



**The Secretariat of the Eastern Partnership Civil Society Forum (EaP CSF)
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SUPPORT TO ANP WORKING GROUPS PROJECTS

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**Prospects of solar energy use in Armenia in the context of CEPA and
other international commitments and opportunities.**

Introduction

Armenia has obligations within EU “20 Eastern Partnership Deliverables for 2020” (deliverables 14-15), within Comprehensive and Enlarged Partnership Agreement between EU and Armenia (CEPA). Armenia intend also to develop its energy sector through cooperation within bilateral governmental agreements and through International Financial Organizations (IFI). Development of renewable energy resources and introduction of energy efficient technologies are of high importance for Armenia within framework of above mentioned obligations and opportunities. Of high interest is solar PV development. The price of PV solar has sharply fallen by more than 65% and more (depending on the region) during last ten years and continue to fall at rate 2.3%/year (<https://news.energysage.com>). 46 percent efficiency is achieved in certain laboratory tests though commercial cells have efficiencies 19-21%. Perovskite solar cells are currently of large interest due to their cost/effectiveness features. With that the latest events related with COVID-19 pandemic will creates definite risks that should be taken into account. A snapshot of energy system of Armenia is brought below.

Energy sector of Armenia

Armenia is a landlocked country and is surrounded by 4 countries, of which two have introduced blockade for any transportation through their territories caused by conflict around mountain Karabagh. The third country (Islamic Republic of Iran) has been under international sanctions, so previous ambiguous plans for cooperation, for example introduction of joint use of Arax river for energy production are remained not realized for more than 10 years with possible reasons of absence of necessary funding to be provided by this country. Armenia has taken and should continue to take many steps to improve its energy system, make it more reliable and energy efficient to provide uninterrupted supply of electricity and heat at least within country.

Armenia has not proven fossil fuel resources of industrial scales and imports them from abroad. Armenian thermal power plants operate on natural gas, which is mainly imported from Russia (79%), in smaller volumes - from Iran (21%) (Data for 2018). In 2018, the total amount of electricity produced in Armenia was 7632.3 mln kWh of which 6244 mln. kWh - for domestic consumption. The share of thermal power plants in domestic electricity consumption was 29.8%. Nuclear fuel for Armenian Nuclear Power Plant (ANPP) is imported from Russia. Due to the modernization of the 2nd power unit of the ANPP, its operation period was extended until 2026 agreed with the International Atomic Energy Agency (IAEA) with the possible subsequent extension. The prospects for building a new nuclear power plant are uncertain. In 2018, the share of the ANPP in the domestic consumption of electricity was 31.9%. The shares of existing HPPs and small HPPs were 21.8% and 16.5%, respectively.

Thus, it is urgent to increase the use of own energy resources, especially renewable energy sources. With that, in previous years, many concerns have been raised in connection with rapid growth of construction volumes of new small HPPs and their adverse influence on environment. The reasons are different including violations of sanitation norms of water intakes for HPPs, use of outdated equipment with low efficiency, absence of monitoring water intake meters (currently internet connected water meters have been installed on many small HPPs, violations of population rights near locations of small HPPs related with unfair use of water resources and impact on environmental. Corruption risks have also been enough high during last 15 years of small HPPs construction.

Sharp reduction in prices on solar photovoltaic systems in last 5-7 years created favorable conditions for its introduction in Armenia taking into account their limited harmful influence on environment and stimulated their rapid rates of introduction and favorable trends.

One more important issue for population is tariff policy on electricity and gas. During winter times its burden is too high to many groups of population, particularly for vulnerable groups with low level of incomes. In rural areas that cause in many cases to sharp increase of illegal cutting of trees for heating purposes.

In order to increase its energy security and contribute to climate change, the Armenian authorities, with the support of international organizations, plan to install up to 400 MW of solar and wind power plants and other renewable energy sources in Armenia in the near future.

