Stop "Rooftop Solar Projects with Net-Metering" Switch to "Virtual Rooftop Solar Power Projects"

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Abstract Virtual Rooftop Solar Power Projects restores balance of subsidizing consumers and subsidized consumers for a DISCOM to operate. Innovation of Retail Solar Power Exchange provides operative mechanism for trading the credited solar power for the investors and other stakeholders.

Keywords Rooftop netmetering · Virtual rooftop solar projects

1 Introduction

Roof Top Solar (RTS) projects with different incentives have been promoted in developed countries in last 2 decades. India adopted the same since 2015 with net-metering policy. As solar power was very expensive till 2014 different incentives were needed. Higher power purchase tariffs were provided to bigger plants and on smaller scale RTS projects were promoted with different financial and tax incentives to fetch retail investment [1]. Situation has changed since 2014 with sudden drop in cost of solar panels, but the policies haven't changed in India. At present utility scale solar power projects provide power cheaper than coal [2] and hence continuation of incentivizing RTS net-metering scheme needs a serious review.

2 Issues with Rooftop Solar Net-Metering

In India, power is treated as essential commodity. People who afford are charged higher tariff with cross subsidy surcharge (CSS), while consumers below poverty level, farmers, charitable organisations etc. are provided subsidized power. The consumers are generally grouped in two categories, 'Subsidizing Consumers' and 'Subsidized Consumers'. Introduction of RTS net-metering scheme kills this very basic financing mechanism ending up subsidizing rich 'Subsidizing Consumers'.

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R. K. Pillai et al. (eds.), *ISUW 2019*, Lecture Notes in Electrical Engineering 764,
https://doi.org/10.1007/978-981-16-1299-2_4

Experience in Maharashtra, Gujarat and other states show that the subsidizing consumers with high tariff category are aggressively adopting RTS net-metering scheme for purely financial reasons and in most cases they end up with payback of less than 3 years. As these 'Subsidizing Consumers' practically do not purchase power, the DISCOMs are losing their revenue. The DISCOMs has to maintain grid supply to such consumers and incur all losses and fixed expenses. 'Subsidizing consumer' eventually becomes 'subsidized consumer'. DISCOMs in Maharashtra realized this problem and have approached electricity regulatory commissions to stop RTS net-metering and switch to 'Gross Metering'. If RTS projects continue at current speed then very soon the DISCOMs will start making huge losses on this account and will fail to subsidize the deserving consumers. Hence implementing RTS net-metering in current form will be disaster for the DISCOMs.

Government of India has set target of 40 GW [3] through RTS projects and the progress is not satisfactory. On Dec. 18, 2017 MNRE has come up with a draft to incentivise DISCOMs so as to complete the RTS targets. Financial impact analysis shows that if target of 40 GW is achieved then it will result in losses of 24,000 crore rupees per year for DISCOMs and accumulated losses over life of the project will be whopping 600,000 crore rupees. Calculations are shown in Table 1.

All DISCOMs are financially in a bad shape and GoI already launched schemes like 'UDAY' for their revival [4]. New schemes are also due to revive stressed power assets. This indirect additional subsidy burden because of RTS will be finally passed on to the consumers and will result in tariff hike of 25–50 paise per kWh. Loss of CSS by DISCOMs may result in withdrawal of subsidy by DISCOMs to subsidized consumers like farmers and BPL families and will result in large scale social unrest.

Other problems associated RTS projects are:

Table 1 Loss calculations of GoI and DISCOMs due to RTS

Target of RTS	40,000	MW
Subsidy by GoI	18,000	Per kW
Target residential with CFA	5000	MW
CFA by GoI for residential	9000	Crore Rs
CFA by GoI to DISCOMs	14,450	Crore Rs
Commercial and industrial target	20,000	MW
Tax rebate	4800	Crores Rs
Total revenue loss of GoI CFA + tax rebate	28,250	Crores Rs
Recurring losses for DISCOM		
Power generation through RTS	60,000,000	MWh/year
Average power purchase cost	4	Rs/kWh
Average selling cost to subsidizing consumers	8	Per kWh
Anticipated losses by DISCOM on RTS	4	Rs/kWh
Annual losses by DISCOM	24,000	Crore Rs/year
Cumulative losses by DISCOM over 25 years	600,000	Crore Rs

