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Research Article

Net-metering: Requirement for India

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Abstract

In India, as there is great demand for solar energy, it is must for us to switch towards that natural energy to avoid the energy crisis. In India already the implementation of solar metering is started which has two categories, one is Gross Metering and other is Net Metering This paper includes simulation of a Net Meter to which an owner and some customers are connected through Micro-Grid, to avail the benefit. This paper also includes the Micro-grid in such a way that, it is not connected to the Macro-Grid, instead it is only meant for the owner and some customers, where we can call it as Private Micro-Grid. Whenever the grid failure happens the extra generated energy will be sent through the Micro-Grid that reaches to the customers. The Net Meter connected to it, will not only calculates the power from and to the Macro-grid, it also computes the power to the Micro-grid and the respective incentives to be paid from and to the electricity board and also the incentives from customers to the owners. This paper has been deals with the details of Net Metering.

Keywords: Net Metering, PV Solar cell

Introduction

Imagine a solar power system on your own residence. If you visit work throughout the day, your own mid¬day power desires area unit low, however the star panels on your roof still manufacture valuable power. That power goes to the grid and also the utility sells it to a different client near World Health Organization desires it. internet metering makes certain that energy customers World Health Organization generate their own electricity get credit on their utility bills for this electricity they deliver to the grid for others to use. after they would like a lot of power than they generate reception, they'll use those credits to lower their power bills. It's like roll over minutes for star This simple request arrangement is one in every of the one most vital policies for empowering yankee homes, colleges and businesses to come up with their own power. By encouraging non-public investmentin clean energy, internet metering advantages star and non-solar customers alike. It reduces the requirement for overpriced, polluting power plants. It keeps energy bucks invested with in native jobs and businesses. And it builds healthier communities by decreasing harmful pollution. Today non-energy charges comprise an oversized proportion of the utility's prices that square measure recovered through a residential customer's retail tariff. These charges generally cowl the mounted prices related to grid services like the gear, the distribution system, equalisation and subsidiary services, and therefore the utility's investment in generation capability. NEM, as practiced nowadays, permits weight unit customers to avoid paying their fair proportion of the prices of those grid services, that then gets shifted onto non-DG customers. differentrestrictive approaches exist for reducing, or whole eliminating, NEM price shifting.

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What Is Net Metering?

Net metering is a billing system that allows electric customers to sell to their electric utility any excesselectricity generated by their DG systems. Many different DG sources may be eligible for net meteringcredits, but rooftop solar installations are the most common typeof DG promoted with net metering. While internet metering policies vary by state, customers with upper side star or different weight unit systems typically arecredited at the complete retail electricality rate for any electricity they sell to electric utilities via the grid. The fullretail electricity rate includes not solely the price of the facility however conjointly all of the mounted pricesof the poles, wires,meters, advanced technologies, and different infrastructure that create the electrical grid safe, reliable, and in a position toaccommodate star panels or different weight unit systems. Through the credit or payment they receive,net-meteredcustomers effectively avoid paying these prices for the grid.

It is the concept which records net energy between export of generatedenergy and import of Discom energy for a billing month. Alternatively, the meter,having the feature of recording both the import and export values, besides otherparameters notified by CEA metering regulations and APTRANSCO / Discomprocedures in vogue, shall also be allowed for arriving net energy for the billingperiod. For implementing the above, the government of Andhra Pradesh has announced a policyon Net Metering for solar grid interactive rooftop and small SPV Power plants in the statevide.

Solar PV Power Generation

Sunlight is converted to electricity directly when made to fall on solarphotovoltaic (SPV) modules. Systems/devices are made for various applicationsbased on SPV modules connected with suitably designed power conditioning unitsfor meeting electricity requirements.

Grid connected roof top solar PV system

In recent years solar PV systems became viable and attractive. Utility scale plants are being set up worldwide with promotional mechanisms which are set up on ground surface. Available roof-top area on the buildings can also be used for setting up solar PV power plants, and thus dispensing with the requirement of free landarea. The electricity generated from SPV systems can also be fed to the distributionor transmission grid after conditioning to suit grid integration.

