Design of Financial Support and Capacity-Building Program for Rooftop Solar Photovoltaic in Turkey

A Summary Note

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**Energy and Extractives Global Practice Group
Europe and Central Asia Region (ECA)**

Acknowledgment

This note presents a summary of the main findings from the technical assistance activity, *Design of Financial Support and Capacity Building Program for Rooftop Solar Photovoltaic in Turkey*, which was financed by the Energy Sector Management Assistance Program (ESMAP) and Korea Green Growth Trust Fund (KGGTF), together with the World Bank's Europe and Central Asia Region. The report produced under this technical assistance has been prepared by Castalia, Econoler, and Stantec. The World Bank team was led by Almudena Mateos Merino and Yasemin Örüçü and included Jas Singh, Manuel Berlengiero, Zhengjia Meng, and Yae Jun Kim. The team would like to thank colleagues and officials from various institutions in Turkey, including MENR, TEIAS, EMRA, ELDER as well as various financial institutions (TSKB, TKYB, Ziraat Bank, and Vakifbank). Key preliminary findings were discussed and shared with sector stakeholders at a consultation workshop in Ankara.

Context

1. Countries around the world are undergoing an unprecedented clean energy transformation, where Distributed Energy Generation (DEG) is an increasingly important player to achieve the paradigm shift. Rooftop solar PV (RSPV) represents an increasingly significant option of DEG, especially when coupled with storage, due to its contribution to (i) reducing energy costs, (ii) viable renewable/carbon free energy, (iii) peak shaving, (iv) helping security of supply, (v) saving capital investment due to decreased system losses and (vi) increased reliability from brownouts, etc.. A driver for DEG is the desire for the customer to become a more active participant (prosumer, demand response, time-of-use) in the electricity market
2. RSPV in Turkey is at a nascent stage. The solar market in Turkey has grown over the last few years with installed solar photovoltaic (PV) capacity growing from 40 MW in 2014 to about 5,063 MW at the end of 2018, benefiting from a feed-in-tariff of 13.3 cents/kWh. However, most solar projects are unlicensed, ground mounted and under 1 MW in size, to take advantage of ease with permitting. As of 2020, only 267 MW of RSPV had been installed in Turkey, mainly in large industrial and commercial establishments. In contrast, in countries with more developed solar markets, such as Germany, the United States, and Japan, a significant portion of solar capacity is produced by RSPV applications with 1 kW to 10 MW capacities. Given the fast pace of urbanization and corresponding residential, commercial, and industrial markets, there is significant potential for RSPV deployment in Turkey, which would help the country have more energy security through decentralized generation, create more jobs, and support clean energy transition.
3. An RSPV market assessment study, conducted in 2018 in response to the request of the Ministry of Energy and Natural Resources (MENR) and its Directorate General for Renewable Energy (DGRE) with financial and technical support from the World Bank and Energy Sector Management Assistance Program (ESMAP), estimated a 4 GW market potential over the next 10 years in a medium-development scenario. It also provided a road map to eliminate key barriers to RSPV development in Turkey. While the study estimated a technical potential of 47 GW for RSPV (as per building types, 23 GW residential, 22 GW commercial and industrial, and 2 GW public), the market potential took into consideration grid capacity constraints, projected growth in RSPV sales, affordability, and creditworthiness. The study identified key barriers to RSPV development and suggested several actions as part of a road map to develop the market in Turkey; examples include transitioning to net metering or net billing, offering additional incentives to the residential sector, streamlining the permitting and licensing process, developing technical standards, putting in place capacity-building and outreach programs, and establishing dedicated financing instruments for RSPV.
4. To tackle existing market barriers, in 2019, the MENR introduced a monthly net metering scheme, streamlined the permitting and licensing process, reviewed the technical standards, and requested support of the World Bank to further assess RSPV barriers, as well as identify measures to address them, including the definition of a program to kick off and scale up the RSPV market in Turkey. For this activity, the World Bank team secured financial support from the Korea Green Growth Trust Fund (KGGTF) and ESMAP and hired Castalia, Econoler, and Stantec to deep dive

on market barriers, design financing mechanisms, and technical assistance (TA) activities targeting capacity-building and awareness-raising campaigns to scale up RSPV in Turkey. The study was completed on January 31, 2020, and has updated the financial feasibility and barrier analysis in light of the recent regulatory changes and proposed a design for a dedicated financing program for the various markets segments (for example, residential, commercial, and industrial), complemented by capacity-building and awareness-raising activities. A consultation workshop was held in October 2019, with relevant sector stakeholders to provide feedback and input into the process and study. Key takeaways from the consultation workshop and its agenda are available in the Annex.

