

## Terms of Reference

### 1. BACKGROUND

The energy sector of Armenia has achieved significant results through reforms and restructuring. The sector has strong payment discipline with collections for electricity at 100% of sales. There are no explicit or implicit subsidies to the energy sector and the sector entities are among the largest tax payers in the country. There is a competent regulatory agency for the sector. Despite these achievements, the energy sector faces a number of challenges.

The key challenges in the energy sector include: (a) emerging power supply gap; (b) threatened energy security; and (c) increasingly unaffordable energy tariffs.

Emerging power supply gap: Armenia currently has sufficient capacity to meet its demand. However, depending on electricity demand growth scenarios, generation capacity shortage to meet the peak electricity demand is estimated to emerge after the planned shut-down of the nuclear power plant (estimated in 2021), and the phasing out of inefficient and old thermal power plants.

Threatened energy security: Heavy reliance on imported fuels as well as old and under-maintained transmission and distribution assets put Armenia at risk of supply interruptions, price fluctuations, and possible outages. The average age of the transmission lines is around 45 years and the transmission company did not make any substantial investments in rehabilitation of the lines. Moreover, fuel for more than 90% of the country's energy needs is imported, including gas and nuclear fuel used to generate around 60% of the country's electricity.

Unaffordable energy tariffs: Rising fuel prices and the need for new, more expensive generating units make the energy tariffs less affordable for the poor. In 2010, the poor Armenian households spent roughly 9% of their household budgets on electricity and gas. The affordability issue will exacerbate if fuel prices continue to rise and the required significant investments are made.

The Energy Sector Strategy (2006), the National Program on Renewable Energy and Energy Efficiency (2007), the Sustainable Development Program (2009), and the draft Development Strategy for 2012-2025 recognize these challenges, including the need to expand the use of renewable energy as a means of improving the country's energy security and ensuring sustainable energy supply.

In 2011, the share of renewable energy in the electricity mix was 40%, however, this included two large hydropower cascades, which account for almost 33% and 130 SHPPs, a wind plant and a biomass plant (all having less than 10 MW of installed capacity) accounting for remaining 7%. The Government is keen to further increase use of renewable energy given significant estimated renewable energy potential (see Table 1 below).

**Table 1. Estimated Renewable Energy Technical Potential in Armenia**

Technology Type	Capacity
PV	>1000 MW
Wind	300-500 MW
Geothermal	50 MW <sup>1</sup>
Small Hydro	250-300 MW
Solar Thermal	>1000 MW
Heat Pumps	>1000 MW
Biofuel	100 thousand tons/year

Source: Renewable Energy Roadmap for Armenia, Renewable Resources and Energy Efficiency Fund, May 2011

However, to date renewable energy generation in Armenia (excluding larger hydro cascades) was almost entirely confined to small hydropower. Development of SHPPs picked up pace due to donor, including World Bank's, support with long-term financing for such projects, assistance in removal of legal and regulatory barriers and establishment of attractive feed-in tariffs and electricity off-take requirements. However, despite the existence of feed-in tariffs and enabling regulation, there has been very limited development of other renewable energy resources.

Armenia has been selected as one of the six reserve countries for the Scaling Up Renewable Energy Program in Low Income Countries (SREP). The objective of the SREP is to pilot and demonstrate the economic, social and environmental viability of low carbon development pathways in the energy sector by creating new economic opportunities and increasing energy access through the use of renewable energy. An initial group of six pilot countries was selected to receive funding under the SREP program (i.e., Kenya, Ethiopia, Mali, Nepal, Honduras, Maldives). In addition, a group of "waitlisted" countries, including Armenia, was selected to receive SREP funding, provided additional resources become available. In March 2012, the SREP sub-committee agreed upon the upper amount of funding and order of priority in which funding would be allocated to these countries: (1) Tanzania, US\$50 million; (2) Liberia, US\$50 million; (3) Yemen, US\$40 million; (4) Armenia, US\$40 million; (5) Pacific Regional (Vanuatu, Solomon Islands), US\$30 million; and (6) Mongolia, US\$30 million. As of May 2012, only Tanzania has secured SREP funding, implying that Armenia will receive SREP funding once additional resources have become available for Liberia and Yemen (in this order).

The Government is committed to promoting the development of renewable energy in the country and to that end, expressed its interest to be one of the pilot countries under SREP and was included in the reserve list. Participation in the SREP would allow Armenia to access donor funds to facilitate the greater exploitation of renewable energy resources.