Green Deal

According to Green Deal (approved in 2019) close cooperation between the EU and the EaP member states is envisaged, with funding to the EaP for green activity increasing from the current 13% to 25%. The European Commission has decided on October 17, 2020 to launch a €1 billion call for research and innovation projects that respond to the climate crisis and help protect Europe's unique ecosystems and biodiversity. The Horizon 2020-funded European Green Deal Call. The European Commission supports a successful participation of EaP countries Armenia, Azerbaijan, Belarus, Georgia, Republic Moldova and Ukraine in the EU's Framework Programmes and the European Research Area (ERA). Therefore, researchers and innovation actors from the EaP countries are assisted in the preparation of applications to H2020 (last calls) and to Horizon Europe. Specifically, the European Commission highlights the cooperation opportunities with regard of the ambitious European Green Deal.

Green Deal Call will cover the following areas:

- Increasing Climate Ambition: Cross sectoral challenges
- Clean, affordable and secure energy
- Industry for a clean and circular economy
- Energy and resource efficient buildings
- Sustainable and smart mobility
- Farm to Fork
- Biodiversity and Ecosystems
- Zero-pollution, toxic free environment
- Strengthening our knowledge in support of the EGD
- Empowering citizens for the transition towards a climate neutral, sustainable Europe
- International cooperation

Special virtual Green Deal Trainings will be organized and will consists of three sessions, each highlighting the Green Deal Call from a different perspective. While session 1 gives a general overview, sessions 2 and 3 go more into detail and also touch general aspects like networking and proposal writings. The participants will be provided with links to other relevant events, information sources and networking opportunities. It is possible to participate either in all three sessions or only in one or two selected sessions. The first virtual Green Deal Training started on 18 September 2020.

Comprehensive and Enlarged Partnership Agreement (CEPA)

The energy issues are also emphasized in Comprehensive and Enlarged Partnership Agreement between EU and Armenia (CEPA) which will be the legal basis of EU-Armenia bilateral cooperation for the next years. Armenia and the EU signed the deal in the margins of the Eastern Partnership Summit in Brussels on 24 November 2017. CEPA was ratified by National Assembly of RA in April 2018 and

now in the process of signing by parliaments of EU countries. The Road Map for CEPA was signed in 2019 by GoA.

CEPA is yet to be ratified by Portugal, Italy and Austria. After the completion of the ratification process in these three countries, the agreement will come into force.

Chapter 2 “Energy cooperation including nuclear safety”, Article 42 clause 2d states: The promotion of renewable energy sources, energy efficiency and energy saving. Indirectly RES are included in enhancement of energy security and diversification of energy supply according to clause d. (p 45).

Prospects of solar energy development and deliverable 15 of JSWD Eastern Partnership - 20 Deliverables for 2020

Objectives of Deliverables 15 are defined as to reduce energy intensity, to promote energy efficiency and increase of renewable energy production, to reduce of GHG (Greenhouse Gases) emissions in EaP countries¹. 6 different activities have been suggested to achieve specific targets by 2020.

Energy commission has funded the following on-going project 1. SUDEP EE & RE for Spitak & Vayq Communities. The Sustainable Urban Demonstration Project (SUDeP) is part of the Covenant of Mayors Initiative which is embedded in the Eastern Partnership (EaP);

United States Agency for International Development (USAID) funded in recent years the following projects: 1. Residential Energy Efficiency for Low-Income Households (REELIH) Program; 2. Energy & Water Program; 3. LEDS (Low-Emission Development Strategies and Plans) Project and least cost generation planning; 4. STIP initiative and plans for water and energy efficiency solutions in fisheries.

Other donors list includes: The United Nations Development Programme/Global Environmental Foundation (UNDP/GEF) (Green Urban Lighting Project; Improvement of EE in buildings Project), KfW (Kreditanstalt für Wiederaufbau), GGF (Green for Growth Fund), EBRD.