Literature Survey

A number of states have attempted to look at the question of rate impacts of net metering, specifically whether a subsidy or “cost shift” from non-participants to those participating in net metering is occurring. A 2009 qualitative study by the National Renewable Energy Laboratory (NREL), performed for the State of Minnesota as that state was considering raising its net metering cap, did not uncover any examples where state analysis had revealed a measurable net metering cross subsidy1 Since then, relevant statewide studies have been performed in New York (as part of a broader review of the benefits and costs to New York ratepayers of increasing in-state solar capacity to 5,000 MW by 2025), Pennsylvania/New Jersey, and California. Additionally, utility-specific studies have been conducted in several states, most notably Texas (Austin Energy) and Arizona (Arizona Public Service).The methodologies used in – and results of – these studies are presented below, as is a generalized methodology for use in evaluating the costs and benefits of net metering recommended by the Solar America Board for Codes and Standards. . However, at that time, none of the states NREL interviewed had conducted a full cost-benefit analysis of their net metering policies, citing limited ratepayer impacts in other states.

In January 2012, the New York State Energy Research and Development Authority (NYSERDA) published a broad analysis of the costs and benefits of meeting their 5,000 MW of solar by 2025 goal. The impact of net metering policy was only a small piece of the analysis, which also explored job and environmental impacts of meeting this goal (impacts are evaluated through 2049, to account for the lifetime of systems installed up until 2025) as well as various policy options for most cost effectively achieving the goal. NYSERDA modeled lifetime average energy costs of residential, small commercial, large commercial, and MW-scale solar generation (modeled through PVWatts) for base-, low-, and high-cost scenarios using NREL’s Cost of Renewable Energy Spreadsheet Tool (CREST). Administrative costs of developing and operating the state’s solar incentive program were also included. Benefits were evaluated using the Integrated Planning Model (IPM) and included: wholesale energy market value, wholesale capacity market value, avoided line losses, price suppression, avoided distribution costs, avoided RPS compliance costs, and monetized carbon values. Macroeconomic /jobs impacts where measured using the REMI PI+ model. The study did not address the potential for physical value of certain applications of solar on the grid, including localized reliability impacts, nor did it evaluate solar’s potential as a fuel price hedge or for its role in grid security.

Table ES-1. Policy Objectives	
Category	**Policy Objectives**
Environmental	• Minimize greenhouse gas emissions • Minimize criteria pollutant, mercury and other air pollution emissions • Reduce impacts related to water use in thermal electric generation (thermal, quality, quantity) • Preserve land from fuel cycle impacts (mining, drilling, etc.) • Minimize use of land with higher value alternative uses • Reduce reliance on finite fossil fuels
Energy Security and Independence	• Increase fuel diversity • Increase energy security and supply reliability • Increase domestic energy production
Reliability	• Reduce electric delivery disruption risk • Minimize negative grid planning and operating reserve impacts • Minimize distribution system negative reliability impacts (avoiding degradation of system loss of load probability)
Economic Development	• Maximize net in-state job creation • Maximize gross state product (GSP) growth • Support existing clean technology industries • Minimize out-of-state capital flows • Create stable business planning environment (for supply chain investment)
Energy Cost	• Reduce distribution system upgrades and minimize additional upgrades caused by PV • Reduce wholesale prices (energy and capacity impacts) • Minimize direct cost of policy to ratepayers • Minimize total cost of policy (exclusive of monetizing environmental, public health or other impacts) • Integrate well with competitive retail market structure in NY • Integrate well with competitive wholesale market structure in NY
Technology Policy	• Create a self-sustaining solar market • Assist emerging technologies in becoming commercial technologies • Foster technology innovation and development
Societal	• Ensure geographic distributional equity/ effectiveness at aligning benefits with those who bear the costs • Maximize benefits to environmental justice communities

The NYSERDA modeling showed that, of the advantages evaluated, worth suppression and avoided electricity production prices were the best drivers of advantages. On the value aspect, the long run value of star and federal incentive levels were the first drivers. The "cross subsidy" bestowed by the power to internet meter is acknowledged and "taken into account" by NYSERDA, in terms of the shift in fastened grid maintenance prices from internet metering participants to different ratepayers, with the overall transfer quantity peaking coincident with the height year for energy production from all systems then deployed.

