



Capacity Building Module: Solar Energy Basics & Solar Photovoltaic Systems

CHAPTER 5:

Business models and financing opportunities for rooftop PV

CONTENTS



Rooftop solar PV
business models



Financing opportunities

A photograph of a rooftop solar photovoltaic (PV) array. The panels are dark blue and arranged in rows, mounted on a metal structure. The background shows a line of trees and a clear sky. The text 'PART 1' is overlaid on a green rectangular background in the upper left corner.

PART 1

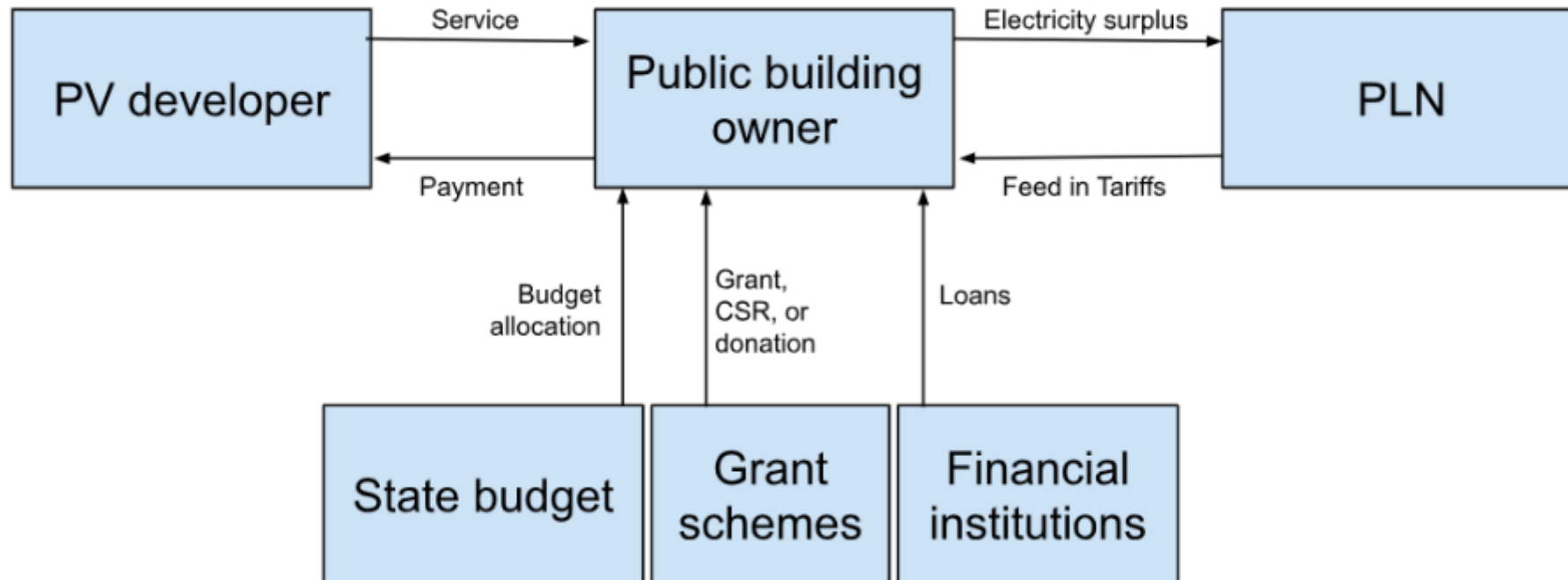
ROOFTOP SOLAR PV BUSINESS MODELS

DIRECT PURCHASE MODEL

Building owners obtain rooftop PV system by direct purchase

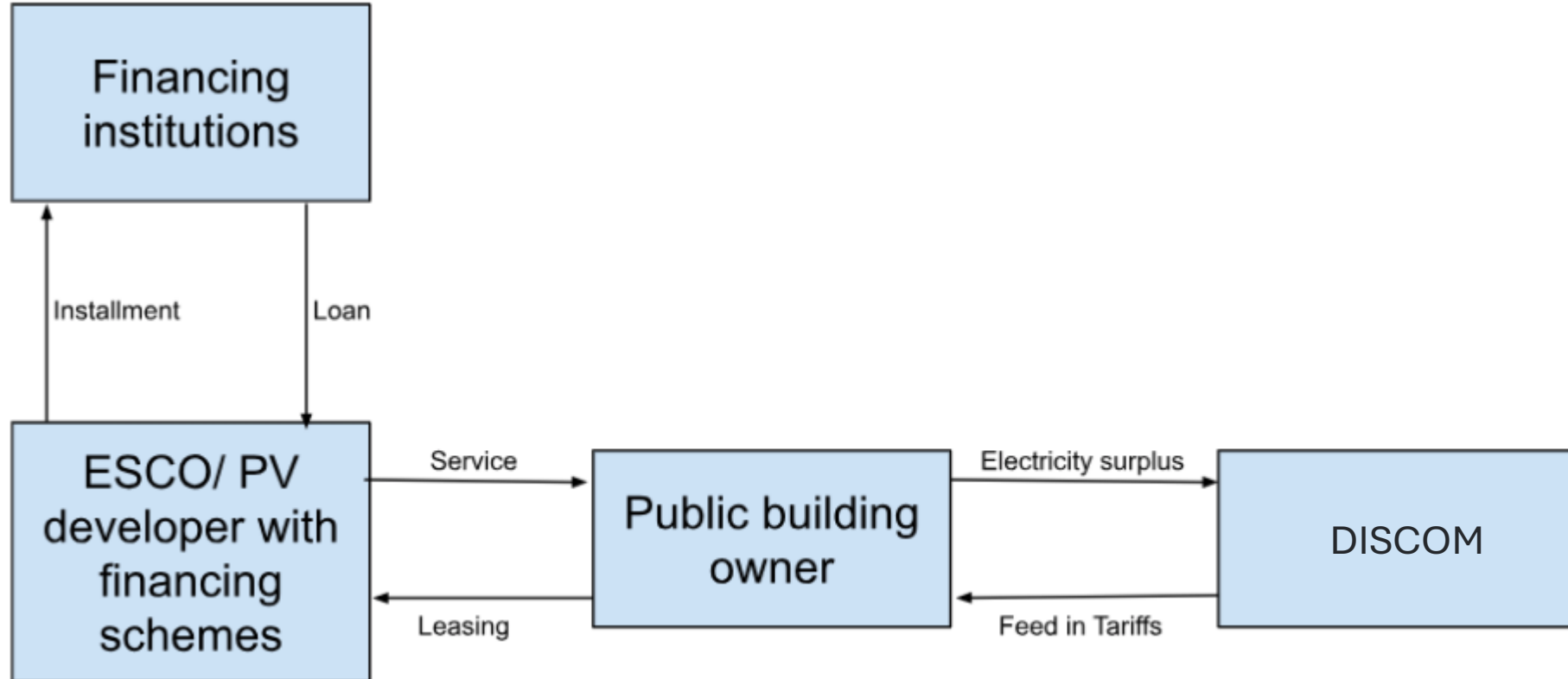
- The high initial costs hinder the widespread adoption of rooftop solar PV system
- Leaving risks to the building owner: risk of damage, O&M problems
- For public buildings such as community health centers, this model can be financed through several sources: 1) State budget and/or 2) grants.

DIRECT PURCHASE MODEL



- Building owners do not need to make an initial investment in rooftop solar PV
- PV developers invest in the construction of rooftop PV
- The building owner makes monthly payments of a fixed amount to the PV developer for a certain period of time, before ownership of the asset can be completely transferred to the building owner
- Technical guarantees and O&M are taken care of by the PV developer so that the risks are borne by the PV developer
- Building owner sells surplus to power grid (now defunct)