Economic Viability of RSPV

5. The scale-up of RSPV would bring significant economic benefits to Turkey due to a combination of reduced generation costs, reduced emissions of local pollutants and carbon dioxide (CO₂).

6. Cost-benefit analysis suggests that Turkey could gain about US\$811 million in cumulative net economic benefits from reduced generation costs from 2020 to 2030. The analysis assumed RSPV reaches 3.9 GW of installed capacity by 2030.¹ By 2021, 0.4 GW of RSPV capacity would decrease total annual generation costs by US\$8.8 million in nominal terms compared to a scenario with no RSPV uptake. By 2030, 3.9 GW of RSPV capacity would decrease annual generation costs by US\$171 million in nominal terms, as shown in **Error! Reference source not found.**.

Figure 1: Avoided generation costs with RSPV uptake, 2020–2030

Source: Castalia, Econoler, Stantec report, 2020.

¹ The uptake of RSPV is based on the annual targets defined in the RSPV Market Assessment, assuming uptake begins in 2020.

7. The analysis hinges on a series of assumptions regarding the country's cost optimal generation plan. The key assumption is that energy generated by RSPV will displace generation from combined-cycle gas turbines (CCGT), which is the most expensive alternative option for generation in Turkey, as well as contribute to a reduction in system losses (today around 14 percent), as energy generated from RSPV is consumed at or near the point of generation, reducing the amount of losses that occur in the transmission and distribution of electricity and it is less prone to nontechnical losses.

8. While the analysis results point to the right direction, more granularity is needed to assess the role of RSPV in the country's least-cost generation plan and merit order compared to CCGT and renewable solutions, such as grid-connected PVs. The World Bank is currently discussing with relevant stakeholders, a planning exercise to update the country's generation options (also taking into consideration recent impacts of COVID-19 on the country's supply-demand balances). The analysis could be expanded to provide a holistic view of integrating RSPV into the country's generation plans. Such analysis should also take into consideration current commercial and technical constraints which may hamper dispatching from gas-based generation (including for balancing).

9. RSPV uptake can also support reducing emissions of local air pollutants. The analysis has estimated that RSPV uptake would reduce emissions of nitrogen oxide (NO_x), sulfur dioxide (SO₂), and particulate matter (PM) by 3,537 tons between 2020 and 2030 assuming 3.9 GW installed capacity by 2030. The avoided cost of local air pollution amounts to an estimated cumulative US\$138 million between 2020 and 2030.

10. Finally, the analysis has shown that RSPV uptake in Turkey can reduce emissions by a cumulative 825,788 tons CO₂ (tCO₂) between 2020 and 2030. This is estimated to be equivalent to annual emissions from about 45,500 cars between 2020 and 2030. The avoided cost of the externalities of CO₂ emissions amounts to an estimated US\$26 million between 2020 and 2030.²

Preliminary Business Models for RSPV Market in Turkey

Based on the above, there is a strong rationale for Turkey to further pursue RSPV to support its clean energy transition. Various business models exist to promote RSPV. All have the goal to allow market players to earn a financial return from investing in RSPV or playing an intermediary role for others. Some business models allow for partnering with financial institutions or third-party aggregators to sell, install, operate or finance RSPV systems. Others rely on Energy Service Companies (ESCOs) or distribution companies (DISCOs). The third-party aggregators could bundle customers or projects together and access financing on behalf of the customers.

² Estimated cost of CO₂ ranging from US\$/tCO₂ 20 in 2020 to US\$/tCO₂ 50 in 2030, as per World Bank. 2017. "Shadow Price of Carbon in Economic Analysis." Guidance note.

11. Specific business models worth to explore in the Turkey's context to facilitate untapped investment opportunities include the involvement of financial institutions (FIs) and third-party aggregators.

12. **Financial institutions.** Support to RSPV could be channeled through local FIs. There are three potential business model options for FIs, as described in Figure 1.

