REPUBLIC OF ARMENIA

Scaling Up Renewable Energy Program

(SREP)

Investment Plan for Armenia

Revision

November 2019

Table of Content

Abbreviations and Acronyms

ADB	Asian Development Bank
CEEP	Caucasus Energy Efficiency Program
CTF	Clean Technology Fund
EBRD	European Bank for Reconstruction and Development
ENA	Electric Networks of Armenia
EPC	Engineering, procurement and construction
FIT	Feed-in Tariff
GEDP	Geothermal Exploratory Drilling Project
GoA	Government of Armenia
IBRD	International Bank for Reconstruction and Development
IP	Investment Plan
IPP	Independent Power Project
MDB	Multilateral Development Bank
MEINR	Ministry of Energy Infrastructures and Natural Resources
MW	Mega Watt
PB	Private Bank
PPG	Project Preparation Grant
PPP	Public-Private Partnership
PSRC	Public Services Regulatory Commission
PV	Photo voltaic
R2E2	Armenia Renewable Resources and Energy Efficiency Fund
RA	Republic of Armenia
RE	Renewable Energy
SHPP	Small hydropower plants
SREP	Scaling Up Renewable Energy Program
SCF	Strategic Climate Fund
TFC	Trust Fund Committee
USD	United States Dollar
WB	World Bank

EXECUTIVE SUMMARY

1. The original Scaling Up Renewable Energy Program's (SREP) Investment Plan (IP) for Armenia was approved by the Strategic Climate Fund (SCF) on June 2014 and included three Components:
    i. Component 1. Geothermal development (World Bank)
    ii. Component 2. Development of utility-scale solar PV (World Bank)
    iii. Component 3. Development of Distributed Geothermal heat Pump and Solar Thermal (EBRD)

2. This note provides the first revision to the original IP, an update on the IP's implementation status and proposes modifications to the original SREP IP for Armenia with the aim to reallocate a remaining balance of USD 2.25 million from one of the Program's components to another component with expected higher impact towards the results framework.

3. With Component 1 (WB project) completed, a balance of USD 2.25 million is remaining. Armenia Renewable Resources and Energy Efficiency (R2E2) Fund on behalf of the Government of the Republic of Armenia proposes to reallocate the remaining balance of USD 2.25 million under **Component 1. Geothermal Development Project** to **Component 3. Development of Distributed Geothermal Heat Pump and Solar Thermal Project** of the original SREP IP. As this reallocation implies shifting resources between the private and the public sector, according to paragraph 9 of the SREP Pipeline Management Policy it "should be presented to the relevant Sub-Committee for review and endorsement" through a decision by mail.

4. Savings equivalent to USD 2.25 million have resulted from implementation of **Component 1. - Geothermal Development Project** due to the lack of attractive results for participation of private sector investors. In particular, Phase I of the project (i.e. drilling of two slim exploration wells) revealed that potential geothermal resources at Karkar are currently not economically exploitable for power generation based on relevant technical and economic parameters and that there is, thus, no justification to proceed to Phase II of the project (i.e. drilling of production-size exploration well and transaction advisory). In light of these results, the Government of Armenia and the World Bank agreed to cancel Phase II of the Geothermal Development Project. R2E2 Fund is now requesting to reallocate the remaining funds and efforts to **Component 3. Development of Distributed Geothermal Heat Pumps and Solar Thermal Project** in the IP.

5. **Component 3** is delivered through the **EBRD Green Economy Financing Facility in Armenia (GEFF)** – a credit line facility under which local private banks (PBs) and financing institutions extend loans to companies and commercial users (sub-borrowers) for green economy investments, including energy efficiency and renewable energy investments, covering solar PV, geothermal heat pumps, solar water heaters and biogas. The EBRD program provides investment funding together with:
    a. Advisory package to prospective sub-borrowers and PBs from a team of qualified consultants; this package includes sub-project assessments, trainings and marketing as well as policy measures to support small-scale RE implementation;
    b. Incentive grants to sub-borrowers implementing technologies eligible for grant support, upon successful implementation and verification of implemented sub-projects.

6. GEFF model delivers proven results through effective financing mechanism coupled with adequate technical support and incentives to address the entrenched behaviour that hinders the uptake of green technologies and practices in the local market.

7. Re-allocation of USD 2.25 million of unused SREP funds will help to increase the impact of GEFF for the Armenian market, ensuring enhanced market penetration of technologies supported by SREP, in particular solar PV, geothermal heat pumps, solar water heaters and biogas.