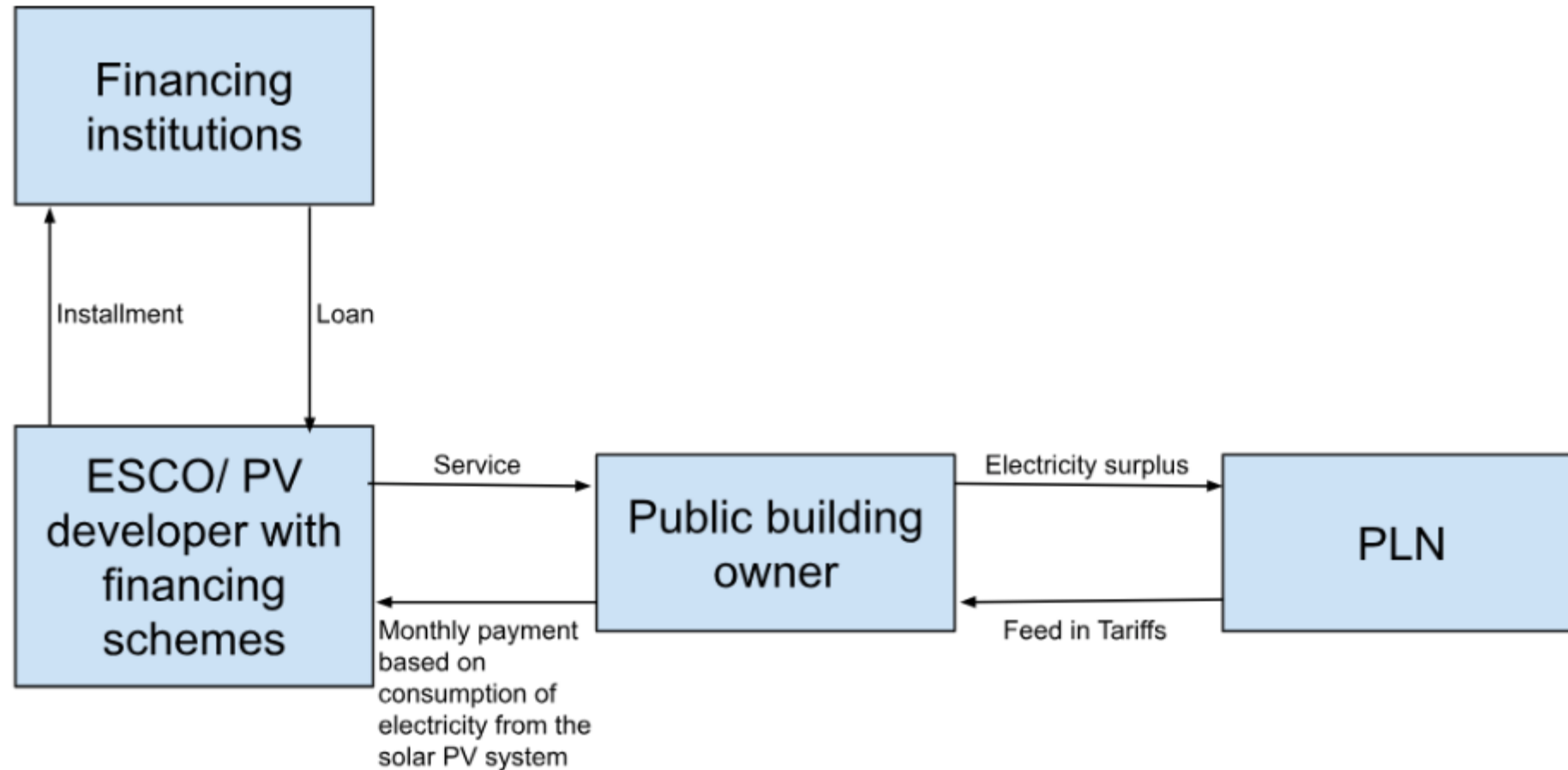
LEASING MODEL



PERFORMANCE-BASED RENTAL MODEL

- PV developers invest in building rooftop PV on buildings and sell the generated electricity to the building owner at a lower rate rather than the local utility (e.g., PLN in Indonesia).
- Excess power can sometimes be sold back to the grid, depending on the local regulations.
- This model typically invoices a longer repayment period compared to the leasing model.
- The PV developer provides technical guarantees and handles operation and maintenance (O&M), transferring the risks to the developer.
- Ownership of the rooftop solar PV assets is transferred to the building owner once the payment period is completed.
- Widely implemented in the industrial sector (globally).
- The minimum capacity requirement is usually 200 kWp to mitigate risks for PV developers (applicable for Indonesia).

