Effectiveness Of Solar Energy Policies In India

Let us turn to the Sun, to power our future

- By Prime Minister Narendra Modi

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Abstract

India is blessed with its strategic geopolitical location. Clear sunny weather is observed in India from 200 to 300 days per year. Its yearly radiation, which ranges from 1600 to 2200 kWh/m^2, is equivalent to that experienced in tropical and subtropical areas. India being a tropical country with abundance of solar energy if strategically used with right technology and investment can fulfill the most populated country's energy requirement and its ambitious goal of achieving net zero GHG (GreenHouse Gases) emission by 2070. With dwindling global reliance on conventional sources of energy, the world is exploring the cheap, stable, renewable and easily distributive alternative in the form of solar energy. India does not lack technology or potential investment to exploit this new transitional energy resource. What India requires is a strategic policy framework which aims to decentralize solar energy production penetrating into the grassroots level. The Government has undertaken efforts to formulate the existing legislative framework in accordance with the solar energy transition, through the Electricity Act 2003, Renewable Energy Certificates (RECs) 2011, Clean Energy Cess 2010 and Corporate Social Responsibility (CSR). However, there was a need for a policy framework in the form of subsidies, tariffs and mandates to robust India's demand and supply of solar energy both domestically and internationally. From legislation developments to net metering incentives, India has harnessed it all by achieving the 4th rank in solar generation globally. The paper outlines the various policy incentives undertaken by the Government to create a market for solar energy production as well as consumption domestically. The said paper also analyzes India's policy framework to strengthen its geopolitical position in the World Trade Organisation and how India incentivises its consumers to become producers in order to be self-reliant in solar production.

International Obligations and Commitments

In pursuance to the Article 4, paragraph of the Paris Agreement, India submitted its Intended Nationally Determined Contribution (INDC) to the United Nation Framework Convention on Climate Change (UNFCCC)[1], to achieve about 50 percent cumulative electric power installed

[1] Microsoft Word - V5 NDC submission to UNFCCC.

capacity from non-fossil fuel-based energy resources by 2030, with the help of transfer of technology and low-cost international finance including from Green Climate Fund (GCF).

At the UN Climate Change Conference in Glasgow (COP26) in November 2021, Prime Minister Narendra Modi outlined India's climate action plan. He proposed a 'Panchamrit' of five goals[2]:

i. Reach 500GW Non-fossil energy capacity by 2030.
ii. 50 per cent of its energy requirements from renewable energy by 2030.
iii. Reduction of total projected carbon emissions by one billion tonnes from now to 2030.
iv. Reduction of the carbon intensity of the economy by 45 per cent by 2030, over 2005 levels.
v. Achieving the target of net zero emissions by 2070.

International Solar Alliance

The International Solar Alliance (ISA) is a treaty-based inter-governmental organisation of 121 Countries having its headquarters in India. The World Bank Group in collaboration with ISA aspires to mobilize $1 trillion in investments by 2030 and to provide more than $1 billion to support India's ambitious initiative to expand solar through investments in solar generation[3].

ISA now observes a Permanent Observer Status at the UN General Assembly. It has signed a Memorandum of Understanding with the United Nations Framework Convention on Climate Change (UNFCCC) at COP 26[4]. For its strategic plan from 2021-2026, ISA aim to attain 3E's i.e., *Energy Access, Energy Security, and Energy Transition.*

Requirement of Solar Energy Policies in India

The futuristic technology that we are seeing today can be traced in its rudimentary form since ancient civilisation. From keeping the homes of Neolithic Chinese villagers warm[5] to being used as a weapon of mass destruction by the Greeks[6], the world has experienced it all. However, it is pertinent to note as to what prompted India to move towards the adaptation of solar energy. With the expansion of international trade in 1972, the value of exports from developing countries

[2] Press Information Bureau (pib.gov.in).
[3] World Bank, India Sign Deal to Boost Solar Globally.
[4] pib.gov.in/PressReleaseIframePage.aspx?PRID=1862753.
[5] J. Perlin, Let it Shine: The 6,000-year Story of Solar Energy. San Francisco (USA): New World Library, 2013.
[6] The history of solar power: solar energy in ancient times(2017, April 7).

including India, increased of about 16% but the world was facing energy crisis due to high rate of increase in demand[7]. Though at that time the world was much more dependent on oil prices that led to global energy crisis than the current scenario which is more dependent on fossil fuels and gas. In 1974, India topped the United Nations list of 30 developing countries affected by the global crisis.

However, even without the hike in oil prices by OPEC, India was facing the energy crisis due to the following factors[8]:

1. Firewood crisis,
2. Scarcity of Capital, and
3. Electricity shortages

This was the beginning of India's efforts towards energy development through its effective policy development on living off the sun. Now with the sudden increase in the prices of oil, uncertainty pertaining to oil supply and balance of payments led to the establishment of Commission for Additional Sources of Energy in 1981. The said Commission was entrusted with the task of formulating the policies for the development of renewable energy. It was for the first time that in the 6th Five Year Plan (1980-1985), the development of solar energy and its implementation in rural areas and industrial units was addressed. Furthermore, in the year 1982, Department of Non-conventional Energy Sources was established which subsequently christened as Ministry of Non-conventional Energy Sources and Ministry of New and Renewable Energy in 1992 and 2006 respectively.

Apart from the price hike and economic instability, a large part of India's expenditure was spent for the development of India's Solar photovoltaic (SPV) power plants through imports from China due to its inability to manufacture critical raw materials and components. This led to rise in high prices of solar equipment.

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[7] World Economic and Social Survey 1972.

[8] Pendse, D. R. "Energy Crisis and Its Impact on Energy Consumers in the Third World: I." *Economic and Political Weekly* 15, no. 3 (1980): 107–16. http://www.jstor.org/stable/4368330.

India's Energy Policy Framework

India's solar energy policy framework is mainly based on three factors:

1. Energy Access,
2. Energy Security, and
3. Climate Change

Renewable Purchase Obligation

In accordance with Section 86(1)(e) of the Electricity Act of 2003 (the "EA 2003") and the National Tariff Policy of 2006, the Renewable Purchase Obligation (RPO) is a mechanism by which the obligated entities are required to purchase a specific percentage of electricity from renewable energy sources relative to their overall electricity consumption. Furthermore, The State Electricity Regulatory Commissions (SERCs) are required to reserve a minimum percentage for the purchase of solar energy under the revised Tariff Policy that took effect in January 2016[9]. This percentage must reach 8% of total energy consumption, excluding hydropower, by March 2022 or as otherwise indicated by the Central Government from time to time.

