STRATEGIC PLAN
FOR
NEW AND RENEWABLE
ENERGY SECTOR
FOR THE PERIOD
2011-17

FEBRUARY 2011

MINISTRY OF NEW AND RENEWABLE ENERGY
GOVERNMENT OF INDIA

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ABBREVIATIONS

BEE	Bureau of Energy Efficiency
CEA	Central Electricity Authority
CERC	Central Electricity Regulatory Commission
CHP	Combined Heat and Power
CSP	Concentrated Solar Power
C-WET	Centre for Wind Energy Technology
DNI	Direct Natural Irradiation
DSM	Demand Side Management
DST	Department of Science and Technology
EA 2003	Electricity Act 2003
ESCO	Energy Services Companies
GBI	Generation Based Incentive
GEF	Global Environmental Fund
GHG	Green House Gases
GOI	Government of India
IEA	International Energy Agency
IEGC	Indian Electricity Grid Code
IEPR	Integrated Energy Policy Report
IPP	Independent Power Producer
IREDA	Indian Renewable Energy Development Agency
IRR	Internal Rate of Return
JNNSM	Jawaharlal Nehru National Solar Mission
MNRE	Ministry of New and Renewable Energy
MoEF	Ministry of Environment and Forest
MoP	Ministry of Power
MoRD	Ministry of Rural Development
M & V	Monitoring and Verification
NCEF	National Clean Energy Fund
PA	Program Administrator

PMD	Performance Management Division
PPA	Power Purchase Agreement
RE	Renewable Energy
RET	Renewable Energy Technology
REC	Renewable Energy Certificate, Rural Electrification Corporation
RESCO	Renewable Energy Service Companies
RFD	Results Framework Document
RPO	Renewable Purchase Obligation
RPS	Renewable Portfolio Standards
SERC	State Electricity Regulatory Commission
SWH	Solar Water Heating
SWOT	Strengths, Weaknesses, Opportunities and Threats
UNDP	United Nation Development Program
WTG	Wind Turbine Generator

WEIGHTS AND MEASURES

BU (billion unit)	–	Unit of energy, equal to $1x10^9$
kWh (kilowatt-hour)	–	Unit of energy, equal to 1 unit
MW (megawatt)	–	Unit of power, equal to $1x10^6$
GW (gigawatt)	–	Unit of power, equal to 1 billion (10^9) watts
MT (metric ton)		Unit of weight, equal to 1,000 kg or 2,204.6 pounds

Conversion:

Rs1 million	–	Equal to $Rs1x10^6$
Rs1 billion	–	Equal to $Rs1x10^9$
Rs1 lakh	–	Equal to $Rs1x10^5$
Rs1 crore	–	Equal to $Rs1x10^7$

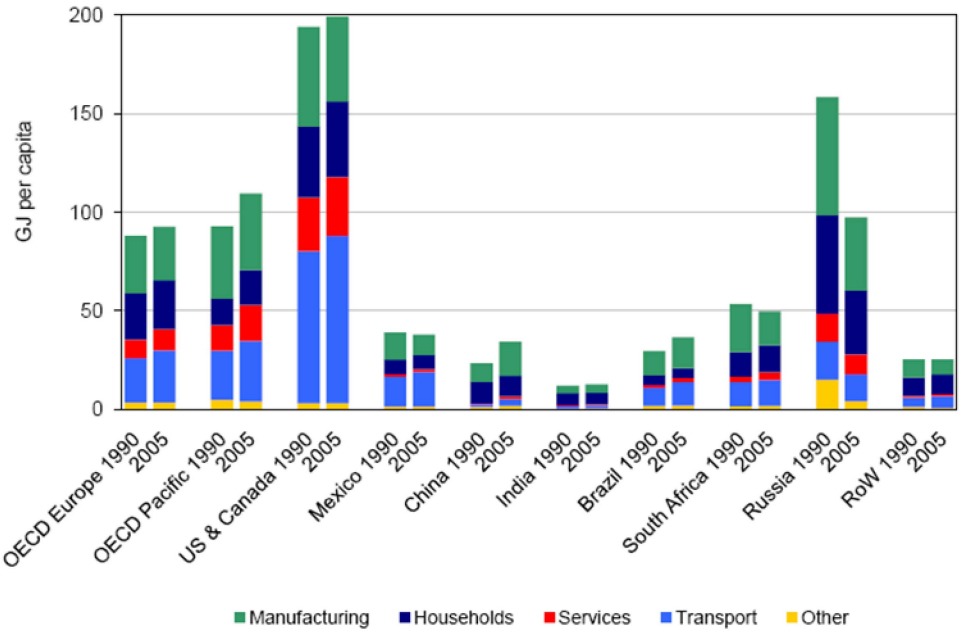
SECTION-I
BACKGROUND

1. ENERGY SCENARIO

1.1 GLOBAL

1.1.1 The International Energy Agency (IEA) forecasts that world primary energy demand between now and 2030 will increase by 1.5% per year from just over 12,000 million tonnes of oil equivalent (Mtoe) to 16,800 Mtoe- an overall increase of 40%. Developing Asian countries are the main drivers of this growth, followed by Middle East. Figure 1 provides the global per capita energy consumption statistics.

Figure 1: World Energy Consumption per Capita



Source: IEA 2009

1.1.2 As the figure illustrates, the growth in per capita energy consumption over the last two decades world-wide has taken place primarily on account of increased share of the transport sector followed by the manufacturing sector. The exceptions to this trend are China and India where the growth has taken place primarily in the manufacturing

sector followed by the household sector. Going forward, some of the trends in global energy consumption are highlighted below:

- Fossil fuels, especially coal, are expected to continue to provide the majority of the increase in marketed energy use worldwide. **Oil and other petroleum products are also expected to continue to account for the largest share of world energy consumption, but their share is likely to fall over the next couple of years mainly due to increasing world oil prices**.
- Petroleum and other liquid fuels will remain the most important fuels for **transportation** in the coming years as there are few alternatives that can be expected to compete widely with petroleum-based liquids. **The share of biofuels is also expected to increase in the coming years**. However there is a significant resource issue that will need to be addressed.
- **The rising price of oil is expected to have an impact on usage and demand for natural gas and non fossil fuel resources as well**. Natural gas consumption is likely to go up in 2012 as it will be used to displace the use of liquid fuels in the industrial and electric power sectors in many parts of the world.
- Global coal consumption is expected to rise sharply because with oil and natural gas prices expected to continue rising, coal will become appealing for nations with access to sufficient coal resources. This is especially going to be true for China, India, and the United States.
- Natural gas and coal will continue to provide the massive shares of the total energy used for electricity generation worldwide.
- **Higher fossil fuel prices, energy security concerns, and environmental considerations are expected to improve the prospects** for new nuclear power capacity and other **grid-connected renewable energy sources** in many parts of the world which is expected to continue to expand over 2012. **Rising fossil fuel costs, particularly for natural gas in the electric power sector, along with government policies and programs to support renewable energy, will allow renewable fuels to compete economically over time**.

Increase in Oil Price and Importance of Non Fossil Fuels in the World Energy Mix

The oil price needed to balance oil markets is set to rise in the coming years, reflecting the growing insensitivity of both demand and supply to price. The growing concentration of oil use in transport and a shift in demand towards subsidized markets limit the scope for higher prices to block off demand through switching to alternative fuels. According to the IEA 2035 outlook, the average IEA crude oil price reaches $113 per barrel (in year 2009-dollars) in 2035, up from just over $60 in 2009, indicating that the short-term price volatility is likely to remain high.

The IEA Energy Outlook for 2035 clearly indicates that if Governments act more vigorously to encourage more efficient use of oil and the development of alternate/ non-fossil fuels, then demand for oil may begin to ease soon and, we may witness a fairly early peak in oil production. However, if Governments do nothing or little more than at present, then demand for oil will continue to increase, supply costs will rise, the economic burden of oil use will increase, vulnerability to supply disruptions will increase and there will be growing energy security concerns across countries.

1.2 INDIAN

1.2.1 India's substantial and sustained economic growth is placing enormous demand on its energy resources. The demand and supply imbalance in energy sources is pervasive requiring serious efforts by GoI to augment energy supplies. India imports about 80% of its oil. There is a threat of these increasing further, creating serious problems for India's future energy security. There is also a significant risk of lesser thermal capacity being installed on account of lack of indigenous coal in the coming years because of both production and logistic constraints, and increased dependence on imported coal. Significant accretion of gas reserves and production in recent years is likely to mitigate power needs only to a limited extent. Difficulties of large hydro are increasing and nuclear power is also beset with problems. The country thus faces possible severe energy supply constraints.

1.2.2 Economic growth, increasing prosperity and urbanization, rise in per capita consumption, and spread of energy access are the factors likely to substantially increase the total demand for electricity. Thus there is an emerging energy supply-demand imbalance. Already, in the electricity sector, official peak deficits are of the order of 12.7%, which could increase over the long term.

1.2.3 In view of electricity supply shortages, huge quantities of diesel and furnace oil are being used by all sectors – industrial, commercial, institutional or residential. Lack of rural lighting is leading to large-scale use of kerosene. This usage needs to be reduced, as it is leading to enormous costs in form of subsidies and increasing the country's import dependence.

1.2.4 At the same time, a very large proportion of the citizens continue to live with no access to electricity and other forms of commercial energy. More than 50% of the population has little or no commercial energy access for their living and livelihood. Others with access often have to cope with poor and erratic availability of electricity and other fuels. With constraints faced in resource availability and in delivery mechanisms, traditional means of energy supply are falling short. This is likely to be the case in the foreseeable future so that energy access will continue to remain a problem.

1.3 ROLE OF RENEWABLE ENERGY

1.3.1 Renewable energy can make a substantial contribution in each of the above mentioned areas. It is in this context that the role of renewable energy needs to be seen. It is no longer "alternate energy", but will increasingly become a key part of the solution to the nation's energy needs.

1.3.2 Renewable energy has been an important component of India's energy planning process since quite some time. The importance of renewable energy sources in the transition to a sustainable energy base was recognized in the early 1970s. At the Government level, political commitment to renewable energy manifested itself in the establishment of the first Department of Non-Conventional Energy Sources in 1982, which was then upgraded to a full-fledged Ministry of Non-Conventional Energy Sources (MNES) in 1992 subsequently renamed as Ministry of New and Renewable Energy (MNRE). This is the only such Ministry in the world. MNRE is the nodal Ministry of the Government of India at the Federal level for all matters relating to new and renewable energy. The Ministry has been facilitating the implementation of broad spectrum programmes including harnessing renewable power, renewable energy to rural areas for lighting, cooking and motive power, use of renewable energy in urban, industrial and commercial applications and development of alternate fuels and applications. In

addition, it supports research, design and development of new and renewable energy technologies, products and services.

1.3.3 In April 2002, renewable energy based power generation installed capacity was 3475 MW which was 2% of the total installed capacity in the country. As on 31.12.2010, it has reached 18,655 MW, which is about 11% of the total installed capacity of 1,68,945 MW and corresponds to a contribution of about 4.13% in the electricity mix. Figure 2 and Table 1 provides the fuel-wise break-up of the installed power capacity in the country.

Figure 2: Fuel-wise installed capacity break-up (%)

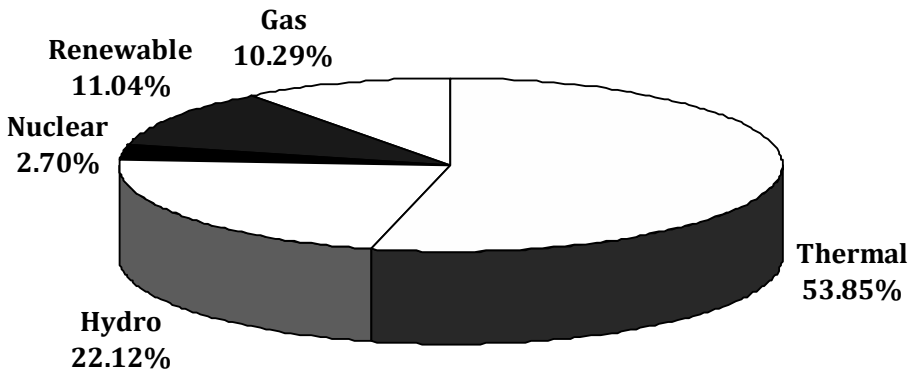


Table 1: Fuel-wise installed capacity break-up (in MW)

Technology	Hydro	Gas	Renewable	Nuclear	Thermal
Installed Capacity (MW)	37,367	17,385	18,655	4,560	90,978

1.3.4 During the first three years of the 11th plan period and the current year upto 31.12.2010, renewable power capacity addition has been 8,395 MW, while the conventional power capacity addition has been 25,598 MW, which corresponds to over 24% of the total capacity addition. It is to be also noted that 23% of all capacity today is large hydro which is renewable but not counted as such. Table 2 below gives an idea of the growth of renewable energy capacity in the last decade. Major contribution has come from wind power which is about 70% of the total capacity.

Table 2: Plan-period-wise capacity addition in grid connected renewable energy based power generation installed capacity

Resource	Estimated Potential (MW)	Capacity Addition (in MW)				
		Upto 9th Plan	During 10th Plan	Targets for 11th Plan	During 11th Plan upto 31.12.2010	Total capacity as on 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**

**Note – including biomass power, bagasse cogeneration, urban and industrial waste to energy.*

1.3.5 Apart from the grid interactive renewable power, MNRE has ambitious programmes for deployment of off-grid/ distributed renewable power and decentralized renewable energy systems for rural applications. Table 3 provides a summary of deployment of various systems under these programmes.

Table 3: Deployment of Off-grid / decentralized renewable energy systems

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.

1.3.6 Extension programmes of the Ministry are largely implemented through the State Renewable Energy Development Agencies. These agencies, in turn, mobilize participation of the State level machinery, local institutions, Non- Governmental Organizations (NGOs) and village level organizations for implementation of these programmes. However, the Ministry is trying to open out more channels to broaden the move in reach and help market mode through other partners. MNRE has set up a Solar Energy Centre near Delhi with the state-of-art facilities for testing of solar thermal and solar photovoltaic materials, devices and systems. This will soon become an apex Centre of Excellence. It also does applied research and training. A Centre for Wind Energy Technology has been set up in Chennai for providing technical support to the Ministry in the implementation of its wind energy programmes. Research and Development programmes are sponsored in research institutions, national laboratories and in industries, both public and private sectors. For market development and financing of renewable energy projects, a separate financing institution called the Indian Renewable Energy Development Agency (IREDA) has been set up as a public sector undertaking. It is perhaps one of the only institutions of its kind in the world which provides institutional finance exclusively in the field of renewables and energy efficiency.

1.3.7 In view of the fast changing energy scenario both domestically and internationally, and the important role expected to be played by new and renewable energy (NRE) sources, it is imperative to take stock of the progress achieved so far adopt a more focussed approach than hithertofore and chart out a clear strategy for accelerated growth of the NRE sector over the short, medium and long term.

SECTION-II
KEY COMPONENTS AND PROCESS

2.1 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.