PERFORMANCE-BASED RENTAL MODEL



PART 2

OTHER FINANCING OPPORTUNITIES

OTHER FINANCING OPPORTUNITIES

- Carbon credits
- Renewable Energy Certificate (REC)
- Green bonds
- Impact investing
- Blended finance
- Rooftop rental model
- Public Private Partnership (PPP)
- Crowdfunding
- Community-based model

CARBON CREDITS

National decrees on carbon economic value: National policies (such as Indonesia's Presidential Decree 98/2021) regulate the implementation of carbon economic value, promoting carbon trading and emission reduction initiatives.

Carbon credits: Carbon credits represent reductions in carbon emissions achieved through mitigation actions, allowing businesses to offset their emissions generated elsewhere.

National registry system: Emission reductions must be registered in a national climate control registry system (e.g., SRN-PPI in Indonesia) to ensure transparency and tracking.

Emission reduction certificates (ERC): Once emissions are registered, they are verified and issued as GHG Emission Reduction Certificates (ERC) after undergoing Measurement, Reporting, and Verification (MRV) processes, serving as proof of emissions reductions.

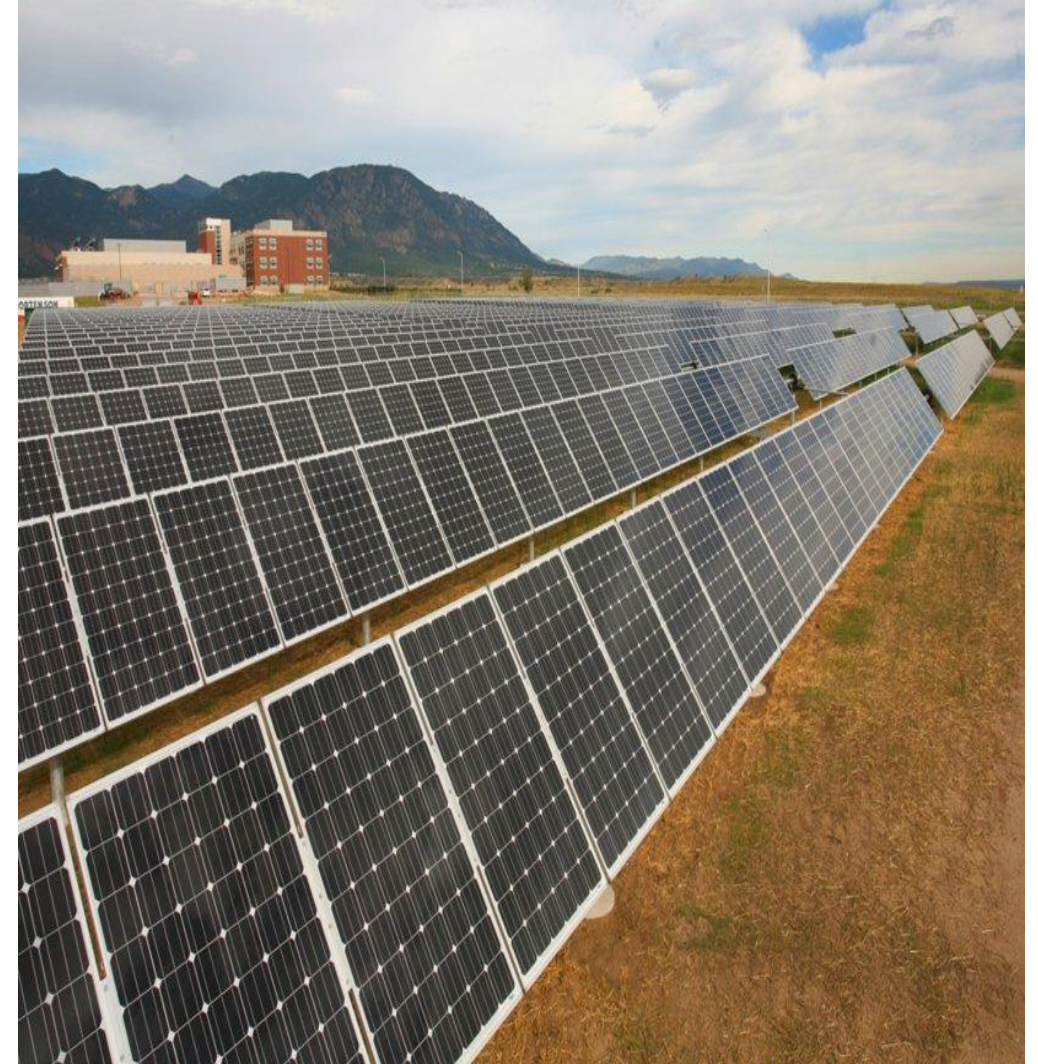
- **Domestic vs. international carbon markets:** Carbon credits can be traded domestically or internationally, impacting a country's ability to meet its Nationally Determined Contributions (NDCs) under global climate agreements.
- **Launch of carbon trading exchanges:** By late 2023, countries like Indonesia introduced their first domestic carbon trading exchanges, with an initial trade of 460,000 metric tons of emission reductions from projects such as geothermal energy. This marks a significant step in carbon market development.
- **Carbon pricing variations:** In domestic markets with low demand, carbon prices may remain modest (e.g., USD 4.45 per metric ton in Indonesia). In contrast, international markets, such as the European Union, see higher prices ranging from EUR 60 to 100 (USD 65-108) per metric ton, reflecting greater demand and market maturity.
- **Carbon credit issuance:** In 2024, carbon registries like Indonesia's SRN-PPI issued over 1.7 million metric tons of carbon credits, showcasing the growing adoption of carbon markets as a tool for emission reductions globally.