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<sup>1</sup> This is the estimated potential of two geothermal sites for which significant field investigation works were done – Karkar and Jermakhbyur (Southern Armenia). The field investigation works for Karkar site were supported by GEF financed recently closed US\$1.8 million grant from GeoFund 2.

## 2. OBJECTIVES

The objective of this assignment is to support the Armenian government to prepare renewable energy investment plan for consideration by the SREP for funding. The plan should be comprehensive, clear and effective in demonstrating how SREP resources and other donor and private sector financing would be used in Armenia to overcome current obstacles to the wider penetration of renewable and low carbon energy.

The study will be conducted in two phases. Phase I will assess the potential and costs of applicable renewable energy technologies, prioritize potential interventions and facilitate discussions of these results with stakeholders.

Based on the outcomes of Phase I, Phase II will develop the draft investment plan for the prioritized areas.

## 3. SCOPE OF WORK

In order to achieve the above objective, the Consultant shall carry out the following principal tasks.

### **Phase 1 – ASSESSMENT OF RENEWABLE ENERGY TECHNOLOGIES FOR ARMENIA AND IDENTIFICATION OF PRIORITY RENEWABLE ENERGY PROJECTS**

A large number of studies and surveys on Armenia have been prepared covering the energy sector in general and renewable energy in particular. However, these studies have been carried out by various entities for various purposes, and there is therefore an absence of an organizing framework to collate and summarize this information.

A list of some of these documents is set out in Appendix 1 and will be shared with the Consultant.

#### **Task 1: Compile background information on the country and energy sector overview.**

Under this task the Consultant is specifically expected to:

- Prepare a background section with description of the country context, including main demographic, social and economic indicators as of the most recent date.
- Prepare an overview of the energy sector, including: (a) basic energy balance (for at least 2008-2012); (b) description of the sector structure; (b) legislation and regulatory framework; government strategy; (c) electricity generation, transmission and distribution assets; (d) electricity generation mix; (d) tariffs and tariff structures; (e) key entities involved in regulation of the energy sector and (f) key challenges facing the sector.
- Prepare an overview of the estimated potential for various renewable energy technologies and renewable energy penetration targets as well as the review of the ongoing and planned activities and projects in Armenia in the field of renewable energy. Include in the overview the expected country-specific environmental and social opportunities and risks associated with the development of the considered renewable energy technologies in Armenia.

- Summarize the key barriers (technical, regulatory, financial) hindering the development of renewable energy technologies reviewed and propose measures to overcome them. This activity should provide detailed description of availability of private or other government financing for renewable energy projects, including terms of financing, discuss the bottlenecks to development of renewable energy associated with availability and/or terms of financing.

**Task 2: Conduct comprehensive assessment of various renewable energy technologies applicable in Armenia.** The Consultant is specifically expected to:

- Assess the levelized economic costs (LECs) of various renewable energy technologies, including SHPPs, geothermal, wind, solar PV, concentrated solar power plants (CSPs), pumped storage, biomass, biogas, solar heaters, heat pumps and any other technology suggested by the Ministry of Energy and Natural Resources (MENR). Build a supply cost curve using the potential and estimated LECs of renewable energy technologies. Since that supply curve will be limited to electricity the use of renewable energy for heating (e.g. solar heating) would require a similar separate analysis.
- Simulate combinations of assessed renewable energy based electricity generation options with other fossil-fuel based generation options considered by the Government for meeting the electricity demand considering the planned shut-down of some of the existing generation assets, planned commissioning of the generation plants under construction and their future availability to meet domestic demand. The generation options shall include all combinations analyzed under the Armenia Energy Sector Issues Note (2011). The simulation analysis shall be conducted assuming base-case electricity demand growth scenario and commercial and concessional financing terms for all types of new generation assets. As part of this activity, the Consultant should refine the demand model<sup>2</sup> developed under the ESMAP/World Bank financed Energy Sector Issues Note (2011) to update the high-growth scenario assuming increased use of electric vehicles.
- Assess the viability of renewable based heating technologies included in the analysis and estimate the relative economic attractiveness of renewable based alternatives to electricity, gas-based, coal-based or firewood based heating. As part of this activity, the Consultant should also estimate the potential impact of heating related fuel switching on projected electricity demand.
- Determine generic environmental and social opportunities and risks of various renewable energy generation technologies considered for Armenia. Based on the available information on the physical, natural, and social environment of various administrative and/or eco-climatic areas of the country, identify those where environmental and social risks and benefits of individual renewable energy technologies are expected to be particularly significant and/or areas where additional information is required to estimate these risks and benefits.
- Based on the above analysis, determine the viable renewable options which should be pursued in Armenia. Besides of the purely economic considerations, evaluation of technologies should also consider other costs and benefits including, but not limited to: energy security; reduction of GHG emissions; and environmental and social costs, including potential impacts related to connection of the specific renewable energy projects to high voltage grid. If some of the economic and other benefits are not quantifiable, the Consultant should provide a description of those benefits.