2.2 KEY COMPONENTS

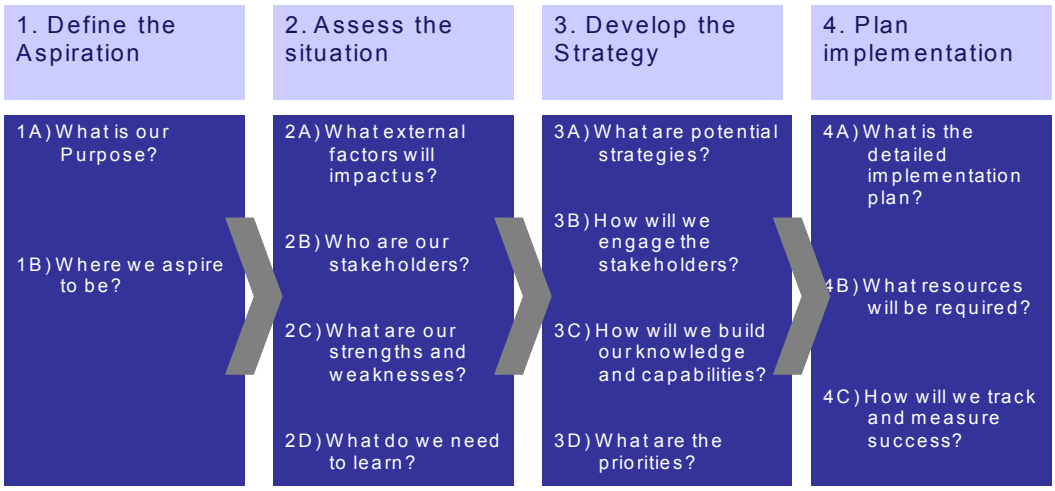
2.2.1 The key components of this Strategic Plan cover the following aspects:

- Vision, Mission and Objectives; Aspiration
- 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

2.3 PROCESS FOLLOWED

2.3.1 The process that has been followed for developing the Strategic Plan is based on the broad guidelines provided by the Performance Management Division, Cabinet Secretariat. It involves four distinct phases as illustrated in Figure 3 below:

Figure 3: Four Steps for Developing the Strategy



2.3.2 Specifically, the Ministry has taken the following main steps (processes followed/ activities completed) in developing the plan:

(i) An action plan for preparation of the Strategic Plan was formulated by the Ministry as per the broad outline provided by the Performance Mgt. Divn. (PMD), Cabinet Secretariat and was submitted to PMD in February 2010.

(ii) The vision and objectives of MNRE were initially reviewed in-house in consultation with different programme divisions of the Ministry at the time of formulation of the Results Framework Document (RFD) for 2009-10. These were further reviewed while formulating the RFD for 2010-11.

(iii) M/s MERCADOS Energy Markets India Pvt. Ltd, a leading international consultancy organization in the energy sector was engaged to assist and coordinate the Strategy development process. The Consultant interacted with most officers of MNRE for their views / inputs on different aspects.

(iv) The interim progress was presented in the workshop organized by PMD at IIFT on 8 Jul 2010.

(v) A Briefing paper giving an Overview of the Renewable Energy Sector and structured Questionnaire (Annexure-I) for circulation to external stakeholders was prepared with the help of the Consultant and sent to major stakeholders by e-mail and post and also posted on the Ministry's website inviting feedback/ inputs on various sections of the Questionnaire and additional suggestions / views latest by 20th August 2010. The

Questionnaire and other related documents were also uploaded on the ministry's website for ease of access by the stakeholders.

(vi) Consultation meetings and workshops with stakeholders – several rounds of discussions and meetings were held with State Nodal/ Implementing Agencies and other stakeholders including NGOs, which provided some very important inputs. Highlights of these meetings are given in Annexure-II.

(vii) One to one meetings were held with important players – Central Electricity Regulatory Commission (CERC), Bankers and Financial Institutions.

(viii) Papers for Public Consultation: a) briefing paper- which outlined the goals, objectives and priorities of the MNRE and defined the context of its operations in detail. The objective of circulating this paper alongwith the structured questionnaire was to seek inputs from state level agencies as well as other entities connected with MNRE to seek a wider stakeholder view and thereafter finalise the strategy and plans using the inputs thus obtained and b) strategy paper titled: Renewable Energy in India- Progress, Vision and Strategy: which covered the vision, mission, objectives, aspirations and strategies of the Ministry for next 5-10 years; it was posted on the Ministry's website for public consultation and to draw larger inputs from stakeholders.

(ix) Feedback received from the aforementioned consultation process has been compiled and the same is summarized in Annexure-III.

(x) International Conference DIREC 2010 organized by the Ministry from 27-29 October 2010 drawing a huge participation of over 13,700 national and international stakeholders: official delegations from 71 countries including about 40 ministers, International Agencies and NGOs. There was a special panel discussion on the strategic vision for renewable energy where the targets and broad strategies for promotion were discussed with participants.

(xi) The existing Strategy of the Ministry for the RE sector has been reviewed and updated taking into consideration the feedback received from Stakeholders and the Strategic Plan for achieving the goals in line with this updated Strategy has been developed.

(xii) Services of an external reviewer: Shri. B B Tandon, Member, Ad-hoc Task Force (Syndicate-III) constituted by the Performance Management Division,

Cabinet Secretariat were also availed to review the Strategy and Implementation Plan and provide valuable inputs for improvement.

2.3.3 The Secretary of the Ministry has been fully involved with this exercise from the beginning. All senior officers of the Ministry and its institutions were also involved. A presentation was also made to the Minister, MNRE and his inputs taken into account.

2.3.4 The subsequent Sections deliberate on each step of the strategy formulation exercise outlined above and address relevant issues.

SECTION-III
VISION, MISSION, OBJECTIVES & FUNCTIONS OF THE MINISTRY

3.1 VISION

The Vision of MNRE is to upscale and mainstream the use of new and renewable energy sources in furtherance of the national aim of energy security and energy independence, with attendant positive impact on local, national and global environment.

3.2 MISSION

3.2.1 The mission of MNRE is to:

- Develop, demonstrate and commercialize technologies for harnessing new and renewable energy sources in close concert with corporate, scientific and technical institutions.
- Replace use of different fossil fuels wherever possible, and increase access to electricity/ lighting in remote and rural areas, through Renewable Energy Systems
- Increase the contribution of Renewable Energy in the total energy mix of the country to 6 per cent by 2022, with about 10 per cent contribution to total electricity mix, in line with IEPR projections.

3.3 OBJECTIVES

3.3.1 The key objectives of the Ministry are:

- To promote deployment of grid-interactive renewable power generation projects
- To promote renewable energy initiatives for:
    - meeting energy/ lighting needs in rural areas
    - supplementing energy needs in urban areas
    - supplementing energy needs in industry and commercial establishments, and
- To promote research, design and development activities at premier national institutions and industries on different aspects of new and renewable energy technologies and help development of new products
- To encourage development of a Robust Manufacturing Industry in Renewable Energy Sector

3.4 FUNCTIONS

- Putting in place suitable policy and regulatory framework at national and state levels for growth of new and renewable energy sector
- Making available necessary fiscal and financial incentives to domestic renewable energy industry, developers and users
- Human Resource Development in new and renewable energy sector
- Fostering International Cooperation in new and renewable energy sector
- Information, Publicity, Public awareness creation in the sector
- Supporting Research and Development related activities/ projects taken up by institutions and industry
- Undertaking resource assessment and potential estimation studies for new and renewable sources of energy
- Taking other special initiatives as may be necessary for growth of the sector

3.5 OUTCOME OF STAKE HOLDER CONSULTATION

3.5.1 As a part of the Strategic Plan formulation exercise, an external stakeholder consultation process was undertaken. The box below summarizes the key questions posed to the stakeholders and their responses to the same.

Box 1: Stakeholder Responses on 'Vision & Objectives of MNRE'

The key question that was raised to the stakeholders was - **In your opinion what should be the vision, mission and objectives of the renewable energy sector?**

Some of the key responses received have been summarized below:

Vision

…decrease dependency on conventional energy sources, reduce Demand- Supply gap by promoting Renewable Energy Sources

…leader in heralding a green energy revolution aiming at energy security, climate change mitigation, green jobs and sustainability through increased reliance on renewable energy

…provision of green and modern energy services to all on a sustainable basis

…provide access to energy based on RE for sustainable development leading to creation of Green Jobs

Objectives

…Shifting the role of RE from bridging the demand supply gap to replace conventional energy sources

…Create enabling policy without technology bias and allow competitive technology and market forces to offer the most sustainable solution

…To expand development and deployment of renewable power generation projects for augmenting access through locally available renewable energy sources

…To promote stand-alone/ decentralized renewable energy systems for meeting energy needs in rural, urban, industrial and commercial sectors

SECTION-IV
TARGETS AND GOALS FOR 2011-17

4.1 For next 5 years (2011-16), which is the focus of the present Strategic Plan, an attempt has been made to quantify the aspirations in terms of SMART (Specific, Measurable, Achievable, Realistic, Time-bound) targets for different renewable resources/ application areas, as detailed in next section. Targets for an additional year 2016-17 have been included so that the exercise becomes co-terminus with the 12th five-year plan period of 2012-17. This reflects the short-term vision of the Ministry.

4.2 As would be evident from the status of current energy scenario in the country, each of the targets, and the totality, is fully commensurate with national and sectoral priorities.

4.3 SPECIFIC, MEASURABLE, ACHIEVABLE, REALISTIC, TIME-BOUND (SMART) TARGETS FOR 2011-17

4.3.1 Grid Interactive Renewable Power: This comprises power generation from mainly the following resources:

(i) Solar power
(ii) Wind power
(iii) Biomass power / Bagasse Cogeneration
(iv) Small hydro power

4.3.1.1 Resource-wise targets have been formulated as specified in Table 4 for the period 2011-17, keeping in view the estimated total potential, the progress made so far, the targets that were set for the 11th plan period and corresponding achievements in the first three years and the current year, and the general constraints in different sectors.

Table 4: Year-wise Targets for Grid interactive RE Power for the period 2011-17 (All Figures in MW)

Technologies/ Year	Biomass / Agri waste[1]	Bagasse Cogen[2]	U&I Energy[3]	SHP[4]	Solar[5]	Wind[6]	Total Targets
Cumulative (anticipated upto 31.03.11)	**1025**	**1616**	**84**	**3040**	**35**	**13900**	**19683**
2011-12	100	250	20	350	300	2400	**3420**
2012-13	80	300	25	300	800	2200	**3705**
2013-14	80	300	35	300	400	2200	**3315**
2014-15	80	250	45	300	400	2200	**3275**
2015-16	80	250	55	350	1000	2200	**3935**
2016-17	80	250	60	360	1100	2200	**4050**
Total Target for the 6-year period	**500**	**1600**	**240**	**1960**	**4000**	**13400**	**21700**
Cumulative Total Target	**1525**	**3216**	**324**	**5000**	**4035**	**27300**	**41383 Say, 41,400**

Basis:

1 Considering average achievement ~100MW /year during 11th plan; competitive local use of traditionally available biomass is a limiting factor.

2 Limited by overall surplus power generation potential of 5000 MW from existing Sugar Mills.

3 Urban/ Municipal Waste projects limitations due various factors.

4 Considering average SHP capacity addition of ~300MW / year during 11th plan period so far

5 As envisaged under National Solar Mission. Larger capacities will actually be installed after the end of Phase I and Phase II.

6 Considering withdrawal of AD incentive; may be only GBI route to continue beyond FY 2011-12. (In general there is no real increase year on year)

4.3.1.2 The funds required for the 12th plan period based on certain assumptions to achieve the targets are assessed in para 8.3 (page nos. 57-60). These are all important and the Ministry is hopeful that they would be made available. However, if there are budgetary constraints, then the obvious option would be to consider the architecture for support for solar power generation, which may include continuation of the current system of purchase through bundling of thermal power. The funds shown for wind power (towards GBI) have been necessitated because of the proposed withdrawal of accelerated depreciation benefit which has been the major driver so far. Revenue loss saved because of tax concession could be provided as budget additionality. It is, however, hoped that through appropriate regulatory instruments (such as RPOs) and market interventions (through RECs, market sale of RE power) there would be a consequent reduction in the requirement of funds for GBI in the coming years.

4.3.2 Off Grid/Decentralized Renewable Energy: Year-wise targets for deployment of various decentralised systems for off-grid applications for 2011-17 have also been formulated on similar basis and are summarised in Table 5 below. It will be noticed that there is reasonable growth proposed year on year. Rural energy supply, rural electrification and rural solar lighting are areas that are receiving increasing impetus. In most cases, there are considerable savings of diesel and kerosene.

4.4 LINKAGE WITH RESULTS FRAMEWORK DOCUMENT (RFD):

4.4.1 The year-wise targets for development and deployment of various renewable energy systems/ devices in the country for the period 2011-17 reflected above take into consideration the trend of achievements during the preceding years and the annual targets for the current year and the targets for 2011-12 as reflected in the RFD of the Ministry for 2010-11.

4.4.2 The targets for 2011-12 have further been set in line with the Annual Plan proposals of the Ministry for 2011-12 and are being incorporated in the Ministry's RFD for 2011-12.

Table 5: Year-wise Targets for Off-Grid RE application for the period 2011-17

RE Applications / Years	Cumulative (likely by 31.3.11)	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	Total Target for 6-year period	Cumulative Total Target
Family Biogas plants ***Nos. in Million***	4.5	0.15	0.15	0.20	0.20	0.20	0.20	**1.10**	**5.60**
Remote Village Electrfn. ***No. of villages covered***	7500	500	-	-	-	-	-	500	8000
Biomass gasifiers- rural ***-No. of villages covered***	150	100	120	130	140	160	200	**850**	**1000**
Rural Electrifn.-SPV ***No. of villages covered***	30	30	40	40	50	50	60	**270**	**300**
Decentralised SPV Systems - *MWp*	132	68	100	150	200	200	250	**968**	**1100**
Rural Solar Lights ***Nos. in Million***	0.2 (sanctioned)	0.6	1.2	1.2	1.2	1.3	1.3	**6.8**	**7.0**
Micro-hydel Water mills- ***Nos.***	1550	200	250	300	350	400	450	**1950**	**3500**
Solar Thermal - water heating, etc- ***Mln. sqm.***	4.4	1.1	1.1	1.1	1.1	1.1	1.1	**6.6**	**11.0**
Urban WTE Plants ***MWeq***	4	10	10	10	10	10	10	**60**	**64**
Industrial WTE/ Bio power -*Weq*	330	50	60	70	80	90	100	**450**	**780**
Industrial WTE/ Bio power - *MWeq*	330	50	60	70	80	90	100	**450**	**780**
Improved Cookstoves- ***million numbers.***	Data not available	0.2	0.4	0.6	0.8	0.10	0.12	0.42	**0.42** (excl. previous)

Basis:

Biogas plants-	Considering trend of yearly achievements so far and the increased levels of CFA from Current FY.
RVE-	Considering likely availability of villages after exclusion from RGGVY.
Biomass gasifiers for rural energy supply-	New initiative.
Rural Electrification through SPV-	As envisaged under National Solar Mission.
Decentralised SPV systems-	-do-
Rural Solar Lights-	The MW equivalent power from such lights are already incorporated in the Decentralized SPV system targets
Micro-hydel/ Water mills -	Considering trend of yearly achievements so far.
Solar Thermal systems for water heating etc-	Considering total achievement of 2.5 mln. during 11th plan till Oct 2010.
Urban WTE Plants-	Urban/ Municipal Waste projects limitations due various factors.
Industrial WTE/ Bio power in Industry-	Covers biomethanation of liquid effluents; combustion/ gasification of biomass and rice-husk (new initiative).
Improved Cookstoves	Additional component not included in 11th plan document; Subject to Planning Commission's approval.

