Regulatory Perspective for Deployment of Rooftop Solar in Nepal

Opportunities, Challenges and Path Forward

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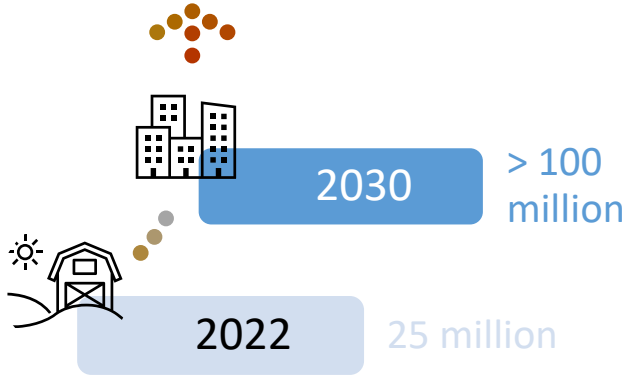
An Overview

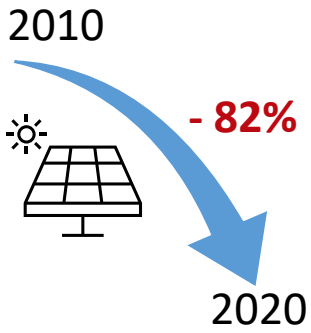
- Outlook on Rooftop Solar and Potential in Nepal
- Policy and Regulations for Solar Energy
- Challenges
- Opportunities for Regulatory Improvement
- Strategic Recommendations and Global Best Practices
- Moving Towards a Hydro-Solar Integrated Future

Outlook on Rooftop Solar (RTS) Growth

Households Relying on Solar Energy (Global) [1]

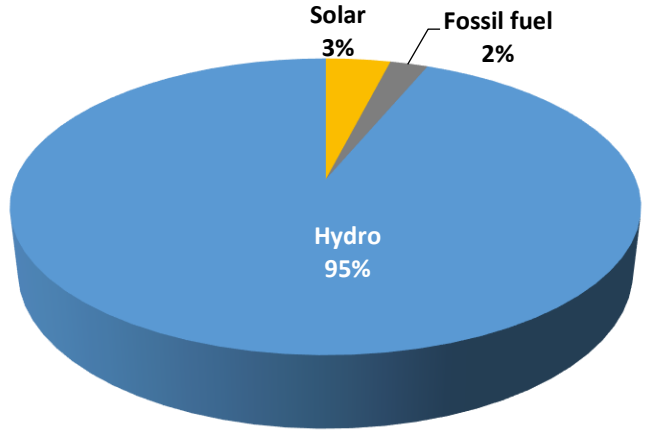


Cost of Solar PV Systems decreased by 82%. [2]



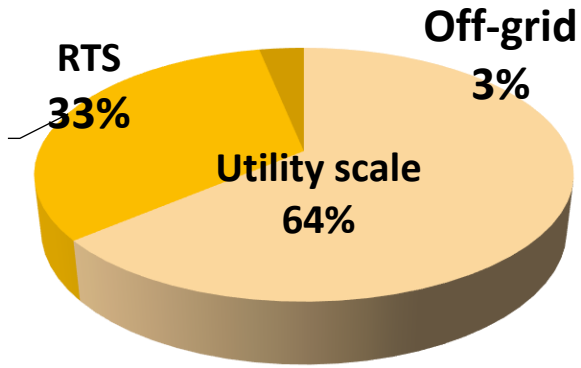
Installed Capacity in Nepal

Sources of Electricity Generation by Capacity



Installed Capacity [3]
Total = 3,122.64 MW
Solar = 81.94 MW

Solar Technologies by Capacity [4]