- (a) *Direct lending:* credit line is provided to partner development banks, that then lend directly to RSPV customers.
- (b) *On-lending through commercial banks:* partner development banks channel funds through partner commercial banks, that in turn lend money to RSPV customers through their branch networks.
- (c) *Leasing:* partner development banks and state-owned banks provide funds to partner leasing companies, which own and maintain RSPV systems that are leased out to RSPV customers in exchange for a monthly leasing fee over a defined period.

Figure 2: Financing channeling options through FIs

Source: Castalia, Econoler, Stantec report, 2020.

13. **Third-party aggregators.** An alternative business model envisages third-party aggregators to apply for financing from FIs and contract RSPV services on behalf of a group of customers. Aggregators can earn a profit in two ways: (i) *leasing:* aggregators own RSPV systems and lease them to RSPV customers against a monthly fee, as Figure 2 shows and (ii) *energy performance contracts*, under which aggregators share the savings on RSPV customers' monthly bill with customers over the contract period.

Figure 3: Business model with third-party aggregators

Source: Castalia, Econoler, Stantec report, 2020

14. Additional business models could be considered for Turkey. In particular, the role of DISCOs should be further explored (see the next section). A dedicated business model, for instance, could be considered for multifamily apartment buildings (MABs), which make up a large share of the market and perhaps offer the greatest development impacts. A model in which all RSPV investments are presumed to be made by the end user with debt financing may not be suitable for MABs. Other programs rely on ESCO to bundle a set of services, perhaps credit, equipment, and installation to develop a market for MABs.

Deep Dive on the Role of DISCOs

15. In 2019, following the recommendation of the RSPV market assessment study, the government further streamlined the permitting and licensing process. It also moved to a net metering system for RSPV (whose features are presented in Figure 4). The net metering system is designed to promote RSPV for self-consumption. RSPV capacity is capped to the capacity that contract customers have with their DISCOs. Electricity consumption is then netted out at the end of the month so that customers pay only for the electricity consumption in excess of the energy generated from their RSPV systems. Excess RSPV generation is injected into the grid and DISCOs remunerate customers for the excess power at the energy rate relevant to that customer's category. Net billing also represents an innovative solution which should be further explored in Turkey (see Box 1).

Figure 4: Features of net metering system

Box 1: Net metering and net billing schemes

Both net metering and net billing schemes are regarded as innovative billing models to compensate prosumers' electricity production, but there is a difference. Net metering allows end users to offset retail electricity purchases using output from RSPV systems, so they get charged based on their net usage of electricity per each billing cycle. In the net billing scheme, both consumption and generation are billed separately, therefore the end users will get different tariff to the excess energy fed into the grid and energy received from the grid under net billing. While there are a variety of net meeting and net billing arrangements, the net billing is generally considered as the next stage of innovation because it helps recover DISCOs' capital expenditures which could have not been compensated under the net metering scheme.

16. The uptake of RSPV could therefore affect DISCOs' financial positions in three ways:

- **DISCOs are not guaranteed to recover their fixed costs to compensate reduced electricity sales.** RSPV customers will generate electricity for self-consumption, meaning they will purchase less electricity from the grid. The current structure of the tariff schedule in Turkey might not allow DISCOs to fully recover their fixed cost and earn adequate profit. The distribution charge goes toward the fixed costs of distribution services, whereas the energy charge covers the cost of purchasing power from the wholesale market. DISCOs forego a share of fixed cost recovery and profits when electricity sales fall, because the distribution is charged on a variable basis.
- **DISCOs pay RSPV customers a higher cost for surplus RSPV generation than the price they would pay on the wholesale market.** This will add to DISCOs' costs to the extent that the energy rate, at which DISCOs buy the monthly surplus of RSPV, is higher than the wholesale price of energy, at which DISCOs would otherwise purchase electricity to supply the market.
- **DISCOs will however save on the avoided distribution losses from the RSPV generation injected into the grid.** RSPV customers inject their surplus RSPV generation

into the grid. DISCOs then sell this surplus to other consumers at the retail rate, avoiding the cost of the distribution losses they would otherwise incur from purchasing electricity on the wholesale market. Distribution losses in 2019 were 12 percent on average, meaning for all electricity supplied to the grid from RSPV, DISCOs save 12 percent of the wholesale cost for that amount of electricity.