Solar Photovoltaic stations in Armenia (current status and prospects)

As of July 1, 2019, for the production of electricity by solar PV power plants with up to 5 MW capacity 27 companies (totally of about 63 MW) have been licensed, 10 of which (totally of about 8,01 MW) are already in operation.

¹ JOINT STAFF WORKING DOCUMENT (JSWD). Eastern Partnership - 20 Deliverables for 2020 Focusing on key priorities and tangible results. EUROPEAN COMMISSION and HIGH REPRESENTATIVE OF THE UNION FOR FOREIGN AFFAIRS AND SECURITY POLICY, 2017, Brussels, XXX [...] (2017) XXX draft

Autonomous solar energy producers. As of July 1, 2019 Technical terms were given to 1233 autonomous energy producers with capacity up to 500kW (total capacity 19,3 MW), 1144 of which have already been connected to energy system (total capacity 16,9 MW).

According to the decision of the PSRC N 159-N dated 29 May, 2019 the tariff for the period from 01.07.2019 to 01.07.2020 for solar power plants with up to 5 MW capacity (including) amounts 24.233 dram/ kWh excluding VAT. For the solar power plants with more than 5 MW installed capacity is reviewed within the framework of separate investment projects.

According to data from PSRC as of end of December 2019 13.1 mln kWh/year was produced from grid connected solar PV stations, and 10.1 mln kWh/year was produced by autonomous producers in 2019.

Renewable energy potential by technology is presented in the Table 1. The detailed research of 150kW Solar PV station in Yenokavan (Tavush Marz, Armenia) that has been in operation since 2017 is brought in separate report within this program. The largest solar PV plant with capacity 5.2 MW was put into operation in Armenia in October 2020 by Optimum Energy LLC (see Figure 2).

Table 1. RENEWABLE ENERGY POTENTIAL BY TECHNOLOGY [Source: Final version of SREP] [Scaling Up Renewable Energy Program, Investment plan for Armenia, 2014.]

| Technology | Capacity, MW | Generation, GWh/yr |
|---------------------------|------------------------|--------------------------|
| Wind | 300 | 650 |
| Solar PV | 830-1,200 ^a | 1,700-2,100 ^a |
| Concentrating Solar power | 1,200 | 2,400 |
| Distributed solar power | 1,300 | 1,800 |
| Geothermal power | At least 150 | At least 1,100 |
| Landfill gas | 2 | 20 |
| Small hydropower | 100 | 340 |
| Pumped storage hydropower | 150 | 1,161-1,362 ^b |
| Biogas | 5 | 30 |
| Biomass | 30 | 230 |
| Total electricity | 3,800-4300 | 7,400-8,700 |
| Solar thermal hot water | n/a | 260 |
| Geothermal heat pumps | n/a | 4,430 |
| Total (heat) | | 4,690 |

Masrik Solar PV station.

According to IFC web site “The World Bank has helped the government with feasibility studies and support preparing the Masrik project since 2015. In 2017, the government, with support from the World Bank, launched a successful international public tender for a 55-megawatt (MW) solar PV project. IFC is financing the development, construction, and operation of Masrik Solar, Armenia’s first grid-scale solar photovoltaic (PV) project which includes a 55-MW power plant and a 9-kilometer transmission overhead line located in Mets Masrik municipality, Gegharkunik Province, a rural community located by Lake Sevan.

The project is estimated to have a total cost of \$55 million. The company will receive a \$35.4 million debt financing package financed on a 50:50 basis by IFC and the EBRD. The project will also receive a €3 million investment grant from the EU. The IFC financing package includes an \$8.9 million loan from IFC's own account and an \$8.9 million loan from IFC. In 2022, Masrik Solar is expected to generate over 128 gigawatt hours of electricity per year at a competitive tariff of 4.19 cents/kWh. The project will help reduce greenhouse gas emissions by around 40,000 tons annually between 2022 and 2042 by replacing power generated from more carbon-intensive sources”.

https://www.ifc.org/wps/wcm/connect/news_ext_content/ifc_external_corporate_site/news+and+events/news/impact-stories/masrik-solar-armenia



Figure 1. Meteo station for Masrik-1 solar PV station.