Table 1. Armenia SREP – Proposed Reallocation of SREP Resources (USD million)

	Original Plan	**SREP Funding Reallocation**	
		INTERNATIONAL BANK FOR RECONSTRUCTION DEVELOPMENT ("World Bank")	EUROPEAN BANK FOR RECONTRUCTION AND DEVELOPMENT (EBRD)
Component 1. Geothermal development			
Project Preparation	0.30 (19.04.2013)	0	
Geothermal resource confirmation	8.55 (16.06.2015)	-2.25	
Component 2. Development of utility-scale solar PV			
Grant for Project Preparation, Feasibility studies, site measurement and monitoring, Transaction Advisory Services	2 (05.06.2015)	0	
Component 3. Development of Distributed Geothermal heat Pump and Solar Thermal			
Investments in geothermal heat pumps and solar water heaters	3.0 (31/08/2016)	0	+2.25

INTRODUCTION

8. Armenia's electricity system currently has 3,238 MW of installed generation capacity, and 2,729 MW of available generation capacity. The electricity generation mix includes 34 percent nuclear, 37 percent thermal, and 29 percent renewable energy, comprising electricity generation from two large hydropower plants, over 180 privately-owned small (less than 30 MW) hydropower plants, 2.6 MW of wind power and 6.3 MW of small PV installations. Small renewable energy plants supply electricity to electricity distribution company, Electrical Networks of Armenia (ENA), under standardized contracts, approved by Public Services Regulatory Commission (PSRC) - independent regulatory agency, which is responsible for tariff setting, service quality and licensing.

9. PSRC with the support from development partners, including the Bank and IFC, created conducive legal and regulatory framework for promoting development of renewable energy, including introduction of feed-in tariffs for renewables (small hydro, solar, wind, and biomass); 20-year mandatory off-take by ENA of all generation from small renewables; streamlining procedures for securing permits required for SHPPs, and promoting local commercial bank lending for small renewable projects. This has resulted in private investments to build more than 328 MW of small hydropower, which currently account for almost 12 percent of total electricity generation in the country.

10. Except for small renewable energy plants, which have feed-in tariffs, the tariffs for all other generation companies are set following the "rate of return" methodology. Under this regime, companies can recover: (a) eligible costs related to licensed activities such as fuel, operation and maintenance, repairs; (b) asset depreciation expenses; (c) taxes and other fees; and (d) an allowed return on invested capital. The allowed returns for existing power sector companies are in the range of 10-15 percent on pre-tax basis. The tariffs are computed in local currency. The large power generation companies, the transmission company, and the power distribution company file tariff revision requests to PSRC at least once a year.

11. Armenia's energy sector has made significant progress in the last two decades. The sector has moved from severe crisis—characterized by crippling supply shortages, and near-financial bankruptcy of the sector—to stability more characteristic of developed countries than emerging markets. The use and development of renewable energy, particularly hydropower, has been an important part of the transition from crisis to stability and will remain important in the years to come as demand grows and ageing thermal plants are retired.

12. Total electricity demand in the country is expected to grow at the long-run average annual rate of 2 percent. Currently, the country has sufficient generation capacity (including reserve margin) to meet the forecast peak load and the total annual electricity demand. However, new generation capacity will be needed to meet the forecast peak load and ensure sufficient reserve margin on the system starting from 2021 when Hrazdan TPP is planned for decommissioning.

13. Around 70 percent of Armenia's electricity generation is dependent on imported fuels. Specifically, Armenia imports all the natural gas required for electricity generation from Russia and Iran, and the nuclear fuel required for nuclear power generation from Russia. Increased energy security is one of the country's top priorities as reflected in the 2013 National Energy Security Concept approved by the President of Armenia and the Armenian Development Strategy (ADS) for 2014-2025.

14. The Government is implementing investment plans to extend the operating life of ANPP from 2017 to 2026. These investments will also increase the annual electricity generation of ANPP by 300 million kWh or 12 percent. In addition, construction of a new 250MW CCGT project is contemplated by the Government.

15. The Government of Armenia has worked for more than a decade to expand the use of renewable energy. A 2004 Law on Energy Savings and Renewable Energy in 2004 provided for, among other things, the establishment of the R2E2 Fund, a non-governmental agency dedicated to promoting and facilitating renewable energy and energy efficiency in Armenia. R2E2 Fund, with the support of the World Bank and GEF, implemented a Renewable Energy Program that helped to remove barriers to the development of renewable energy generation, and to create an enabling environment for private investors. The project was co-financed by EBRD and local private financing institution.

16. However, by 2014, there had been no relevant progress with development of solar and geothermal technologies, which were estimated (with support from World Bank, SREP and other development partners) to have the highest potential for scale-up. Therefore, the Government requested support from the Scaling-up Renewable Energy Program (SREP) under the Strategic Climate Fund (SCF) to scale up the solar and geothermal technologies with participation of the private sector, including supporting assessment of the resource potential, preparation of projects, structuring, tendering, and financing. The SREP Investment Plan (IP) for Armenia, which was developed with joint support from the World Bank, IFC, ADB, and EBRD, was approved by the SREP Sub-committee in June 2014. Under the SREP IP, the Government identified the following priority renewable energy technologies to develop with SREP Support: (a) utility-scale solar photovoltaic (PV); (b) geothermal; and (c) heat pumps. The technologies were assessed against several criteria[1]through comprehensive analyses and stakeholder consultations, which aligned well with SREP's objectives. Of these criteria, the potential for scale-up of the technology, its cost-effectiveness, and the immaturity of the market were of key importance.