1 IEA Nepal Data
2 IEA Global Energy Outlook

3 Nepal Electricity Authority (NEA) Annual Report 2023-2024
4 AEPC Annual Progress Report 2023-2024

RTS Potential in Nepal

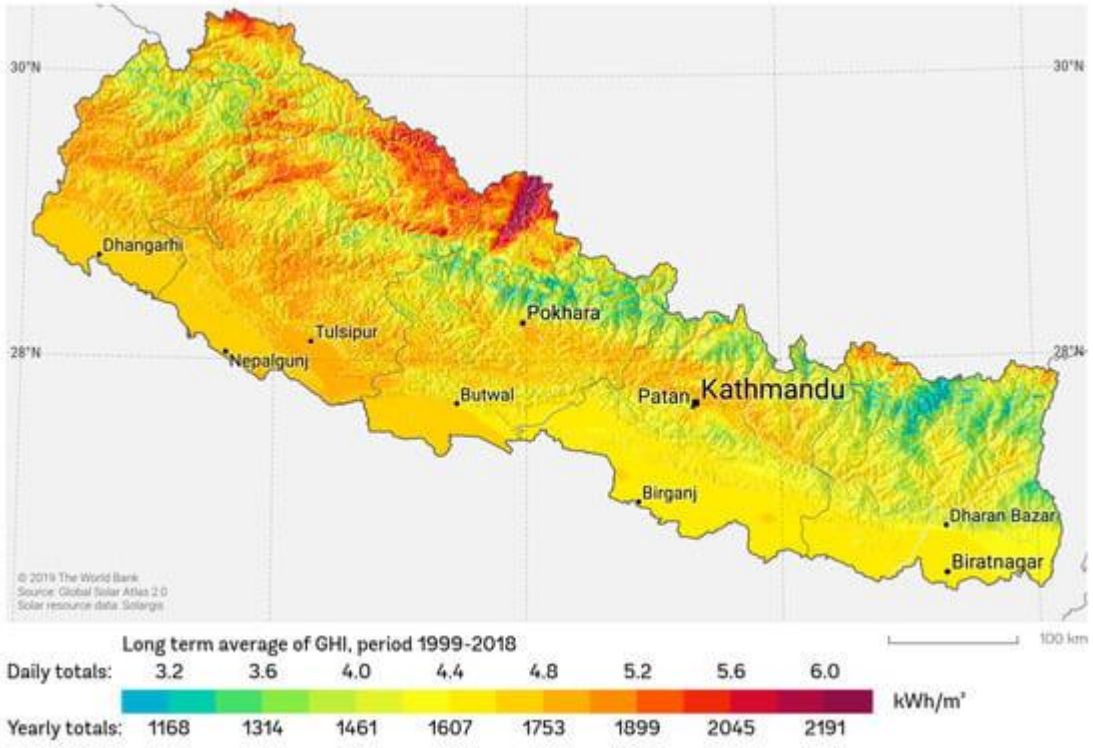
Nepal lies in the sunbelt region, with the country being between 26° N to 30° N latitude.

300 sunny days a year, average of 6.8 sunshine hours per day, average insolation of 4.7 kWh/m2/day. [1]

About 1.1 million solar home systems, rated at nearly 30 MWp, have been installed across Nepal.

Potential theoretical output of RTS ranges from 637 GWh per annum in Kathmandu to 50 GWh per annum in Butwal. [2]

Total RTS potential from urban households of Nepal is estimated to be in the order 6.5 TWh per annum. [3]



PV Power Potential in Nepal

1 Global Solar Atlas. Available online: **https://globalsolaratlas.info/map** (accessed on 10 October 2021).
2 Kafle U, Anderson T, Lohani SP. The Potential for Rooftop Photovoltaic Systems in Nepal. *Energies*. 2023; 16(2):747. https://doi.org/10.3390/en16020747
3 Kafle U, Anderson T, Lohani SP. The Potential for Rooftop Photovoltaic Systems in Nepal. *Energies*. 2023; 16(2):747. https://doi.org/10.3390/en16020747

Current Policy and Regulations Governing RTS

- Implemented in 2016, allowing grid-connected RTS consumers to sell excess electricity back to the grid, enhancing the financial viability of RTS.
- Net metering is limited to systems up to 100 kW for residential and 1 MW for industrial installations.

Net Metering

- RTS systems below 1000 kW only require registration with the local government.
- Systems above this threshold need approval from DOED and a Grid Connection Agreement with NEA.
- NEA buys power from IPPs for utility scale solar thru competitive process

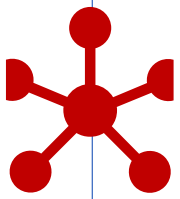
Licensing and Approvals

- Tax exemptions on solar equipment imports.
- AEPC Subsidy Policy for Solar Rooftop System
  - 50% Interest Support on Bank Loan for 5 years OR NPR 1.5/KWh for energy generation for five years.
  - 50% for Solar Rooftop system under PPP Model through Viability Gap Funding.

Incentives

Ensuring 15% of total energy is supplied through RE by 2030

Technical and Financial Challenges



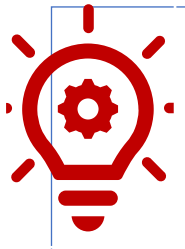
The increasing penetration of RTS creates challenges for grid operators, especially with reverse power flow, which occurs when excess solar energy flows back into the grid, destabilizing the system.

Reduced tariff rates [from USD 0.063/kWh (NRs 7.30/kWh) to USD 0.045/kWh (NRs 5.94/kWh)] are likely to impact project viability for developers.

Despite subsidies and falling costs, high upfront costs deter many potential consumers.