National Action Plan On Climate Change

The Ministry of Environment & Forests established the Expert Committee on Impact of Climate Change in June 2007, and it evaluated the effects of climate change on six domains, including water resources, agriculture, natural ecosystems, health, coastal zone management, and climate modelling. Following the creation of the Expert Committee's reports, a number of policies and programmes were launched to address the issue of climate change within the framework of sustainable development.

The National Action Plan on Climate Change (NAPCC), unveiled by the Prime Minister on June 30, 2008, is guided by the following principles[10]:

- To Safeguard the well-being of underprivileged populations by promoting an inclusive and sustainable development approach that considers climate change.

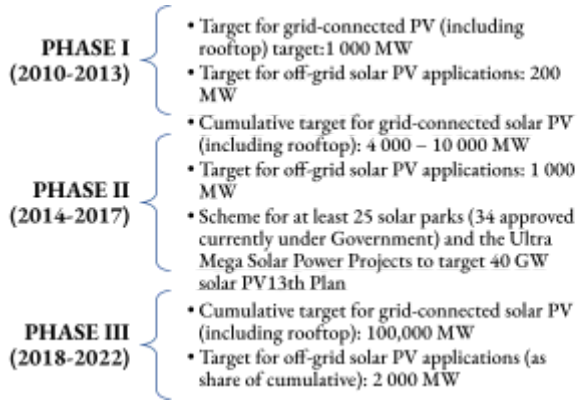
[9] TARIFF POLICY No. 23/2/2005-R&R (Vol-IX), MINISTRY OF POWER (Jan. 28,2016).
[10] "NATIONAL ACTION PLAN ON CLIMATE CHANGE" , prime minister's council on climate change.

- To Attain national growth goals by fundamentally shifting towards ecologically sustainable practices, thus reducing greenhouse gas emissions.
- To Create efficient and cost-effective strategies for managing energy demand on the consumption side.
- To accelerate adoption of suitable technologies for both adapting to and mitigating greenhouse gas emissions.

The National Solar Mission was the first out of the eight missions which was launched in the year 2010 with the aim of creating policy conditions for solar technology diffusion across the country as quickly as possible.

Jawaharlal Nehru National Solar Mission (JNNSM)

JNNSM was launched in the year 2010 with an objective of making India as a global leader in solar energy. The mission was based on three phase approach:



Solar Energy Corporation of India (SECI) has been designated as the implementing agency for Viability Gap Funding (VGF) Scheme, 750 MW, 2000 MW and 5000 MW of Grid connected Solar Power Projects.

A total of 533 MW solar PV projects had been commissioned under NSM Phase-I, the distribution of the same is as follows:

Phase I Batch I

Eligible Capacity		Aggregate Capacity (Allotted)		Bid Tariffs (Average)		Commissioned	
SPV	5MW	28 SPV Projects	140 MW	SPV projects	Rs.12.12/unit	28 SPV projects	140 MW aggregate capacity
ST	upto 100 MW	ST Projects	470 MW	ST projects	Rs.11.48/unit	3 ST projects	200 MW aggregate capacity

Phase 1 Batch 2 (SPV)

Capacity Fixed	5-20 MW
Aggregate capacity of 27 SPV Projects	340 MW
Alottment at Tariff	Average of Rs. 8.77/Unit
Commissioned	26 SPV Projects of aggregate 330 MW

Solar Energy Corporation of India (SEI) was authorised by the Government of India to implement Phase II. In order to achieve the targeted goal of Phase 1 and Phase 2 the following financial schemes were launched under the JNNSM:

1. ***Bundling Scheme:***

In order to facilitate Grid Connected Solar Power at lesser price, a bundling scheme was launched under JNNSM. Bundling involves grouping of products or services in order to sell them as a single entity. Under the said mechanism, relatively expensive solar energy is combined with energy from the Government of India's (Ministry of Power) unallocated quota, which is produced at National Thermal Power Corporation (NTPC) stations, to make it relatively cheaper before it is offered to the Distribution Companies (discoms).

2. Viability Gap Funding (VGF) Scheme

A capital subsidy known as "viability gap funding" fills the difference between a project's cost, which is determined by the current electricity tariff, and the price a developer has offered. VGF will be awarded using reverse bidding in accordance with the rules. Therefore, the project will go to the bidder with the lowest VGF. The purpose of VG was to undertake the implementation of Batch 1 Phase II which consisted of 750 MW Grid-connected Solar PV Power Projects. A project capacity of 680 MW was commissioned. The distribution is as follows:

- Rs. 500 crores for Payment Security Mechanism (PSM) to SECI for 750 MW, 2000 MW and 5000 MW VGF Scheme initially.
- Total 680 MW capacity of SPV plants were commissioned in 7 States (Rajasthan, Gujarat, Maharashtra, Madhya Pradesh, Karnataka, Tamil Nadu & Odisha).
- Total VGF Disbursement by SECI to SPDs, for the period from 01.01.2018 to 31.03.2019 was Rs.184.801 crore.

VGF was capped at 30% of the project cost or 2.5 crore per MW, whichever is lower. The Solar Energy Corporation of India (SECI) has signed Power Purchase Agreements (PPAs) with these selected developers, obligating SECI to buy all project-generated power for 25 years at a rate of 5.45

Rs. per unit (or 4.75 Rs. per unit with accelerated depreciation)[11]. The Government has efficaciously remedied the shortcomings of the VGF Scheme, such as:

- VGF was released in three stages, out of which 25% of the total VGF was to be released when at least 50% of the equipment was delivered, which was subsequently inspected by the MNRE committee.
- Following that, 50% will be released once the plant's full capacity has been successfully commissioned.
- 25% of the remaining amount after one year of operation and fulfilment of the "requirements of generation".
- Furthermore, in case of the failure generate any power continuously for any 1 year within 25 years or its major assets (components) are sold or the project is dismantled during this tenure, then SECI had a right to refund of VGF on pro-rata basis and if not paid by the developer, then a claim on assets equal to the value of VGF which was released.

Subsequently, VGF was provided to cover the cost difference between domestic and imported solar cells and modules for the implementation of the Central Public Sector Undertaking (CPSU) scheme phase-II for setting up 12,000 MW grid-connected solar projects[12].

3. Standard Bidding Guideline:

To accelerate the building of solar PV power plants, the SBG's bidding process was initiated on August 3rd, 2017. The projects with the capacity of 5 MW or more were approved under this programme. Further, the said programme was inclusive of Solar tariffs, which can be either fixed for 25 years or tariffs with annual escalation fixed for the PPA period of 25 years.

