessary to understand it. It explains how all the technical, financial and market related factors are scrutinized to check the viability of the project. The appraisal form snapshot has been attached with the

	midterm report.
2.	To provide with low cost solutions, one can also look into hybrid low cost solutions, for instance, solar-wind technologies, using both solar panels and wind mills in a model to produce power. The cost of such models can be estimated and if found economical, they too can be implemented

5. Discussion Details of Fifth Field Visit

S.No.	Mr. Rakesh Bhalla Financial Advisor, IREDA
1.	NCEF can be used efficiently by the ministry to make the renewable sector work more efficiently. The coal cess earmarked for NCEF goes to the consolidated fund of India and does not reach MNRE for further appropriation, thus it is necessary to have a mechanism in place which mandates the proper allocation of this fund. It can be used to finance many projects which need government support for the incubation costs. Thus a proposal should be made to the government to take steps to make this fund more useful.
2.	Micro financing can only be successful if the process of collecting installments on daily basis is cost effective and in India where the daily wage earners will be reluctant to pay, it becomes less successful. Thus it cannot be a sustainable solution and will have to be supported with regional banks or other organizations to give low cost finance to villagers.
3.	There have been successful instances of provision of earmarked loans for solar lanterns at concessional rates through the help of regional banks and interested IPPs

	to provide with solar lanterns, such steps have been taken in villages of U.P. and other states in India. Thus in order to have a large scale impact, such small efforts should be congregated to make an impact.
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6. Discussion Details of Sixth Field Visit

S.No.	Mr. K. Yeptho AGM, IREDA
1.	<p>The central government and the MNRE do have efficient policies at place but the problem lies in the implementation of the same due to the federal structure of the government, as a result for which state governments rarely work in accordance with the central government. The funds that reach the state nodal agencies do not use the end users. Thus intervention from motivated parties such as</p> <ul style="list-style-type: none"> • Not for profit organizations • International organizations • Public sector companies • Leading private corporate • Regional banks and other financial intermediaries
2.	<p>MNRE and the central government does provide with directives and funds to state nodal agencies but those funds do not reach the desired end owing to intermediate corruption. The REC market has also not shown successful results owing to absence of mention of any penultimate actions if a state does not abide with the RPO, REC obligations. Thus it is required that a change in policy is made so as to include certain penalties such as removing any sort of incentives such as capital/ interest subsidies or any other benefit that the state might be receiving from the centre.</p>
3.	<p>There is a recent policy decision of restructuring the State Electricity Boards (SEBs), basically improving the state of sick units and bringing them out of debts, for this there would an infusion of around INR 200000 cr. Such restructuring measures should also consider the renewable sector and invest as to how to improve the condition of investment towards this sector.</p> <p>In the areas where there is no access to electricity and households there are too poor to afford electricity, Government should provide with certain policies which can promise two lanterns per household. But for this major step has to be taken to identify the</p>

mass in real need of such policies because as seen in NREGA, the fund was misused and never used for its desired objective. Apart from this, there is a need to look for alternatives which might put less fiscal burden on the government and still help in propagation of the solar energy use. The possible options can be:

- Corporate Social Responsibility: Every registered company is obliged to do something towards CSR, if there is a provision which makes companies invest certain resources for renewable energy then it would help in great deal. There are examples such as NTPC which do support RE projects.
- Public Private Partnerships: when the government gives funds to state nodal agencies, it never gets utilized properly thus there is a need to incorporate parties who are motivated and can help efficiently, thus the ministry should favour public private partnerships.
- Efforts should be made to think as to how de urbanize and empower rural areas.
- MNRE subsidy schemes should focus on remote areas.
- Schemes like VGF can be made for off grid projects as well.
- Encourage banks to give loans.
- Interest subsidy should not be uniform. It should be more for the poor and lesser as we move to businesses and government officials.

For any off grid to be successful it can either work through traditional channels of government ministries that never work efficiently or it can be done through some third party intervention

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“The highest measure of democracy is neither the ‘extent of freedom’ nor the ‘extent of equality’ but rather the highest measure of participation.”
- A.D. Benoist

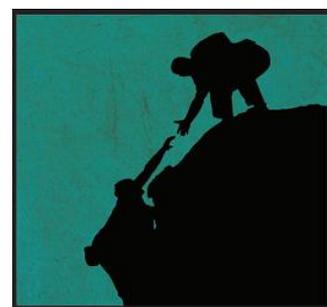
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