SECTION-V
ASPIRATION OF THE MINISTRY

5.1 The long term aspiration of the Ministry follows from its Vision and Mission statement given in para 3.1 & 3.2 and is as under:

- Develop, demonstrate and commercialize technologies for harnessing new and renewable energy sources in close concert with corporate, scientific and technical institutions. In particular, the aspiration would be to reach grid parity for both solar PV and solar thermal and achieve technological breakthroughs is second generation biofuels and hydrogen energy/ fuel cells.
- Replace use of different fossil fuels wherever possible in even greater quantities, and increase access to electricity/ lighting in all remote and rural areas where it is needed, through Renewable Energy Systems
- Increase the contribution of Renewable power in the total installed power generation capacity of the country from 16 per cent to about 18 per cent by 2022, with 7.3 per cent contribution to electricity mix. This would require an achievement of about 13% over the already ambitious targets proposed.

5.2 Quantification of the Aspirations for Grid Connected Renewable Power

5.2.1 Resource-wise current status of development is as under:

- Wind power, Biomass power / Bagasse Cogeneration and Small hydro power technologies are mature and commercially viable per se. However, their deployment is dictated/ limited by local resource availability and logistics and environmental conditions.
- Both Solar PV and thermal are in the developmental stage and real progress will take place only after technologies have been further established and costs have been substantially reduced. Proposed targets are already incorporated in the Solar Mission and these are quite ambitious by themselves.
- In the last decade, there have been many developments in wind power technology leading to availability of higher capacity and better efficiency

turbines and also turbines suiting low-wind density conditions However, issues related to environmental, forest clearance and transmission constraints could adversely affect growth. Therefore, the potential is variable. However, the Ministry will aspire to do more.

- Generation of power from biomass could increase if Ministry's efforts initiated recently regarding creation of dedicated energy plantations could bear fruit. Competitive local use of traditionally available biomass is a limiting factor.

- There is significant potential for Small Hydro power in Himalayan and sub-Himalayan region but the power evacuation and transmission network needs expansion. Besides, remoter areas have tremendous logistical constraints.

5.2.2 Keeping above limitations in mind but recognising the need to achieve more, Table 6 summarizes the sector-wise aspirational goals that have been formulated for grid-connected renewable power for 2022.

Table 6: Aspirational Goals for Grid Connected Renewable Power for 2022

(All Figures in MW)

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

5.2.3 Considering the projections reflected in the Integrated Energy Policy Report (IEPR) and the Perspective Plan of Ministry of Power in respect of conventional power capacity addition, it is estimated that the total power generation installed capacity (conventional and renewable) will reach around 4,65,500 MW by 2022, corresponding to electricity generation of around 2540 BU. The contribution of renewable power to the total installed capacity and electricity mix would be around 18% and 7.3% respectively. Of course, these percentages could change depending on actual achievements of the proposed conventional power capacity, and it is quite likely that these will be higher than visualised.

5.2.4 However, the above aspirational goals cannot be achieved in a business-as-usual scenario. There is a complex interplay of policies, regulations, technology development and resources with a large number of players and stakeholders. These factors coupled with availability of adequate financial resources will be critical for achievement of the aspirational goals.

5.2.5 Aspirational Goals for Decentralised Renewable Energy Applications

5.2.5.1 Decentralised Solar Energy systems: The greatest potential area of off grid relates to solar technologies. These include solar water heating systems, home lighting systems which include solar lanterns, solar cooking systems, solar pumps, small power generating systems. Under the Solar Mission, it has been proposed to cover 2,000 MW equivalent off-grid power systems by 2022 which includes all the above, except solar water heating systems for which there is a separate target of 20 million sq. metres. Within the off grid component, there is a separate target of covering 20 million rural households with solar lights. This includes both, coverage under the Remote Village Electrification Programme as well as through loans given by banks in areas where grid is available to meet unmet demand. These are very ambitious targets. However, our aspiration goals would be an additional 2,000 MW in the same period. This would entail coverage of niche areas like solarisation of telecom towers, large scale use by industrial establishments in the manufacturing sector where diesel generating sets have been installed for partly mitigating daytime use of diesel, increased coverage in areas like Ladakh where diesel is the prime source of energy generation, etc. This would require support of other Ministries and industries and more resources.

5.2.5.2 Rural Electrification through Renewable Energy**:** An extension of off grid relates to rural electrification. Over 40% of the country's population is currently denied energy access. This has become a major problem and, inspite of large investments under the RGGVY for rural transmission, it has been found increasingly difficult to provide this access, especially in certain identified areas, partly because of continuing supply constraints. But biomass and Solar PV based solutions are possible. Biomass based solutions are relatively more viable commercially and can be implemented with some Government support. The Ministry would like to cover about 10,000 villages from biomass-based systems and over 1000 villages from solar power up to 2022. The latter

will, however, require substantial Government support or financial support which may come as grants through some fund or the other to meet the initial capital cost. This would be apart from the target of coverage of 20 million households to be covered with solar lights. These achievements would make a huge dent in the critical matter relating to energy access.

5.2.5.3 Green Buildings: Almost 40% of the total energy is utilized in the building sector. A green building designed through solar passive concepts and including active renewable energy systems can save substantial conventional energy apart from generating energy for meeting various requirements in different seasons. Keeping in view our climatic conditions, a National Rating System - GRIHA has been developed which is suitable for all types of buildings in different climatic zones of the country. It is expected that the Rating system will promote the design and construction of green buildings in the country. The Ministry wants to pursue promotion of green buildings in a mission mode and intends to undertake a huge capacity building effort in this regard. It aspires to have 200 million sq. mtr. GRIHA rated buildings by 2022. This concept is also being promoted for campus developments. It is hoped that this would have become the norm by then.

5.2.5.4 Renewable Energy based Cooking systems: Another important area of off grid relates to rural cooking needs. This involves the Family Size Biogas Plants Programme as well as covers the issues of cook stoves, both at the level of the individual households or the community level. The Ministry has been traditionally doing about 1 lakh family size biogas plants annually. Normally, 1.5 lakh would continue as an increased annual target, but the Ministry would like to increase this further and reach coverage of over 2 million by 2022. Cook stoves is a big problem as either biomass is inefficiently burnt, creating both emissions and health hazards and substantial higher consumption of firewood as far as community cook stoves are concerned or the cost of the stove becomes too high. The Ministry has launched a National biomass cook stove initiative to address both. A research programme has also been initiated to identify the right stoves which could be used by households. At the same time, a pilot project has been launched to test the efficiency and marketability of improved community cooking stoves. This pilot project covers governmental institutions like Anganwadi Centres, schools for mid-day meals and tribal hostels, etc. apart from private dhabas. The Ministry would like to

enable distribution of over 10 million stoves for households with some limited Government support by 2022 which would require additional funds and half a million community stoves to be installed in market mode. Naturally, the latter would require support of line Ministries including the Ministry of Tribal Affairs, Department of Women and Child Development and Department of Elementary Education.

5.2.5.5 In addition, Ministry would like to cover at least 1000 solar cooking systems by 2022. All institutions including large institutions with hostels, hospitals/ medical colleges, military/ para-military establishments, industrial organizations - wherever large number of meals is cooked are the targets of the Ministry. Many such systems have already been installed and technology refinements are taking place. Essentially, these reduce the consumption of cooking gas. Reduction in subsidy on cooking gas would make this target much easier to achieve. That may also help growth of solar dish cookers for individual use.

5.2.5.6 The Ministry has initiated research into various solar cooling applications. Aspirational goals would include commercially viable systems to be developed in the next five years. Thereafter, this could be an area for upscaling.

5.2.5.7 Table 7 summarizes the aspirational goals for off-grid renewable energy deployment by 2022.

Table 7: Summary of Aspirational goals for off-grid RE deployment by 2022

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.

5.2.5.8 The deployment of off grid renewable energy solutions is dependent on so many variables that in most cases it is difficult to forecast the future deployment of such systems. But the vision is to increase the possible numbers of off-grid application and villages to be covered. It would also require additional resources.

5.3 POTENTIAL SAVING OF CONVENTIONAL FUEL/ ELECTRICITY

5.3.1 It must be emphasized that there is an important, unrecognized consequence of off-grid applications. In one way or the other, they replace consumption of fossil fuels. For instance, rural lighting replaces scarce kerosene, a biogas plant or solar cooking systems replace scarce cooking gas, solar PV replaces scarce diesel or furnace oil, cook-stoves would reduce consumption of biomass/ firewood. An estimate of the norms has been made in Table 8 below of the quantum of conventional fuel/ electricity likely to be saved annually through use of various renewable energy sources in the country.

Table 8: Norms for computing likely annual savings of conventional fuel/electricity through renewable energy deployment

Renewable energy source/systems	Likely annual saving of conventional fuel / electricity
Wind Power	2.00 MU / MW
Small Hydro Power	3.00 MU/ MW
Solar Photovoltaic (PV) Power	1.66 MU/ MW
Solar PV Lantern	50 litre K-Oil/ Lantern
Solar PV Home Lighting System	100 litre K-Oil/ System
Solar Thermal Energy	
- Power Generation	2.00 MU/ MW
- Thermal Energy Systems	36 TOE/ 1000 m^2 collector area
	0.50 – 0.70 MU/ 1000 m^2 collector area
Bio Energy:	
i. Bagasse Cogeneration	4.00 MU/ MW
ii. Biomass Power	6.00 MU/ MW
iii. Biomass Energy (Thermal)	1000 TOE/ MW_{eq}
iii. Urban & Industrial Waste to Energy	
- Power Generation	4.00 MU/ MW
- Thermal Energy/ Cogeneration	1000 TOE/ MW_{eq}
iii Family type biogas plants	450 Kg. LPG/ 1000 m^3 Biogas
iv. Medium Size Biogas Plants	0.36 MU/ 1000 m^3 Biogas

MW = Megawatt	(Installed Capacity of Power Plant)
MW_{eq} = Megawatt equivalent	- do-
MU = Million Units	(Electricity generated/ saved)
TOE = Tonnes of Oil Equivalent	(Oil saved)
LPG = Liquefied Petroleum Gas	(LPG saved)

Remark: 1 Unit of electricity = 0.7 Kg. of Oil.

5.3.2 Benefits: The above solar power capacity addition will result in substantial savings of kerosene, diesel and fuel oil as detailed below:

- 20 million solar lights are estimated to avoid use of 1 billion litres of kerosene per annum in 2020.
- 20 million sq. m thermal collectors are expected to save fuel oil in industrial applications and electricity in other applications.
- 5 million sq. m thermal collectors are expected to save about 350 million litres fuel oil per annum in 2020.
- 15 million sq. m thermal collectors are expected to save 9 billion units of electricity per annum in 2020.
- 3,000 MW of roof top PV systems and 3,000 MW of other power plants by 2020, 50% of which will mainly be used for avoiding use of diesel during daytime for power generation, are expected to save about 1050 million litres of diesel per annum in 2020.

5.3.3 In all aspects, the positive environmental impact of RETs is clearly obvious. It can substantially contribute to a lower carbon footprint which will help ensure that India does not fall behind in its contribution to arrest climate change trends and the Prime Minister's commitment in 2008 regarding India not exceeding the emissions of developed economies is honoured. Importantly, this will be a key tool for ensuring energy security since the resources are entirely indigenous. It is also these applications which are likely to generate thousands of jobs at local levels over the years.

5.3.4 The Strategy and approaches that have been formulated / elaborated later in Chapter VII for achievement of the aforementioned targets/ aspirations are general in nature. But they reflect an attempt to innovate and to reach out to different areas in different ways. An attempt has been made to identify those areas where RE applications are likely to have the greatest impact and which are particularly beneficial to the country in terms of contributing to inclusive development, energy access, energy security, reduction of emissions, etc. However necessary course corrections and new policy initiatives will have to be taken depending on the actual achievements in the different RE sectors as well as funds available at different points of time.

5.4 OUTCOME OF STAKE HOLDER CONSULTATION

5.4.1 As mentioned earlier, as a part of the Strategic Plan formulation exercise, an external stakeholder consultation process was undertaken. The structured questionnaire used for the consultation has been provided at Annexure-I. The box below summarizes the key questions posed to the stakeholders and their responses to the same.

Box 2: Stakeholder Responses on 'Defining the Aspiration'

The stakeholders were asked - **In your opinion what should be the aspirations of the renewable energy sector?**

Some of the key responses received have been summarized below:

Aspirations

...to secure that India sustain its global position as a leading emerging renewable energy market offering best potential business opportunities

...renewable energy should compete with conventional sources of energy without subsidies

...enhanced consumer access

...ensuring desired output/quality

...large scale deployment and cost reduction

...to achieve the comfort level of indigenous manufacturing base in five years period

5.4.2 As indicated in para 7.5.3, other Ministries are significant stakeholders. The Ministry has been continuously holding dialogues with different Ministries related to the various issues mentioned therein. In general, support has been partial. However, the solar mission is a good example of this Ministry and the Ministry of Power working in close cooperation.

5.4.3 The Ministry has taken into account these suggestions made by the stakeholders while formulating its vision, objectives and aspiration.

SECTION-VI
ASSESSMENT OF THE SITUATION

6.1 EXTERNAL FACTORS HAVING AN IMPACT ON THE SECTOR

6.1.1 A brief status of the current energy scenario including renewable energy has been given in paras 1.1 & 1.2. In that context there are several important factors which are likely to affect the growth of the renewable energy sector.

6.1.2 Development of renewable energy off-grid solutions will be critically dependent upon the actual retail price of diesel, kerosene and furnace oil as they will become more attractive alternatives, even at current costs, if fuel prices rise. This would in turn depend upon global prices of crude as well as level of subsidies to these fuels nationally. Rural lighting through solar could be saturated even if fully subsidized initially simply by a few years equivalent kerosene subsidy.

6.1.3 Rural electrification systems would depend upon the capacity created for conventional power systems as it correspondingly depends upon ability to actually supply cheap power to rural areas.

6.1.4 Grid connected renewable energy power would be dependent upon cost reduction and greater efficiency. Therefore, improvements in technologies and applications, particularly for solar power are very important. Growth would depend on total quantum of thermal/gas power generated and its cost. Should there be decline in power shortages utilities may not have an incentive to buy higher costing renewable power.

6.1.5 A summary of the external factors that will impact the renewable energy sector has been provided through a PESTEL (Political, Economic, Socio-Cultural, Technological, Environmental and Legal) analysis as illustrated in table 9 below.

