Final Draft

National Solar Mission

Introduction

In launching India's National Action Plan on Climate Change on June 30, 2008, the Prime Minister of India, Dr. Manmohan Singh stated:

"Our vision is to make India's economic development energy-efficient. Over a period of time, we must pioneer a graduated shift from economic activity based on fossil fuels to one based on non-fossil fuels and from reliance on non-renewable and depleting sources of energy to renewable sources of energy. In this strategy, the sun occupies center stage, as it should, being literally the original source of all energy. We will pool our scientific, technical and managerial talents, with sufficient financial resources, to develop solar energy as a source of abundant energy to power our economy and to transform the lives of our people. Our success in this endeavour will change the face of India. It would also enable India to help change the destinies of people around the world."

As pointed out in the National Action Plan on Climate Change, "India is a tropical country, where sunshine is available for longer hours per day and in great intensity. Solar energy, therefore, has great potential as future energy source. It also has the advantage of permitting the decentralized distribution of energy, thereby empowering people at the grassroots level".

Based on the vision set out above, a National Solar Mission is being launched under the brand name "Solar India".

Importance and relevance of solar energy for India

There are 4 criteria on which to assess the suitability and viability of different energy sources: (i) scalability, (ii) environmental impact (iii) security of source; and (iv) cost.

1. **Scalability:** India is endowed with vast solar energy potential. About 5,000 trillion kWh energy is incident over India's land area with most parts receiving 4 – 7 kWh per sq. m per day. Hence both technology routes for conversion of solar radiation into heat and electricity, namely, solar thermal and solar photovoltaics, can effectively be harnessed providing huge scalability for solar in India. Solar also provides the ability to generate power in a distributed basis and enables rapid capacity addition with short lead times (especially PV) which is advantageous from a rural electrification perspective. In addition, PV applications can work effectively in diffused radiation conditions also.

2. **Environmental impact & security of source**: Solar energy scores high on environmental impact (close to 0) as it has zero emissions while generating electricity/heat

3. **Security of source**: From an energy security perspective, solar is the most secure of all sources, since it is abundantly available – a small fraction of the total incident solar energy (if captured effectively) can meet the entire country's power requirements

4. **Cost:** Solar is currently high on absolute costs compared to other sources of power like coal. However, the Mission's objective would be to drive down costs as rapidly as possible, to Rs 4-5/kWh by 2017-2020 timeframe (2009 as base year), making solar very competitive with respect to other fossil fuel based power sources.

Main Objectives

The objective of the National Solar Mission is to establish India as a global leader in solar energy through:

- 20,000 MW of installed solar generation capacity by 2020 and 100,000 MW by 2030; 200,000 MW by 2050
- Solar power cost reduction to achieve grid tariff parity by 2020.
- Achieve parity with coal based thermal power generation by 2030.
- 4-5 GW of installed solar manufacturing capacity by 2017

Mission Strategy:

The development of solar energy in the country may be envisioned in three phases:

1. **Phase I of solar deployment (2009-12)**

The objective in Phase I will be to achieve rapid scale up to drive down costs, to spur domestic manufacturing and to validate the technological and economic viability of different solar applications. This will be achieved through the consolidation and expansion of on-going projects for urban, rural and off-grid applications and through a number of new initiatives detailed below. These initiatives take into account the major constraint of land and space availability in scaling up solar power in the short and medium term .

- Promotion of commercial scale solar utility plants. These will predominantly be Solar PV, but some utility scale Solar Thermal plants are not ruled out.
- Mandated deployment of solar rooftop or onsite solar PV applications in Government and Public Sector Undertaking (PSU) buildings and establishments. It is estimated that, based on a minimum 500 sq. metres of rooftop or vacant space (such as land kept vacant to meet environmental or security guidelines, reserved for future expansion or even parking areas) available, in about 2000 to 3000 such buildings and establishments, roughly 3 million sq. metres can be used for solar applications. A target of 100MW installed capacity is achievable.