17. SREP support was deemed critical in reducing the cost of technologies that lied at the threshold of competing with the expected future cost of generation in Armenia (the next large thermal gas or nuclear plants to be built in Armenia will have substantially higher cost than current generation costs). SREP funding assisted in overcoming the perception that high-cost renewable energy technologies are an unnecessary expense, as well as concerns about affordability. For technologies such as geothermal power and utility-scale solar PV the initial projects would help to reduce resource and performance risks, develop local markets and expertise, and provide Government the impetus and opportunity to put in place reforms - in particular appropriate tariffs - to support their development.

18. The approved SREP funding by component is summarized in the table below:

Table 2. Armenia SREP – Funding by component (USD million)

[1] The five criteria were: Cost-effectiveness of the technology, the potential for scaling up the technology, the maturity of the market, the potential for job creation, and the effect of each technology on the stability of the grid

	Approved funds (mln USD)	Committed funds by 31.08.2019 (mln USD)	Balance (mln USD)
Component 1. Geothermal development			
Project Preparation	0.30	0	0
Geothermal resource confirmation	8.55	6.3	2.25
Component 2. Development of utility-scale solar PV			
Grant for Project Preparation, Feasibility studies, site measurement and monitoring, Transaction Advisory Services	2	1.93	0.07
Utility-Scale Solar Development Program	26		
Component 3. Development of Distributed Geothermal heat Pump and Solar Thermal			
Investments in geothermal heat pumps and solar water heaters	3	3.0	0

19. The purpose of this note is to provide an update on the implementation status of the SREP IP and propose modifications to reallocate remaining balance of USD 2.25 million to Program's components with higher impact towards the results framework.

STATUS OF ORIGINAL INVESTMENT PLAN IMPLEMENTATION

Table 3: Status of Approval of EBRD SREP Program

Project/Program Title	SREP SC Approval Date	MDB Board Approval Date	SREP Funding (US$ million)	Leveraged Funding (US$ million)
Component 1 (IBRD)	03/03/2015	06/08/2015	USD 8.55m	USD 0m
Component 2 (IBRD)	06/27/2014	NA[2]	USD 2 m	NA[3]
Component 2 (IBRD) Utility-Scale Solar Development Program	05/24/2018	-	USD 26m	USD 124
Component 3 (EBRD)	09/26/2016	10/31/2018	USD 3 m	USD 22m

Component 1. – Geothermal development

20. The objective of Geothermal Exploratory Drilling Project (GEDP) was to assess whether the geothermal resource at Karkar is suitable for power generation and, if confirmed, to involve private sector in the development of a geothermal power plant. The project was structured in two phases: drilling of two slim wells in Phase I and, if technically and economically feasible resource were identified, one or two full size production wells would be drilled under Phase II and a Public Private Partnership (PPP) would be designed to involve private sector developers in development of the steam field and construction of the power plant.

21. Phase I, which was completed in January 2017, supported drilling of two slim exploration wells (B-1 and B-2), including construction of associated infrastructure and well logging and testing services. B-1 and B-2 were drilled to depths of 1,500 m and 1,682 m respectively. The bottom hole temperatures measured in the two wells were around 115˚C for B-1 and around 125˚C for B-2. Well B-1 was a dry well in the sense that it did not encounter any productive aquifers. Well B-2encountered a circulation loss zone at 1,660 m depth, but during well completion debris accumulated in the bottom of the well precluding the testing of the productivity of this aquifer. The technical information gathered from drilling wells B1 and B2 does not provide conclusive proof of the existence of a geothermal resource at Karkar given that no geothermal flow was found. Thus, the resource risk remains high.

22. The findings of Phase I however show that the temperature at a depth of 1,500 m is above the technical threshold for generating electricity with binary technology (around 90˚C, provided that the required flow is also available) whereas the observed temperature would be too low for power production using conventional flash technology. These findings confirm Scenario 3 as defined in the Project Appraisal Document (PAD) and the SREP Grant Agreement: "If the results from the slim well(s) show that the nature of the geothermal resource is not suitable to build a flash power plant[but above 90˚C], then the Government will decide whether it would like to build a binary geothermal power plant, *considering its associated energy costs*, and based on the *interpretation of the drilling results provided by the technical supervision and support consultant*. Under this scenario, the Government will *prepare and furnish to the Word Bank a letter of request acceptable to the World Bank, which details the Recipient's rationale*

[2] Non applicable as Project Preparation Grant.
[3] Non applicable as Project Preparation Grant.

for constructing a Binary Power Plant in the future and its justification for proceeding to Phase II of the Project."