Table 9: PESTEL Analysis of External Factors

Factors	Opportunities	Threats
Political	Conducive Policy & Regulatory Framework for Renewable Energy, domestically	Non availability of financial resources for supporting RE
	Availability of funds for renewable energy	Political support at the State Government level/ institutions vary widely
	Regulatory developments in grid and market integration of RE	Lack of interest to support such resources by other Ministries
	Growing private sector interest in RE	
Economic	Increasing price of oil	Continuation of high subsidies for diesel, kerosene, cooking gas
	Increasing energy demand-supply gap	Readiness of financial institutions to take on risks
	Increasing pressure on availability of conventional fuel sources such as coal	Ability to maintain cost competitiveness vis-à-vis international markets
	Several regions in the country with no access to grid power	
	Possibility of significant reduction in costs of solar technologies	
Socio Cultural	Significant potential of employability	Resistance from local community/ end-users towards use of certain technologies (e.g. waste to energy)
Technological	Technology break-through in solar	Inadequate transmission system capacity
	New technology breakthrough – for example, second generation biofuel technology breakthrough	Infrastructure bottlenecks
	Development of storage technology	
Environmental	Decreasing domestic coal allocations	
	Increasing awareness of climate change concerns	
Legal	Conducive legal framework – Electricity Act, National Energy Policy, National Tariff Policy	
	National Action Plan on Climate Change	
	Kyoto Protocol and new Global Climate Protocol	

6.2 KEY STAKEHOLDERS

6.2.1 The key stakeholders of the Ministry and their roles & responsibilities have been summarized in table 10 below. This is elaborated further in para 7.5.3.

Table 10: Stakeholder Analysis

	Power		Stakes	
Group/ Individuals	**How can they help us?**	**How can they block us?**	**What would they want from us?**	**What do we want from them?**
Research & Development (R&D)/ Technical Institutions	- Engaged in technology development/ indigenisation efforts - Manpower development	Misuse of assistance/ subsidy	- Skill development - Financial support	Incubating new technologies
Equipment Manufacturers and Technology Providers	- Product marketing partners - Technology innovation - Awareness creation among users	Misuse of assistance/ subsidy	Financial support	Providing high quality products
State Governments	Promotion of renewable energy programs at the state level through conducive policies	- Lack of adequate support for RETs - Lack of appropriate fund allocation - Inefficiency in delivery	- Financial support - Timely releases - Skill development	Facilitating effective implementation of RE programs & schemes
Regulators (CERC, SERCs)	Formulating conducive regulations that would support the RE policy initiatives of the Ministry	Through regulations that have inadequate enforcement measures	Cooperation	Working together at the time of formulation of policies and regulations
Different Ministries of Government of India	Promotion of renewable energy programs in complementary programs	- Lack of adequate support for RETs - Sectoral interests can block/ hamper growth	Convergence for inclusive growth	Facilitating large scale off grid applications such as SWH, solar cooking, solar street lighting, solar air-conditioning, kitchen waste processing, green buildings and campuses in their establishments

	Power		Stakes	
Group/ Individuals	**How can they help us?**	**How can they block us?**	**What would they want from us?**	**What do we want from them?**
Indian Renewable Energy Development Agency (IREDA) and other Financial Institutions/ Partner Banks	Concessional financing for RE projects	By not financing RE projects through high cost of finance	Financial support through for instance guarantees	Large scale financing of RE projects through concessional funds
International Financial Institutions	- Source of low cost funds - This would be particularly helpful for development of large solar power plants with storage.	Lack of support		Helping particularly off grid initiatives and rural electrification efforts by providing debt funds at low cost
Developers/Investors (including foreign)	- Implementing RE projects & programs - Innovation in business models for inclusive growth	- Availing financial support from the Ministry but not implementing projects - Unfair practices - Sub-optimal monitoring of projects	- Financial support - Conducive policy & regulatory framework	- Implementing RE projects & programs - Innovation in business models for inclusive growth
Non Governmental Organizations (NGOs)	Spreading awareness	Fictitious NGOs Spreading of misinformation	Financial support	Awareness generation
End-users	Large scale use of RE devices	Non cooperation towards usage of RE devices on account of: - lack of awareness - high cost - utility factor	Awareness creation Cost of such devices being made available at same cost or lower cost than conventional systems	Increased usage and promotion of RE systems and devices

6.3 STRENGTHS & WEAKNESSES OF THE RENEWABLE ENERGY SECTOR

6.3.1 Given the nature of renewable energy technologies, there are certain sector specific strengths and weaknesses that have affected the growth of the renewable energy sector till date. These need to be taken into account before formulating strategies and plans to facilitate development of such technologies.

6.3.2 An assessment of the strengths and weaknesses of the renewable energy sector and the Ministry has been carried out in consultation with key stakeholders. A summary of this is being provided in Figure 4 below.

Figure 4: Strengths and Weaknesses of the Renewable Energy sector in India

Strengths	Weaknesses
• Conducive policy and regulatory framework at central level • Good resource potential • Growing technology maturity in certain sectors such as grid connected wind power • Emergence of indigenous manufacturers and developers • Ability of renewable energy technologies to offer off-grid/ decentralized energy solutions	• Absence of conducive policy and regulatory framework in some States • High cost of certain technologies • Current acceptability of end-users • Inconvenience of use of certain renewable energy based applications vis-à-vis conventional means • Quality and therefore reliability of equipment – particularly for decentralized applications • Lack of availability of adequately skilled, technical manpower • Lack of adequate transmission infrastructure in states for evacuation of renewable power • Lack of implementation infrastructure • General lack of awareness of end-users • Lack of adequate distribution and service network

6.4 STRENGTHS & WEAKNESSES OF THE MINISTRY

6.4.1 It is also important for the Ministry to map its own internal strengths and weaknesses vis-a-vis the above mentioned sector specific strengths and weaknesses for effective discharge of its functions and development of sector-specific strategies. The same have been briefly assessed and are outlined below.

6.4.2 Strengths

- Independent Ministry: The Ministry is the nodal ministry of the GOI at the federal level for all matters relating to new and renewable energy. It is the only such ministry in the world, dedicated towards promotion of renewable energy sector. This enables focussed attention as well as high degree of autonomy in formulation of sector specific plans and policies.

- Adequate Budgetary support for promoting renewable energy technologies: The growing concern over use of fossil fuels and the potential and prospects offered by renewable energy sources has been a driving force for allocation of adequate budgetary support to the Ministry for implementation of its programmes. However, this support needs to be substantially up-scaled in the coming years.

- Existence of specialised technical institutions: The Ministry has three specialised technical institutions functioning under its control – SEC, C-WET and NIRE (being operationalised). These are a definite strength of the Ministry for coordinating the research, design, development and demonstration activities in their respective fields. However, they need strengthening, particularly SEC.

- Technical skills of officials: The officers of the ministry and its technical institutions are mostly highly qualified scientists/ engineers, which is a definite asset.

- Wide mandate: The Ministry's mandate covers promotion of all forms of new and renewable energy resources which are aligned to the emerging global energy scenario.

6.4.3 Weaknesses

- Staffing: It is noted that while the deployment and development activities of the Ministry have been gradually increasing, the availability of scientific manpower has been shrinking because of retirements and absence of fresh recruitments in past. This problem has to be resolved.

- Inadequate database management, documentation/ recording system: These are problem areas and needs to be strengthened. A Resource Centre needs to be

developed and more expertise in finance, economics and evaluation studies is also required.

- Dependence on other Departments/ Agencies: The performance under various programmes is sometimes critically dependent on other Departments/ Organizations. Besides, state units need to be strengthened. State power authorities do not bother much about renewable energy and generally this is yet to get importance. This perception both in the centre and the state needs to change.

6.5 LEARNING AGENDA FOR THE MINISTRY

6.5.1 The learning is being drawn from an assessment of the strengths and weaknesses of the Sector as well as the Ministry as outlined above. The following main agenda points have been identified:

- Ensuring adequate number of technical personnel at different functional levels
- Continual improvement of skill set of the officers through suitable training programmes and exposure to latest technological developments worldwide.
- Strengthening of database, documentation and recording system of all the important data and information. In this regard it may be desirable to develop a centralised IT enabled database for easy access as well as security of data.
- Strengthening of economic/ financial, analytical abilities

6.6 OUTCOME OF STAKE HOLDER CONSULTATION

6.6.1 As discussed in the previous chapter, as a part of the Strategic Plan formulation exercise, an external stakeholder consultation process was undertaken. The box below summarizes the key questions posed to the stakeholders and their responses to the same. The inputs provided by the stakeholders have been taken into account by the Ministry during the strategy formulation process.

Box 3: Stakeholder Responses on 'Assessing the Situation'

The following questions were raised to the stakeholders:

- **What are the external factors (International and National factors external to the renewable energy sector) that will impact the renewable energy sector in India?**
- **What are the internal factors (internal to renewable energy sector) that will impact the renewable energy sector in India? E.g. cost, technology breakthrough, etc**
- **Who are the key stakeholders of the renewable energy sector in India?**
- **What according to you are the key opportunities and threats facing the renewable energy sector in India?**

Some of the key responses received have been summarized below:

External Factors

- ✓ Climate change
- ✓ Technological development/ technological innovations
- ✓ Price of Oil

Internal Factors

- ✓ Policy and Regulatory environment
- ✓ Research & Development
- ✓ Technology innovation & transfer

Key Stakeholders

- ✓ Central & State Government Agencies
- ✓ Utilities & System Operator
- ✓ Financing Institutions
- ✓ Developers
- ✓ Technology Providers/ Manufacturers
- ✓ Investors
- ✓ End Users

Opportunities

- ✓ Potential
- ✓ Favourable Policies
- ✓ Demand- Supply Gap
- ✓ Inadequate access to energy in rural areas
- ✓ Employment opportunities

Threats

- ✓ High subsidy on conventional energy
- ✓ Lack of low cost financing
- ✓ Lack of distribution and service network
- ✓ High cost vis-a-vis international markets

SECTION-VII
OUTLINE OF THE STRATEGY

7.1 POTENTIAL STRATEGIES

7.1.1 Based on an assessment of the external factors that are likely to affect renewable energy growth in the future and internal capabilities, the following strategy has been proposed to address general and sector-specific weaknesses even as successful policy initiatives are proposed to be upscaled and emerging opportunities exploited. The Ministry's strategic initiatives have been formulated to address the following issues:

- Pursue initiatives that fit our strengths,
- Overcome weaknesses with new knowledge and capabilities,
- Identifying actions that can leverage our strengths to reduce vulnerabilities to external threats, and
- Establishing a defensive plan to prevent our internal weaknesses from making it susceptible to external threats.

7.1.2 **Resource Assessment:** For accelerated deployment of renewable energy technologies, availability of detailed and credible information on the resources is imperative. There is need to continue to create/ update/ validate database on Renewable energy resources through a systematic approach in association with expert and specialized institutions.

7.1.3 **Cost reduction - Incubating technologies with high future potential:**

- Even as several of the renewable energy technologies are fast achieving maturity, there are some that require focused attention to ensure that they are effectively deployed. The Ministry has identified thrust areas in different renewable energy sectors encompassing technologies, processes, materials, components, sub-systems, products and services etc. in which R&D efforts are required and will continue to support these efforts in R&D institutions with industry participation.

- Wind and Small Hydro are mature technologies. New generation wind turbines are coming through competitive efforts of manufacturers.

- Solar PV and Solar Thermal are critically important in the short and medium term. For PV, the thrust areas are: development of silicon and other materials, efficient solar cells, thin film materials, concentrating PV technology, PV system design with the objective of significantly reducing the ratio of capital cost to power generation, etc. For Solar Thermal, the thrust areas are development of technologies for power generation, industrial process heat systems, solar cooling; technology improvement for various low temperature applications viz. solar water heating, solar cooking, etc. In both solar PV and solar thermal, storage methods are also important.

- Biomass also has short term priorities, though largely developed but improvements in gasification, various sizes of engines, boiler, etc for various feed-stocks are needed. This is ongoing.

- In the medium term, second generation biofuels have great promise.

- In the longer term, hydrogen has great potential – production, storage and distribution. R&D in these areas has to be strengthened. Storage technologies including fuel cells are also going to be important.

7.1.4 Opening market channels and introducing new business models

- Too much dependence so far has been on ad hoc proposals sent only through state nodal agencies. Hence, a projectised approach is being adopted which provides greater focus, better targeting, easier implementation and more effective maintenance and monitoring. Further, renewable energy technologies often do not have the economies of scale as individual projects. Hence the overheads of standalone projects tend to be high, often rendering such projects expensive. Channels that result in economies of scale and hence reduced unit costs can thus be extremely beneficial for deployment of such technologies. Further, different channels can take advantage of entrepreneurs which is

necessary to make projects more sustainable. Simultaneously, therefore, different business models have to be developed.

- Typically a renewable energy project involves multiple entities in the course of development. These include:
  - Equipment manufacturers and suppliers
  - Banks and other financiers
  - Installation service providers
  - Maintenance service providers
  - Subsidy providers (wherever subsidies are involved)
  - Regulators (for grid based renewable projects)
  - Validators (for projects requiring external validation)
  - Off-takers of energy
- Robust channels, financing instruments, documentation can help bring about very significant efficiencies through aggregation and standardization. It is also an important element for risk management and hence reduction in the cost of finance. Various policies and initiatives of the Ministry recognise this, including the JNNSM program, the UNDP/GEF assisted Global SWH Program, etc. The JNNSM guidelines for distributed and off-grid generation provide for Program Administrators (PA) who will manage the various initiatives as per roles defined. Under the SWH program, Energy Services Companies (ESCOs) are also being encouraged to bring about aggregation and efficient delivery. The Ministry is continuously working towards creating such mechanisms for various initiatives, as and when necessary.
- Key to efficient and effective delivery is also the role of State Nodal Agencies (SNA). The performance of various SNA's has varied widely. This has resulted in effective renewable energy deployment in certain states, even as others with considerable potential have been falling behind. It will be important to strengthen the SNAs and other elements of the delivery chain (including, for example, banking channels). An overall capacity building and communication program will be developed to address this.

7.1.5 Continuing improvements in regulatory and policy initiatives to promote renewable energy technologies

- The Ministry will continue to work closely with the Regulatory Agencies at the centre and state level with regard to promoting a facilitative framework for promotion of renewable energy technologies. This will include issues relating to tariff for renewable energy technology based power projects, renewable purchase obligations and measures like renewable energy certificates and other market based mechanisms, market and grid connectivity issues, inter-state exchange of renewable energy.

- Ministry would like to assist states in setting up transmission systems required primarily for renewable energy projects. Similarly some assistance may be required for Solar Parks.

- In some areas, higher tariff may be required or generation based incentives may have to be rationalized further.

- Just as efficiency of delivery channels will be important, so will be strong monitoring and evaluation frameworks for the various schemes and programs. The deployment being widely distributed (often in inaccessible areas), the performance is extremely difficult to monitor. This often leads to leakages and endangers the credibility of the programs, which are otherwise very important for the country. Most of the Ministry's present programs incorporate monitoring and verification programs that are less intrusive and yet more effective. Several of these provide for significant amounts of automatic data acquisition. Others provide for independent third party verification.

7.1.6 Developing and deploying appropriate financial instruments

- Even as there has been substantial drop in technology costs in some of the key technologies, there is still a need for fiscal and subsidy support for them. The Ministry will continue to work towards creation of a fund to promote effective deployment of renewable energy technologies and utilizing the same to promote development in areas of energy access. The Ministry will continue to urge the

banking and financing community to support the renewable energy sector in the light of the current problems that affect development of the sector.