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<sup>2</sup> The demand model will be provided to all short-listed bidders

**Task 3: Identify specific prospective renewable energy projects.** The Consultant is specifically expected to:

- Identify specific renewable energy projects (excluding SHPPs) based on the above analysis, existing assessments of renewable energy resources and potential; pre-feasibility and feasibility studies; as well as resource mapping (list of available studies is attached to the TOR).
- Conduct trade-off analysis of promising renewable energy projects considering advantages and disadvantages and prioritize the projects based on at least four criteria agreed with the Government. The criteria might include, but not limited to, LECs, employment impacts, energy security, GHG reduction, finance-ability, etc.
- Assess total investment costs for identified renewable energy projects.
- Assess the impact of identified priority renewable projects on end-user tariffs by drawing upon the analytical framework and the model developed under the ESMAP/World Bank financed Power Sector Tariff Study and the Energy Sector Issues Note (2011).
- Recommend business models and financing schemes for identified priority projects, including discussion of the potential sources of funding. As part of this activity, the Consultant should review existing financial mechanisms used for renewable energy projects (e.g. existing arrangements for SHPPs) and consider whether it is best to expend these same mechanisms to cover the new renewable energy technologies or set up new mechanisms.
- Conduct environmental and social screening of the available documents analyzed for the identification of specific renewable energy projects. Depending on the scope and nature of the reviewed material: (i) identify possible gaps in the coverage of the expected positive and negative environmental and social impacts of the proposed projects, pointing out whether the existing information and data gaps will preclude proper analysis/prioritization of a project and will need to be filled in before it is recommended for the inclusion into the investment plan; and (ii) conduct environmental and social assessment of available pre-feasibility and feasibility studies. As part of this activity, the Consultant should also discuss the potential gender benefits from identified priority renewable energy projects.

**Task 4: Provide necessary support to the MENR and the R2E2 Fund for stakeholder discussions of the priority list of renewable energy projects.** The Consultant is specifically expected to:

- Help the R2E2 Fund to prepare summary of the main findings of Phase I to be discussed with key stakeholders.
- Participate in meetings with the key stakeholders and prepare the minutes of meetings.
- Consult with private sector companies for identification of potential renewable energy projects to be included in the Investment Plan.
- Support the R2E2 Fund to review and prepare draft responses to stakeholder comments.
- Support the R2E2 Fund with presentation of key findings to the MENR and discussion on the strategy to proceed with the development of the Investment Plan for SREP.

## **PHASE 2 – PREPARATION OF DRAFT SREP INVESTMENT PLAN FOR ARMENIA**

**Task 5: Prepare the draft Investment Plan for developing renewable energy in Armenia, based on the findings from Phase 1 analysis and the consultations with key stakeholders.** As part of this task, the Consultant is specifically expected to:

- Prepare the draft Investment Plan following the structure defined in Appendix 2, based on prioritized list of renewable energy investments. The Investment Plan, among other key aspects, shall: (a) describe the role of SREP in initiating a process leading to transformational low carbon growth; (b) describe likely development impacts and co-benefits from SREP investments; (c) provide estimate of the financing requested from SREP; (d) assessment of absorptive capacity of SREP and leveraged resources.
- Prepare concept briefs of the priority investments for SREP funding as per template presented in Appendix 3.
- Identify the issues that need to be addressed in order to successfully allow the implementation of the proposed Investment Plan.

The Investment Plan shall also meet the requirements of, and be compatible with, the procedures and goals of the SREP. The draft investment plan will be revised and finalized in response to comments received from stakeholders.

### **4. IMPLEMENTATION**

The Consultant shall closely coordinate the implementation of the activity with the R2E2 Fund and Task Force under the MENR and will report to the designated staff of the R2E2 Fund. The Consultant should closely collaborate with the project team representing Multilateral Development Banks (MDB), Public Services Regulatory Commission, Ministry of Finance, Ministry of Economy, and other stakeholders and keep them posted/up-to-date on the progress, deliverables and issues during all stages of the project.