4. Generation Based Incentive Scheme (GBI) and Grid Connected Rooftop Solar Programme

The aim of the Grid Connected Rooftop Solar Programme was to create additional RTS capacity of 38000 MW in the country by 31.12.2022 out of which a capacity of 4000 MW in residential

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[11] **"Schemes launched by the Government to promote Solar Energy in the country,"** Ministry of New and Renewable Energy (Dec. 28, 2017).

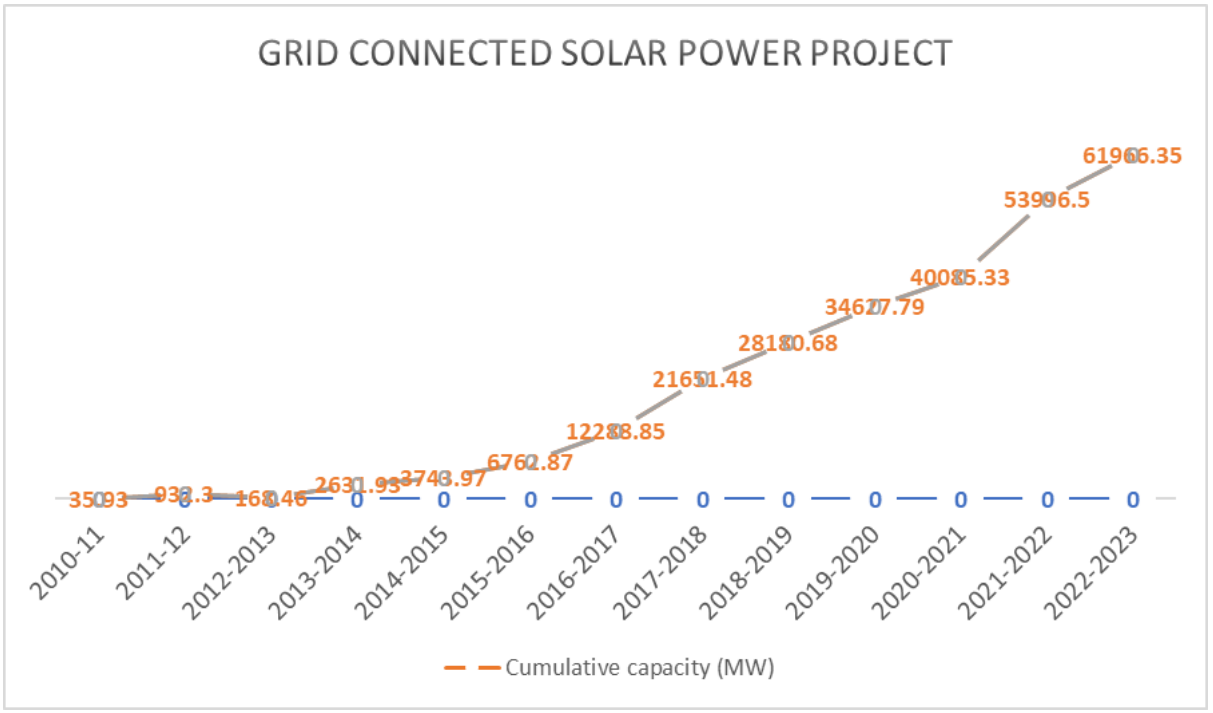
[12] **"12,000 MW CPSU phase-II Solar project scheme", Ministry of New and Renewable Energy (June 07, 2021).**

sector with Central Financial Assistance and 34000 MW in other sectors (i.e Social, Government, educational, PSUs,Statutory /Autonomous bodies, Private Commercial, Industrial Sectors etc.) by suitably incentivizing DISCOMs)[13].GBI programme was launched in 2011 to implement Rooftop PV and the Small Solar Power Generation Programme (RPSSGP). As a financial incentive, GBIs are offered to close the difference between a base tariff of INR 5.5 (by 2010–2011, with an annual increase of 3%) and the tariff set by the Central Electricity Regulatory Commission (CERC).

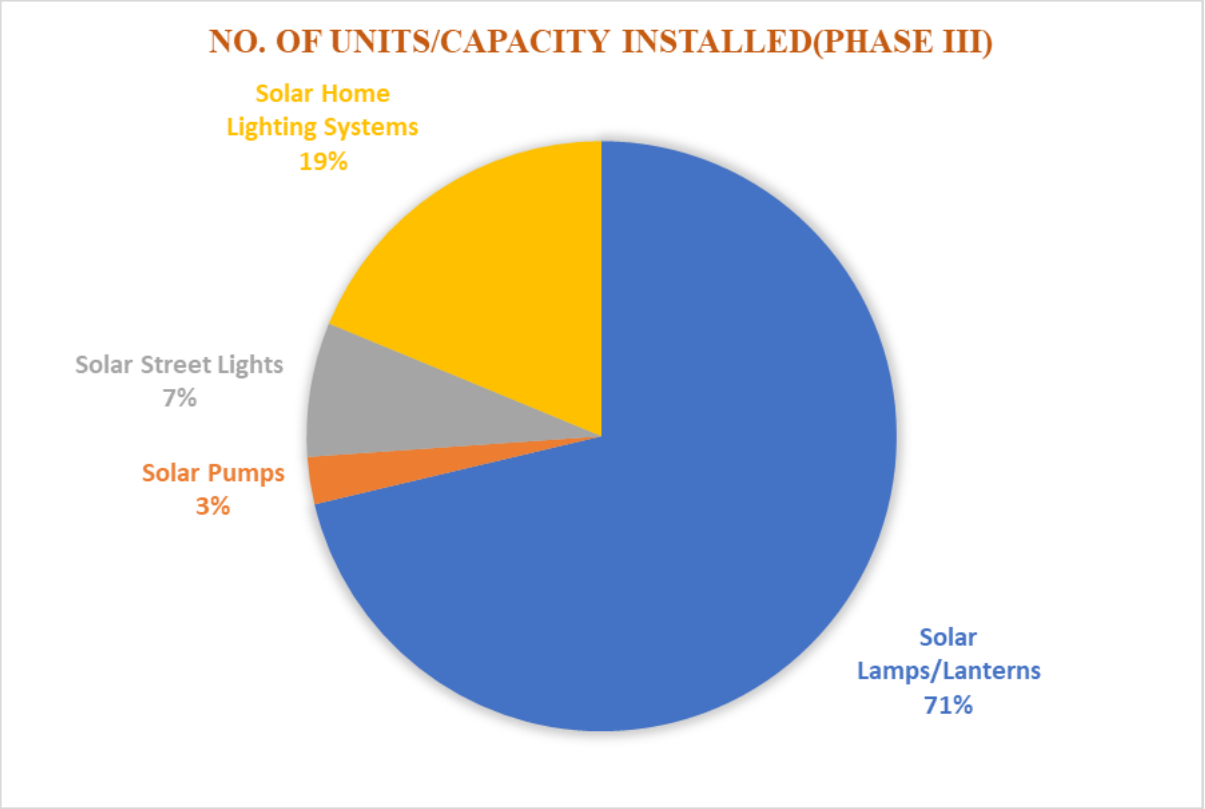
5. Loan and International Funding

Grid-connected solar rooftop systems and other renewable energy projects are now eligible for bank loans from the Reserve Bank of India up to a maximum of Rs. 15 crores as priority sector financing projects. For single-family residences, the maximum loan amount is Rs. 10 lakh per borrower. The World Bank has authorised a grant of USD 28.8 million for the Solar Roof Top Programme.