23. The Government carried out three activities to inform its decision on whether proceeding to Phase II of the project was justified:

i. ***Assessing the viability of cleaning and production testing well B-2.*** In agreement with the World Bank, R2E2 Fund explored the possibility of directly contracting the drilling service company that drilled wells B-1 and B-2 to clean the debris accumulation at the bottom of well B-2, so that its productivity could be tested. The drilling contractor found this task technically risky and showed no interest in mobilizing equipment and crew for such a small job (this is in line with the very limited interest in the contract for drilling the two slim wells in 2016, for which only one bid was received). Informal inquiries by R2E2's Technical Supervision and Support Consultant to drilling contractors active in the Turkish market yielded the same results, i.e. there was no appetite for such a small and risky job. It should be noted that even if the operation to clean the debris would had succeeded, it would only have had limited material implications on the evaluated unit cost of energy from a potential geothermal plant as the bottom hole temperature of the well is fairly well constrained. *For these above reasons, the Government and the World Bank agreed in March 2017 not to pursue the cleaning option*.

ii. ***Estimating power generation costs***. The temperatures observed in the exploration wells (B-1 and B-2) are in the range where power production, using binary cycle technology, is technically possible. The generation cost, and thus the economic feasibility, of power from a binary geothermal power plant depends mainly on three parameters: (1) resource temperature; (2) well productivity; and (3) water level in the reservoir. The resource temperature and the water level at the Karkar prospect are known from temperature and pressure logging after drilling, whereas the productivity of well B-2 could not be tested due to debris accumulation in the bottom of the well and well B-1 had no productivity. The R2E2 Fund updated the economic and financial analysis (E&FA) for a potential binary geothermal power plant at Karkar based solely on the observed temperatures and water level over a range of assumed possible well productivities. *The results indicated that the geothermal plant would not be economically viable compared with other supply options and that the minimum tariff required to make the project financially viable would be significantly above the average supply cost for Armenia*.

iii. ***Gauging private sector interest***. During 2017, the Government also reached out to a wide range of geothermal developers to gauge their interest in participating in development of a geothermal project in Karkar based on the technical information available. These direct solicitations did not attract any significant interest from developers.

24. Taking into consideration the results of exploratory drilling, the outcomes of the economic and financial analysis, as well as the feedback from the market, the Government agreed with the

World Bank to discontinue this activity and request a reallocation of the remaining funds as proposed in this Note.

Component 2. Development of Utility-Scale Solar PV

25. As presented in the original SREP IP and summarized in the SREP financing plan, the utility-scale solar project was originally split into 2 sub-projects, to be implemented by the Asian Development Bank (ADB) and the World Bank, with ADB as the lead MDB for project preparation. In April 2015, the Government formally requested the World Bank to process and supervise implementation of the Project Preparation Grant (PPG) and lead the preparation of the full project. Furthermore, in January 2017, ADB formally decided to pull out of the project. As a result, World Bank is the sole implementing MDB for the second IP component ("Development of Utility Scale PV").

26. The US$2 million PPG received by the Government of Armenia in 2015 and implemented by R2E2 Fund has supported: (a) over 1-year of ground-based solar resource measurements at four locations, including at the Masrik site; (b) preparation of an updated solar resource map of Armenia; (c) preparation of feasibility studies and structuring recommendations for involvement of private investors to develop the identified sites (six in total, with a cumulative capacity around 120 MW); (d) transaction advisory services to support selection of a private developer for the 50 MW Masrik-1 site; (e) environmental and social impact assessments for identified sites; (f) capacity building for R2E2 Fund in implementation of solar power projects; and (g) incremental operating costs of R2E2 Fund.

27. The six sub-projects will be publicly tendered in two phases. The first phase consisting of the Masrik-1 subproject is in advanced implementation stage. The Government and R2E2 Fund officially launched the tendering process with the issuance of Request for Proposals (RFP) for the 55 MWpMasrik-1 Utility Scale Project on December 27, 2017. The draft key project agreements (such as the PPA, GSA, License Agreement) and indicative terms and conditions of the offered IBRD and SREP Guarantee Agreements were included as part of the RFP. Subsequently 10 pre-qualified bidders were invited to participate in field visit and pre-bid conference in the week of January 29, 2018. The pre-bid conference was well attended by eight out of ten pre-qualified bidders as well as Development Finance Institutions (DFIs) and local commercial banks as potential financing partners.

28. Five bidders submitted offers by the RFP deadline in March 2018. The lowest tariff was proposed by a Consortium comprised of the leading international companies: Fotowatio Renewable Ventures B.V, Netherlands (Lead Sponsor) - FSL Solar S.L., Spain (Anchor Sponsor). The proposed tariff is 0.0419 USD excluding VAT. Following the issuance of the Letter of Award by the Government of Armenia, the Government Support Agreement (GSA) has also been executed between the Government of the Republic of Armenia and FRV MASRIK CJSC (as the Developer) and FOTOWATIO RENEWABLE VENTURES B.V, – FSL SOLAR S.L. (as the Sponsor), in the Ministry of Energy Infrastructures and Natural Resources of the Republic of Armenia on July 18, 2018. The GSA establishes a financial close deadline of December 16, 2019 and a plant commission deadline of December 2022.