### **5. Deadlines and Deliverables**

The Consultant should submit the following reports and deliverables as specified in the below table. All reports and deliverables should be submitted in English language accompanied by Armenian translation. The Consultant should also make available all the relevant analytical material in MS Excel or other software format.

Deliverable	Deadline
Inception report	Contract signing + 15 days
Task 1 and Task 2 reports	Contract signing + 55 days
Task 3 report	Contract signing + 85 days
Task 4 Stakeholder consultations	Contract signing + 95 days
Draft Task 5 report	Contract signing + 140 days
Final Task 5 report	Contract signing + 160 days

## **5. KEY STAFF REQUIREMENTS**

### **Expert No 1: Team Leader**

The team leader will be the main interface with R2E2 during the project and regarding all logistical and follow-up issues. The team leader shall have the following minimum qualifications:

- Master's or equivalent degree in engineering or economics/finance, with at least 12 years of relevant international experience in power system planning, economic assessment/feasibility studies for renewable energy projects, assessment and structuring of renewable energy investments;
- Experience in similar energy related projects in the region;
- Good knowledge of the Armenian power sector would be an advantage;
- Excellent knowledge of English.

### **Expert No 2: Renewable Energy Technology Specialist**

The Renewable Energy Technology Specialist will have the following minimum qualifications:

- Master's or equivalent degree in engineering, with at least 10 years of relevant international experience in renewable energy technologies, including, but not limited to wind, geothermal, solar, biomass, and biogas. Strong expertise in the analysis/assessment of renewable energy projects, including CAPEX, OPEX and energy production; experience in solar heating;
- Experience in similar energy related projects in the region;
- Excellent knowledge of English.

### **Expert No 3: Energy Economist**

The Energy Economist will have the following minimum qualifications:

- Master's or equivalent degree in economics and/or engineering, with at least 10 years of relevant international experience in economic appraisal of renewable energy projects; assessment of economic/financial viability of renewable energy potential and similar assignments;
- Experience in similar energy related projects in the region;
- Excellent knowledge of English.

### **Expert 4: Environmental and Social Safeguards Specialist**

Environmental and Safeguards Specialist will have the following minimum qualifications:

- Master's or equivalent degree in environmental, social science with at least 10 years of relevant international experience in implementation of environmental and social safeguards policies, including assessment of environmental and social impacts of energy sector projects related to renewable energy and preferably funded by International Financial Institutions.
- Excellent knowledge of English.

**APPENDIX 1: LIST OF AVAILABLE DOCUMENTS**

<b>N</b>	<b>Report Title</b>	<b>Year</b>	<b>Language</b>
1	Wind Power Development in Armenia, R2E2/World Bank	2008	Eng/Arm
2	The update of the existing scheme for small hydro power stations of the republic of Armenia, R2E2	2008	Eng/Arm
3	Independent interpretation of the results of the 3D MT, gravity and CO <sub>2</sub> surveys conducted at the Karkar Site, Georisk/R2E2	2008	Eng
4	Renewable Energy Roadmap for Armenia, R2E2	2011	Eng/Arm
5	A preliminary feasibility assessment of the preferred alternative for implementing a commercial scale bio-ethanol fuels program for Armenia in the near to mid term, Enertech/BBI/R2E2	2008	Eng/Arm
6	Assessment of PV Industry Development Potential in Armenia, Danish Energy Management/SolarEN int./R2E2	2010	Eng/Arm
7	Independent interpretation of results of MT study for Gridzor and Karkar geothermal sites	2009	Eng/Arm
8	Demand-Side Management Study” FINAL REPORT, Danish Energy Management, The World Bank	2011	Eng
9	Charged Decisions: Difficult Choices in Armenia’s Energy Sector, World Bank	2011	Eng
10	The Other Renewable Resource: The Potential for Improving Energy Efficiency in Armenia, World Bank	2008	Eng
11	Wind Energy in Armenia: Overview of Potential and Development Perspectives, USAID	2010	Eng/Arm
12	Wind Energy Development in Armenia: Legal, Regulatory, Tax and Customs Regulations, USAID	2010	Eng/Arm
13	Armenia energy security and regional integration (Summary of year 1 technical results), USAID	2010	Eng
14	Connection of Photovoltaic Power Plants (with up to 5 MW of capacity) to the Common Grid of Electrical Power System, USAID	2010	Eng/Arm
15	Small Hydro Power (SHPP) Sector Framework, Status, Development Barriers and Future Development, USAID	2010	Eng/Arm
16	Methodology for Evaluating the Economics, Financial Viability and Environmental Consequences of Proposed Georgian Interconnection and Transmission Line Options, USAID	2011	Eng/Arm
17	Overview on Solar Electric Power in Buildings with Applications in Armenia, USAID	2011	Eng/Arm
18	Contract for the sale and purchase of electricity generated by wind power, USAID	2011	Eng
19	Developing an improved wind power purchase agreement for Armenia, USAID	2011	Eng
20	Congestion management in European grid and Applicability of Methodologies for Armenia draft report, USAID	2011	Eng
21	Armenia Energy Sector Note, World Bank	2011	Eng/Arm
22	Armenia Power Sector 2006 Least Cost Generation Plan APPENDIX A: ANPP Upgrade Projects, Decommissioning, Life Extension and Replacement Issues and Cost APPENDIX B: Renewable Energy Technologies and Resources APPENDIX C: Capital Structure of the Electric Sector Companies	2006	Eng