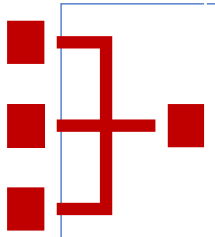
Currently, local financing is provided at 12-12.5% rate of interest, leading to higher cost of capital

The RESCO model (Renewable Energy Service Company) has been a potential solution, allowing consumers to avoid upfront costs by entering into PPAs with developers. However, its adoption is still limited.



Limited technical knowledge amongst key stakeholders regarding floating solar since it is an emerging segment.

Regulatory and Market Barriers



High project risk perception due to challenges in land acquisition and aging grid infrastructure.

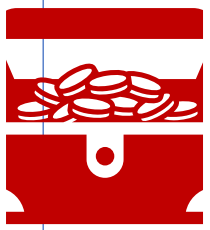
Lack of energy storage solutions to address intermittency in RTS.

Limited knowledge of RTS benefits and incentives among the general population.

Inadequate dissemination of information on how to navigate the regulatory framework.

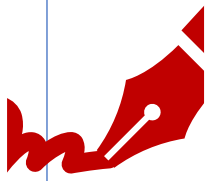
Approval processes are time-consuming and involve multiple agencies (AEPC, NEA, local authorities).

The absence of a clear single-window clearance system.



Financing in the solar sector in Nepal has primarily come through grants and special funds.

Commercial financing options for rooftop solar are still underdeveloped, with long payback periods.



Delays in signing PPAs has created uncertainty and led to intermittent project commissioning.

Electricity Regulatory Commission (ERC): An Opportunity to Address Barriers

- ERC is an independent and autonomous regulator of Nepal's electricity sector established pursuant to the ERC Act, 2017 and ERC Regulation, 2018.
- Established to regulate the Generation, Transmission, Distribution, and Trade of electricity in Nepal.

Opportunities for Regulatory Improvement

- Streamline licensing and approval requirements to accelerate installations.
- Expand eligibility and easing the requirements for net metering participants.
- Ensure clear and consistent policies on feed-in tariffs to incentivize large-scale deployment.
- Explore additional tax credits or rebate schemes to reduce the upfront cost burden on consumers.
- Introduce fair pricing mechanisms such as time-of-use tariffs to reflect the varying value of energy produced by RTS systems at different times of the day.
- Offer additional benefits for commercial RTS installations and larger systems.
- Introduce performance-based incentives for solar developers to ensure quality and efficiency.
- Develop risk-sharing mechanisms with commercial banks to improve access to loans for small and medium-sized solar projects.
- Encourage public-private partnerships for the installation, operation, and maintenance of RTS systems.

Strategic Plan

Regulatory Harmonization

- Establish stronger coordination between ERC, AEPC, NEA, and local government bodies to ensure seamless policy implementation and oversight.
- Establish cost-reflective PPA rates.

Expand Subsidies and Incentives

- Introduce time-bound incentives to accelerate RTS adoption, such as accelerated depreciation, particularly in underserved and remote areas.

Capacity Building for Grid Integration

- Invest in upgrading grid infrastructure to manage solar energy and support stable energy transmission.
- Encourage deployment of solar-plus-storage systems to address the intermittency of solar power.

Innovative Financing Solutions

- Work with commercial banks to introduce solar-specific loan products, green bonds, or revolving credit lines for solar system purchases.
- RE Certificates.

Innovative Technical Solutions

- Virtual Net Metering, suitable for urban areas with limited roof space.
- Peer-to-Peer (P2P) Energy Trading, suitable for congested regions.

Consumer Outreach and Awareness

- Initiate nationwide campaigns to educate consumers about the financial and environmental benefits of RTS and the regulatory processes involved.

Global Best Practices in Rooftop Solar Regulation

India

India's **Rooftop Solar Power Programme** has been a success, largely due to simplified regulatory frameworks, state-level incentives, and robust net metering policies. 1

India's target of 40 GW of rooftop solar by 2022 created a strong model for public-private partnerships.

Bangaladesh

Through its **Solar Home Systems Program**, Bangladesh deployed over 6 million RTS systems in rural areas, emphasizing financial inclusion, private investment, and decentralized energy. 2

Germany

Known for its leadership in decentralized solar, Germany's **feed-in tariff** model, coupled with progressive net metering, facilitated the rapid adoption of rooftop solar. 3

1 Ministry of New and Renewable Energy (MNRE) India

2 World Bank's report on Bangladesh Solar Home Systems

3 German Federal Ministry for Economic Affairs and Energy

Moving Towards a Hydro-Solar Integrated Future

RTS can play a vital role in Nepal's energy mix, enhancing energy security, improving grid stability, and promoting environmental sustainability.

A progressive regulatory framework is key to unlocking the potential of RTS in urban and rural areas alike.

Collaboration between the regulator, industry stakeholders, and financial institutions will be essential to achieve widespread RTS adoption.

Thank You

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