India has now secured the 4th rank globally in terms of solar energy installed capacity[14]. The successful implementation can be traced as follows:



[13] "Grid Connected Rooftop", Government of India, Office Memorandum, No. 318/331/2017.
[14] REN21 Renewables 2022 Global Status Report.



Overview Of India's Energy Landscape Post National Solar Mission

India has reached a cumulative installed capacity of 71,145.01 MW in the field of solar energy[15]. India's growth to be self-resilient in the energy sector is tremendous, however, its targeted growth still seems to be elusive.

Trajectory from producers to consumers

Apart from investing huge capital on establishment of solar parks, the Government has decided to encourage the consumers to make energy easily accessible.

Prosumers are the individuals who both consume and generate electricity from and into the grid respectively, at the same energy supply point for Discoms (Distribution Companies). To spur India towards the global target, the Government through this proactive framework intends to enable the

[15] Data As on 31.07.2023. State wise list.

consumers to maximise their profits inclusive of the capital invested by them on rooftop solar systems. The Government has amended the Electricity (Rights of Consumers) Rules, 2020 by Electricity (Rights of Consumers) (Amendment) Rules, 2021, as follows:

- Amended the definition under Rule 2 pertaining to gross metering, net metering and net billing or net feed-in.
- Increased the load for availing net metering from 10 Kw to 500 Kw.
- Encouraging the distribution licensee to install a solar energy meter to measure the gross solar energy generated from the Grid Interactive rooftop Solar Photovoltaic system for the purpose of renewable energy purchase obligation credit.
- The Commission may permit gross-metering for Prosumers who would like to sell all the generated solar energy to the distribution licensee instead of availing the net-metering, net-billing or net feed-in facility and the Commission shall decide for this purpose the generic tariff for gross-metering as per tariff regulations.

The grid-connected rooftop solar scheme under Period of existing Phase-II scheme has been extended till 31.03.2026, with the aim achieve a cumulative installed capacity of 40,000 MW from Grid Connected Rooftop Solar (RTS) projects[16].

Subsidy for residential sector is as follows:

- Individual Household - For first 3 kW is Rs. 14588/ kW and for RTS capacity beyond 3 kW and upto 10 kW is Rs. 7294/kW.
- Resident Welfare Associations/Group Housing Societies (RWA/GHS) is Rs. 7294/kW for common facilities up to 500 kWp @ 10 kWp per house.

Furthermore, Gujarat which leads the solar rooftop programme, implemented Surya Urja Rooftop Yojana which offers State subsidies of 40% for installations ranging up to 3 KW and 20% for installations between 3-10 KW. Additionally, under its new solar policy, the state permits consumers to lease their properties to third parties for electricity generation.

[16] "Grid Connected Rooftop", Ministry of New and Renewable Energy, No.- 318/331/20"17.

Seeing the growth trajectory of India, it can be said that improved awareness, Government subsidies and rising prices of electricity has attracted many consumers to install rooftop solar systems. In Q1 2023, residential consumers contributed almost 58% of the added capacity in contrast to Commercial and Industrial consumers (C&I) who contributed 28% and 14% respectively[17].

Solar Energy Investment Opportunities

The Union Budget for 2022-23 allocates ₹3365 crore to the solar power sector, encompassing both grid-interactive and off-grid initiatives with the ambition to achieve 280 GW of installed solar capacity by 2030. This marks a 29% rise compared to the previous year's budget of ₹2606 crore[18].

Furthermore, green debt securities are created to fund projects that have positive environmental benefits including solar energy, the proceeds from which are earmarked for green projects[19]. The SEBI (Issue and Listing of Non-Convertible Securities) Regulations, defines green debt security as a debt security issued for raising funds that are to be utilised for projects falling under any of the nine categories, one such is Renewable and sustainable energy including wind, solar, bioenergy, other sources of energy which use clean technology.

Production Linked Incentive

India has set an ambitious renewable energy target of 450,000 MW by 2030. Around 280,000 MW of this capacity should come from solar energy by 2029-30[20]. To meet these goals, approximately 25,000 MW of solar energy capacity needs to be installed annually until 2030. Currently, a significant portion of solar capacity relies on imported solar PV cells and modules. Subsequently, to make India Aatmanirbhar Bharat, by enhancing the Country's manufacturing and exports of high efficiency solar PV modules, the PLI scheme was approved by the Cabinet on 11 November, 2020[21].

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[17] Q1 2023 Mercom India Rooftop Solar Market Report.
[18] https://www.indiabudget.gov.in/doc/eb/sbe71.pdf.
[19] pib.gov.in/PressReleaseIframePage.aspx?PRID=1885728.
[20] Central Electricity Authority (CEA) and their Optimum Energy Mix report, April 2023.
[21] Guidelines for Production Linked Incentive Scheme 'National Programme on High Efficiency Solar PV Modules,(April 8, 2021).

Tranche 1	INR 4500 Cr (US$ 550 Mn)
Tranche 2	INR 19,500 Cr (US$ 2.37 Bn)
Direct employment	30,000 persons
Indirect employment	1,20,000 persons
Import substitution	INR 17,500 Cr every year

Till now, under Tranche-II, the Government has allocated a total capacity of 39,600 MW of domestic Solar PV module manufacturing capacity to 11 companies, with a total outlay of Rs. 14,007 Crores. Manufacturing capacity totaling 7400 MW is expected to become operational by October 2024, 16,800 MW capacity by April 2025 and the balance 15,400 MW capacity by April 2026[22].

Waiver of Inter State Transmission System Charges

For projects that will be put into service up until June 30th, 2025, the Ministry of Power has issued an order extending the waiver of Inter-State Transmission System (ISTS) tariffs on transmission of electricity generated from solar. Though initially it was till 30th June, 2023.

Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM) Scheme

The scheme aims to add 30.8 GW of solar capacity with central financial support of over ₹34,000 crore in order to generate additional income for farmers and encourage them to produce solar power[23]. The scheme is divided into three components in order to target solar power capacity addition by 2026, which is as follow:

[22] "Government allocates 39600 MW of domestic Solar PV module manufacturing capacity under PLI (Tranche-II)", PIB Delhi (March 28, 2023).