Net-metering is essential for India, but here is why it's failing

Net-metering will probably drive widespread implementation of distributed generation by incentivizing end-users to adopt localized power generation through technologies such as solar. In theory, net-metering is that the proverbial solution designed to assist Asian country bring home the bacon larger energy security through generation at purpose of consumption (distributed generation) additionally to helping consumers cut back their energy bills, it's conjointly alleged to facilitate stabilize the national, regional and state grids, give monetary relief to the distribution corporations (DISCOMs) through shopper default risk mitigation and reduction of AT&C losses, and facilitate block the per-capita energy footprint. Unfortunately star adoption through net-metering has not picked up, even in twelve states and union territories wherever it's been enforced. each DISCOMs and end-consumers area unit reluctant to adopted-metering. this text is post one of two on this matter and discusses the buyer aspect of the issue.

- Net-metering is crucial for Asian country if it needs to realize energy security by 2022
- Improvement in electrical converter technology and innovation in monetary incentives is required for large scale adoption of net-metering
- whereas technological enhancements can change market growth, monetary innovations will drive the expansion

There area unit 2 main reasons for the dissatisfactory adoption of net-metering by the consumers: the tariff structure (a policy matter) and grid-reliability (a technical concern) each problems area unit relevant for the residential, industrial and industrial segments. during this post, I actually have targeted on the residential segments since it exemplifies the problems well.

Reason 1:Tariff structure (a policy issue)

Net-metering permits customers WHO generate their own electricity from star to feed unusedelectricity back to the grid and be paid for that. If the energy provided by the buyer tothe grid (selling) is at a special, sometimes higher, tariff rate than the one at that electricity is boughtfrom the grid (buying), then it's known as a "feed-in-tariff". However, if the merchandising and shopping for area unit at thesame tariff-rate (usually the shopping for rate), then it's known asnet-metering. And herein lies a haul.Residential (and agricultural) tariffs area unit purposefully and by artificial meansunbroken low (through subsidy) toinfluence the voters (e.g. city elections). the particular average tariff rate varies wide in every stateranging from roughly Rs. 2.8/unit in Chhattisgarh to Rs. 6.15/unit in geographic area for MSEDCLconsumers. within the highest consumption block, they will even reach Rs. 11/unit in bound states. Residential upside star PV systems nowadays, on the opposite hand, manufacture electricity at a reasonablyconstantcost across the country of roughly Rs. 10/unit – reducing yearly as system costs drop.Thus a net-metering client in Chhattisgarh can ought to sell electricity at a loss of virtually Rs 7/unit.Only residential customers within thehighest consumption of some states profit as they'll sell at aprofit and recover their investment at intervals someyears.DISCOMs recover the revenue lost owing to grant for residential and agricultural users by levying extracharges on the business and industrial segments. If one removes this "cross subsidy" then thetariff rates can become additionalrealistic and net-metering for all users can create additional money sense.

Net Metering

Consider, an owner who got his building installed with rooftop PV system with Net Meter. Suppose, the amount ofpower required for building is less than the solar power generated then he will use the main grid power. If the buildingrequirement is less than the generated power, he has the provision to send that extra power through the Micro grid. Thisprocess we call it as Net Metering. The device used for this calculation is called as Net Meter.When the owner is using the power from Micro grid the Net Meter will run in usual direction, if the owner is feedingthe extra generated power to the Micro grid the Net Meter will run in opposite direction, finally that provides thecomplete information about the incentives that is to be paid by the owner to the electricity board or vice versadepending upon the usage.