29. The second phase, which will be informed by the results and process of the Masrik-1 tender, will consist of up to 4 subprojects. These 4 additional sites have been identified and prepared

to the same standard of the Masrik-1 sub-project and are at due diligence stage on social and environmental issues.

30. The total cost of the SREP-supported solar program is estimated at US$150 million and is expected to be financed with 25 percent equity and 75 percent commercial debt. The Government intends to request up to US$4 million of IBRD funds in the form of a guarantee and up to US$26 million in SREP funds in the form of a loan guarantees to help mobilize commercial capital, as per the project proposal approved by the SREP Sub-Committee on May 23, 2018.The choice of the guarantee instrument (instead of an IBRD/SREP loan) is driven by the Government's intention to minimize the impact on its sovereign debt while facilitating long term commercial debt to finance the program on a sustainable manner.

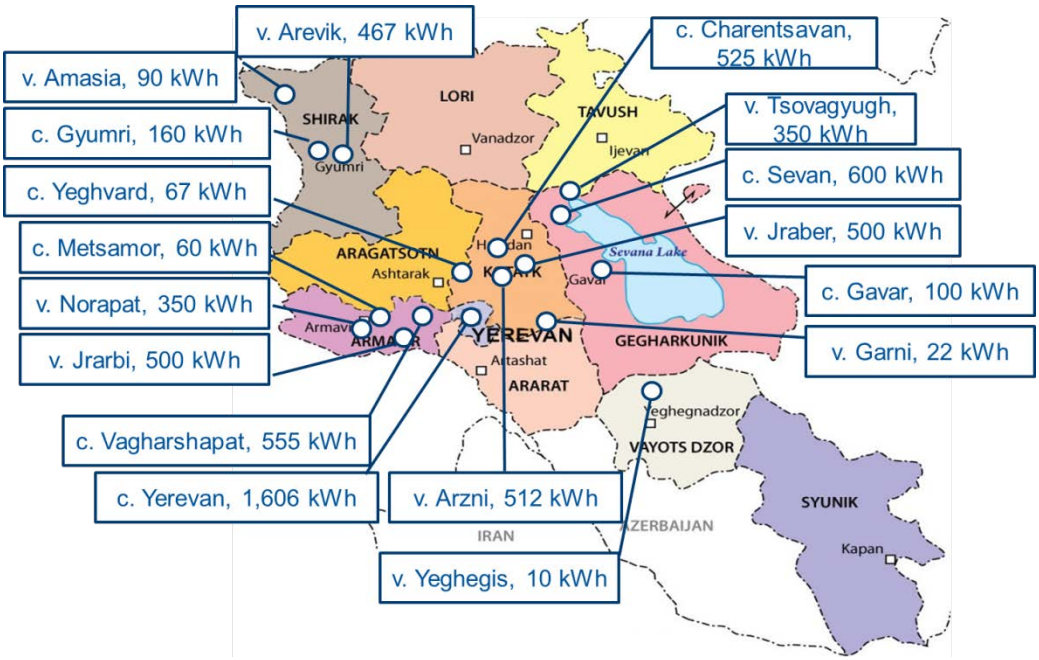
31. The Government and the World Bank are in discussions to extend/offer the guarantee to the Phase 2 projects for mobilization of local financing.

Component 3: Development of Geothermal Heat Pumps and Solar Thermal

32. Component 3 of the original SREP IP and SREP financing plan includes USD 3 million for the EBRD Green Economy Financing Facility in Armenia (GEFF in Armenia) that delivers finance through local financing institutions to green economy developers for implementation of EE/RE technologies in Armenia. Eligible technologies include SREP-eligible solar PV, geothermal heat pumps, solar water heaters and biogas as agreed with the GoA. USD 20 million of the EBRD GEFF finance are leveraged by the private sector co-financing.

33. GEFF in Armenia was approved by the EBRD Board in October 2018, with the first end beneficiary project financed and implemented in December same year. Within 8 months of operation, as of August 2019, 100% of EBRD and SREP funds were allocated to four local financing institutions and the following results have been achieved:
    - 57 projects by SMEs in various industry sectors (food production, manufacturing, textile, healthcare, accommodation, services, agriculture, trade) for total loan amount of EUR equivalent of 7.1 million;
    - 60% of projects are in the rural areas;
    - Enabling the cumulative installed small-scale RE capacity of 7.6 MW (as of July);
    - Annual primary energy savings : 34.8 GWh/year (Aug 31)
    - Annual CO2 emissions: 8,800 tCOeq/year (Aug 31)
    - Investment size vary between USD 8,000 and USD 300,000, demonstrating strong uptake by small businesses;
    - Projects are sufficiently spread across the country (6 regions out of 11) leading to enhanced energy independence, energy security and sustainability of energy supply in the heavily energy-dependent country as Armenia (the country can meet only 35% of the total energy demand from domestic sources).