RENEWABLE ENERGY CERTIFICATES (RECS)

- Renewable energy certificates (REC): A certification that verifies electricity is produced from renewable energy sources.
- One REC unit: Represents one megawatthour (MWh) of electricity generated from renewable energy sources.
- Global REC certification platforms: International platforms, such as IREC and APX, are widely used to certify renewable energy generation.
- Minimum project capacity requirement: Many countries set a minimum project size for REC certification, often at 5 MW or larger.

RENEWABLE ENERGY CERTIFICATES (RECS)

- **Main producers of RECs:** In the REC market, large electricity providers tend to dominate, holding huge shares of the total supply, such as one company owning a lion's share of the production of RECs.
- **Price of REC:** Prices of RECs can vary significantly depending on the region; for example, domestic prices may be lower, such as USD 2.35 per unit, compared to international markets, at EUR 7 or USD 7.56 per unit in Indonesia.
- **Lack of specific regulations:** Most countries have not issued comprehensive regulations on RECs to date. Consequently, there is the ability for local renewable energy companies to sell these certificates to international markets.
- **Registration and claims:** Where the jurisdictions have provided for registration of RECs, they cannot claim the same credit as other forms of emission reductions or credits.



GREEN BONDS

- **Green bonds:** These are financial instruments whose proceeds are utilized for funding projects with environmental relevance.
- **Value to investors:** It offers fixed returns on investment to the investors while helping them participate in the financing and management of various projects on sustainability.
- **Conventional bond vs. green bond:** While conventional bonds would finance well-established commercial projects, green bonds finance green technologies and projects that are still in their infancy stage.
- **Risk considerations:** Return on green projects could be relatively uncertain as opposed to conventional projects, raising a higher level of risk for the investor.
- **Growing investor interest:** Interest is seen to rise in green bonds whereby investors start changing their investment strategy, considering climate change risks.
- **Role of the developers:** Rooftop solar PV developers can issue Green Bonds with a view to financing their projects and ensure that these are viable at an affordable electricity rate.
- **Regulatory framework:** The regulation that considers issuance and conditions for green bonds provides a framework in terms of green finance initiatives.