- Beyond the existing subsidy schemes, the Ministry will aim towards ensuring that the newer deployments become progressively self sustaining. For this, the alternate financial instruments that will be supported include:
  - Products like Risk Guarantee Fund that will address the technology risks, specially for solar
  - Enabling availability of debt at a lower cost (both for grid and off-grid projects) through channels such as external borrowing or tax rebates, especially for solar technologies
  - Enhancing the term lending period from 5 to 10 years particularly for technologies such as solar, in order to avoid an asset-liability mismatch in the long term
- The National Clean Energy Fund (NCEF) that has been created by the GoI is an ideal vehicle for such projects. At the present level of cess on coal @Rs. 50 per tonne, the NCEF would have annual accretions to the tune of Rs. 3000 crores per annum and this will progressively increase considering the large expansion of coal based capacity in the country. The fund is intended to support clean technologies, including renewable ones. The detailed implementation plan provides for this (including the involvement of IREDA), which is the principal financial institution functioning under the Ministry. It needs to be noted that the funds are controlled by the Ministry of Finance, GoI and the Ministry will be interfacing extensively with the Ministry of Finance for effective allocation and deployment of the funds.

7.1.7 Framework for robust monitoring & verification for projects and schemes

- Strong monitoring and evaluation frameworks for the various schemes and programs will be crucial for successful operation of the schemes. The deployment being widely distributed (often in inaccessible areas), the performance is extremely difficult to monitor. This often leads to leakages and

endangers the credibility of the programs, which are otherwise very important for the country.

- Most of MNRE's present programs incorporate monitoring and verification systems but these need to be strengthened. Modern technology needs to be used for greater and more efficient monitoring and verification which is possible through automatic data acquisition.

7.1.8 Human Resource Development

- The Ministry has been implementing the scheme for human resource development in the renewable energy sector that provides for financial support for organizing trainings, deputation of professionals in trainings and study tours within the country and abroad, award of fellowships etc. Training needs are broadly categorized under the categories a) Specific and highly specialized areas; b) Related to technological, scientific and management areas and training programmed formulated to meet these needs; c) general management area; d) Related to State Nodal Agencies professional under various renewable energy application oriented programs; e) Financial sector on the issues relating to project financing of renewable energy project; f) Small and medium scale manufacturing, industrial undertakings, services and business enterprises (SME) on development of convenient technology packages for different SME groups, technological solution awareness, best practices for renewable energy use, strengthening outreach of renewable energy technologies to consumers etc. The Ministry is in the process of formulating sector wise HRD strategies in consultation with academic institutions and Industry.

7.1.9 Strengthening of the Ministry and its affiliated Institutions

- While the deployment and development activities of the Ministry have increased substantially, the availability of manpower both scientific and administrative has been shrinking. There has been no new recruitment in the scientist cadre in the Ministry for a very long period.

- There is an urgent need to strengthen the current manpower of MNRE and inducting younger scientists for working on new and research activities and technology demonstration projects in the field of renewable energy. Introduction of new staff with different experience and skill-sets will be essential for complementing the technical skills that exist currently within the Ministry.

- The Ministry has the advantage of having IREDA, a financial institution focused on clean and renewable energy operating under it. IREDA has strong skills in its operating arena. However, it is far too small (in terms of its balance sheet size) to support the large scale deployment of RETs. It will be incumbent on the ministry to strengthen this organisation.

- The Ministry also has three technical institutions functioning under its control including the Solar Energy Centre, Centre for Wind Energy Technology, National Institute of Renewable Energy. It will be important to strengthen and orient their functioning in line with the strategy of the Ministry.

- Considering above general background and approach, which incorporate some of the proposed actions, a few of the specific strategies for short-term period 2011-17 (the focus of the Strategy document) are summarised below. These are especially important to help achieve the aspirations for the sector.

7.2 STRATEGY FOR 2011-17

- Promote concept of small power plants at tail-end of grid for both solar and biomass and developing financial support structures

- Development of entrepreneurship for rural electrification through biomass wastes , rice husk, solar, etc. and enabling availability of banks/ grant funds

- Large-scale deployment and movement towards indigenisation as already incorporated in the Solar Mission.

- Incremental improvements in technologies for achieving greater efficiencies to make them more viable and acceptable, especially for solar cooling and cooking.

- Identifying niche areas for application of RE technologies and reducing consumption of diesel and evolving suitable mechanisms for off-grid deployments.
- Identifying possible business models to promote large-scale adoption of improved cook-stoves with limited government support.
- Developing new financial instruments including Risk Guarantee Fund.
- Promoting energy plantations of fast growing species of bamboo/ other trees to provide feedstock for small capacity biomass power plants for captive/ local use.
- Capacity building and awareness generation in Green buildings and campuses.
- Demonstration projects for new technologies such as solar thermal hybrid for small plants, rice straw boilers, pine needles based gasifiers, solar thermal gas hybrids and solar thermal with storage for large plants.
- Development of independent concurrent monitoring systems.
- Develop pilot projects for off-shore wind generation.
- Pursue the compliance of renewable energy purchase obligations with regulatory authorities and states

7.3 It is felt that the scenario in 2016-17, when 12th plan ends, will be quite different. There would have been further technological improvements and, hopefully, cost reduction in solar; oil prices prevailing at that time are unknown and could have increased substantially; environmental concerns and other factors may limit further thermal power generation expansion. Therefore, opportunities and needs for Renewable Energy could increase manifold and cost economics and imperatives change which would then require new strategies and policies. It is difficult to visualise these at this stage. But the approach given above would essentially continue. Niche areas as they develop would require specific interventions.

7.4 Twelfth Five Year Plan: The Planning Commission has identified twelve challenges which would be addressed in the formulation of the 12th plan. A note on these challenges and how the strategic plan of the Ministry incorporates these is placed at Annexure IV.

7.5 INVOLVEMENT OF STAKEHOLDERS OF THE MINISTRY

7.5.1 The Ministry cannot execute the identified strategies on its own and will put in place a plan for such interaction. Periodic and regular interaction will be conducted with all concerned stakeholders.

7.5.2 The Ministry's aspiration for grid and off-grid renewable energy development is very ambitious and the Ministry will be able to achieve its aspiration only if there is adequate support from stakeholders outside the Ministry. This will require a close coordination of the Ministry with relevant state agencies, channel partners and concerned line ministries.

7.5.3 The Ministry proposes to engage its key stakeholders as follows:

Table 11: Stakeholder Engagement Plan

Group/ Individuals	Questions we must ask	Mode of interaction	When	Who will be responsible for doing it
Research & Development (R&D)/ Technical Institutions	Sector-specific R&D facilities available , activities undertaken / proposed	Direct communication/ meetings	During periodic meetings of R&D Committees of various RE sectors	Concerned Programme Divisions of MNRE
Equipment Manufacturers and Technology Providers	Technology/ product range Cost effectiveness and Domestic content thereof	-do-	Yearly	-do-
State Governments	State Plans and Policies for RE sector; State Budget allocation Implementation/ monitoring arrangements Central support needed, if any	-do- Annual Review Meetings	Yearly	-do-

Group/ Individuals	Questions we must ask	Mode of interaction	When	Who will be responsible for doing it
Regulators (CERC, SERCs)	Fixation of RPOs and Tariffs for Renewable power Guidelines for same.	Direct communication/ meetings/ workshops	Yearly	Ministry
Different Ministries of Government of India	Synergy of RE with their programmes/ activities	-do-	As needed	Concerned Programme Divisions of MNRE
Indian Renewable Energy Development Agency (IREDA) and other Financial Institutions/ Partner Banks	Sector specific financing targets, status of projects, financed resource mobilisation, policy interventions required	Annual MoU; Direct communication/ meetings.	Yearly	MNRE-IREDA Cell; Also IREDA in case of other FIs/ banks.
International Financial Institutions	Availability of foreign funding for specific high investment requirement projects of mutual interest; terms thereof.	Direct communication/ meetings with DEA and funding organisations	As per sector specific needs.	MNRE-IR Division IREDA
Developers/ Investors (including foreign)	Details of projects/ clearances required means of financing/ Govt contribution/ incentives sought.	Direct communication/ meetings/ workshops	-do-	Concerned Programme Divisions of MNRE and State Nodal Departments/ Agencies.
Non Governmental Organizations (NGOs)	Capacity and capability for projects implementation/ monitoring/ awareness generation activities	Meetings/ Workshops, etc.	-do-	-do-
End-users	Degree of awareness ; Feedback on their experience with use of RE systems	Workshops, Exhibitions; Electronic and print media Surveys; communication over MNRE website, etc.	-do-	-do-

7.5.4 Some of the specific initiatives for involving certain key stakeholders of the Ministry have been highlighted below.

- Research & Development (R&D)/ technical institutions and technology providers: The Ministry has been supporting R&D for technology and manpower development in renewable energy. The current emphasis is on reduction in cost and increase in efficiency. For sustained development of this sector, efforts are being made so that renewable energy is driven to a large extent by the market and the consumer. With a view to achieving this goal, the Ministry has evolved a policy of supporting R&D with close involvement of the industrial sector. This will bring about increased interaction and close co-operation between the research and teaching institutions of the country - which are reservoirs of knowledge and experience, and the Indian industry which has the requisite entrepreneurship and market-orientation. The broad spectrum of new and renewable technologies provides a great opportunity for innovation. Ministry is also developing Centres of Excellence.

- State Governments: There are several issues that require proactive action by States. Many States have not announced clear-cut / conducive policies to encourage private sector involvement in different renewable energy projects. It is noted that due importance is not being given to renewable energy in many States and adequate budget provisions are not available. In many States the process for allotment of sites and statutory clearances, including land acquisition, forest clearance, irrigation clearance etc is extremely time consuming. There are also inadequate power evacuation and transmission facility especially for Wind power projects, matching with the development of the sector in the State. The Ministry will ensure regular interaction with concerned State Departments, Regulatory Authorities and Agencies to periodically address issues relating to State policy & regulatory issues including appropriate enforcement of RPO regulations, statutory clearances, land acquisition, power evacuation & transmission, for sector specific renewable power projects.

The Ministry will also work closely with State Governments for working out and introducing innovative business models for promotion of renewable energy at the state level to move towards increasingly a market oriented mechanism.

- State Nodal Agencies: Since the actual implementation of the Ministry's programmes is through the State Nodal Agencies it is of vital importance that these agencies are adequately strengthened in terms of manpower and skill set. There is need to encourage states to strengthen the administrative set-up and get local self-government institutions like Municipalities and Panchayats involved in planning and implementation process. The need to gear up the SNAs for playing a much more proactive role for promotion of renewable energy in their respective States in tune with the Ministry's strategy for growth of the sector cannot be undermined. Prima-facie it is felt that SNAs require strengthening, especially in the area of capacity building and availability of technical manpower for which the GOI should step up its budgetary support.

- Other Ministries of Government of India: Key to the successful implementation of the Ministry's plans is effective co-ordination with the other functional ministries. The main ones among these are:
    - Ministry of Power: With grid integration of renewable and their mainstreaming, close operations of the MoP and MNRE on renewable energy technologies is essential. This has been successfully undertaken for the JNNSM guidelines, and will need to be continued on an ongoing basis; Development of transmission systems for renewable energy is also required. Utilities would need to fulfill renewable energy purchase obligations.
    - Ministry of Petroleum and Natural Gas: Interaction is necessary for bio-fuel blending as well as initiatives like Solar-Gas hybrids as also future pricing strategies of fossil fuels including lesser subsidies for diesel, kerosene and cooking gas.
    - Ministry of Finance: Ministry has been interacting frequently with the Ministry of Finance on matters related to subsidies, fiscal incentives and the like. With the National Clean Energy Fund in place, and being

intended for deployment of clean and renewable energy technologies, it will be important for the Ministry to interact closely and act in concert with the Ministry of Finance to get more resources as well as help in creation of financial instruments which will reduce costs of RE projects, particularly solar. Capabilities of IREDA also need to be strengthened.

- Ministry of Environment & Forests for facilitating dedicated energy plantations, use of pine needles, etc so that an important new area for biomass power can be opened up.
- Ministry of Urban Development: to promote regulations which, would make mandatory installation of solar water heaters and construction of energy efficient buildings
- Ministry of Education, Department of Women & Child Development and Ministry of Tribal Affairs can utilize efficient cook stoves
- Other Ministries – which can facilitate large-scale off-grid applications such as solar water heating, solar cooking, solar street lighting, solar air-conditioning, kitchen waste processing, green buildings and campuses in their establishments (Defence, Home ,Railways, HRD- big institutions, schools, health- medical colleges, hospitals, nursing homes, tourism- hotels, resorts), etc.

- **Financial Institutions:** With mainstreaming of renewable energy technologies, the banking channels are playing an important role in the delivery mechanisms. The area being vast and complex, the Ministry will work closely with this channel to ensure that the requisite funds are available for the projects.

- **End-users of energy:** The effective implementation of renewable energy programs and the success of these programs will depend on the awareness and acceptability of end-users.

7.6 LEARNING PLAN OF THE MINISTRY

The learning plan of the Ministry is being prepared based on the learning agenda that was identified in para 6.5 in the earlier section.

Table 12: Action Plan for Ministry's Learning Agenda

What do we need to learn	From where or from whom can we learn	How will we organize this	Who is responsible
Ensuring adequate number of technical personnel at different functional levels	-	Direct interaction with Cab Sect. and DoPT	MNRE Administration
Continual improvement of skill set of the officers through suitable training programmes and exposure to latest technological developments worldwide.	-	National/ international training programs and workshops; field visits	MNRE- respective programme Divisions / IR Division/ Administration CWET, SEC, NIRE
Strengthening of database, documentation and recording system of all the important data and information. In this regard it may be desirable to develop a centralised IT enabled database for easy access as well as security of data.	-	Utilising IT management tools and IT enabled software. Engaging consultancy firms for knowledge of best practices/ models.	MNRE Administration
Strengthening of economic/ financial analytical abilities	-	Tie-ups for training with financial management institutions; outsourcing specialized assignments to consulting firms.	-do-

7.7 PRIORITIES OF THE MINISTRY

7.7.1 For the strategies that have been highlighted earlier, Figure 5 illustrates the priorities of the Ministry. Each strategic initiative has been marked out of a score of hundred (100).

Figure 5: Priority Matrix

Strategies	Priority	Influence	Sequencing	Weight (out of 100)
Resource Assessment	Medium	Medium	Medium term	7
Cost reduction	High	High	Medium/ Long-term	25
Opening Market Channels	High	High	Short-term	20
Continuing improvements in regulatory and policy initiatives	High	High	Short/ Medium-term	20
Developing and deploying appropriate financial instruments	High	High	Short/ Medium-term	15
Human Resource Development	Medium	High	Medium-term	8
Strengthening of the Ministry	Medium	High	Short-term	10

7.7 OUTCOME OF STAKEHOLDER CONSULTATION

7.7.1 As also discussed in the previous two chapters, as a part of the Strategic Plan formulation exercise, an external stakeholder consultation process was undertaken. The box below summarizes the key questions posed to the stakeholders and their responses to the same.

Box 4: Stakeholder Responses on 'Developing the Strategy'

The following questions were raised to the stakeholders:

What are the outcomes desired from the renewable energy sector? Please rank the following options, with 1 being highest priority.