17. The following additional issues will also need further investigation during the design and preparation of the IBRD operation:

- **Technical and regulatory issues.** Additional TA activities should be dedicated to addressing outstanding technical issues, such as the development of a dedicated and specific standard interconnection agreement for RSPV, or support for DISCOs to ensure they can continue to maintain grid reliability and safety. Assess the optimal tariff structure and regulatory process to allow DISCOs to fully recover cost and earn adequate profit with the uptake of RSPV should also be further explored.
- **A more active role of DISCOs as RSPV service providers.** The perception of negative impact is likely among the key reasons for the distribution companies' reluctance to promote RSPV. It is also likely to cause significant delays in the application process for new solar rooftop installations and connections. To address such issues, in a new scheme to promote RSPV in India, the government has decided to make the distribution company a partner in the implementation of solar rooftop. The new scheme promotes a utility-led model, where the distribution company can become an aggregator (of demand or financing or both). In this way, the uptake of solar rooftop becomes an income stream for DISCOs, who can also monitor the impact of solar generation on their distribution infrastructure. Box 2 presents the case in India, which could be further explored for Turkey.

Box 2: Utility-led business models in India

So far there are two types of utility-led business models which have already been approved by the state electricity regulators—solar asset ownership by utility (in case of Kerala) and solar asset ownership by consumer (in Andhra Pradesh).

In both the models the consumer aggregation is done by the utility because they interface with consumers. In case of asset ownership by utility, the assets are owned by the utility itself or by a third-party ESCO player while the consumer gets a certain percentage of solar energy generated as energy credit, toward compensation for roof rent. In case of asset ownership by consumer, the utility ties up with banks to provide finance to consumers. The utility continues to collect the monthly electricity payments from the consumers that includes the equated monthly installment (EMI) of debt repayment, which is collected by the utilities and passed on to the lending banks. Under the scheme the Government of India also provides performance-linked incentives to DISCOs for the incremental capacity addition in all consumer sectors.

Existing Market Barriers

18. The RSPV market in Turkey still faces significant barriers for each category of service providers and consumers, as summarized in Table 1.

Table 1: Summary of market barriers to uptake RSPV by stakeholders (service providers and categories of consumers)

Bank/financial institutions	Distribution Companies (DisCos)	Intermediaries
<p>Financing</p> <ul style="list-style-type: none"> Weak borrowing appetite and capacity to absorb investment loans due to deteriorating financials amid Covid-19 Relatively high interest rate and currency depreciation risks limit borrowers' appetite Banks' difficulties in providing long-term loan due to structural issues of bank financing (short term borrowing and deposit) High transaction costs including project assessment, risk evaluation, loan origination, etc. <p>Awareness Capacity</p> <ul style="list-style-type: none"> Limited knowledge of lending for energy 	<p>Institutional/regulatory</p> <ul style="list-style-type: none"> Perceived negative impact on fixed cost recovery and profit Revenue decrease due to net metering Limited ability to conduct technical analyses at the distribution level Lack of standardized interconnection agreement for RSPV Regulatory constraint to directly participate in and benefit from RSPV business 	<p>Intermediaries could include installers, EPCs, energy service companies, and cooperatives</p> <p>Financing</p> <ul style="list-style-type: none"> Difficulty in accessing financing due to size and quality of their balance sheet Lack of economies of scale and thus low margin Little room for a reasonable profit due to high equipment price in Turkey <p>Market Awareness</p> <ul style="list-style-type: none"> Limited experience and number of intermediaries Shortage of skilled labor in the RSPV field
Industry and large commercials	SMEs and small commercials	Residential sector
<p>Customers: manufactories, hospitals, hotels etc.</p> <p>Capacity: >200kw</p> <p>Financing</p> <ul style="list-style-type: none"> Prevailing high borrowing costs and expectations of persistently cheap power offset the incentives provided by net metering. High transaction costs including procurement, installation, permits, connection agreement, metering, etc. <p>Institutional/regulatory</p> <ul style="list-style-type: none"> Lack of systematic approach for scale up; <p>Market Awareness</p> <ul style="list-style-type: none"> Limited awareness of potential benefits of RSPV; 	<p>Customers: SMEs, shops, small hotels, private schools, etc.</p> <p>Capacity: 10-100kw</p> <p>Financing</p> <ul style="list-style-type: none"> Challenging economics (equity NPV/IRR might not be attractive) including high transaction costs; Lack of access to financing beyond 3 years while investment payback over 5 years; <p>Institutional/regulatory</p> <ul style="list-style-type: none"> Inefficient permitting and licensing process (long waiting time and high costs); <p>Market Awareness</p> <ul style="list-style-type: none"> Limited awareness of potential benefits of RSPV; 	<p>Customers: multi-family apartment; individual households</p> <p>Capacity: <10kw</p> <p>Financing</p> <ul style="list-style-type: none"> Challenging economics (equity NPV/IRR not attractive) including high transaction costs; High upfront investment costs unaffordable to many residential users; Lack of access to financing without collateral or credit record; Difficulty in coordination of MABs. <p>Institutional/regulatory</p> <ul style="list-style-type: none"> Inefficient permitting and licensing process (long waiting time and high costs); Spatial planning; common area coordination challenge <p>Market Awareness</p> <ul style="list-style-type: none"> Limited awareness of potential benefits of RSPV;