- Promotion of rooftop solar applications, including solar PV panels and solar heating systems on commercial buildings. Based on a minimum availability of 500 sq. metres of rooftop space available, on buildings with optimum maximum number of floors (may vary from 7 to 10), it is estimated that there may be a total potential of 700 million sq. metres currently available in commercial and industrial establishments.
- Mandated installation of solar generation capacity of at least 5% of total installed capacity of all thermal power plants based on coal, gas and oil. This will result in the setting up of 150-200MW of solar power per annum, based on the assumption that, on an average, 3000-4000MW of thermal power generation capacity is being added each year. The advantage would be that cost of transmission and distribution would be negligible, since the power plant would already be connected to the grid. It will be up to the plant to either use part or the whole of the solar power for some of its internal power requirements, such as heating, and feed the rest into the grid and earn feed in tariff.
- Mandated use of part of vacant land in existing power plants , including in the non-thermal sector, for setting up solar power units. It is estimated that about 5000 acres of land may be currently available in existing thermal power plants alone, which may be utilised to create 800-1000MW solar generation capacity. It will be up to the plant to decide how large a proportion of its solar power it wishes to use for in house power or heating requirements and how much it wishes to feed into the locally available grid and earn feed-in tariff.
- Encouraging the use of solar applications to meet day-time peaking power requirement, currently being covered through diesel generation. It is estimated that currently diesel generation capacity of 20-25 GW has been installed to meet peaking power shortage and that such shortage may reach 60 GW by 2020. Since diesel generation costs are currently in the range of Rs. 13 to 15/kWh, use of solar power during day-time peak would be quite competitive even at current cost levels.

- Net metering system would be introduced to encourage commercial, industrial establishments and PSUs to expand solar energy use to meet day-time peaking requirement and feed the excess power to the grid and earn the feed in tariff.
- Promotion of solar PV panels to charge existing inverter systems both in the residential and commercial buildings. It is estimated that on an average about 30% of grid power is wasted in the charging of current models of inverters. The aim should be to develop more efficient solar power inverter systems in due course.
- Establishment of 2-3 large-scale solar thermal utility scale plants (CSP) of 50 MW, 100 MW with storage, and 150-200 MW gas/solar hybrid to demonstrate technological and economic viability of solar thermal power in India.
- Pilot project for on-site distributed generation through tail-end grid solar plant.
- Pilot project to validate business models for large-scale rural electrification projects. These will include:

  (a) Stand-alone village power plants with micro-grid for remote villages (single or cluster of villages) to provide electricity for residential, community and commercial purposes.

  (b) Small grid connected rural plants (25 kW to 5 MW) for capacity addition in existing rural grid to augment and maintain power supply in rural areas where grid connectivity to villages already exists. Such plants will typically be connected to an 11 KV grid.

- Further expansion of solar lighting systems through market initiatives including micro financing, both in rural and urban sectors. The target would be to provide access to lighting for 3 million households by 2012. Setting up of solar charging stations are also proposed for solar lanterns currently being distributed on a large scale in rural areas. The promotion of solar lighting

system is expected to require Rs. 1200 crores in Government support.

- Promotion of solar heating systems. It is estimated that 40-50 million sq. mts of area is currently available for installation of solar collector for various low and medium temperature applications in domestic, industrial and commercial sectors. The target for solar heating application is 7 million sq. mts by 2012.
- The National Solar Mission proposes in this Phase to make it mandatory for all functional buildings such a hospitals, hotels, guest houses and nursing homes to install solar water heaters, and the residential complexes, if the minimum plot area of 500 sq. mts. is available.
- Promotion of local manufacturing capacities across the solar value chain, from raw materials to components, through the establishment of dedicated solar manufacturing and technology parks. Target is an installed capacity of 1-1.5 GW by 2012 – 13 time frame. Establishment of solar generation parks with dedicated infrastructure for setting up utility scale solar plants, both PV and thermal. Each park will have ready access, adequate transmission line capacity, and water supply provisions to ensure ease of capacity creation. These generation parks will aim at using existing technology in providing energy solutions both in specific localities as well for feeding into the grid. They may be developed and bid out in a manner similar to the Ultra Mega Power Plant (UMPP) but the exact model and funding sources will be subsequently worked out by the Mission. Sufficient land will have to be identified for large-scale solar generation parks for which the Mission will need to work together with interested states.

2. Phase II (2012-17) will consist of:

- Scaling up of various validated applications, mainly but not exclusively, grid-tied applications;

- Rollout of rural electrification business models, with initial focus on field trials.
- Commercial deployment of solar thermal power plants including with storage.
- Pilot deployment of next generation technologies, including (i) Dish-Stirling, (ii) Concentrated Solar Power (iii) thin film applications' and (iv) storage systems.
- Promotion of solar lighting and heating systems on large scale, in the market mode, without subsidies, but including micro-financing.
- Installed capacity to reach 6-7 GW by 2017.