The 4 strategies of the Ministry – cost reduction, opening market channels, resource assessment and deployment of appropriate financial instruments will lead to Large scale deployment

a. **Large scale deployment**
b. **Enhanced consumer access**
c. **Reaching desired levels of investment and capacity installation**
d. **Ensuring desired output/quality**
e. **Cost reduction**
f. **Awareness created on applications**
g. **Others (please specify)**

What should be the strategy for promotion of renewable energy? Please rank the following options, with 1 being highest priority.

a. **Facilitating investments**
b. **Identifying new deployment models for commercialisation of RETs**
c. **Technology innovation**
d. **Bridging funding gap for promoting technologies**
e. **Enhancing awareness and capacity**
f. **Creating standards**
g. **Strict monitoring and evaluation**
h. **Others (please specify)**

Some of the key responses received have been summarized below:

Desired Outcomes

*Majority of the respondents ranked **large scale deployment and cost reduction** as number one desired outcomes from the renewable energy sector.*

*The next factor that was ranked as a desired outcome from the sector was, **reaching desired levels of investment and capacity installation**.*

Desired Strategy

*Majority of the respondents ranked **technology innovation** as the number one desired strategy for the renewable energy sector.*

*The next factor that was ranked as a desired strategy for the sector was, **facilitating investments followed by identifying new deployment models for commercialization**.*

7.7.2 These inputs of the stakeholders have formed a core part of the strategy formulation exercise and have been broadly incorporated in the strategies of the Ministry.

SECTION-VIII
IMPLEMENTATION PLAN

8.1 DETAILED IMPLEMENTATION PLAN

8.1.1 The strategy development initiative is the start of a long journey towards realising the renewable energy potential of the country, and creating a robust policy framework and strong capabilities within the Ministry towards this end. Table 13 summarizes the different action steps that have been identified for the various identified priorities.

Table 13: Implementation Plan for identified Priorities

S.N	Initiative	Description	Key Actions Required
1.	Resource base development	Creation/ up-dating / expansion of existing data base on resource assessment	✓ Comprehensive offshore wind resource mapping exercise ✓ Updating existing resource maps
2.	Developing and deploying appropriate financial instruments	Alternate financial instruments : - equity support/ debt - loan guarantees/ partial risk guarantees	✓ Framework for operation and administration of the CEF ✓ Interaction with banking channels, FIs ✓ Implementation roadmap for utilization of CEF proceeds
3.	Incubating technologies with high future potential	Developing conducive policy framework	✓ Encouraging Private sector participation in R&D ✓ Supporting demonstration projects in emerging technologies in partnership with private sector Results-oriented fiscal incentives rather than R&D grants
4.	Market integration of RETs	Promoting market integration of RETs and eliminating any artificial discrimination between home state/ PPA sales and open access/ market sales	✓ Reviewing policy pronouncements such as Capital/ Interest subsidies / GBI ✓ Regular interactions with CERC and market players on such issues
5.	Creating robust channels and institutional arrangements for project development and technology deployment	Facilitating creation of robust channels, financing instruments, documentation that can bring about significant efficiencies through aggregation and standardization	✓ Enhancing capability of SNAs programs thro' workshops, training programs ✓ Support to SNAs to take up revenue generation activities through PPP projects

S.N	Initiative	Description	Key Actions Required
6.	Framework for robust M&V for projects and schemes	Facilitating effective M&V of all projects under MNRE's renewable energy programs and schemes	✓ Putting in place appropriate M&V systems using modern technologies
7.	Enhancing organization (MNRE) capability and strengths	Strengthening the capability and strengths of MNRE's current staff	✓ Strengthening of the current manpower of MNRE ✓ Recruiting younger scientists
8.	Enhancing the capability of States especially in implementation of renewable energy programmes	Strengthening areas of the capacity building and availability of technical manpower	✓ Step up budgetary support ✓ Organise trainings, workshops, study tours for the personnel of the Agencies.

8.2 The sector specific Implementation Plan has been detailed in Table 14 below.

Table 14: Sector-specific Implementation Plan

SECTOR	ACTION PLAN	PROPOSED TIME PLAN
Wind Power	**Re-powering of existing wind turbines:** A pilot scheme would be developed	2011
	Wind Resource Assessment: Updating/ expansion of existing data base Off-shore resource assessment	Ongoing activity 2013
	Regular interaction with all stakeholders to periodically address policy, regulatory, evacuation transmission matters for wind power.	Ongoing activity
	Regular interaction with States to periodically address land acquisition, E&F clearance and State policy issues.	Ongoing activity
	Prepare pilot project for off-shore wind	2011-12
	Support development of evacuation & transmission infrastructure for renewable power	2011-13
Small Hydro Power	Draw/ update State specific plans for systematically harnessing SHP potential in consultation with State Governments	Ongoing activity
	Strengthen project-monitoring system (to form part of overall M&V framework)	
	Regular interaction with States to periodically address land acquisition, E&F clearance and State policy related issues.	Every 6 months
Bio-Energy -Biogas	Following cluster-saturation approach instead of scattered one for installation of the plants and involving entrepreneurs/ Renewable Energy Service Companies in the operation & maintenance of the plants.	a)
	Strengthen project-monitoring system (to form part of overall M&V framework)	Ongoing activity
	Persuade lagging States to take this up (e.g. UP, Bihar, Haryana).	Regular field visits

SECTOR	ACTION PLAN	PROPOSED TIME PLAN
-Energy from agricultural / crop residues	Promoting establishment of sustainable fuel linkage systems including biomass collection, densifying, processing and storage facilities. Encouraging long-term fuel supply agreement and captive energy plantations Setting up of such pilot plants Setting up of Pilot project for pine needles Support R&D project for Rice straw boilers Getting tariff declared for small biomass gasification plants Regular interactions with all stakeholders to periodically address policy / regulatory matters for the projects.	Ongoing activity Pilots by 2012 2011 2011 2011 2011 Ongoing activity
Biomass Gasifiers	Focus on areas having surplus biomass wastes (esp. rice husk, pine needles) for rural electrification/ meeting unmet electricity demand. Development of entrepreneurs, training of technicians Promotion of Gasifiers for meeting captive energy needs of industry, esp. rice mills. To encourage Energy Servicing Companies (ESCOs), Co-operative, NGOs, Local bodies etc. availing the subsidy and balance as bank loan, equity etc.	2011 Ongoing activity Ongoing activity
Bio-Energy in Industry	Awareness creation in target industries –Seminars/ Workshops	2011/12
Urban Wastes to Energy	Sensitising Urban local Bodies about the advantages, potential and prospects	Ongoing activity
Solar water heating systems:	Focussed attention in Cities and Hill States. Special attention to cluster based development in industrial sectors. UNDP/GEF project underway. Policy Guidelines to be issued to States.	2011 2011/12 2011/12
Solar steam generation/ cooling/ cooking systems	Interaction Meets with industries/ institutions Pilot projects to improve technology	Ongoing activity 2011/12
Tail-end SPV power plants	Installation of approved plants Technological/ performance analysis of the plants	By Sept 2011 By March 2012
Off-grid SPV systems including those for rural lighting	Rural lighting: ▪ Guidelines formulated; to follow-up with RBI for priority sector lending for the sector ▪ Capacity building of Bankers ▪ Training of Solar Technicians Special focus on diesel abatement in Industry, Telecom towers, etc.	 2011 2011 2011 2011/13
Biomass cookstoves	Promoting demonstration projects Interaction with other Ministries for support policies Evolving new business models Review/updation of test protocols and standards	2011 2011/12 2011 2011
Green Buildings	Huge capacity building exercise Develop Centre of Excellence	2011 2011
Solar R&D	Implementation of sanctioned projects Sanction of new projects Setting up of Centres of Excellence	2011/12 2011/12 2011/12

8.3 RESOURCE REQUIREMENTS FOR ACHIEVING THE GOALS/ TARGETS FOR 2011-17

8.3.1 The funds required for implementing the year-wise targets in grid and off grid renewable energy for the period 2011-17 has been summarized in table 15 and 16 below.

Table 15: Funds required for Grid Interactive Renewable Power (Rs./crore)

Technologies/ Year	Biomass / Agri waste (MW)	Funds reqd. (Rs. Cr)	Bagasse Cogen (MW)	Funds reqd. (Rs. Cr)	U&I Energy (MW)	Funds reqd. (Rs. Cr)	SHP (MW)	Funds reqd. (Rs. Cr.)	Solar Target (MW) *(Commissioning)*	Funds reqd. (Rs. Cr.)	Wind (MW)	Funds reqd. (Rs. Cr.)
2011-12	100	10	250	40	20	30	350	160	300	206	2400	50
2012-13	80	5	300	45	25	37	300	200	800	206	2500	110
2013-14	80	5	300	45	35	53	300	200	400	606	2300	330
2014-15	80	5	250	40	45	67	300	150	400	2214	2200	550
2015-16	80	5	250	40	55	83	350	175	1000	2476	2100	770
2016-17	80	5	250	40	60	90	360	180	1100	2660	1900	990
Total Fund Requirement for the 6 year period		**35**		**250**		**360**		**1065**		**8368** *+ ~ 49000 spread over next 19 years**		**2800** *+ 10500 spread over next 10 years***

8.3.2 The basis for calculating the technology specific funds requirement is summarized below:

- **Biomass/Agri Waste:** Continuation of existing subsidy @~ Rs. 8-10 lakh/ MW depending on capacity of the project.

- **Bagasse Cogen:** Subsidy @ Rs. 30 – 50 lakh per MW (surplus power) for cooperative sector sugar mills, depending on boiler pressure; incl. BOOT projects.
- **U&I Energy:** Average subsidy @Rs.1.5 crore/ MW
- **SHP:** Subsidy of an average 10-20% of project cost. More funds would be required during 2012-13 and 2013-14 for special projects in Arunachal Pradesh and Ladakh where 100% financial support is provided.
- **Wind:** Generation based incentive @Rs.0.50 per kWh. Funds requirement calculated for capacities installed in previous years; *committed liabilities under the GBI scheme to continue for next 10 years. Annual generation of 2 million units per MW per year.
- **Solar:** The requirement of funds is based on -
    (i) Commitment towards 100 MW projects of phase-I sanctioned in 2010-11 @ Rs.12.41 per unit, calculated for 1.66 million units per MW per year for 20 years.
    (ii) 1000 MW projects of phase-I through bundling by NVVN; no subsidy
    (iii) Commitment towards new phase-II projects of 1,000 MW sanctioned at 2013-14 tariff, 1,100 MW at 2014-15 tariff, 400 MW at 2015-16 tariff and 400 MW at 2016-17 tariff, all calculated for 1.66 million units per MW per year for 20 years.
    (iv) The tariff is likely to reduce to Rs.11.80 per kWh in 2013-14, Rs.11.00 per kWh in 2014-15, Rs.10.00 in 2015-16 and Rs.9.00 per kWh in 2016-17. However, the exact tariffs and consequently the commitments will depend on the actual tariffs to be fixed by CERC in respective years/ outcome of bidding process.

    **committed liabilities will continue for a total duration of 25 years co-terminus with the CERC tariff validity period.

Table 16: Funds required for Off-Grid RE applications (Rs./crore)

RE Applications / Years	Family Biogas plants *Nos. in Million*	Funds reqd.	Remote Village Electrfn. *No. of villages*	Funds reqd.	Biomass gasifiers for rural energy supply *No. of villages*	Funds reqd.	Rural Electrification through Solar PV *No. of villages*	Funds reqd. *(included under Decentralised SPV systems in next column)*	Decentr-alised SPV systems *MWp*	Funds reqd.
2011-12	0.15	200	500	95	100	5	30	(45)	68	1010
2012-13	0.15	190	-	-	120	6	40	(60)	100	1283
2013-14	0.20	220	-	-	130	6	40	(60)	150	1650
2014-15	0.20	220	-	-	140	7	50	(75)	200	1833
2015-16	0.20	220	-	-	160	8	50	(75)	200	1833
2016-17	0.20	220	-	-	200	10	60	(90)	250	1833
Total Fund Requirement		**1270**		**95**		**42**				**9442**

8.3.3 The basis for calculating technology specific funds required for off-grid programs has been summarized below:

- Biogas plants: Average CFA@ Rs.10,000/ plant (General category States), Rs.16,700/ plant for NER States
- Remote Village Electrifn: CFA @90% of project costs; 70% release with sanction, balance after completion. C/F liabilities ~ Rs. 78crore.
- Biomass Gasifiers for rural energy supply: Continuation of existing CFA @ Rs.5lakh/ village.
- Rural Electrification through Solar PV: As per NSM provisions: Subsidy@ Rs.150/ Wp; average 10kWp system/ village.
- Decentralised SPV systems: The requirement of funds is based on (i) Capital subsidy @ 30% of systems benchmark capital cost + 50% of benchmark capital cost to FIs for refinancing @ 5% interest rate (ii) Likely reduction in benchmark cost from Rs. 270/ Wp in 2011-12 to Rs. 120/ Wp by 2016-17.

Table 16 contd.: Funds required for Off-Grid RE applications (Rs./crore)

RE Applications / Years	Micro-hydel Water mills *Nos.*	Funds reqd.	Solar Thermal - water heating, etc *Mln. sqm.*	Funds reqd.	Urban WTE Plants *MWeq*	Funds reqd.	Industrial WTE/ Bio power *MWeq*	Funds reqd.	Improved Cookstoves *Mln. Nos.*	Funds reqd.
2011-12	200	2	1.1	300	10	15	50	75	0.20	15
2012-13	250	3	1.1	390	10	15	60	90	0.40	30
2013-14	300	3.5	1.1	355	10	15	70	105	0.60	45
2014-15	350	4	1.1	320	10	15	80	120	0.80	60
2015-16	400	4.5	1.1	285	10	15	90	135	1.00	75
2016-17	450	5	1.1	120	10	15	100	150	1.20	90
Total		**22**		**1760**		**90**		**675**		**315**

8.3.4 The basis for calculating technology specific funds required for off-grid programs has been summarized below:

- Micro-hydel/ Water mills: Continuation of Subsidy Rs.1 lakh per Water mill.
- Solar Thermal systems for water heating etc: NSM Average Capital Subsidy @Rs.3,500 per sq.m. for 1/ 3rd of deployment; Interest and Capital Subsidy @ Rs.4,000 / sqm. and refinancing @ Rs. 5,000/ sq. m for another 1/ 3rd of deployment and rest 1/ 3rd without subsidy.
- Urban WTE Plants: Subsidy @ Rs.1-3 crore/ MW_e depending upon technology; 20% higher in Special Category States.
- Industrial WTE/ Bio power in Industry: Subsidy @ Rs.0.2-1.0 crore/ MW_e depending upon technology; 20% higher in Special Category States.
- Improved Cookstoves: Average subsidy @ Rs.750 per cookstove.

8.4 CONSOLIDATED FUNDS REQUIREMENT

8.4.1 The consolidated funds requirement for grid connected renewable energy technologies for the period ending 2016-17 has been summarized in Table 17.

Table 17: Consolidated Funds required for grid connected renewable energy technologies (Rs. Crores)

Technologies	Biomass/ Agri waste	Bagasse Cogen	U&I Energy	SHP	Solar	Wind	TOTAL (2011-17)
Total Fund Required	35	250	360	1065	8368*	2800**	12,878

+ approx. 49000 spread over next 19 year* *+ Rs.Cr.10500 spread over next 10 years*

8.4.2 The consolidated funds requirement for off grid renewable energy programs for the period ending 2016-17 has been summarized in Table 18.