[23] PM-KUSUM (Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan) Scheme| National Portal of India.

COMPONENTS	FINANCIAL ASSISTANCE
Component A: Setting up of 10,000 MW of Decentralized Grid Connected Renewable Energy Power Plants on barren land.	Procurement Based Incentive (PBI) @ 40 paise/kWh or Rs. 6.60 lakhs/MW/year, whichever is less, will be provided for the first five years by MNRE to DISCOMs, for buying the power from farmers/developers
Component B: Installation of 17.50 Lakh stand-alone solar agriculture pumps	CFA of 30% of the benchmark cost or the tender cost, whichever is lower. State Government subsidy 30%; Remaining 40% by the farmer. In North Eastern States, Sikkim, J&K, Himachal, Uttarakhand, Lakshadweep and A&N Islands- CFA of 50% and State Government subsidy 30%, Remaining 20% by the farmer.
Component C- Solarisation of 10 Lakh Grid Connected Agriculture Pumps.	Same as Component B.

Sustainable Goals

One Sun One World One Grid was jointly launched by the United Kingdom and the Government of India, International Solar Alliance with the support of the World Bank in the year 2018, with the mantra that *the sun never dies.* The strategic aim behind the said initiative is to support India's vision of One Sun One World through technical, financial and research assistance by the global leaders.

Furthermore, the finance minister adopted seven priorities termed "Saptarishi", in the Union Budget for FY 2023-24 to guide the country towards 'Amrit Kaal', including green growth[24].

Overview Of WTO Ruling Against India's Solar Policies

On 6 February 2013, the United States claimed before the WTO Panel that the Domestic content requirement measures under the Jawaharlal Nehru National Solar Mission ("NSM") for solar cells and solar modules, imposed by India are inconsistent with Article III:4 of the General Agreement on Tariffs and Trade 1994 (GATT 1994) and Article 2.1 of the Agreement on Trade-Related Investment Measures (TRIMs Agreement).

Brief Background:

Each individually power purchase agreement (PPA) under the DCR measures in Phase I (Batch 1), Phase I (Batch 2), and Phase II (Batch 1-A) guaranteed rate for a 25-year term at which the electricity generated by the Solar power developers (SPD) will be bought by the Central Government. The Government resells the electricity that it purchases to downstream distribution companies, which in turn resell it to the ultimate consumer. the DCR requirements are as follows:

Under Phase I (Batch 1), it was mandatory for all projects based on crystalline silicon (c-Si) technology to use c-Si modules manufactured in India, while the use of foreign c-Si cells and foreign thin-film modules or concentrator photovoltaic (PV) cells was permitted.

Under Phase II (Batch 1-A), any solar cells and modules used by the SPDs had to be made in India, irrespective of the type of technology used.

Contentions of USA[25]

1. The DCRs operate to accord "less favourable" treatment to imported solar cells and modules than that accorded to cells and modules of Indian origin and is violative of India's national treatment obligations under Article III:4 of the GATT 1994.
2. The DCRs under the JNNSM Programme measures are inconsistent with India's national treatment obligations under Article III:4 of the GATT 1994, because

[24] Union Budget 2023-2024| National Portal of India.
[25] "INDIA – CERTAIN MEASURES RELATING TO SOLAR CELLS AND SOLAR MODULES", REPORT OF THE PANEL , WT/DS456/R/Add.1.

- imported and domestic solar cells and modules are "like products";
- they impose "requirements" on SPDs "affecting" the "internal" "sale," "purchase," or "use" of solar cell and modules; and
- they accord imported solar cells and modules treatment less favorable than to "like products" of Indian origin.
- JNNSM Programme measures make distinction between imported and domestic solar cells and modules on the basis of country of origin.

Contentions of India

1. India is seeking to develop a functional local manufacturing base for cells and modules, which are the essential components in a solar PV generation plant, thereby ensuring a sustained supply of the same in the event of disruptions in imports[26].
2. India has also explained that the execution of these important public functions were "not with a view to commercial resale. India reduced solar power costs through Bundling and VGF schemes, making it affordable for consumers, preventing higher charges[27].
3. It was contended that the DCR measures are justified under the general exception in Article XX(j) of the GATT 1994, on the grounds that its lack of domestic manufacturing capacity in solar cells and modules, and/or the risk of a disruption in imports, makes these "products in general or local short supply" within the meaning of that provision[28].
4. DCR measures should be seen in light of the policy objectives of: "(i) Energy Security and Sustainable Development; and (ii) Ecologically sustainable growth, while addressing the challenges of climate change and must be exempted under Article XX(j)[29].

Findings of the Panel and Appellate Body

Bothe the Panel and Appellate Body sustained the USA's claims, the Panel found that the measures undertaken by India are not covered by the government procurement for exemption under Article

[26] Supra Note 25.
[27] Ibid.
[28] "INDIA – CERTAIN MEASURES RELATING TO SOLAR CELLS AND SOLAR MODULES", Report of the Appellate Body ,WT/DS456/AB/R.
[29] Ibid.

III:8(a) of the GATT 1994, because the product being procured (electricity) was not in a "competitive relationship" with the product discriminated against (solar cells and modules).

Disregarding India's argument of abysmally low" domestic production capacity, the Appellate Body stated that an assessment of whether products are in short supply should take into account the quantity of available supply of a product from all domestic and international sources, and that consideration should be given to all relevant factors, including the availability of imports, the level of domestic production, potential price fluctuations in the relevant market, and the purchasing power of foreign and domestic consumers.

The WTO ruling was mainly based on the precedent of Canada — Renewable Energy / Canada — Feed-in Tariff Program (FiT) based on similar facts. However, the said ruling disregards the right of a country to prioritize one's national energy development over INternational Trade Liberalisation. Though the USA offers to establish a free trade world, it does not practice what it preaches. At that time India was foraging its bilateral relations with the USA, so it might have remained quiet and agreed to mutually settle the dispute. However, in 2017, India requested consultations with the United States aegis of the WTO regarding certain measures of the United States relating to domestic content requirements and subsidies instituted by the governments of the states of Washington, California, Montana, Massachusetts, Connecticut, Michigan, Delaware and Minnesota, in the energy sector. Ruling in favour of India, the panel found that all the measures provide an advantage for the use of domestic products of USA, which amounts to less favourable treatment for imported products from India[30]. Though subsequently, USA and India again mutually decided to terminate the dispute and USA withdrew the case from further appeal.

The potential USA- India disputes underscores the need to adapt a policy framework which aligns the domestic interests with the International Law obligations. Strategically India's adoption of the International Solar Alliance is one such instance.