19. Gender-based challenges for entrepreneurs, bank customers, and RSPV consumers represent a particularly important set of barriers. At 34 percent, Turkish women's labor market participation is lagging their male counterparts (73 percent) as well the regional average for Europe and Central Asia (51 percent). Only 11 percent of firms have female participation in ownership, 4 percent of firms have a female top manager, and only one in five employees is female, according to Turkey's 2019 Enterprise Survey. On paper, women are largely protected against legislative discrimination in the labor market (the Labor Act of 2003 prohibits employment discrimination and a previous Turkish law that required a woman to obtain her spouse's permission to work was repealed in 1990). However, social and cultural norms in Turkey present women with significant barriers to engage in paid work.

20. Access to finance is rated as the top business environment concern by businesses of all sizes in Turkey. However, women face additional challenges. Nearly 30 percent fewer women than men have access to financial services in Turkey, and SMEs owned by women face a credit gap of US\$5 billion. However, when looking at savings, 40 percent of women report having saved the previous year compared to 38 percent of men.

21. The ratio for NPLs for female SMEs is significantly lower than NPLs of the whole portfolio, as shown by emerging data from one of the Turkish private banks collaborating with the International Finance Corporation (IFC). Moreover, a recent lab-in-the-field experiment with 334 Turkish loan officers showed that loan officers are 30 percent more likely to make loan approval conditional on the presence of a guarantor for female entrepreneurs. Further, discrimination is most pronounced for loans that perform well in real life, making this implicit discrimination not only costly for female entrepreneurs but for the bank itself.

22. Sectoral segregation is a key determinant when it comes to the gender earnings gaps. Data on the percentage of women working in RE in Turkey were unavailable, but key informant interviews suggest that the renewable energy sector is considered a male sector within Turkey's already male-dominated labor market. Turkish Women in Renewables and Energy (TWRE), an established networking group for female professionals in the sector, highlights that "women need to work hard and to know where and how to behave and to adjust their social relations [...]. The slightest mistake causes the male community to ignore you." Nevertheless, women are active and successful in the sector and data from TWRE show that over a third of their members are in technical roles in the sector.

Financial Viability of RSPV

23. Some of the drivers of financial viability for RSPV investments include upfront capital cost (CAPEX), operation and maintenance (O&M) cost, debt interest rate and debt ratio. A preliminary analysis has shown that debt interest rate is a key driver for RSPV financial viability and that RSPV would be financially viable only for large commercial customers and multifamily buildings borrowing in Turkish Lira (TRY), under 2019 and expected 2020 commercial lending terms. The analysis also looked at borrowing in foreign currency, which could make RSPV financially viable for industrial customers as well.

24. However, since early 2020, the COVID-19 crisis has significantly affected the economy and financial markets in Turkey, and further increased the stress on the Turkish banking sector. Bank funding, liquidity, and asset quality risks are likely to escalate as the real sector is being hit hard by labor and supply chain disruptions and sharp deterioration in global, regional, and domestic demand. In the short term, accelerated depreciation of the currency and capital leaving emerging markets like Turkey could lead to liquidity pressures on banks and potential RSPV customers. In the medium term, the dual supply and demand shock in the real sector and rising unemployment are expected to result in higher corporate and retail Non-Performing Loans (NPLs), further reducing banks' appetite to lend to 'risky' sectors and technologies deployment including RSPV. Early policy actions to support the nascent RSPV market will be important to prevent the crisis from completely derailing the RSPV scale-up.