IMPACT INVESTMENT

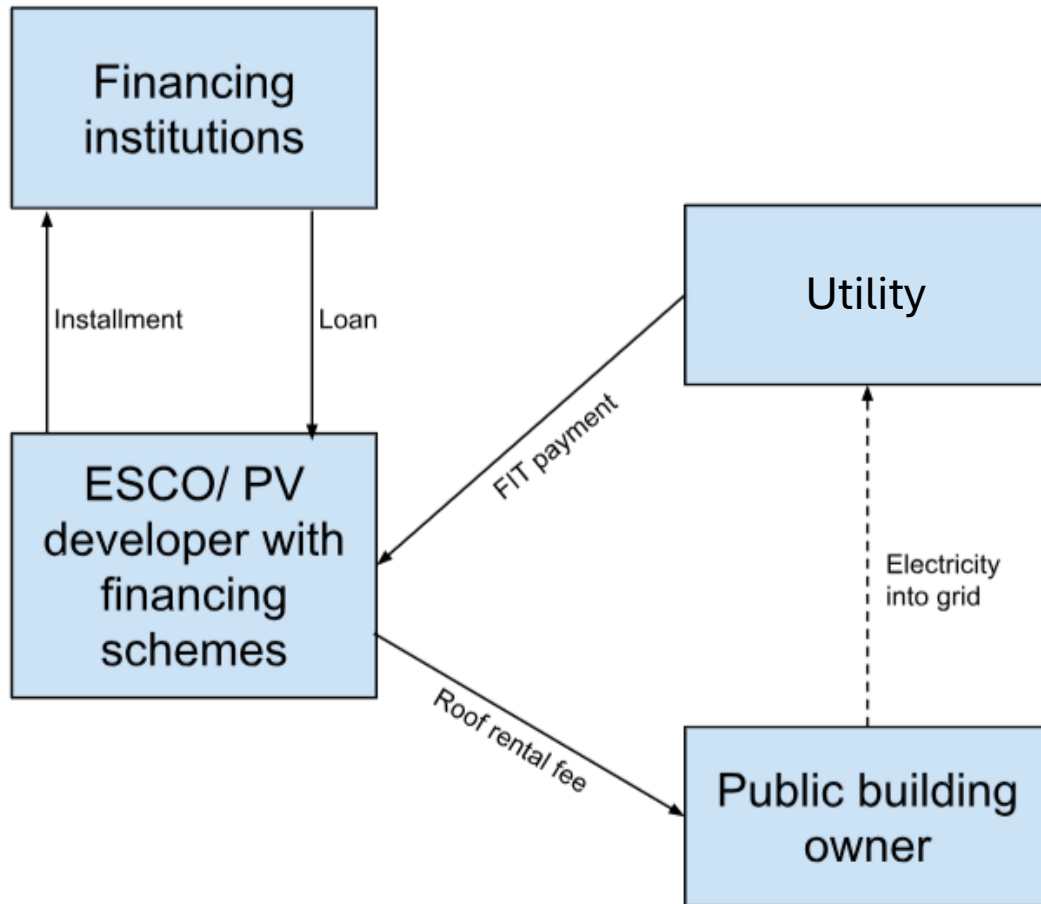
- **Impact investing:** With impact investment, again, the investor's goals of making money are aligned with the pursuit of positive social and environmental outcomes; one could make a profit while benefiting society.
- **Return on investment:** Normally, impact investors take a discount on IRR, approximately 4.7 percentage points less than the current market rates. That itself depicts their dedication toward positive impact.
- **Market growth:** Impact investment in the United States reached a value of \$500 billion in 2023, testifying to the rising interest in socially responsible financial opportunities.
- **Investment opportunities for developers:** Any developer, therefore, has a crystal clear possibility of returns through long term PPAs by selling electricity to the local grid similar to DISCOMs.

In rooftop solar projects, that revenue flexibility may not be the same; thus, affecting their return potential.