Figure 1 - GEFF projects regional distribution



34. The pipeline of potential RE sub-projects under the existing Framework comprises:
    - 29 projects for the total of USD 5.9 million loan amount[4];
    - With expected installed RE capacity above 9.5 MW.
    - The currently available incentives are expected to be allocated to sub-projects by the end of Q1 2020, hence the need to secure additional USD 2.25 incentives is required immediately, namely by Q2 2020 latest .

35. The facility has led to mobilization of the Armenian market of small-scale RE technologies and service providers, enhancing the local suppliers' value proposition, development of quality service and helping users to overcome the first mover barriers.

36. The current Framework aims to implement policy measures to enhance small-scale RE implementation. The recent stakeholder consultation has identified two to three potential areas for intervention, including support GoA with development and implementation of a medium-long term vision for the distributed small-scale solar PV support mechanisms, and support with design of an appropriate quality assurance mechanism for eligible technologies. Mobilization of the respective technical assistance is aimed for Q1, 2020.

[4] USD 1.18m of incentives.

CIRCUMSTANCES AND RATIONALE FOR INVESTMENT PLAN UPDATE

Context

37. Despite Armenia's top challenges in the sector such as affordability, security of the energy supply, the emerging electricity supply gap arising from the increasing demand and aging nuclear and thermal generation capacities, despite the favourable conditions for the renewable energy generation, certain barriers remain in place preventing the scaled-up implementation of renewable energy technologies. Lack of experience with respective technologies, lack of reliable installation service and access to finance, as well as high upfront cost prevent the end beneficiaries from realizing the economic potential of renewable energy generation that is also beneficial for the environment.

    In the last two decades, GoA has made a significant progress in delivering a combination of policy, legal, regulatory and institutional reforms targeting the energy sector. Among other, in 2015 the GoA approved the "Strategic Programme for the Long-Term Development of the Energy System of the Republic of Armenia" aiming to increase the share of RE up to 40% of the energy production market. In 2015, a law was adopted enabling net metering for PV installations up to 150 kWp for households and up to 500 kWp as amended in 2018 for legal entities.

    The value of the implemented legislation, however, can't be utilised without sufficient investments into the sector and support to early adopters.

Development of Geothermal Heat Pump and Solar-Thermal Projects

38. Substantial solar thermal and geothermal heat resource potential exists in Armenia, but the use of these technologies is not yet widespread. Absence of long-term and low-cost capital for such projects is cited by Armenian geothermal heating companies as one of the main barriers to the technology's deployment. Existing facilities that are currently lending for geothermal heat pumps and solar water heaters through commercial banks can be expanded to ensure sufficient financing for investments.

39. The geothermal heat pump and solar thermal component forms part of the EBRD GEFF program. Under this program, EBRD extends loans to local private banks (PBs) and financing institutions to on-lend to companies/ commercial users for green economy investments, including energy efficiency and renewable energy investments, covering inter solar PV, geothermal heat pumps, solar water heaters and biogas. Loans are also extended on a demand-drive basis:

40. Examples of renewable energy projects under the GEFF include:

    - Solar water systems generating hot water for processes and/or heating
    - Biomass systems generating heat only or heat and electricity
    - Gas engines using biogas
    - Geothermal heat pumps

- Rehabilitation of boilers (enhanced controls, economizers, improved insulation, regenerative burners, automatic blow-down, etc.)
- Installation of heat recovery from processes (e.g., installation of economizers for pre-heating purposes, heat recovery for space heating, heat recovery for drying, etc.)
- Rehabilitation of steam distribution systems: installation of steam traps, increased condensate recovery, etc.

41. The EBRD program provides investment funding together with:
    a) advisory package to prospective sub-borrowers and PBs from a team of qualified consultants; advisory package among other includes sub-project assessments, trainings and marketing;
    b) incentive grants to sub-borrowers implementing technologies eligible for grant support, upon successful implementation and verification of implemented sub-projects.

42. The development of geothermal heat pump and solar thermal heating projects in Armenia has a number of environmental, social and gender co-benefits. If deployed on a large-scale, these technologies could have very significant co-benefits. For instance, because geothermal and solar thermal technologies tend to be deployed in smaller and more distributed implementations than utility-scale power generation technologies, these technologies tend to be more labour-intensive per unit of installed capacity. Therefore, these technologies could have a greater potential for job creation. Specifically, geothermal heat pump and solar thermal heating projects are expected to create the following social, environmental and gender co-benefits:

- **Potential for improvements in domestic air quality.** The deployment of renewable energy alternatives offsets the need to use wood for heating.

- **Stabilization of energy prices for consumers.** By providing a new source of heat energy for domestic consumption, these technologies help stabilize energy prices for consumers. This reduces energy poverty for households, which currently cannot afford sufficient heating and it reduces poverty for households who spend a large portion of their income on heating.