One of the notable observations of 2016 WTO ruling against India is that the Appellate Body disregarded India's Preferential Procurement on the ground that the procurement was based on electricity and not solar panels. This ruling can be the basis for future bilateral negotiations or even

[30] "United States — Certain Measures Relating to the Renewable Energy Sector",DS510.

developing a municipal policy framework, where the Government can opt for Preferential Procurement of Solar Energy Technology which will in turn increase the manufacturing capacity of the country and supply of solar equipment.

Policy Shortcomings and Achievements

India's solar energy sector is growing rapidly with a robust policy framework. However, pursuant to the pursuit of formidable objectives, one can say that these policy frameworks might have to face shortcomings due to infrastructure, investment, technological gaps, social barriers, lack of efficient storage and supply shortage. Furthermore, the north-eastern region which is blessed with hydroelectricity still lacks development with respect to solar energy.

However, India's proactive policy framework whether domestic or international and geopolitical location has bridged the gap from being in need to generating need globally.

In order to fulfill the shortage of solar battery storage due to supply constraints, on 6th September, 2023, the Government of India has approved the VGF scheme for development of 4,000 MWh of Battery Energy Storage Systems (BESS) projects by 2030-31[31]To manage the peak demand, the scheme aims to achieve a Levelized Cost of Storage (LCoS) ranging from Rs. 5.50-6.60 per kilowatt-hour (kWh), enhancing electricity grid and minimising wastage. This scheme will prove to help the solar energy accessibility in north eastern states.

In order to achieve 365 gigawatts (GW) of installed solar capacity by 2031-32, Basic Custom Duty (BCD) was imposed as 40% on imported Solar PV modules and 25% on Solar PV Cells[32]. Though the duty discourages import from China, India's Solar Module manufacturing capacity is 25 GW per annum against the requirement of 52 GW. Furthermore, it is difficult to achieve price competitiveness as that of China because of the presence of a global supply chain at cheaper prices. To counter this, countries are becoming more resilient to reduce Chinese dominance on solar supply chains. For instance, the USA has been imposing dumping and countervailing duties against china to offset the chinese export subsidies and dumping of solar panels, crystalline silicon

[31] Press Information Bureau (pib.gov.in).
[32] file_f-1664268571796.pdf (mnre.gov.in). w.e.f. 1st April 2022.

photovoltaic cells, and modules in the US market at a cheaper price[33]. The practice of dumping by China is very common, where it tries to affect the profit margin of the importing country through price undercutting and price suppression because of which the domestic manufacturers face competition with the imported products.. It can be said the the Basic Custom Duty was imposed by the Government on the backdrop of various Anti-Dumping investigations conducted against China[34].

As per the report of Institute for Energy Economics and Financial Analysis, India's manufacturing capacity has almost doubled from 18 MW in 2022 to 38 MW in 2023. Due to record law tariffs, the Solar PV installation has increased. Subsequently with cheap labour as well Government's proactive approach against the chinese import, providing a combination of solar equipment with that of chineses cheaper equipment has increased the solar manufacturing capacity of India as well. Due to the effective implementation of National Solar Mission and Product Linked Incentive Scheme, the manufacturing capacity of India is expected to increase to 50 GW by 2023, becoming the second largest manufacturer trailing behind China.

Lessons India can learn from other nations

Germany

Germany is one of the most influential players in the solar energy industry, with a strong policy support in combination with advanced technology and a focus on research and innovation. Since the Russian invasion started, the market volatility has increased resulting in rising prices which prompted every one in three households to consider setting up solar panels either for power generation or heating purposes. One of the policies that stands out as exemplary is the implementation of carbon pricing policy which significantly increases the number of solar power users.

USA

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[33] Federal Register :: Crystalline Silicon Photovoltaic Cells, Whether or Not Assembled Into Modules, From the People's Republic of China: Final Results of Changed Circumstances Reviews, and Revocation of the Antidumping and Countervailing Duty Orders, in Part.

[34] signed initiation notification final.pdf (dgtr.gov.in).

The policy strategy undertaken by the Biden administration is more related to technological diversification in order to compete with Chinese manufacturers. The policy aims to build a substantial market opportunity for domestic solar production through tax initiatives aiming to increase investment in the domestic solar supply chain. For this the federal government uses tax credits for instance totalling over 30% of the system cost and additional bonus of 10% if domestically manufactured solar panels are purchased.

China

Over the past few years China has invested in its own right and scaled up incredibly, by becoming the world's largest renewable power capacity hub. Chinese policies aim to reduce cost and improve efficiency through its solar factories, for instance reducing the labour cost and even manufacturing polysilicon using cheap electricity, which is supplied through coal plants. The incentive undertaken by China in combination with imposition of high import duties helps China to become an end-to-end supply nation.

Policy Issues

1. Rooftop Solar System ("RTS"):

(a) Unachieved Target: Initially the Government has set to achieve the target of 40 GW through RoofTop Solar scheme by the end of 2022. However, the same target is now extended to 2026. Currently an aggregate of about 8.03 GW rooftop solar capacity is reported to be installed in the country as on 28.02.2023.

(b) Discrepancies in Net Metering and Gross Metering policies of various States: In net metering the consumer is charged for the net energy utilised which is the difference between the energy produced and the energy consumed over the billing period. Whereas, if a consumer opts for gross metering the maximum load for it is above 10 KW. According to the Feed-in-Tariff rate set by the State Electricity Regulatory Commission, the consumer is reimbursed for the electricity they export to the grid. However, they have to pay a retail supply tariff for energy imported from the grid.

(c) Many States offer compensation for surplus injection at an Average Power Purchase Cost ("APPC"), which is the average price at which the distribution licensee purchases the electricity. In India, the average power tariff for rooftop solar is RS. 6.3/kwh, whereas the payment received by the consumer for electricity generation is significantly lower at national level APPC, which is Rs. 3.85/kWh during the FY 2021-22[35]. Such minimal compensation arrangement will discourage the consumers to opt for rooftop solar installation.

(d) Furthermore, Many States have come up with their net metering /RoofTop policy in accordance with the Electricity Act 2003. However, these net metering regulations allow the maximum capacity limit ranging between 1KW-1MW only, even when the consumer load is much higher. This maximum limitation is comparatively small for large scale solar developments and will not be able to meet the demands of C&I consumers who have high energy requirements. Furthermore, The Electricity (Rights of Consumers) Rules, 2020

[35] Proposal-National_APPC-2021-22.pdf (cercind.gov.in).

mandates net metering for loads upto 10KW which in turn limits the choice of consumers interested in setting up RTS, especially Railways which have ample rooftop space.