25. Battery storage systems can be used together with RSPV for peak-shifting and other synergic benefits to be exploited including enhanced power quality, RE integration such as frequency control and ramp control, fast response, deferred T&D investment, etc. The viability analysis shows that RSPV combined with battery storage systems requires grants to bridge the financial viability gap to all customer segments. Taking into account current trends in cost reductions and all the broader benefits, it could be an attractive technology to be considered for further RSPV deployment. To unleash the potential of battery storage development, policies, regulatory framework and incentives (e.g., time of supply variable FIT, tax credits, or other measures supporting storage application) to support storage system investments are all critical for attracting new business model to the market.

Designing a Program to Kick off the RSPV Market

26. To further sustain the development of the RSPV market in Turkey, a targeted program is needed. Such program should deploy financing incentives, accompanied by regulatory and institutional measures, as well as awareness programs to help address RSPV market barriers and promote the uptake of RSPV investments. The program could provide financing support for the first few years of RSPV market development to test the technology, business model and consumer behavior. A snapshot of such potential program is presented in Figure 5.

27. The financing mechanisms could improve financing conditions of RSPV investment by providing medium to long term loans to match the payback period and capital for upfront investment at better condition, as well as build local banks' expertise on RSPV lending. The technical assistance component could support and complement the financing offered through the RSPV program, defined as training and capacity building for market players. This component could start before the financing mechanisms to ensure effective implementation of the program. Finally, an awareness raising campaign should be aimed at sparking interest in RSPV among households and businesses and marketing the financing mechanisms offered through the program to potential RSPV customers.

Figure 5: Snapshot of the proposed RSPV program

28. Many options could be considered to design the financing mechanism in support of the program. A dedicated national fund could be considered, through which financing could be provided to a wide customer base, with specific targeting of small and medium enterprises (SMEs) and residential and selected commercial and industrial players. Government could entrust a dedicated fund manager (i.e. a development bank or an investment fund), which could then design a ring fenced RSPV debt portfolio. The lending to RSPV consumers and service providers could be done either by direct lending or through intermediaries (via Apex banks).

29. Alternative structures could entail the creation of a Risk Mitigation Facility to absorb NPLs to encourage commercial banks to lend to SMEs and residential consumers. The risk-sharing facility offers FIs credit risk protection from a portfolio of RSPV lending by covering a predetermined portion of portfolio losses, while loan guarantee facility provides credit enhancement to partially cover FIs' risk in lending to RSPV customers. A risk-sharing facility is a good option if there is enough liquidity in the market but FIs are looking for protection against credit risk. This option recognizes that lack of liquidity might no longer constrain FIs' lending in the medium term, as commercial interest rates are projected to decrease in the next two years, which will increase liquidity in the market (this assumption was made before the COVID-19 crisis).

30. Finally, a loan guarantees could support lending in an incipient market with high risk perception by providing credit enhancement to borrowers who lack enough collateral or credit history to take out loans for RSPV.

Main Feature of TA for Training and Capacity Building

31. A complementary TA should also be considered to support the financing offered by the program through analytical activities, trainings, capacity building, and an awareness campaign to: (i) enable DISCOs to streamline the permitting and licensing process; (ii) train the participating financial institutions to evaluate and underwrite RSPV risks; (iii) provide capacity enhancement program for bundle service providers other stakeholders to ensure high quality in operations; (iv) develop detailed technical standard and guidelines for interconnection and installation; and (iv) enhance awareness by targeted digital marketing campaigns to deepen the consumer understanding of RSPV technology, market and benefits; and to generate demand.

32. Figure Error! No text of specified style in document.6 shows an overview of the training and capacity building activities needed for RSPV market stakeholders including government officials in relevant departments (including the regulatory agency), RSPV engineering-procurement and construction companies (EPCs), RSPV technicians, and partner FIs.

Figure Error! No text of specified style in document.: Scope of the technical assistance

Note: If third-party aggregators are to play a role in the business models used, the TA should also provide them with training on public relations and marketing for RSPV.