- **Job creation and industrial development**. These technologies create short-term and potentially long-term jobs in project installation and operations (jobs for operations are only expected for larger systems). Given the size of the resource potential and the relative labour-intensity of these technologies, an industry is emerging around the installation of these technologies and create many jobs. Also, some components of geothermal heating and solar thermal systems can be manufactured in Armenia. Further stimulating the domestic market for these technologies could encourage the further development of a domestic manufacturing industry for renewable heating technologies.

43. Distributed renewable energy technologies are anticipated to have inherently smaller-scale environmental and social risks and opportunities than utility-scale technologies, as individual installations of these technologies are relatively small-scale. However, the cumulative environmental and social risks and opportunities of deploying these technologies as part of a strategy can still be significant due to the large number of units constructed.

Market demand

44. Armenia has a sufficient RE potential[5], which has not yet been realised, even with the current GEFF facilities that are in place with local financial institutions:
    - Solar PV – 835-1,169 MW
    - Solar thermal hot water generation – 254 GWh/yr
    - Geothermal heat pumps – 4,423 GWh/yr

    GEFF launch in Armenia and the first months of operation demonstrated that there is a clear demand and momentum for the uptake of small-scale RE technologies. The earlier adopted legislation together with investment funding, dedicated technical assistance and incentives has kick-started the market, delivering projects across a variety of industries and end beneficiaries, leading to increased demand from the private sector, increased supply of technologies, growing demand for qualified local skills and services.

    Additional EBRD and private sector investment and SREP support will allow scaling-up the small scale RE investments and delivering a wider and potentially transformative impact to the market and economic development.

[5] "Renewable energy in Armenia" presentation by Tamara Babayan, Sr. Sustainable Energy Expert, Yerevan, November 25, 2017

PROPOSED CHANGES TO THE INVESTMENT PLAN

45. Savings equivalent to USD 2.25 million are available from the Geothermal component 1, given the Government's decision not to proceed with Phase 2 under the component based on the results of Phase 1. The Government wants to propose a reallocation of these funds to Component 3, **Development of Distributed Geothermal heat Pump and Solar Thermal**, as shown in Table 1.

46. The reallocated funds will be supported by additional Technical Assistance funds for implementation of the following activities within the EBRD GEFF Programme under the geothermal heat pump and solar thermal component:

- Project management and implementation support to GEFF sub-borrowers implementing SREP eligible RE technologies (biogas, geothermal, solar PV and solar thermal).
- Support to the market penetration of the SREP eligible RE technologies:
    a) Outreach events to international manufacturers and suppliers of the target technologies, including Trade Facilitation Programme (TFP), to increase the market penetration of technologies in Armenia.
    b) Outreach to local vendors and service providers (trade fair/exhibition/conferences) including TFP;
    c) Series of workshops for PFIs and their selected clients to promote the business case for investing in the target technologies.
- Visibility activities, including preparation of video case studies on SREP eligible technologies and sub-projects, Capacity building of local technology and service providers (through R2E2 Fund within the limit of 75.000 EURO).

Additionality

47. The USD 2.25 million of unutilized SREP funds from Component 1 are expected to leverage additional USD 13.5 million of the IFI and private sector finance. Extension will allow engaging a larger number of local partner financing institutions to the framework, thus extending the supply channels and the reach out. As of June 30, 2019, only four partner-financing institutions (PFIs) could join the existing Framework of USD 20 million from the EBRD and GCF, while four more PFIs remain in the pipeline. Framework extension[6] will enable the increase of the local technology production, import, as well as development of the necessary infrastructure (engineers, spare parts, quality assurance, etc.) to support the momentum and the nascent small-scale RE market in the country. Upon availability, the funds can be provided to existing PFIs in pipeline to increase the limited volume of their current credit lines.

48. SREP funds will mobilize additional investment funding as per the below table:

[6] The submission date of Armenia GEFF Framework extension for USD 11m to the EBRD Board is expected in Q1-Q2 2020.