(e) Varied Transformer Capacity: States permit an overall RTS capacity expansion of up to 50% of transformer capacity. Though the numbers are few. States like Haryana and Madhya Pradesh provide limitation in the RTS capacity system of upto 30% of transformer capacity. Though it is pertinent to note that States like Jharkhand and Tamil Nadu have a transformer capacity of 100 and 90 percent respectively. This lesser capacity requirement will result in underutilisation of available infrastructure and discourage investments in larger solar projects. The initial lower capacity, if required to be upgraded in future will not be cost effective. In cases where solar generation is high, such low transformer capacity can even result in voltage fluctuations.

(f) Urbanisation: One of the essential requirements of rooftop solar systems is shade free rooftop areas. However, Under the existing net metering legislation, residential owners of multi-story buildings are unable to produce clean electricity, which in turn hinders the RTS scheme to achieve its targeted capacity.

(g) Regressive Measures against the C&I Consumers: Many States are now opting for key regressive measures related to net metering policies especially against C&I consumers. States like Uttar Pradesh have withdrawn net metering for commercial, industrial and public building. It is pertinent to note that 49 % of electricity is consumed by Commercial and Industrial Consumers[36] and 20% by the MSMEs[37]. These regressive measures by the States will affect the electricity costs of the said MSMEs which are the backbone of the Indian economy. Even the State of Tamil Nadu had removed the net metering for all consumers, allowing gross metering to the residential consumers.

(h) High Financing: Even with the financial assistance, it is difficult to finance small-scale rooftop solar projects especially the residential ones, because of the high initial cost which is more than the average electricity bill of a consumer household.

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[36] Untapped-Opportunities-in-Indias-Rooftop-Solar-Market_July-2020.pdf (ieefa.org).
[37] Energy usage in MSMEs — An outlook | by Zodhya | Medium.

(i) DISCOMS: Power Distribution Companies are the key players in vertical integration of supply chains. They act as an intermediary between the utilities and consumers. Power being a subject of concurrent list under the Indian Constitution, most of the DISCOMS are owned by State Governments, leading to various legislations burdening the power distribution companies to comply with these regulations. Many DISCOMS face the following challenges with regards to policy implementations:

- Financial Aspect: Many low paying consumers are dependent on DISCOMS for the supply of solar power, this results in an increase of cross subsidy burden, making C&I consumers as the most expensive electricity segment for DISCOMS.
- Operational Aspect: There is a shortage of skilled labour manpower which poses a challenge in managing operational activities such as metering, billing and energy accounting.
- Technical Aspect: Many utilities face technical issues in grid balancing such as anti islanding, voltage sags, reverse power flow or other power related issues.

2. <u>Tariff Barriers:</u>

(a) The Basic Custom Duty of 40% imposed on Solar Panels and 25% on Solar Cells creates a supply shortage of high-quality modules in India as India is still not self-sufficient in its manufacturing capacity. Even though keeping aside the domestic manufacturing shortfall, most of the Indian developers prefer to export the solar material in Countries Like EU with the aim of earning high profit margin, ultimately causing supply shortage domestically.

(b) Furthermore, the exclusion of solar developers from the benefit of a concessional rate of 7.5% import duty under the project imports scheme causes a set back to India's power addition plan.

(c) With the imposition of BCD and implementation of Approved List of Models and Manufacturers (ALMM) policy to subsidize rooftop solar systems has resulted in Tariff inflation.

(d) The rise in the GST rate from 5% to 12% on solar power-based devices will also result in the increase in the solar power cost which will ultimately reduce the input tax credit of the developer.

3. Transition from Feed in Tariff to Reverse Auction:

(a) Central Electricity Regulatory Commission (CERC) issues tariffs on solar energy which are not binding upon the States.

(b) The States choose their own method of project allocation, which derives competition amongst the project developers, who even offer more than 50% discounts over the base tariff during the solar power auctions. This forces the solar developers to forfeit their projects which obviously seems to be financially unviable.

(c) The solar developers who have access to low-cost funding undertake aggressive bidding in reverse auctions which in turn results in lower tariff rates. These lower tariffs can reduce the investment capacity of the developer or can all together result in abandonment of projects by solar developers due to less profit margin.

(d) Furthermore, in order to offer the lowest bid, the developers will opt for cost cutting measures, which will ultimately raise concerns over the quality of the project.

(e) Unlike FiT, aggressive bidding can be a sign of financial instability. Which would make it difficult for the winning bid developer to finance his project as lenders would become more cautious before financing such projects.

4. PM KUSUM Scheme:

(a) Multiple stakeholders: The scheme involves various stakeholders such as State Government, DISCOMS and renewable energy developers for the successful implementation of Component A. However, such complex involvement without laying down a structured policy procedure will lead to delay in implementation of the scheme. This results in developers to bear late penalties in the form of reduced tariffs.

(b) Metering: To incentivise the Solarisation of 10 Lakh Grid Connected Agriculture Pumps, the farmer is allowed to use the generated solar power for irrigation, and any extra solar power is then sold to DISCOMs at a predetermined tariff, known as net metering. However, it is pertinent to note that operational implementation with respect to net metering is still a challenging aspect in urban areas. Lack of skilled labour and technical awareness may cause a hurdle in achieving the said target in rural areas.

(c) Financing: When it comes to financing, farmers are unable to avail loans from the Banks due to lack of Collateral (other than land) especially in case of third-party agreements. Furthermore, banks feel wary to fund the solar projects due to the poor payment track record of DISCOMS. Even many developers prefer to enter into PPAs with Government entities in order to minimise the payment risks.

(d) Income: One of the ingredients of Component A is that the farmer can lease their land to the developer for the deployment of a renewable energy power plant. However, most of the States prohibit leasing of agricultural land, this limits the project exposure, reducing the income of the farmers.

(e) Solar Pumps: To increase the grid connected solar pump there is a need to replace the old water pumps. However not many States are completely able to replace the old pumps with the new solar pumps. Agricultural States such as Punjab and Haryana have installed percentages of around 16 and 22 respectively. States like West Bengal and Telangana have zero percent of installed solar powered pumps.

Recommendations

1. <u>Increasing more rooftop solar power panel:</u>
    (a) Increasing Transformer Capacity: States are cautious in increasing the transformer capacity because of the risk of overloading. However, it is recommended that in order to reduce the overload, the States can install grid connected storage battery systems, which can store the excess energy without overloading the transformers.

(b) Furthermore, the State can also invest in installation of capacitor banks to provide voltage stability. The other advantage of capacitor banks is that they can also be used to compensate for losses caused in transmission systems.

(c) The Government can also mandate the installation of rooftop systems in every new housing establishment.