(a) Our grids are designed for one way transportation of energy. From power plants to grid and from grid to consumer through distribution system. RTS generates power at tail end of the grid and practically causes two way transmissions for which the grids are not designed. Distributed generation makes the task of grid management more and more difficult and we really need a smart grid; which is not in sight in near future.
(b) Most of the people advocating for RTS projects put saving of distribution losses as one of the major advantage. It's not so. Approximately 5% saving is feasible in distribution losses by rooftop project, however such projects produce 10–25% less power than centralized projects and all the advantage of saving in losses is eaten up.
(c) Small systems are executed by small companies and one faces all issues of technical competency, quality and reliability. Many consumers are just not competent to maintain such systems.
(d) Insurance companies do not insure performance of RTS systems as they do in centralized bigger projects.
(e) Capital investment in RTS projects is 20–40% higher than that in centralized MW scale projects. Studies in USA indicate that levelised cost of power through RTS is double that of centralized MW scale projects.

For all these reasons, it makes sense to stop RTS power projects completely. The biggest advantage in RTS projects was to get retail investment in capacity building of solar power. The same can still be achieved by adopting author's innovation of "Virtual Rooftop Solar Power Projects" where retail investment is fetched to setup a grid interactive utility scale projects and the investors get their share of power through the same grid. The business model benefits all stakeholders, especially DISCOMs so that it creates a Win–Win Situation. This innovation can complete 40 GW target in no time.

3 Innovation: "Virtual Rooftop Solar Power Projects"

Author has proposed this innovative business model; "Virtual Rooftop Solar Power Projects". This model fetches huge retail investment from retail investors who get solar power credits as return. As the innovation provides returns to all stakeholders in the form of share in generated power. It creates a Win–Win situation. Biggest beneficiary is DISCOM. It gets 30–50% share in power generated which it can use for subsidizing the deserving categories of consumers. Also 100% Renewable Energy Certificates (RECs) are owned by DISCOM to fulfill their Renewable Power Obligations (RPO).

Mechanism of "Virtual Rooftop Solar Power Projects" is explained below.

Capital for the project is raised from retail investors while other stakeholders pitch in for the services they provide. Other stakeholders include land owner, O & M company, innovator, project developer and DISCOM. All these investors and

stakeholders are issued solar power cards against their investments or services as shown in Fig. 1.

As all investors can participate in the project who does not own a physical rooftop but get all benefits as if the owner of conventional solar rooftop projects and hence the name of the innovation is "Virtual Rooftop Solar Power Projects".

Each solar power card has unique consumer ID corresponding to stake in the project. All capital raised from the retail investors is invested in utility scale solar power plant.

Once the plant is ready and start generating power, the generated power is recharged in the solar power cards in proportion of the stake of the investor or other stakeholder on monthly basis. This is shown in Fig. 2.

Solar power card holder can set off the available recharge power in the solar power card with his/her own power bills on the same lines as that of netmetering polity followed for RTS projects. The difference in this innovation is that the DISCOM also gets substantial share in the generated power in the form of CSS (Cross Subsidy Surcharge). For e.g. If a residential consumer sets off his power bill with credit of say 100 units from his solar power card, then say 40% of the credit goes to DISCOM and

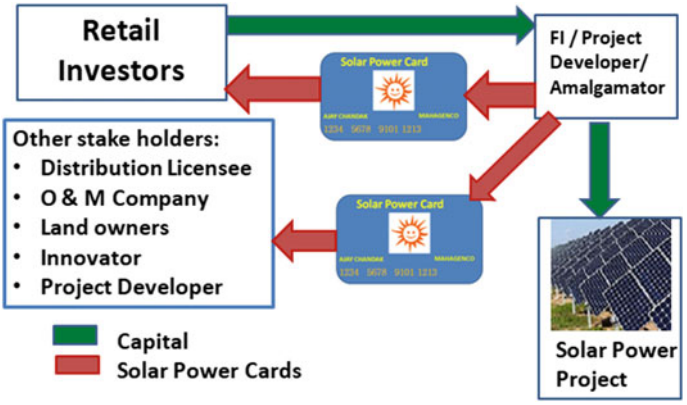

Fig. 1 Capital flow and issue of solar power cards

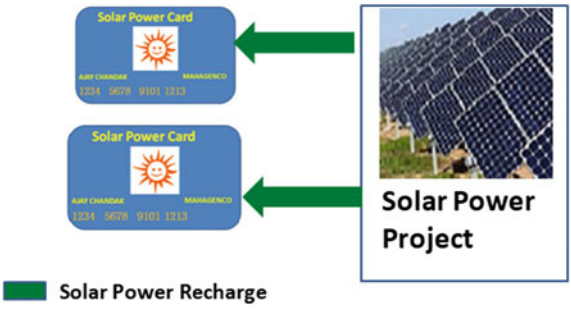

Fig. 2 Recharge of power in solar power cards

60% to the residential consumer. So DISCOM gets 40% units while the consumer gets set off of 60% units from his bills. The ratio can be something like 30–70% in case of industrial consumer and 50–50% for commercial consumer. DISCOM gets large amount of share in generated solar power at zero cost. This power can be utilized for subsidizing consumers.