Table 5. Additional funding mobilised

Source	Financing (USD million)
EBRD	11.25
SREP	2.25
Private	2.25
Total	15.75

POTENTIAL IMPACTS OF PROPOSED CHANGES ON INVESTMENT PLAN OBJECTIVES

Table 6. Assessment of re-allocation

SREP Program Objectives	Original SREP Plan	Effect of re-allocation[7]
Transformative impact	Better security of supply and reliability by increasing the proportion of domestic renewable energy in the energy mix. Reduced greenhouse gas (GHG) emissions as compared to the business-as-usual scenario, under which Armenia will likely continue to expand the use of natural gas for power generation and heating	Increased security of supply and reliability by further increasing the proportion of domestic renewable energy in the energy mix. Additional reduced greenhouse gas (GHG) emissions (indicatively 14,891 tCO2e p.a.) as compared to the business-as-usual scenario.
Enabling environment	The creation of a utility-scale solar sector and geothermal power sector attractive to private investors. Improvement to the enabling environment for renewable energy technologies. The first utility-scale solar PV and geothermal projects will provide an opportunity for PSRC to streamline administrative procedures and fiscal policies to encourage investment in a wider range of renewable energy technologies.	The suggested re-allocation and IP amendment does not target Window 2 (Development of utility scale solar PV), therefore, this objective remains without changes.
Implementation capacity	Contribution to reduction of impending supply capacity gap to meet forecast demand.	Further contribution to reduction of impending supply capacity gap to meet forecast demand, of around 17 MW of small-scale renewable energy capacity.
Catalyze increased investments in renewable energy in total sector investment	Develop the first utility-scale solar PV projects, which through gradual tariff increases will eventually become commercially viable without SREP/MDB support	The suggested re-allocation and IP amendment does not target Window 2 (Development of utility scale solar PV), therefore, this

[7] Based on the current portfolio's GHG performance and the total investments of USD 15.75m (11.25m EBRD + 2.25m SREP + 2.25m Private sector co-financing). GHG performance and energy savings of the current SREP-eligible portfolio are based at: 1170 kWh/kWp (PVGIS - https://re.jrc.ec.europa.eu/pvg_tools/en/tools.html) and 0.437 tCO2/MWh in line with EBRD Methodology for Assessment of Greenhouse Gas Emissions (2010) .

		objective remains without changes.
Improve the long-term economic viability of the renewable energy sector	Empower Armenian energy users to realize the economic benefits of switching from electricity and natural gas to geothermal heat pumps and solar thermal heating technologies for heating and cooling.	The expected outcomes of the re-allocation are improved economies of scale for the SREP IP, additional job creation, more development of the local technical skills, improved market penetration of technologies and value proposition from suppliers, and new financing products from local banks.

Risks and mitigation measures

49. In addition to risks and mitigation measures identified in original SREP IP, the following risks should be considered:
50. Risks relate to slow uptake of financing by sub-borrowers due to low awareness among local businesses of the benefits and opportunities of sustainable energy and climate resilience investments, as well as due to high cost associated with such high performance technologies. In addition, there is a risk of local financial institutions lacking the capacity to promote climate mitigation, and particularly adaptation, investments.
51. These risks will be mitigated by the tailored design of the Programme that combines the commercial financing together with an increased technical assistance package, including raising awareness and capacity building, and targeted policy dialogue activities. Continuing dedicated assistance to local banks in structuring their green lending operations is expected to result in demand-oriented and continued supply of projects for improving carbon and energy performance in the private sector. The use of re-allocated SREP funding for the GEFF as investment incentives to end beneficiaries will motivate the uptakers to prioritise investments in climate change mitigation and adaptation projects.

MONITORING AND EVALUATION

Table 7. Results Framework

Results Indicator	Baseline	Expected Results in Original SREP Plan	Expected Results from proposed re-allocation[8]
Transformative Impact			
National measure of „energy poverty" such as the Multi-dimensional Energy Poverty Index (MEPI), or some equivalent mutually agreed measure			
Annual electricity output from RE in GWh		Armenia plans to increase installed in the following sectors: • geothermal capacity from 0 to (pending resource availability) 100 MW by 2025. SREP-funded investments represent the first 28 MW. • solar capacity from 0 to 80 MW by 2025. SREP-funded investments will represent the first 40-50 MW. • geothermal heat pump output from 1 GWht/year to 33 GWht/year by 2025 and increase solar thermal output from 1 GWht/year to 25 GWht/year.	Additional: • 9,033m2 of solar heat capacity • 2.5MW of geothermal capacity • 14.63MWp of solar PV • 0.53MW of biogas digesters
Increased public and private investments (US$ million) in targeted subsector(s) per country per year	Less than US$ 1 million in annual investments	US$ 45 million in annual investments	Additional: US$ 13.5 million in annual investments
SREP Program Outcomes			

[8] Please note that figures in this column only refer to the USD 2.25 mln relalocation request to GEFF/Component 3, while in the column to the left for the whole IP (Components 1 to 3).

Annual electricity output from RE as a result of SREP interventions (GWh)	Geothermal electricity output: 0 GWh Utility-scale solar PV output: 0 GWh Solar thermal heating output: 1 GWh Geothermal heat pump output: 1 GWh	Geothermal electricity output: 373 GWh by 2020; 745 GWh by 2025; Utility-scale solar PV output: 88 GWh by 2020; 176 GWh by 2025 Solar thermal heating output: 25 GWh by 2025 Geothermal heat pump output: 33 GWh by 2025	Additional: 11.72 GWh solar heat 3.64 GWh geothermal (net) 21.21 GWh solar PV 8.97 GWh electricity from biogas
Number of women and men, businesses and community services benefiting from improved access to electricity and fuels as a result of SREP interventions			Additional: About 1,000 households About 5,000 women About 4,000 men About 50 SMEs/MSMEs