2. Combination of Tariff and Non-Tariff Barriers:

(a) The Government can also implement a low tariff barrier in combination with non-tariff barriers. This can be done by giving preference to the domestic developers in power procurement agreements.

(b) Furthermore, it is recommended to extend the Approved List of Models and Manufacturers (ALMM) from two years to five years, which will not only increase the confidence of solar developers but also align the interest of solar projects which are extended beyond the period of two years. This longer duration will also attract long term investments in innovation and market expansion and reduce the short-term crisis of modules at competitive prices.

3. Increasing the reach of PM KUSUM Scheme:

(a) It is recommended to provide a policy framework on leasing regulations specifically for solar projects. This policy framework can include provisions like deemed diversion of agricultural land.

(b) There must be standard methodologies for calculation of feed in tariff (FiT)for all the States, especially taking into consideration the opportunity cost of export of power undertaken by the farmer.

(c) Furthermore, very few States are providing collateral free loan incentives that too, upto a very limited amount. It is recommended that the Government can mandate the collateral free loan incentive amongst the States, especially agricultural States.

(d) The Government can also implement credit guarantee schemes by being a partial guarantor, in cases where farmers lack any collateral. Furthermore, the Government can also promote group lending services amongst banks, by collectively granting loans to the group of farmers, which will not only reduce the financial burden, but also help to mitigate risks.

(e) Lastly, with the issue of slow replacement of old pumps with the solar pumps, it is pertinent to note that 30% of financial assistance is provided by the Central Government, whereas the State Government has to bear a subsidy of at least 30 % and the remaining 40% is to be borne by the cash strapped farmer. It is recommended that the States can reduce the financial burden for old pump replacement in a phased manner through performance based incentives.

4. Reverse Auction:

(a) In order to avoid aggressive bidding in reverse auction, it is recommended to impose a floor price, below which the project developers cannot bid, thus resulting in a better return on their investment.

(b) The Government is also recommended to provide a policy framework clearly outlining the standard bidding rules, project timeline and even imposition of penalties in case of project abandonment by the winning bidder.

5. State level taxes on solar parts and State level Strategies:

(a) The States can promote manufacturing of solar equipment through tax incentives and land subsidies.

(b) State Government can partner with the local developers to promote rooftop solar systems mainly focussing on RTS installation upon Government and public Buildings. In the case of public buildings, States can own the panels and sell the power generated from it to the grid owner. Such Governmental intervention will lead to additional revenue generation and increase the confidence of private investments.

(c) The States are recommended to divert the power procurement by Commercial and Industrial Consumer from DISCOMS to Open Access sources,which will help to lower their power cost. The Government can also mandate the procurement process according to the need of the consumers, such as:

- Opting for a Third party Open Access model, if the C&I consumers do not have sufficient access to RTS. This will ensure zero uncertainties, certainty in tariff rates and cost saving.

- Captive capex model can be mandated for the buyers who can accord 100% upfront investment. In such a model cross-subsidy surcharge is waived off which will result reduce the investment risk and help to attract more investment.

(d) Promoting alternative solar generation systems: The State Governments can promote alternative forms of solar system such as solar parks. The other alternative is floating solar panels which can help to replace the land or rooftop use issues. The floating panels can also lead to many environmental benefits such as promoting water conservation. The said strategy will be useful in States having access to water bodies, adding the increased capacity of power generation and helping India to achieve its set goal by 2030.

(e) Land Regulations: States can help to promote Solar Park Projects through favourable land regulations.They can incentivise the developers by easing the leasing requirements, identifying and optimising the usage of barren or waste lands and even outsourcing the lands to the developers. This will offer lower risks and favourable project equity internal rate of return which will attract more investors.

(f) Cross Subsidy: The State Government can give incentives like electricity duty or direct subsidies to needy consumers, which will somehow reduce the burden of cross subsidy on DISCOMs.

6. Capital Subsidy towards financing R&D research:. R&D in the solar industry is directly correlated to the growth of technology. The Government is recommended to incentivise research and development in the solar energy industry through tax deductions and custom duty exemptions to R&D units. Domestic companies conducting scientific research, skill development are provided with tax deductions under Section 35 and subsections 35AD, 35CCC, and 35CCD of Income Tax Act, 1961. However, the weighted deduction has been reduced from 200% to 150% on R&D expenditure. It is recommended to increase the tax deduction, or provide capital subsidy so that the in-house R&D units both Government and Private will get incentives to undertake the desired research and development projects.

7. Investment Structure: The Government is recommended to invest more in infrastructure to reduce the setting and transmission cost. Upshot investment in infrastructure and technology can have a downward impact on cost resulting in low cost of power generation.Many factors influence the investment of a country, for instance international collaboration and favourable government policies.

   Over the years, several countries like China, USA and Germany have emerged as the largest investment markets in the solar energy sector with an investment pool of $177 billion, $36 billion and $11.9 billion respectively.

   Whereas India is still lagging behind in its set investment target. For instance, the estimated investment for Solar Rooftop scheme was Rs. 6100 Crore, however only Rs. 1051.6 Crore of the financial incentive is provided by the Central Government.

   It is pertinent to note that the total installed capacity of solar power as of July 2023 is 67.07 GW[38]. To achieve the goal of 450 GW installed renewable energy capacity by 2023 inclusive of 60% contribution from solar energy, India will need to install solar capacity of approximately 35 GW every year.

   Currently, India's forex reserves are $598.89 Billion. To fund its green energy requirement, India will be needing approximately $250 Billion. As per Institute of Energy Economics and Financial Analysis, India will be needing to mobilise the capital of about $500 Billion in renewable energy infrastructure by 2030[39].

8. Training and Awareness Programmes: It is recommended to launch various training programmes with an aim to develop a skilled workforce in the solar industry. Furthermore, for successful implementation of solar policies, it is important to generate awareness about various incentives provided to the potential consumers. This can be done through advertising and solar camps.

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[38] National Investment Promotion & Facilitation Agency.
[39] IIEFA.ORG (Feb 2021).

Conclusion

India's journey from being unknown to known in the solar energy transition has been commendable. India's solar energy policies have a promising future of making the country self resilient in Energy accessibility, Energy availability and Environmentally clean green energy. Though the policy's full potential is contingent on intermittency due to various factors such as unclear policy framework, lack of enthusiasm on the part of States and most prominently need for technological advancement. India's solar energy policies need a holistic approach to compete with its counterpart nations such as China, not only in terms of achieving its targeted solar capacity but also becoming a solar equipment supplier. Nonetheless, India's solar energy vision, if anchored with a clear, responsive and effective policy framework, can contribute to a sustainable future, not only domestically but globally too.