ROOF TOP SOLAR PV SYSTEM WITH BATTERIES FOR CLIMATE CHANGE MITIGATION

TECHNOLOGY DESCRIPTION

TECHNICAL DESCRIPTION

Roof top Solar PV with Energy Storage System including battery is a technology which have signifcant potential for climat change mitigation in the Maldives. This technology has signficant potential for the reduce the dependency on fossil fuel for electricty production. Maldives is a country which is highly dependent on fossil fuels for electrity production particularly diesal generators. Utilization of Rooftop Solar PV systems for electrity production will this reduce the GHG emission from diesal generators.

Roof top Solar PV with Energy Storage System including battery consist of Solar PV Modules, Invertor, Utility Power and Meter and Charge Controller. The following Figure 1 illustrates a typical Roof top Solar PV with Energy Storage System including battery storage.

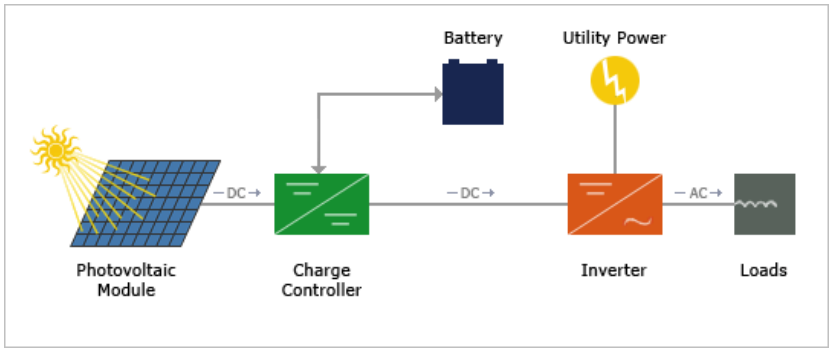

Figure 1: Components of a Roof top solar PV with Energy Storage System (Adapted from Synergy Enviro Engineers (India) Private Limited, 2016)

The following are the main components of a Roof Top Solar PV with Energy Storage System:

PV Modules: PV cells are the basic unit which converts the sunlight to energy. A PV module consists of PV cells arranged in frames to form a module. A PV module is constructed by connecting PV cells in series for high voltage and in parallel for high current. By connecting series of PV modules, a PV array is formed.

Inverter: Inverters convert Direct current (DC power) into standard Alternating Current (AC power) which can be used for the household appliances, synchronizing with utility power whenever the electrical grid is distributing electricity.

Battery: Battery stores any excess energy produced by PV modules and delivers it back when in demand.

Utility Power and Meter: At nighttime, and if the demand exceeds the power produced from Solar PV during the day, electricity is provided through utility power source.
The utility meter would spin backwards when solar power production exceeds house demand. This allows you to credit any excess electricity in the future utility bills.

Charge Controller: it avoids overcharging the battery and prolongs the life of the PV system.

CURRENT TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX

Technology Readiness Levels (TRL)

TRL 6 – technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)

Commercial Readiness Index

Level 4 - Multiple commercial applications

CLIMATE RATIONALE OF THE TECHNOLOGY

Rooftop Solar PV systems with batteries are expected to reduce the dependency on fossil fuel thus GHG emission from the diesel-based electricity generation. The Rooftop Solar PV systems is expected to have the following benefits:

- The Rooftop Solar PV systems will contribute to climate change mitigation efforts of the country.
- The Rooftop Solar PV systems will contribute to energy security of the country.
- The Rooftop Solar PV systems will improve the air quality as air pollutants from fossil fuels power plants will be avoided.
- Diesel based power generation requires significant amount of water for cooling purpose and this water pollution and water requirements can be avoided through Rooftop Solar PV systems.
- Unlike large-scale solar farms, rooftop solar utilizes existing infrastructure, minimizing the need for land development and preserving natural habitats

AMBITION OF THE TECHNOLOGY

SCALE FOR IMPLEMENTATION AND TIME-LINE

The main ambition of technology is to contribute to the renewable energy target of the country. The current RE target is to generate 33% of the country's electricity demand from renewable energy sources by 2028. Since, Rooftop solar PV systems are the most prevalent RE technology in the country, a majority of this target is expected to be achieved through implementation of Rooftop Solar PV systems.