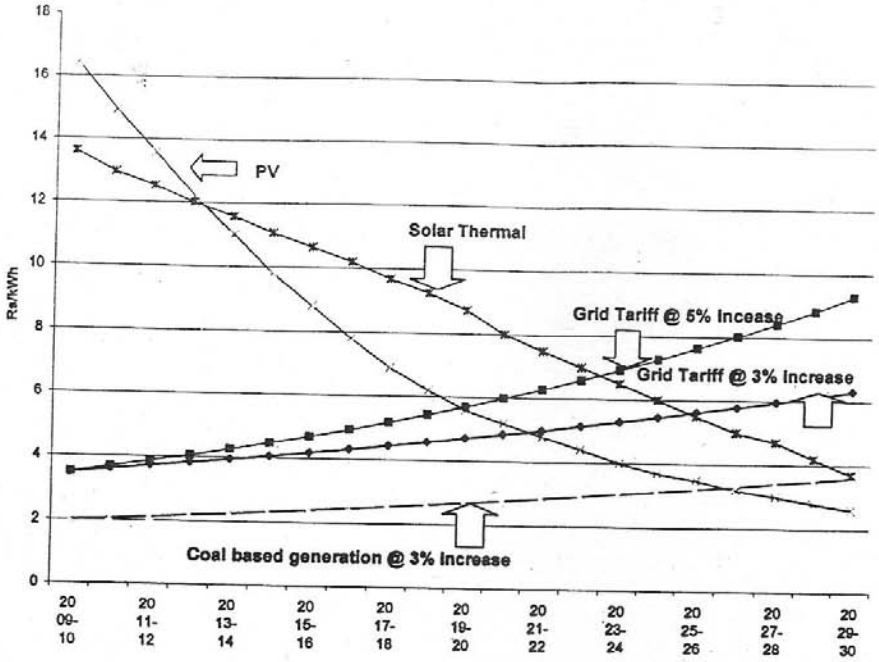
3. Phase III (2017-2020):

Rapid scale up across all validated applications with minimal or no subsidy:

- Achievement of tariff parity with conventional grid power.
- Commercialisation of storage technologies, though subsidy may still be required for large scale storage applications.
- Commercialisation of other indigenously developed PV and solar thermal technologies emerging from R&D programmes.
- Installed capacity to reach 20GW by 2020.
- One million rooftop systems, with an average capacity of 3KW by 2020.

It is envisaged that the proposed strategy of the Mission will help in achieving significant reduction in the cost of solar power and creating a robust infrastructure for solar power in the country.

Figure 1 : Cost Projections and Grid Parity



The above graph projects the likely parity of solar power tariff with grid tariff, achieved during 2017 – 2020, with 3% and 5% annual increase on the average grid tariff of Rs. 3.5 per kWh (2009 as the base year). The continuing R&D efforts in improving plant design, component efficiencies, plant capacity scale up and volume build up will help in further reducing the generation cost of solar technologies to achieve parity with the coal based generation (Rs. 2 per kWh generation cost, 2009 as base year and 3% annual escalation) by 2030.

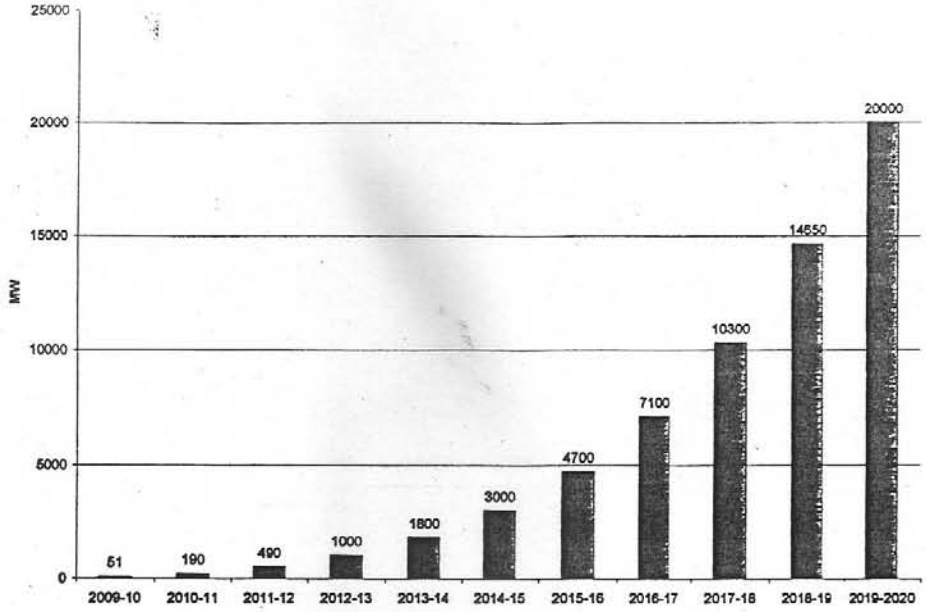
Proposed roadmap to 20 GW by 2020

The aspiration is to ensure large-scale deployment of solar generated power for both grid connected as well as distributed and decentralized off-grid provision of commercial energy services. The deployment across the five application segments is envisaged as follows:

Utility (grid) power (including tail-end support)	12000 MW
Rooftop PV (captive & grid connected)	3000 MW 1 million solar roofs @ average 3 kW per system
Rural Installations (rural grid plants + stand-alone applications)	3000 MW
Other distributed solar PV applications (e.g.: telecom towers)	2000 MW
Solar lighting, heating & other applications	Solar lighting for 20 million households Solar collector area of 20 million square metres for heating applications;

The cumulative capacity numbers stated above are only intended to serve as a guideline to the Mission steering committee and not as a policy management tool. The envisaged ramp-up of capacities is as shown in Figure 2 below

Figure 2: Ramp up of solar capacity as envisaged by the National Solar Mission



Environmental Benefits

- The above solar power capacity addition would also result in about 42 million tonnes CO_2 emission reduction. This will also result in substantial savings of kerosene, diesel and fuel oil as detailed below:
- 20 million solar lights are estimated to save 1 billion litres of kerosene per annum by 2020, which translates into 3 million tonnes of CO_2 emissions per annum.
- 20 million sq. m thermal collectors are expected to save about 15 million tones pf CO_2 emissions by 2020.
- It is also estimated that when 20 million sq. m solar collectors are used for heating applications in industrial, institutional and residential sectors, this could result in a peaking load shaving of around 7500 MW. This would also free up 4600 MW of installed power capacity currently being used for heating applications. There will be a saving of fuel oil of about 350 million litres per year in 2020 over the life of the systems.

- 3,000 MW of roof top PV systems by 2020, which will mainly be used for avoiding use of diesel for day time power generation, are expected to save about 1050 million litres of diesel every year and avoid about 2.36 million tones of carbon emissions.

Policy and Regulatory Framework for solar generation

The objective of the policy would be to create an environment which enables rapid and large scale capital investment in solar energy applications and provides an incentive structure that encourages technical innovation and lowering of costs to grid parity, preferably by 2020.

The key design principles underlying the regulatory/incentive mechanism are as follows:

1. Incentive for solar electricity generation will be a combination of three elements depending on the specific application:
    - Feed-in tariff that will be set for various applications by the respective state regulators based on guidelines provided by the Mission, national tariff policy and the Electricity Act.
    - 10 year tax holiday
    - Customs duty and excise duty exemption on capital equipment and critical materials

    (Note: These are already available to infrastructure and IT projects).

Capital subsidy or accelerated depreciation will not be available for programmes under the Mission, except for solar heating applications and for rural applications which will be covered under the rural electrification scheme for a limited period.

2. Use of a market based price discovery mechanism (e.g.: by inviting bids for government solar electrification projects and

bids for larger utility scale projects) to set feed-in tariffs. Costs are expected to reduce at a rate between 7-9% (rough estimate, actual could vary) per annum resulting in lowering of tariff with a view to eliminate all subsidies by 2020. Revised tariff guidelines and subsidy levels will be specified by a Mission sub-committee on tariffs before the beginning of each financial year to facilitate tariff announcement by the regulators.

3. Solar power purchase obligation for states mandating 1-3% (depending on state's solar resources) of power consumed within the state to be generated from solar energy by 2017. The state regulator will set and ensure annual targets for solar capacity addition every year. This will be complemented with a Renewable (Solar) Energy Certificate mechanism to allow states to buy and sell certificates to meet their solar power purchase obligations.

4. In view of the high cost of generation and need to have high feed-in tariff for solar power, it will be necessary to compensate the utilities by providing generation based feed-in tariff incentives. The feed-in tariff incentive for solar installations will be distributed between Centre, State and utility, with the utility paying Rs 3.5/kWh and the balance amount borne by the Centre and State in the 70:30 (Centre: State) proportion. The central incentive will be provided for a period of 20 years i.e. duration of the Power Purchase Agreement (PPA). The utility component should have atleast 3% increase per annum built into each PPA as is the practice with wind power tariffs in some states.