	APPENDIX D: Electricity Demand Forecast APPENDIX E: Fuel Price Forecast Update APPENDIX F: Results of Detailed Analysis		
<b>23</b>	Analysis of feed-in tariff for renewable energy sources in Armenia (eng), IFC	<b>2011</b>	Eng/Arm

## **APPENDIX 2: INVESTMENT PLAN TEMPLATE**

- 1) Proposal Summary (2 pages)
  - a) Objectives
  - b) Expected outcomes
  - c) Program criteria, priorities and budget
- 2) Country Context (3-4 pages)
  - a) Energy sector description (market structure, demand supply, and dispatch composition, electricity cost and pricing) incl. renewable energy status
  - b) Gap/barrier analysis; needs assessment
- 3) Renewable Energy Sector Context (3-4 pages)
  - a) Analysis of RE options (technology, cost, mitigation potential, barriers)
  - b) Government plans or strategy for the sector (willingness to move towards renewable energy investments, existing or envisioned policy, regulation, plans, and resource allocation)
  - c) Institutional structure and capacity (technical, operational, financial, equipment supply, information)
  - d) Role of private sector and leverage of resources
  - e) Ongoing/planned investment by other development partners
- 4) Contribution to National Energy Roadmap (2 pages)
  - a) Likely development impacts and co-benefits of SREP investment
  - b) How SREP investment will initiate a process leading towards transformational low carbon growth
- 5) Program Description (6-8 pages)
  - a) Capacity building and advisory services
  - b) Investment preparation activities
  - c) Technology deployment investments
  - d) Parallel activities to be funded by other development partners
  - e) Environmental, social and gender co-benefits
- 6) VI. Financing Plan and Instruments (3-4 pages)
  - a) Budget envelop for investments
  - b) Costs and sources of funding
  - c) SREP assistance (grant, concessional debt, etc.)
  - d) Recipients of funding

7) Additional Development Activities (2-3 pages)

- a) Leverage complementary co-financing with other development partners such as bilaterals, private sector, and financial institutions

8) VIII. Implementation Potential with Risk Assessment (2 pages)

- a) Country/regional risks - institutional, technology, environmental, social, financial
- b) Absorptive capacity for SREP and leveraged resources

9) IX. Monitoring and Evaluation (1/2 page)

- a) Results framework table

Annexes

Information should be included in annexes on the following areas:

- Assessment of countries absorptive capacity
- Stakeholder consultations
- Co-benefits
- Existing activities in the field of renewable energy, particularly activities of other development partners
- Request for MPIS
- Request for PPGs (if applicable)
- Independent Technical Review: matrix addressing comments and Government/MDB responses

Note that the Independent Technical Review report should be submitted as a separate file.

### **APPENDIX 3: CONCEPT BRIEF PROJECT TEMPLATE**

For each Investment Plan component, an investment concept brief (maximum two pages) should be provided as annex that includes:

- Problem statement (1-2 paragraphs)
- Proposed contribution to initiating transformation (1-2 paragraphs)
- Implementation readiness (1-2 paragraphs)
- Rationale for SREP financing (1-2 paragraphs)
- Results indicators
- Financing plan
- Project preparation timetable
- Requests, if any, for investment preparation funding