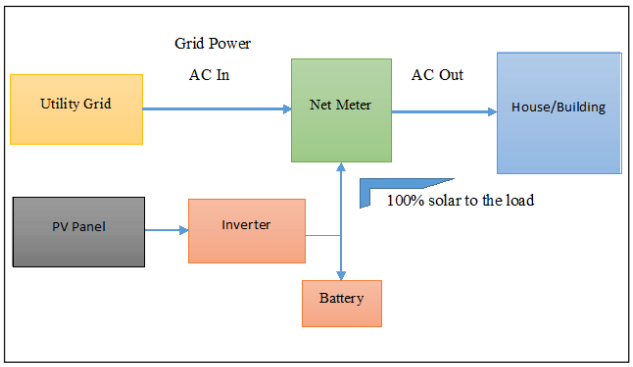

Figure1: Net Meter Connections

Principle of Working

The principle of working is explained with help of flow chart shown in the figure 2.6. When the system starts it checkswhether the power generated from solar panel is excess, if it is excess it proceeds further to feed that power to themicro grid. If it is not excess, that means the owner has utilized all the power generated from solar panel. Then itchecks whether the micro grid is available to feed the power, if it is then the power will be fed to the micro grid bymatching many parameters such as frequency, phase grid and many. If the micro grid is not available it then checkswhether the customers in the micro grid need any power. If they are in need of power then the power is sent through themicro grid and their usage is monitored in the Net Meter. Finally if neither the micro grid nor the micro grid is availableat that time, the extra power that is generated is stored in some sort of efficient battery like flowbattery and many.

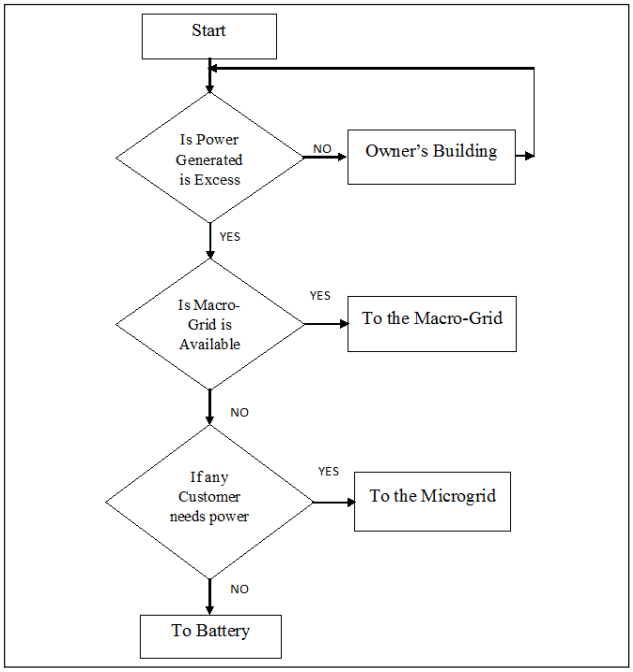

Figure2: System Working Flow Chart

Advantages

The grid connected roof high star PV system would fulfil the partial / full power desires of massive scale buildings. the subsequent area unit a number of the advantages of roof high SPV systems:

Generation of environmentally clean energy. shopper becomes generator for his own electricity needs. Reduction in electricity consumption from the grid. Reduction in diesel consumptionwhere decigram backup is provided. Feeding excess power to the grid.

Conclusion

In essence, shoppers square measure seeking higher incentives and a resolution of technical obstaclesbefore they invest in residential star PV systems. Policy manufacturers, meanwhile, square measure coming back upwith multiple mechanisms to incentivize net-metering adoption from each side to helpDISCOMs improve their monetary health and to change a reliable energy offer.Unfortunately, this can be only one aspect of the story.DISCOMs square measurecautious of net-metering forvarious reasons. Policy manufacturers square measure operating arduous to convincethem to simply accept it as a viablesolution. This convoluted state of affairs is, sadly, workingagainst net-metering andIndia's reach bring home the bacon energy security. within the next post i will be able to cowlwhyDISCOMs viewnet-metering unfavourably. within the meanwhile, I hope that the star trade can realizesolutionsto the problems lined during this post

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