5. Feed-in tariff incentive will be paid by the Central Government through utilities who have to sign a PPA for 20 years at the pre-determined tariff announced by the state regulator, based on guidelines issued by the tariff sub-committee of the Mission. They will maintain a separate account for the incentive received from the Central Government. The feed in tariff specified in the PPA will be linked to the actual commissioning and generation date.

The proposed incentive and regulatory enablers for each target segment are given below:

1) **Utility plants (including tail-end support and rural plants):**

Incentives for utility plants (valid for all capacities commissioned and feeding into the grid) will be through a feed-in tariff determined through competitive bidding and paid for a period of 20 years.

A 40 – 50 MW capacity solar plant can be set up on one sq. km land area. Sufficient land is available at the existing thermal, nuclear and also hydro power plants, a part of which can be used to set up solar power plants. . The rural and tail-end connected plants would require about 5 – 25 acres land per plant, preferably close to sub-stations, which should be available in rural areas.

To facilitate creation of solar capacities, the following additional enablers will be put in place:

- Single window clearance mechanisms for all required permissions;
- Standard lease agreement format/template for solar installations on government land;
- State transmission utilities mandated to provide connectivity from nearest substation to the solar plant in a prompt and time bound manner. The cost of this link will be borne by the state transmission company.

2) **Rooftop PV:**

The Mission objective is to promote rooftop installations on commercial, industrial and residential buildings, for which incentives will be in the form of feed-in tariffs as follows:

- For rooftop PV installations higher than 3.0 KW (grid-connected or stand-alone), the utility will pay a feed-in tariff to the installation owner of the solar asset based on

a dedicated meter installed by the utility to monitor the output of the PV system used or fed into the grid.

- Feed-in tariff for grid-connected rooftop systems including building integrated PV systems, shall be an additional Rs 1.5 per KWh over and above the tariff announced for utility PV systems, in order to cover the higher cost of grid connected electronics and higher capex costs.
- It will be mandatory for the distribution utility to:
  1. Provide grid-connectivity to rooftop systems (wherever required), provided the installation meets the quality specifications for grid interconnection defined by the utility
  2. Sign a standardized agreement with the rooftop system owner for 20 years at the specified feed-in tariff rate. The Mission will create a draft agreement format to be adopted by each utility
  3. Install net metering for all grid-connected rooftop PV installations
- Rooftop incentive will only be given for BIS certified modules and system equipment and when installed through accredited installers. Globally reputed solar certification and accreditation service providers will be engaged for this purpose.
- The Mission will also explore the possibility of making rooftop solar installations a permanent feature of all new commercial buildings through appropriate mechanisms such as standards and incentives to developers to encourage adoption.

Institutional arrangements

An appropriate organization will be required to monitor technology developments, adjust feed in tariffs, manage funding requirements and pilot projects.

It is envisaged that an autonomous Solar Energy Authority of India will be set-up to meet this need. The Authority will bring together representatives of different sectors and agencies who

can contribute to the Mission objectives. The Ministry of New and Renewable Energy (MNRE) will provide necessary guidance and supervision to the Authority. It is envisaged that the Authority may comprise of 3 divisions.

- **Financing division**
  - Create and manage solar fund from cess
  - Oversee capital subsidy funding through banks, and ensure feed-in payments through power utilities

- **Technology & tariff division**
  - Monitor global and domestic technology developments and production costs to set tariff levels
  - Define tariff levels through its sub-committee each year using a price discovery mechanism through open bidding
  - Oversee the creation and maintenance of solar insolation database
  - Publish and review grid connection standards
  - Authorize certification agency for rooftop inspections

- **Special projects**
  - Execute utility and rooftop demonstration projects
  - Set up solar generation park infrastructure
  - Develop solar technology parks in 2-3 states and promote aggressively
  - Partner with the Technology & tariff division in the price discovery mechanism

Solar Manufacturing in India

One of the Mission objectives is to take a global leadership role in solar manufacturing (across the value chain) of leading edge

solar technologies and target a 4-5 GW of installed capacity by 2017, including setting up of dedicated manufacturing capacities for poly silicon material to annually make about 2 GW capacity of solar cells. India already has PV module manufacturing capacity of about 700 MW which is expected to increase in the future. Currently, there is no indigenous capacity/capability for solar thermal projects, therefore new facilities will be required to manufacture concentrator collectors and receivers to meet the demand for CSP plants

To achieve the installed capacity target, the Mission will do the following:

- Local demand creation: The 20 GW plan supported with right level of incentives for solar generation coupled with large government pilot/demonstration programs will make the Indian market attractive for solar manufacturers
- Financing & Incentives: SEZ like incentives to be provided to the manufacturing parks which include:
  - 10 yr income tax holidays and no sales tax
  - Zero import duty on capital equipment, raw materials and excise duty exemption
  - Low interest rate loans, priority sector lending
  - Incentive under Systematic Investment Plans (SIPs) policy to set up integrated manufacturing plants; (i) from poly silicon material to solar modules; and (ii) thin film based module manufacturing plants. (The stand alone cell or module manufacturing plants should be set up outside the SIPs policy). Similar incentives will be required for manufacture of CSP systems and their components.
- Ease of doing business: Create a single window clearance mechanisms for all related permissions
- Infrastructure & ecosystem enablers: Create 2-3 large solar manufacturing tech parks consisting of manufacturing units (across the solar value chain),

housing, offices, research institutes. These will have 24x7 power and water supply and will likely need to be located near large urban centres with good linkages to ports and airports to ensure rapid access to imported raw materials and high quality engineering talent.

The Mission will have a dedicated small team focusing on promoting these solar manufacturing parks to global players and attracting investments in these parks

Research & Development

- The Mission will aggressively pursue Research & Development in solar energy through:

(i) Solicited Research in identified thrust areas, including storage systems
(ii) Industrial research, for increasing efficiency and reducing costs
(iii) Basic research in new materials and concepts
(iv) Consortium approach and networking of R&D efforts by different Ministries
(v) International cooperation in research & development

Availability of reliable solar radiation data is vital to the success of the solar power generation, specially solar power generation parks. As a part of the Mission the government is committed to mapping of the ground insolation in detail, specially in the high potential solar regions of the country. Solar radiation data collection is an ongoing activity and information for some sites is available as published hand books and also on the website of MNRE. India Meteorological Department (IMD) and some other organizations are engaged in solar radiation data collection. However, it will be necessary to expand the existing data base and strengthen the ongoing efforts, specially for direct beam ground radiation data collection to set up CSP power plants. The solar radiation mapping will be done through the ground measurements and also through satellite data collection. The Mission will support

radiation mapping activity for each proposed generation park and other similar potential sites, which are expected to receive high direct beam radiation. These measurement stations will be in addition to the existing efforts by India Meteorological Department and other organizations. The detailed data collected for the new sites will also be published and made available to the project developers.

A coordinated research programme is vital to success of the Mission goals. The Mission will aggressively pursue R&D in solar energy technologies to achieve significant reduction in cost and improved reliability and life expectancy of solar applications by 2020.

The basic strategy to support research and development would include the following:

- Transforming the Solar Energy Centre (SEC) into a Centre of Excellence for R&D in Solar Energy. The Solar Energy Centre will be made an autonomous apex research institute for solar energy that will co-ordinate a network of solar research centers across the country. The centre will undertake research, system engineering, technology development/demonstration, testing and field performance monitoring, and facilitation of patent search, patenting and technology transfer. SEC will be the focal centre for all international cooperation for solar research.

- A research council comprising eminent experts and representatives from academic and research institutions, industry, Government and civil society, will guide the overall technology development strategy. The council will periodically review and update the technology roadmap to accelerate the technology development efforts and achieve cost reduction in a time bound manner.

- In addition to SEC, the government will select and fund other academic and research institutions to participate in

the research programme based on their core competence and capacity to deliver results in a time bound manner. The government will establish Centres of Excellence in thrust areas of research.

- Encourage industry to undertake performance-linked research by providing partial financial support (say 25% - 50% on reimbursement basis).

- Support pilot plants to demonstrate the viability of new technologies and innovative ideas. Attract technology companies to scale up the new technologies developed elsewhere for pilot/commercial production.

- Leap frog, taking benefit of the ongoing research efforts in other countries through (i) funding collaborative research involving Indian universities /industry and global institutions, with the benefits of the research accruing to Indian institutions through joint access to the IPR (ii) support contracted research for exclusive use by Indian companies, and (iii) buy equity in research companies in select countries.

- Encourage research groups from other countries to undertake joint project with Indian academic or research institutions to utilize their infrastructure and create a base in India. In addition, technology transfer involving Indian research groups could also be considered.

Human Resource Development

The rapid and large-scale diffusion of Solar Energy will require a concomitant increase in technically qualified manpower of international standard. It is envisaged that over the Mission period, about 100,000 trained and specialized personnel would be required by 2020 for engineering, management and R&D functions.