Solar PV energy is an indigenous resource with the most immediate exploitation possibilities in Maldives. Solar radiation is in the order of 1,200 kWh/m2/year, which is considered good for any solar PV project.

The solar PV project is being successfully implemented in hybrid systems in several inhabited islands through donor financed projects. PV panels are installed on the roofs of diesel power plants, schools, water desalination plants, sewage

plants, and public buildings. PV panels are connected to diesel power plants through an energy management system (EMS) that enhances the regulation of power supply. This hybrid configuration can offer short pay back times when compared to current prices of electricity produced by diesel generation sets. Rooftop solar PV is also being installed in the country, under net metering.

There are 3 major donor financed projects which is currently implemented in Maldives which focuses on installation of Solar Photovoltaic. They include the following;

- The Accelerating Renewable Energy Integration and Sustainable Energy (ARISE) project;
- Preparing Outer Islands for Sustainable Energy Development (POISED) project.
- Accelerating Sustainable System Development Using Renewable Energy (ASURE) Project.

The ARISE project is funded by World Bank Group while POISED and ASURE projects are funded by Asian Development Bank (ADB). All these projects involve installation of Solar PV systems of different types and scale across Maldives.

AMBITION FOR TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX

Technology Readiness Level

TRL 9 – actual system proven in operational environment

Commercial Readiness Index

Level 6 - "Bankable" grade asset class

EXPECTED IMPACTS OF THE TECHNOLOGY

The expected impacts of the Rooftop Solar PV are positive and negative impacts; The main position impacts include

- According to First Biennial Transparency Report (2024) of Maldives Rooftop Solar PV technology is expected to reduce GHG emission of 64,993 tCO_2e per year.
- Reduction of dependency on fossil fuels for electricity generation thus reducing GHG emission.
- Reduction of air pollutants generated from fossil fuel-based electricity generation.
- Rooftop solar PV systems is expected to reduce expenditure on the energy generation.
- Rooftop solar PV system is expected to create jobs for technicians.
- Rooftop Solar PV system is expected to build resilience of the electricity grid as alternative energy generation source can be assessed during power outages.

The negative impacts of Rooftop Solar PV systems include;

- Rooftop Solar PV systems have the potential for causing voltage fluctuations when connected to an electricity grid.
- Rooftop Solar PV systems have aesthetic impacts has they can be visually unappealing.

POLICY ACTIONS FOR TECHNOLOGY IMPLEMENTATION

EXISTING POLICIES IN RELATION TO THE TECHNOLOGY

- Maldives Climate Emergency Act (08/2021)
- Maldives Energy Act (18/2021)
- Utility Regulatory Authority Act (26/2020)
- Net-metering Regulation and amendments (2015/2020)
- Maldives Energy Policy (2015)
- Maldives Climate Change Policy Framework (2015)
- Maldives Nationally Determined Contribution (2020)
- Maldives SREP investment plan 2013 – 2017

PROPOSED POLICIES TO ENHANCE TECHNOLOGY IMPLEMENTATION

The main proposed policies for enhancement of Rooftop Solar PV systems include;

1. Enhance implementation of the Net-metering regulation
2. Introduction of a Feed-In-Tariff (FIT)

COSTS RELATED TO THE IMPLEMENTATION OF POLICIES

The main cost for implementing the above-mentioned policy includes a study on the identification of barriers and needs for the implementation of the Net-metering regulation and introduction of a FIT. The study is expected to cost 110,000 USD.

USEFUL INFORMATION

CONTACT DETAILS

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LINKS TO TNA REPORTS

Technology Needs Assessment (TNA) Report and Barrier Analysis and Enabling Framework (BAEF) Report

https://tech-action.unepccc.org/country/maldives/

Maldives Biennial Transparency Report

https://www.environment.gov.mv/v2/en/news/30245