Table 18: Consolidated Funds required for off grid renewable energy programs (Rs. Crores)

Technologies	Family Biogas plants	Remote Village Electrfn.	Biomass gasifiers for rural energy supply	Decentr-alised SPV systems	Micro-hydel Water mills	Solar Thermal systems for water heating, etc	Urban WTE Plants	Industrial WTE/ Bio power in Industry	Improved Cook-stoves	TOTAL (2011-17)
Total Fund Required	1270	95	42	9442	22	1760	90	675	315	13,711

8.4.3 It is evident, therefore, that achievement of targets would require substantial up-scaling of resources, particularly for the Solar Mission. Further upscaling would be required if the aspirational goals would have to be achieved.

SECTION- IX
TRACKING AND MEASURING SUCCESS OF THE IMPLEMENTATION PLAN

9.1 The targets that have been set in this Strategic Plan are highly ambitious and it is required to set an aggressive tracking and monitoring system for measuring the success and effectiveness of the outlined programs and activities.

9.2 The Ministry will undertake the following activities for ensuring effective implementation of the outlined Strategic Plan:

- Quarterly Review Meetings with State Governments and concerned Stakeholders
- Monthly Reporting Systems for specific Programs under a standard format providing information of funds utilized, progress made on commissioned projects, hourly/ monthly output from systems (wherever relevant/ required), etc
- Development of independent Monitoring and Verification Systems
- Strengthening IT systems for reporting of M&V status of specific programs

9.3 The Ministry currently undertakes periodic evaluation of its existing programs / schemes through consultants etc.. The Ministry will dovetail this current exercise with the tracking system proposed under this Plan. Some of the key indicators of success of implementation of the Ministry's programs have been outlined below:

- Achievements of Installed capacity of grid-interactive renewable power and its contribution to electricity mix
- Achievements with regard to deployment of various off-grid / decentralised RE systems vis-a-vis the set targets
- Deployment in areas not covered by conventional electricity supply
- Substitution of usage of kerosene/ diesel in different sectors–rural/ urban/ industrial

- General improvement in quality and affordability of RE systems/ devices
- General users' perception/ satisfaction.

9.4 Existing mechanisms for tracking these success indicators will be periodically reviewed and suitably modified for better feedback.

SECTION- X
CONCLUSION

10.1 MNRE has initiated systematic programmes for renewables including for research and development. Renewable energy is currently experiencing increasing vibrancy across all sectors of the economy driven by sustained economic growth and growing global concerns regarding climate change. There are various stakeholders that directly/ indirectly contribute towards the promotion of renewable energy, and each one has some aspirations and expectations from this sector, just as they have a significant responsibility. This is in a way laying foundation of a new economy that is inclusive, sustainable and aspires for de-carbonization of energy in a definite time frame. However, there is a long way to go. In order to create an enabling environment, the Ministry as a policy maker will have a significant contribution to make.

10.2 While policy and budgetary support for renewable energy have progressively increased over the years, particularly for large scale grid connected power, there continue to exist many barriers that hinder up- scaling of renewable energy deployment. And perhaps more importantly, some critical gaps remain, particularly for decentralized distribution in the areas of access to capital, technology development & adaptation, innovation induction, and strategies to up-scale deployment. The Implementation Plan that has been proposed in this Strategic Plan along with the process and tools for measuring success of the implementation plan will facilitate achievement of the ambitious targets and aspirational goals proposed.

ANNEXURES

Annexure-I

Structured Questionnaire for External Stakeholder Consultation

1. Specify your role in the renewable energy sector.
   a. Policy/ Regulatory
   b. Deployment
   c. Financing
   d. Industry (please specify sector)
   e. R&D
   f. Any other (please specify)_____

2. What have been the highlights of the major activities that have been undertaken by your organization during the last one year?

   _____
   _____
   _____

3. In your opinion what should be the vision, mission and objectives of the renewable energy sector? Please be brief.

   Vision

   _____
   _____
   _____

   Mission

   _____
   _____
   _____

   Objectives

   a._____
   b._____
   c._____

4. In your opinion what should be the aspirations of the renewable energy sector? Please be brief.

   a._____
   b._____
   c._____

5. Which renewable energy resource/ applications do you think should be the priority for promotion? Please rank the following options, with 1 being highest priority.

S. No.	Resource/ Application	Priority/ Ranking of Resource	Inter-se ranking of application under each resource	Reasons for the priority accorded*
1	Wind Energy • Aerogenerators/ decentralized power • Grid-interactive power	1/ 2/ ../ 9	1/ 2/ 3/ 4	
2	Hydro power • Watermills/ microhydel units • Mini/ small hydel -grid power			
3	Solar PV • Off-grid/ Decentralized systems • Grid power			
4	Solar Thermal • Water Heating (Household) • Water Heating (Industrial) • Solar Driers (Rural/ Industrial) • Solar Cookers (Box/ Dish/ Conc.) • Water desalination • Cooling/ refrigeration systems • Power generation (Grid/ off-grid)			
5	Biogas • Family type plants • Institutional/ community plants • Power generation			
6	Biomass (non-fuel wood) • Grid-power • Bagasse cogeneration • Biomass Gasifiers for rural electrfn. • Biomass Gasifiers for industrial energy			
7	Waste to Energy • Urban/ Municipal Waste to Energy • Industrial Waste to Energy			
8	Emerging Technologies • Geothermal • Tidal/ Wave			
9	Any Other (please specify)			

* A-Techno-economically viable B-Environmentally benign C-Large potential
D- Community benefit E-Any other –please specify

6. What are the outcomes desired from the renewable energy sector? Please rank the following options, with 1 being highest priority.
    a. Large scale deployment
    b. Enhanced consumer access
    c. Reaching desired levels of investment and capacity installation
    d. Ensuring desired output/ quality
    e. Cost reduction
    f. Awareness created on applications
    g. Others (please specify)

7. What should be the strategy for promotion of renewable energy? Please rank the following options, with 1 being highest priority.
    a. Facilitating investments
    b. Identifying new deployment models for commercialisation of RETs
    c. Technology innovation
    d. Bridging funding gap for promoting technologies
    e. Enhancing awareness and capacity
    f. Creating standards
    g. Strict monitoring and evaluation
    h. Others (please specify)

8. What are the external factors (International and National factors external to the renewable energy sector) that will impact the renewable energy sector in India?

    International (e.g. price of oil, climate change, etc)
    a. _____
    b. _____
    c. _____

    National (e.g. coal availability, economic growth, etc)
    a. _____
    b. _____
    c. _____

9. What are the internal factors (internal to renewable energy sector) that will impact the renewable energy sector in India? E.g. cost, technology breakthrough, etc

    a. _____

    b. _____

    c. _____

10. Who are the key stakeholders of the renewable energy sector in India?

    a. _____

    b. _____

    c. _____

11. What according to you are the key opportunities for the renewable energy sector in India?

    a. _____

    b. _____

    c. _____

12. What according to you are the key threats facing the renewable energy sector in India?

    a. _____

    b. _____

    c. _____

13. Has your organization made any estimation of the available potential of any specific renewable energy technology? Please elaborate.

    _____
    _____
    _____

    Please specify technology-wise projections for renewable energy achievement that you perceive upto March 2017 at the State and National level, as per the table below.

S.No	Sources/systems	State level		National level	
		Cumulative Achievements (in MW) (upto 31.03.2010)	Projections/Plan By 31.03.2017 (MW)	Cumulative Achievements (in MW) (upto 31.03.2010)	How much should the country aim for By 31.03.2017 (MW)
Grid interactive renewable power					
1.	Biomass Power (Agro residues)			865.60	
2.	Wind Power			11807.00	
3.	Small Hydro Power (up to 25 MW)			2735.42	
4.	Cogeneration-bagasse			1334.03	
5.	Waste to Energy			64.96	
6.	Solar Power			10.28	
	Sub Total (in MW) (A)			**15691.43**	
Off-Grid/Distributed Renewable Power					
7.	Biomass Power/Cogen (non-bagasse)			232.17	
8.	Biomass Gasifier			122.14	
9.	Waste-to-Energy			46.72	
10.	Solar PV Power Plants			2.46	
11.	Aero-Generators/ Hybrid Systems			1.07	
	Sub Total (in MW) (B)			**404.56**	
	Total (A+B)			**17221.86**	

S.No	Sources/systems	State level		National level	
		Cumulative Achievements (in MW) (upto 31.03.2010)	Projections/Plan By 31.03.2017 (MW)	Cumulative Achievements (in MW) (upto 31.03.2010)	How much should the country aim for By 31.03.2017 (MW)
Decentralized Energy Systems					
12.	Family Type Biogas Plants			42.40 lakh	
13.	SPV Home Lighting System			5,83,429 nos.	
14.	Solar Lantern			7,92,285 nos.	
15.	SPV Street Lighting System			88,297 nos.	
16.	SPV Pumps			7,334 nos.	
17.	Solar Water Heating- Collector Area			3.53n. Sq. mts.	

14. Specify the type of support that you would like to receive from MNRE.

(a) Financial (Subsidy)

_____
_____
_____

(b) Fiscal

_____
_____
_____

(c) Policy

_____
_____
_____

(d) Implementation

_____
_____
_____

(e) R&D support

_____
_____
_____

(f) Others-Specify

_____
_____
_____

15. Any other remarks that you wish to make.

_____
_____
_____
_____
_____
_____

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Annexure-II

Stakeholder Consultation Workshops/ Meetings

The Ministry organized several sector specific workshops/ meetings during the course of preparation of the Strategic Plan to get inputs on various aspects impacting the development of the respective sectors. Highlights of the same are given below:

Solar Mission

A number of multi stakeholder consultations through meetings and workshops were held during January, 2010 to May 2010 to finalize the guidelines for selection of grid solar power projects and the off-grid solar projects under the Jawaharlal Nehru National Solar Mission. On the basis of the inputs received through consultations, draft guidelines for selection of grid solar power projects were prepared and put on the website of the Ministry for comments and suggestions from various stakeholders, before these were finalized. The consultation process with various stake holders is continuing for implementation and review of the progress. Another set of consultation meetings were held during January 201 to July, 2010 with the financial institutions, commercial and regional rural banks to discuss about the financing of solar projects and their appraisal. Multi stake holder groups were constituted and meetings held to finalize a plan on capacity building including education and training related activities in solar energy. Multi stakeholder meetings were also held for developing strategy to set up radiation monitoring facilities in different parts of the country.

Solar Water Heating Systems: With a view to up-scale deployment of various solar thermal systems, particularly the solar water heating systems, a series of workshops/ meets (over 20 nos.) with different stakeholders were organized in different sectors like healthcare, education, building, hotels, hospitals, industries, etc. at different locations/ industrial clusters like Gurgaon-Manesar, Rudrapur and Ludhiana and in Centre and different States - Uttar Pradesh, Karnataka, Uttarakhand, Chandigarh, Himachal Pradesh, Punjab, Haryana, , etc.

Small Hydro

Consultative meetings were held with the State Governments and small hydro developers to discuss strategy for faster implementation of SHP projects and capacity addition likely to be achieved during the 12th Plan Period. Meetings with the States of Himachal Pradesh, Karnataka, J&K, Arunachal Pradesh and Uttarakhand were held in respective States while those with Madhya Pradesh, Tamilnadu, Maharashtra and Kerala in Delhi. Discussions covered issues relating to allotment of sites and procedure for granting statutory clearances. A meeting with equipment manufacturers was also held with a view to assess manufacturing capabilities and future growth.

Wind Power

In order to plan the future strategy for the wind power development in the country, 6 consultation meetings were organized with the concerned stakeholders including state nodal agencies, state utilities, state policy makers, wind power developers, and manufacturers of wind turbines to take stock of the progress made so far, understand the barriers/constrains faced and possible remedial actions. Three of these meetings were held at New Delhi and one each at Bangalore, Hyderabad and Chennai.

Biomass Gasifiers

Series of discussion meetings were held with different State Government departments, regulatory commissions, state agencies, resource persons, technology developers, manufacturers, biomass power project developers, financial institutions, NGOs, consultants, industrial associations, Rice millers, etc with a view to develop and promote Biomass Gasifiers based on rice husk, pine needles, etc. for captive energy needs of Rice Mills/other Industries and rural electricity supply.

Biomass power

6 meetings were organized with Project Developers, Financial Institutions, Research Institutions on identification of barriers for large scale deployment of projects, resource assessment, evaluation of performance of the existing biomass power plants, reviews of

policy & regulatory frame work and development of financial models for different types of biomass based electricity generation projects. Meetings were held with Developers for establishment of Model Investment Projects based on Fuel Linkage, Biomass Cogen, Gasification and Combustion.

Bagasse Cogeneration

Three business meets on promotion of bagasse cogeneration in cooperative sector sugar mills were organized at Pune, Vadodara and Chandigarh on 20.09.2010, 26.10.2010 and 09.12.2010, to increase awareness among existing and upcoming cooperative sugar factories, stakeholders and cogenerators about grid-connected high efficiency cogeneration, latest technical developments and sharing of experiences/ success stories, and instrallation of bagasse cogeneration projects in cooperative/ public sector sugar mills by IPPs/ JV companies on BOOT/ BOLT basis.

Biogas

Four meetings were held with various stakeholders - Implementing Agencies, Biogas Development & Training Centers, Manufacturers and Technology providers for obtaining inputs for better implementation, technology development and monitoring of biogas programmes. The discussion and consultation also covered R&D/ technology demonstration on generation, purification and bottling of biogas.

Biomass Cookstoves

Two stakeholder consultations were held with representatives of selected State Nodal Agencies, NGOs, Industries, and Experts to discuss test protocols and facilities and develop future plan for promotion of Biomass Cookstoves.

Solar Cities:

Over 30 Stakeholders Meetings/ Consultations were held with various Stakeholders in different places with Municipal Corporations, Electricity Department and other City

Representatives. Their inputs were included in the Master Plans being prepared for the Solar Cities and the scheme itself has been revised..

Green Buildings

About 15 interaction meetings/workshops/Trainings were held with various Stakeholders i.e. Architects, Engineers, Town Planners, Builders and Government Officials. This has resulted in building the capacity of about 200 Trainers for carrying out evaluation of Green Buildings under GRIHA Rating System. A National Conference on Green Design: Buildings and Habitats was also organized with various Stakeholders to get useful inputs in developing further Strategy for implementation of the programme.

***

Annexure – III

Summary of Key Outcomes of External Stakeholder Consultation Process

The list of stakeholders from whom the responses were obtained during the consultation process has been provided below:

1. Central Electricity Regulatory Commission (CERC)
2. Indian Renewable Energy Development Agency (IREDA)
3. Development Alternatives
4. The Energy and Resources Institute (TERI), New Delhi
5. Ecogrid
6. Enercon
7. Vestas
8. IIT Delhi
9. Nualgi Nanobiotech
10. Technology and Action for Rural Advancement (TARA)
11. Rohita Electronics
12. Suntechnics
13. Aditya Associates
14. Emmvee Solarizer
15. Central Power Research Institute (CPRI)
16. ICF Consulting

This annex summarizes some of the key outcomes of the stakeholder consultation process. Some of the key questions that have been analyzed are:

- In your opinion what should be the vision, mission and objectives of the renewable energy sector?
- In your opinion what should be the aspirations of the renewable energy sector?

- Which renewable energy resource/ applications do you think should be the priority for promotion?
- What are the outcomes desired from the renewable energy sector?
- What should be the strategy for promotion of renewable energy?