BLENDING FINANCING

- **Blended finance:** Blended finance pools funds from the public sector for development with private investment to achieve better viability of projects and catalyze additional, positive social and environmental impacts.
- **Mobilization challenges:** Attridge and Engen (2019) also cite that mobilizing private financing becomes increasingly costly for projects that are "investment-worthy," adding to the complication in financing.
- **Estimates of investment mobilization:** ODI research estimates that every dollar of development funding mobilizes only 37 cents of private investment in low-income countries, underscoring the need for an effective approach to blended financing.
- **Blended finance case study:** In Indonesia, the state-owned enterprise PT SMI developed the SDG Indonesia One initiative. This platform has facilitated 62 blended finance projects valued at close to USD 3.19 billion by December 2022, showing that blended finance has the potential for securing development gains.

ROOFTOP RENTAL MODEL



- **Solar PV development model:** Solar PV developers usually rent rooftops, install and maintain the solar power installation, and then sell the generated electricity to the grid.
- **Rooftop rental:** The scheme a PV developer and the owner of the building or rooftop usually enter into involves a rental agreement of about 25 years; in this manner, unused space is utilized by the developers.
- **Cost reduction benefits:** The model helps in reducing initial investment costs in the form of land acquisition, while ensuring maximum utilization of idle roof space for productive purposes.
- **Electricity market regulation:** Regulates who can sell or inject electricity into the grid

PUBLIC PRIVATE PARTNERSHIP (PPP)

- **Public private partnerships (PPPs):** PPPs are applied globally to finance public infrastructure projects. This enables governments to engage in business partnerships with private organizations.
- **Regulatory framework:** National governments can stipulate PPP frameworks on the basis of which government and business entities are supposed to build infrastructure in the public interest.
- **Risk allocation:** The PPP model is based on an efficient distribution of risks among the parties, which means that both the public and private sectors share responsibilities for undertaking projects.
- **Payment mechanisms:** The general components of payment mechanisms for PPP projects are tariffs directly paid by users and APs, which ensure compensation for the private partner in maintaining project availability.
- **Social and economic benefits:** The projects under the PPP scheme will also have to achieve social and economic benefits for the community, ensure welfare, and in general, help people.
- **Inclusion of small projects:** PPPs can also cover small projects. This is expanding the opportunities for small scale projects in various infrastructure development stages.

- **Crowdfunding:** Crowdfunding is among the preferred methods through which funds are raised in support of projects or ideas. It allows individuals or organizations to create a pool for a certain initiative.
- **Crowdfunding types:** Generally, crowdfunding falls into four categories: donation-based, reward-based, equity-based, and loan-based, to serve various project funding needs.
- **Funding for sustainable projects:** Donor-based crowdfunding can be one of the main routes to the funding of sustainable energy projects in rural areas. In these, the emotional driver is high, community support is there for responding to local challenges.
- **Notable example:** In Indonesia, UNDP managed to raise over IDR 350 million-or around USD 24.800-in 2016 to fund solar-powered water pumps in villages affected by the drought in East Sumba, East Nusa Tenggara, proving that crowdfunding can indeed work for impactful projects.
- **Issues related to rooftop solar PV:** Crowdfunding might be useful for particular kinds of projects, but the concept is quite difficult to justify in the case of rooftop solar PV installations that are grid-connected, due to complexities associated with financing and regulatory frameworks.

COMMUNITY-BASED MODEL

- **Community-based renewable energy model:** It focuses on empowering a community-based approach to developing its own renewable source of energy to self-sufficiency and sustainability.
- **Off-grid infrastructure funding:** Several mini off-grid PV systems get funded from government initiatives or grants due to the perceived risks or low profitability of projects in attracting private sector investment.
- Operations become sustainable when assured income sources are set up for maintaining and operating renewable energy systems.
- **Successful operation:** In the case of an organization such as IBEKA, over 60 remote villages are electrified, local welfare has been improved through the establishment of Village Enterprises, and sustainable resources have also been obtained to ensure continued operations and maintenance of the systems.



END OF CHAPTER 5 OF 7

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