The following steps may be required:

- IITs and premier Engineering Colleges will be involved to design and develop specialized courses in Solar Energy, with financial assistance from Government. These courses will be at B. Tech, M. Tech and Ph. D level. Some of the IITs, Engineering Colleges and Universities are teaching solar energy at graduation and post graduation level. Centres for Energy studies have been set up by some of the IITs and engineering colleges. These initiatives will be further strengthened. In addition, a countrywide training programme and specialized courses for technicians will be taken up to meet the requirement of skilled manpower for field installations and after sales service network

- A Government Fellowship programme to train 100 selected engineers / technologies and scientists in Solar Energy in world class institutions abroad will be taken up. This may need to be sustained at progressively declining levels for 10 years. This could be covered under the ongoing bilateral programmes. Institution to institution arrangements will also be developed. Fellowships will be at two levels (i) research and (ii) higher degree (M. Tech) in solar energy.

International Collaboration

There is considerable work going on in several countries to develop Solar Energy as a clean and alternative source of energy. Strategic international collaborations and partnerships aimed at meeting the priorities set out under the Mission would be developed, along with effective technology transfer mechanisms and strong IPR protection.

Cooperation will be encouraged at the level of research organizations along with industry partners and at individual level also to generate new ideas. Wherever feasible, cooperation through bi-lateral and multi-lateral arrangements would be facilitated.

Requirements for funds

The total anticipated funds from the Union Government for the above programme are Rs 85,000-105,000 crores over a 30 year period starting with Rs. 5,000-6,000 crores (including cost of demonstration plants) in the current Five Year Plan (upto 2012) increasing to Rs. 12,000 – 15,000 crores in XIIth five year plan (2013-2017).

These funds will be collected and disbursed through a non lapsable Solar Fund in order to insulate the program from budget related variability. Initially the Central Government could provide Rs. 5,000 crores during the 11th plan period as budgetary support. The strategy should be to tax fossil fuels and fossil fuel based power generation to mobilize additional resources. Cess on some of the following should supplement the Solar Fund. The funds so collected would support the major initiatives on deployment and technology development initiatives envisaged under the Mission till 2020. Cess may be levied on some of the conventional fuels at the rate of 10 paise/10000 Kcal and 5 paise per kWh on thermal power generation. These options could result in mobilizing about Rs. 4240 crores annually, which is expected to grow every year. However, a cess on thermal power may be preferred keeping in view the anticipated growth in thermal power generation by 2020.

Fuel	**Present Annual Fuel consumption / Power capacity**	**Proposed Cess**	**Annual amount of Cess Rs in crores**
Coal	300 Million Tonnes	Rs 25/T	1200
Petrol	10327 K T	Rs. 0.1/litre	140
Diesel	42847 K T	Rs 0.1/litre	500
Thermal Power	78,398 MW	Rs. 0.05/kWh	2400

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Annex I

National Solar Mission : Requirement of land by 2020

The deployment across the five major application segments is envisaged as follows:

Utility (grid) power (including tail-end support)	12000 MW
Rooftop PV (captive & grid connected)	3000 MW
Rural Installations (rural grid plants + stand-alone applications)	3000 MW
Other distributed solar PV applications (e.g.: telecom towers)	2000 MW
Solar lighting, heating & other applications	Solar lighting for 20 million households Solar collection area of 20 million square metres for heating applications;

Typically, a solar power plant would require about 5 – 6 acre of land per MW. 12,000 MW capacity addition to the utility grid would require about 72,000 acre land area. While the CSP plants would be of about 50 MW to 500 MW capacities, the majority of PV plants are expected to be of relatively lower capacities (1 MW to 50 MW). It should be possible to utilize the vacant land available with the thermal, nuclear and also the hydro power plants for setting up utility connected plants. The advantage of setting up solar power plant in the campus of thermal plants will be that additional power evacuation facilities will not be required and a part of the solar power can be utilized to meet the auxiliary power consumption.

Thermal power plants are required to leave about 0.08 – 0.15 acre land per MW for the green belt. If 50% of this space could be utilized for setting up solar power plants, with the existing thermal power plant capacity of 78,398 MW, about 5,000 acre land would be available that can be used to set up 800 – 1,000 MW capacity solar plants.

Nuclear power plants are required to leave significantly higher land area vacant, due to safety reasons. The nuclear plants are required to leave at least 1.5 km radius land area around the plant as exclusion zone which is under the control of the plant management, wherein public habitation is prohibited. In addition, a sterilized zone around the exclusion zone covering an area up to 5 km radius around the plant is also established. Only the natural growth of population is permitted in the sterilized zone. The total area around the nuclear plant is estimated to be around 75 sq. km. Therefore, if a part of the land (20%) is utilized to set up solar power plants, on average each nuclear power plant could accommodate about 500 - 1000 MW capacity solar plants, depending up on the natural habitation in the sterilized zone around the nuclear plant.