33. The purpose of the TA will be to build a strong community of partners in the Turkish RSPV market. Training and capacity-building measures will be designed to address the market barriers. Training will be made up of classroom and on-the-job trainings that teach FIs, EPCs, and technicians the skills that are needed to finance, design, build, and operate and maintain RSPV. Capacity-building activities will fill the gaps in knowledge and experience that exist because of the undeveloped market for RSPV in Turkey. These activities will ensure the smooth implementation of the program and sustainability of the RSPV market even after the program ends. Consumer-awareness campaigns should also be developed as part of the program. Another tool to be explored is testimonials from people who are using solar rooftop—as peer-to-peer advertisements.

34. Gender aspects and specific challenges should also be considered when designing the support program for RSPV. Specific gender actions should include the following:

- **Strengthen internal processes to foster diversity in implementing partner(s):** Closing the gender gap in employment through leadership and human resource actions to promote a diverse workforce including women in key positions, equal pay, and family-friendly practices with the implementing partners.
- **Target women through training to close the skills gap in RSVP:** Ensure all training and capacity building is gender responsive. For example, the TA could ensure time and location are suitable to women, offer childcare facilities as needed, and consider gender targets for white lists of EPCs. The program should specifically use female-only networks such as TWRE, in addition to traditional networks, to recruit female technicians into the training and consider female trainers and female-only sessions (which are specifically relevant to women who require additional skills compared to men to close the gender gap).
- **Strengthen access to finance for women through partner FIs:** Deliver diversity and inclusion training for partner FI leadership and customer engagement training for loan officers. Both should be embedded in business case arguments for banks to increasingly lend to women. Support FIs to routinely collect and use sex-disaggregated data to assess loan performance.
- **Support female entrepreneurs to cross over into RSVP and grow their business:** Access to finance should be accompanied by financial literacy training, coaching, mentoring, or other peer-to-peer support through sector-specific networking groups, such as TWRE. The program should clearly state that it encourages female enterprises to take part in trainings and initiatives, such as the EPC endorsement.

Annex. Consultation Workshop in October 2019

On October 25, 2019, the World Bank team together with a consortium of global consulting firms (Castalia, Econoler and Stantec) visited Ankara to hold a stakeholder consultation workshop on Scaling up Rooftop Solar Photovoltaics (RSPV) in Turkey. The objectives of the workshop were (i) to present the results of an ongoing World Bank study on scaling up RSPV funded by KGGTF and ESMAP and (ii) to hold open discussion and collect feedback on the potential World Bank financing program, including capacity building and awareness raising measures.

The event was opened by Murat Zekeriya Aydin, Head of General Directorate for Energy Affairs from the Ministry of Energy and Natural Resources, after welcome remarks by Habib Rab (Program Leader and acting CM, ECCDR). Presentations were delivered by the World Bank and the consultants, including overview of the proposed RSPV program, methodology, economic and financial viability analysis on customer segments, tailored financing mechanisms and targeted technical assistance. The event was attended by approximately 65 participants including government officials, financial institutions, EPCs, DisCos, and NGOs.

During the first session, the results of the viability assessment for RSPV were shared with workshop participants. The agenda covered economic benefits of RSPV, potential business models, commercial viability of RSPV by customer segment, key drivers of viability, impacts on DisCos, and market barriers and solutions. It is estimated that, in the next ten years, RSPV can generate U\$528 million of net economic benefits from reduced generation costs if a market potential of about 4.2GW is developed. Various business models such as lending or leasing through Partner Financial Institutions and third-party aggregators as channels of RSPV services were also discussed..

A detailed proposal for a comprehensive RSPV support program was presented at the second session of the workshop. Various potential financing mechanisms were discussed. The key principles of a training and capacity building program for PFIs, EPCs, DisCos, RSPV technicians, and government officials, were presented, with the purpose of enhancing technical skills and improving institutional capacity and knowledge to implement the prospective RSPV program successfully. Also, as part of the technical assistance component, it was proposed to create a white list of EPCs to ensure RSPV customers can have access to high-quality installations. In parallel to the training and capacity building program, an awareness raising campaign would be rolled-out to inform potential customers about the benefits of RSPV and how it can work be implemented. The channels for this campaign would be an RSPV program website, brochures, social media, and seminars and conferences. In addition, during implementation gender equality will be mainstreamed in all processes as feasible to provide equal opportunities for women in the sector.