Unlike conventional RTS netmetering where the consumer gets 100% credit for the power generated, the DISCOMs lose huge revenue, while in Virtual rooftop solar power projects, DISCOMs get large chunk of power from the solar power generators at no cost. This share of power can be used by DISCOM for subsidizing power to the consumers like BPL category, farmers and charitable organisations. Innovative concept of Virtual rooftop solar power project puts back the balance between subsidizing consumers and subsidized consumers.

Operating mechanism for implementation of the innovation is a solar power card or solar valet. The billing system will operate in the same manner as that of existing RTS net-metering system and no challenges are envisaged at this level.

4 Retail Solar Power Exchange

Further innovation of developing "Retail Solar Power Exchange" will open up solar market completely with 100% transparency and flexibility. The mechanism of retail solar power exchange is shown in Fig. 3.

Under this concept of a 'retail solar power exchange' the investors and stake-holders get flexibility to trade the solar power credits in a market and the rates are decided on more transparent manner. Amount of CSS can be fixed by electricity regulatory commissions for different category of consumers. For e.g. the CSS can be 30% for industrial consumer, 40% for residential and 50% for commercial consumers.

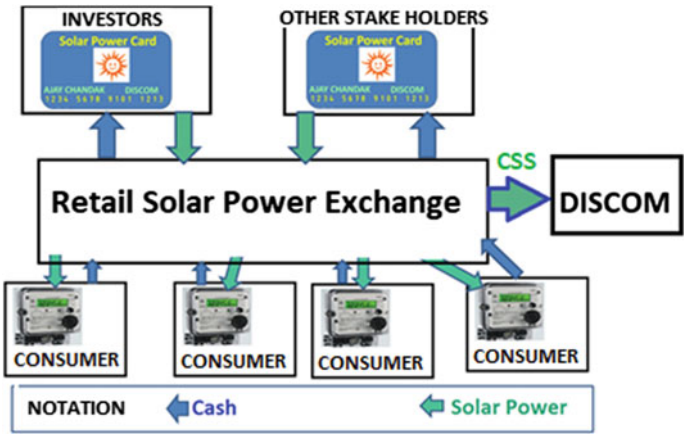

Fig. 3 Concept of solar power exchange

Solar power card holder can trade the solar power credits in the retail solar power exchange and whenever any such transaction occurs power corresponding to the CSS will be credited to the account of DISCOM while balance power will be credited to the consumer who purchases the power from the solar card holders. Payment and delivery mechanism of solar power credits will be exactly on the same lines of share market; solar power credits will be traded in DMAT (Dematerialised) form and payments are made to the seller.

5 Conclusions

The innovative business model has following features which are in line with the Indian Electricity act and current policies of Government of India.

(i) Virtual Rooftop solar power projects is the only business model that provides access to solar power to 100% consumers irrespective of the fact whether they possess a suitable rooftop or not. It also provides opportunity for retail investors for capacity building in solar power segment.
(ii) New proposal reduces the financial losses of DISCOMs to great extent and give them justified returns of minimum 30% plus 100% RECs.
(iii) New proposal provides compensation for DISCOMs for wheeling and CSS. Existing rooftop model does not provide the same.
(iv) New proposal is consumer friendly as the tariff hike of 20–50 paise can be averted or at least reduced to large extent.
(v) 100% flexibility, liquidity and transparency for the investors.
(vi) Virtual Rooftop Solar proposal will separate "Grid" and "Business". Energy minister has shown his intent to do so.
(vii) There is no better model to comply solar power obligation of 10% under clause 6.3 of "Smart Cities".
(viii) The innovation provides better capacity utilization by the solar power companies who can do business at will and need not wait for winning contracts.

Target of 100 GW will look smaller if "Virtual Rooftop Solar Power Projects with Retail Solar Power Exchange" is adopted, with no incentives required from Government of India or state governments.

This innovative business model is ranked amongst top 10 global innovations in 'Renewable Transformation Challenge' by 'Elsevier' and 'International Solar Energy Society' and also has many other credentials and is awaited for implementation.

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