The hydro plants also have large vacant area, possibilities of utilizing the vacant land, which normally would not be submerged, needs to be explored.

A detailed assessment is required on the available land in the existing power plants, modifications to the existing environment and safety related guidelines and also formulation of guidelines for setting up new thermal/nuclear/hydro power plants. This could facilitate setting up of up about 5,000 MW capacity solar plants by 2020. Further, these guidelines would be important and necessary to make more land available for setting up solar plants beyond 2020.

The rural plants either stand alone or tail-end grid connected are expected to be of smaller capacity (up to 5 MW), where the requirement of land is likely to be up to 25 acres. Therefore, availability of land is not expected to be a major concern to set up 3,000 MW by 2020.

About 700 million sq. m roof space is already available in commercial, industrial, Government and PSU establishments, a part of this space could be used to set up solar power plants

and also the solar water heating systems. The roof top space is expected to grow to 3 billion sq. m by 2020. Therefore, with the proposed incentives, atleast 3,000 MW capacity rooftop systems can be set up by 2020.

Annex II

Mission Decision Points

Targets by 2020	a) 20,000 MW Solar Power o 20 million Solar lights o 20 million sq.m Solar thermal for heating applications

	b) Break up of 20,000 MW • 12,000 MW of utility grid power • 3,000 MW of rooftop PV on a million roofs • 3,000 MW of rural installations • 2000 MW of other distributed applications (e.g. telecom towers) c) 4-5 GW of installed solar manufacturing capacity by 2017
Requirement of Fund	Rs. 80,000 – 100,000 crores for above targets over a 30 year period
Resource Mobilization	Non-lapsable Solar Fund with initial corpus of Rs. 5,000 crores during 11th plan through budgetary support Supplemented by cess of fossil fuels / thermal power generation. Cess of thermal power preferred
Regulatory Measures / Policy decisions	1. Approval for (i) proposed tariff incentive structure and guidelines for utility, rooftop, and rural solar power generation provided by the centre for 20 years, higher rate for roof top and rural grid power plants and phase out by 2020; (ii) Bidding based tariff setting approach for utility scale solar power plants. (iii) 90% capital subsidy for rural solar installations for a limited period 2. Solar Power Obligations (average 2%) for States 3. Single window clearance for generation and manufacturing parks 4. Setting up of solar plants on extra land/space available with generation companies. Amendments to environmental clearance related provisions for this. 5. Policy on mandatory provisions to provide grid connectivity, evacuation facilities and net metering etc by the utilities. 6. Mandatory provisions for installation of solar systems in buildings (plot area of 500 sq. m and above) through amendment of building bye laws by local bodies and also the building codes

	7. Renewable energy certificates 8. Tax holiday for solar power projects for 10 years, duty free import of raw materials, specified devices and system components, excise duty exemption, incentive for manufacture of materials, components and systems. 9. Priority sector lending for all solar power projects and solar lighting through banks
Special projects	1. Mandatory setting up of solar plants equivalent to 5% of thermal power plant capacity to be set up by the generation companies through directives. 2. Mandatory use of solar systems on roof top of 3000 Government and PSU buildings (old and new, allow up to 50% space to be used) 3. Establishment of 8-10 solar generation parks 4. Establishment of 2-3 integrated manufacturing technology parks
R&D Policy	1. Approve strategy for R&D and capacity building 2. Solar Energy Centre to be made as apex autonomous national R&D centre ; public private partnership for research 3. Set up Research Council to guide R&D institutions and oversee implantation of technology development road map for the Mission
Institutional Arrangements	Set up high powered structure to manage the activities of National Solar Mission including Solar Fund 2. Ministry of New and Renewable Energy to provide necessary guidance and supervision to Mission

Final Draft

Annex-III

Financial Abstract

Total requirement of funds over 31 years:

Incentive for 18,000 MW solar power	Rs. 81,983 crores
Grant for demonstration projects	Rs. 4,500 crores
Grant for R&D, capacity building	Rs. 4,800 crores
Grant for Rural Electrification/ solar lighting	Rs. 1,200 crores
Total	**Rs. 92,483 crores**

Estimated requirement of funds by 2020 : Rs. 34,000 crore

Estimated cess on thermal power by 2020 : Rs. 37,000 crore

Assuming 10% annual growth in thermal power generation (78,000 MW)