Outcomes (1) – Defining the Vision

Aspects	External Consultation	Internal Consultation	Remarks
Vision	*..decrease dependency on conventional energy sources, reduce Demand- Supply gap by promoting Renewable Energy Sources.* *...leader in heralding a green energy revolution aiming to secure energy security, climate change mitigation, green jobs and sustainability through increased reliance on renewable energy* *...aim of energy security and environmental sustainability through use of local solutions portraying the economic, environmental and social benefits of these technologies.* *...provision of green and modern energy services to all on a sustainable basis* *...strive for global leadership in new and renewable energy by committing to upscale rapid and sustainable development and deployment of RET through SMART planned approach constituting a major contribution on energy and ecological security.* *...provide access to energy based on RET for sustainable development leading to creation of Green Jobs*	**To upscale and mainstream the use of New and Renewable Energy sources in furtherance of the national aim of energy security and energy independence, with attendant positive impact on local, national and global environment.**	Key differences: *- Decrease dependency on conventional sources* *- Reduce demand-supply gap* *- Green energy revolution* *- Creation of green jobs* *- Portraying economic, environmental and social benefits of RETs* *- Global leadership in new and renewable energy* *- Provide access to energy based on RETs*

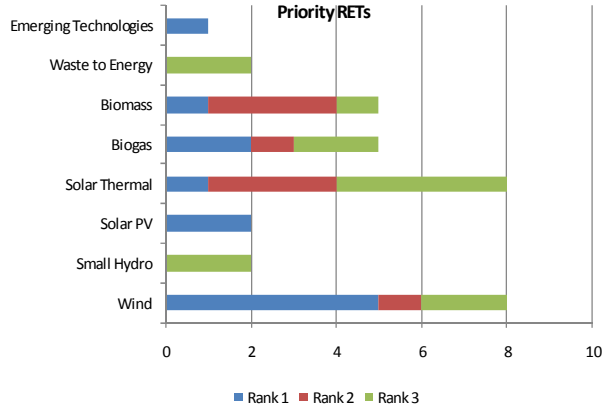
Outcomes (2) – Defining the key Objectives

Aspects	External Consultation	Internal Consultation	Remarks
Objectives	*…Increase percentage of Renewable Energy to 30% in total energy mix by 2025* *…Shifting the role of RE from bridging the demand supply gap to replace conventional energy sources.* *…Create enabling policy without technology bias and allow competitive technology and market forces to offer the most sustainable solution* *…To expand development and deployment of renewable power generation projects for augmenting access through locally available renewable energy sources* *…To promote stand-alone/ decentralized renewable energy systems for meeting energy needs in rural, urban, industrial and commercial sectors;* *…To facilitate transfer, absorption and adoption of the most efficient renewable energy technologies for Indian conditions.*	1. **To promote deployment of grid-interactive renewable power generation projects to augment contribution of renewables in total electricity mix.** 2. **To promote renewable energy initiatives for meeting energy/ lighting needs in rural areas** 3. **To promote renewable energy initiatives to supplement energy needs in urban areas** 4. **To promote renewable energy initiatives to supplement energy needs in industry and commercial establishments** 5. **To promote research, design and development activities at premier national institutions and industries on different aspects of new and renewable energy technologies.** 6. **To encourage development of a robust manufacturing industry in renewable energy sector** 7. **To take other special initiatives for growth of renewable energy sector**	Key difference: - *Increase percentage of Renewable Energy to 30% in total energy mix by 2025* - *Shifting the role of RE from bridging the demand supply gap to replace conventional energy sources.* - *Augmenting access through locally available renewable energy sources*

Outcomes (3) – Defining the Aspirations

Aspects	External Consultation	Internal Consultation	Remarks
Aspirations	*...to secure that India sustain its global position as a leading emerging renewable energy market offering best potential business opportunities.* *....achieve grid-parity by 2015.* *....at least 30% of national energy mix to be contributed by 2022* *...renewable energy should compete with conventional sources of energy without subsidies* *...enhanced consumer access* *...ensuring desired output/quality* *...large scale deployment and cost reduction* *...reaching desired levels of investments and capacity installation* *...to achieve the comfort level of indigenous manufacturing base in five years period*	**Replace use of different fossil fuels wherever possible** **Increase access to electricity/lighting in remote and rural areas** **Increase the contribution of renewable energy in the total electricity mix of the country to 6 percent by 2022, with about 10 percent contribution to total electricity mix**	Key difference: *- ensuring desired output/quality* *- large scale deployment and cost reduction* *- comfort level of indigenous manufacturing base in five years period*

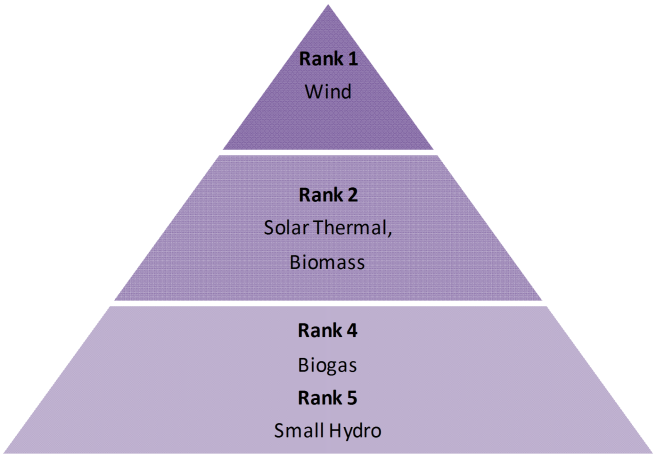
Outcomes (4) – Which RETs would you accord highest priority to



Stakeholders were asked to rank renewable energy technologies from highest to lowest priority and also provide reasons for the same.

Within each technology, different respondents have given different ranks based on priority. In the adjoining figure, the blue bar represents rank 1, red represents rank 2 and green represents rank 3.

Within Wind – majority of respondents have ranked aerogenerators/ decentralized power as no. 1 and grid interactive power as no. 2. The reasons that have been attributed are (a) community benefit and (b) environmentally benign.

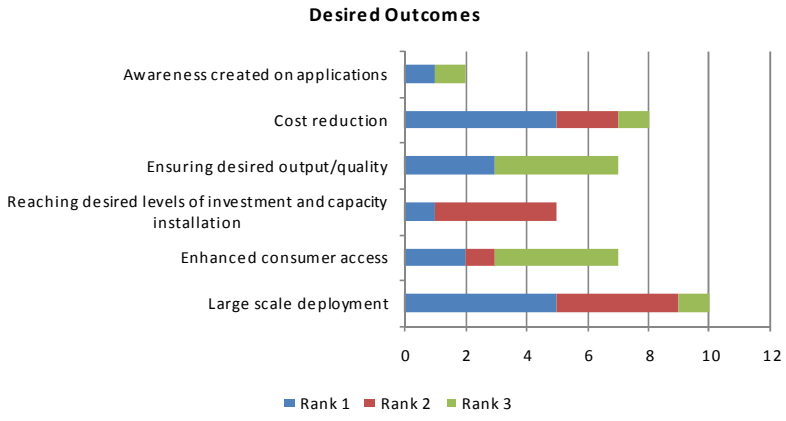


Within Solar Thermal - majority of respondents have ranked water heating (for household and industrial applications) as no. 1. The reasons that have been attributed are (a) large potential and (b) environmentally benign.

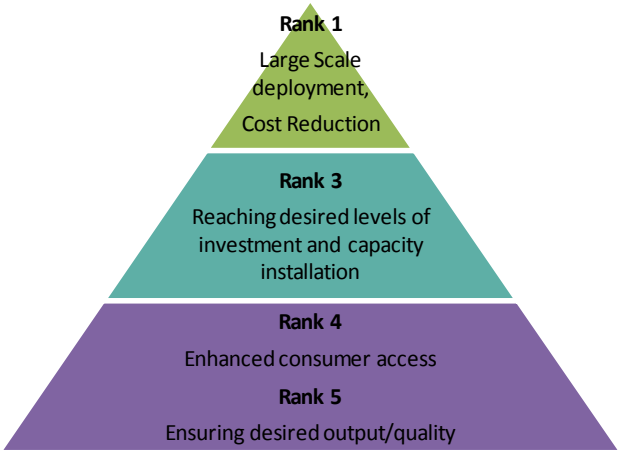
Within Biomass - majority of respondents have ranked bagasse based cogeneration as no. 1, followed by biomass gasifiers for industrial energy.

Outcome (5) – Desired Outcomes from the renewable energy sector

Stakeholders were asked to rank the desired outcomes from the renewable energy sector from a given set of options. In the figure below, the blue bar represents rank 1, red represents rank 2 and green represents rank 3.



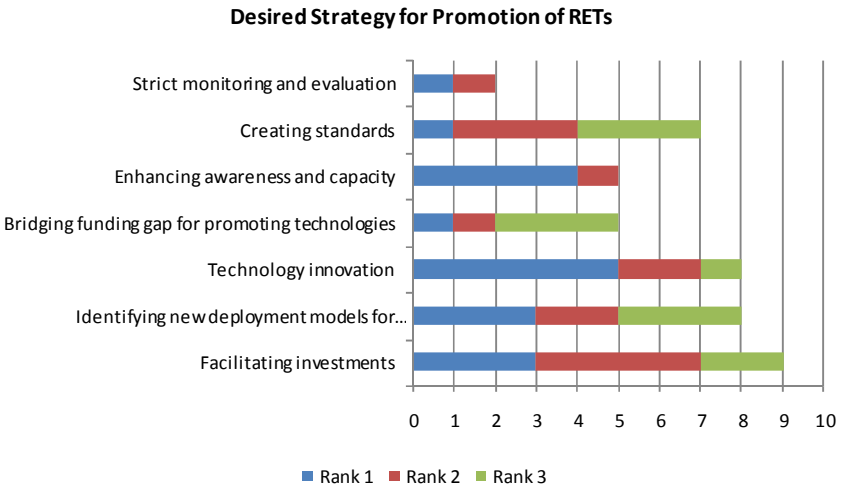
Majority of the respondents ranked large scale deployment and cost reduction as number one desired outcomes from the renewable energy sector.



The next factor that was ranked as a desired outcome from the sector was, reaching desired levels of investment and capacity installation.

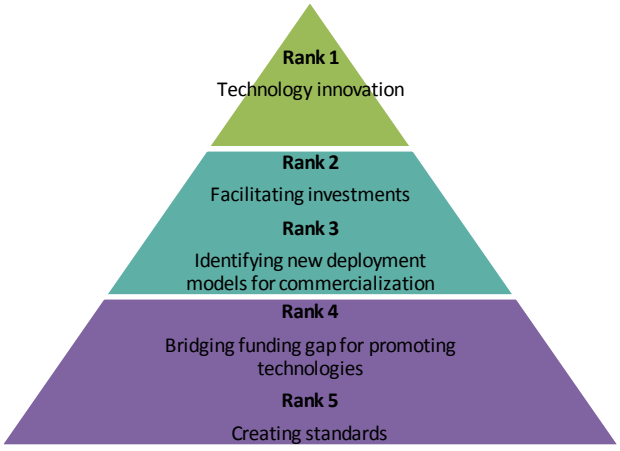
Outcome (6) – Desired Strategy

Stakeholders were asked to rank the desired strategy for the renewable energy sector from a given set of options. In the figure below, the blue bar represents rank 1, red represents rank 2 and green represents rank 3.



Majority of the respondents ranked technology innovation as the number one desired strategy for the renewable energy sector.

The next factor that was ranked as a desired strategy for the sector was, facilitating investments followed by identifying new deployment models for commercialization.



Annexure – IV

Note on Challenges to be Addressed in the 12th Plan by MNRE

List of Potential Challenges that have been outlined by the Planning Commission, Government of India for the 12th Plan period have been summarized below:

i. Enhancing capacity for growth

ii. Enhancing skills and faster generation of employment

iii. Managing the environment

iv. Markets for efficiency and inclusion

v. Decentralization, Empowerment and Information

vi. Technology and innovation

vii. Securing the energy future for India

viii. Accelerated development of transport infrastructure

ix. Rural Transformation and Sustained Growth of Agriculture

x. Managing Urbanization

xi. Improved access to Quality Education

xii. Better preventive and curative healthcare

A summary of how the Ministry's Strategic Plan addresses these challenges is given below.

The functions and objectives of the Ministry of New and Renewable Energy incorporate all the above potential challenges to be addressed in the formulation of the 12th Plan. Sustaining a high GDP growth would require, amongst other things, greater generation of power. To the extent Renewable Energy can contribute to the total power generated, this problem would be eased. Further, to the extent that energy can be distributed to rural areas and it improves the livelihood and productive capacity in those areas, it would also help the process of bottom up and inclusive development. Reduction in consumption of fossil fuel helps reduce not only the large outgo on subsidies but also reduces the import dependence, thereby helping the energy security of the country.

Increase in energy access, by providing clean lighting, would even help improve the living conditions of households as well as contribute to help improve their health and education. It has been reported that wherever lights have become available in the evenings, it has enabled children to study more. Spread of rural energy which would help create business opportunities and requirements for service and maintenance systems would lead to creation of locally available jobs, thereby also reducing unemployment in a limited way and helping increase rural incomes. Every project of Renewable Energy, whether grid related or off-grid, helps the environment because it creates clean energy and also helps avoid use of fossil fuels. Rural energy systems will also help create new market opportunities where currently these are very limited. At the same time, grid generation by wind, solar, hydro and biomass sectors offer large investment opportunities to the private sector not only in generation of power, but also in manufacturing. Some of this would also be foreign investment. Most of these investments are through PPP route. This will help create a substantial number of jobs and create demand for skilled workforce contributing to the overall economic growth. In order to meet this demand, efforts are being made to widen the courses available in IITs and Engineering Colleges to produce the needed professionals, both in deployment and research. In large areas related to Renewable Energy such as solar - both PV and thermal, second generation biofuels and various biomass applications, hydrogen, technical innovation is being encouraged through research and demonstration projects. Indeed, this will play a crucial role. The Ministry is also supporting a Centre for innovation and incubation in IIM Ahmedabad. The Ministry is contributing towards management of the energy requirements of urban areas which are going to increase substantially. The efforts to saturate the use of solar water heaters would help reduce the energy demand in urban areas particularly in peak morning time, use of solar PV for reduction in consumption of diesel would reduce their pollution load and the demands to construct building energy efficient buildings and campuses would greatly impact the future energy demand requirements of urban areas. The Ministry is trying to spread the use of solar cooking systems for large institutions to replace subsidized cooking gas. It is initiating steps to have more efficient community cooking systems, in smaller Govt. and private institutions where meals are cooked for certain number of people to reduce the consumption of wood substantially. Pilot projects are also under way to establish business models to promote efficient family size cookstoves which could reduce the

consumption of biomass and burn it more efficiently thereby improving the health impact of that consumption. Although there is no direct connection with the transport infrastructure, the Ministry is trying to promote the use of both hybrid and electrical vehicles and also taking steps for development of second generation biofuels which would allow for greater blending in both petrol and diesel. Experiments with the use of hydrogen are also being done in this area. It would, thus, be seen that the activities of this Ministry in one way or the other, and to a greater or lesser degree, address in a significant manner each of the challenges identified.

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