Figure 2. The largest solar PV plant with capacity 5.2 MW was put into operation in Armenia in October 2020 by Optimum Energy LLC and connected to grid. (Photo by Optimum Energy)

Conclusions

Armenia has technological solar potential up to 1GW. Several local companies have acquired experience in installing PV stations. The largest solar PV plant with capacity 5.2 MW was put into operation in Armenia in 2020 and connected to grid. In 2022, 55 MW solar PV station (Masrik Solar) is expected to come into operation. More extensive researches are required to evaluate required investments in solar energy technologies and time period to reach 400 MW capacities of solar PV stations in Armenia.

Literature

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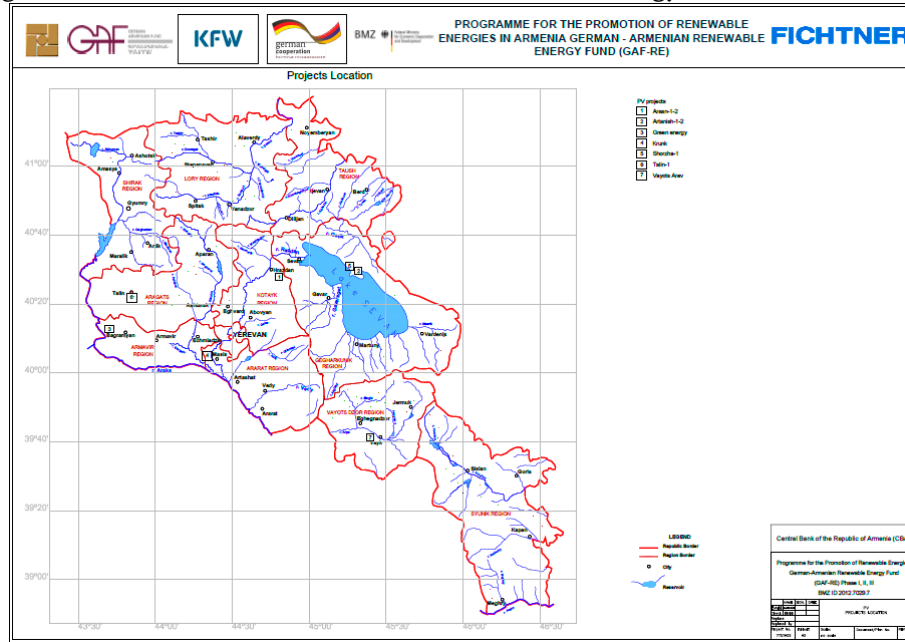
Annex 1. Recommendations by Ministry of Territorial Administration and Infrastructure RA (<http://minenergy.am>) to organizations that want to construct solar PV plant:

Guide for the construction of utility-scale solar PV plant

To construct a solar PV plant the investor should:

1. Chose a landing (landing may be chosen from Solar Resource Map presented at http://minenergy.am/storage/hh_taracqum_avevayin_neruji_qartezner.pdf web-site).
2. Get Land Use Right and change the Land Use Destination to «Objects of energy, transport, communication and utility infrastructures» as needed.
3. Make a Business Plan.
4. To get information on licensing in the sphere of energy visit web-site of the Public Services Regulatory Commission of RA- www.psrc.am, section «Information for Investorts»
5. Apply to Public Services Regulatory Commission of RA to get License for producing Electricity.
6. For free professional consulting apply to Armenia Renewable Resources and Energy Efficiency Fund - www.r2e2.am and/or to German-Armenian Fund - www.gaf.am (soft loans are available here).
7. Construct solar PV Plant by keeping the terms of the above mentioned License.

Annex 2. Map of 7 Licensed PV projects in Armenia within programme for promotion of renewable energies in Armenia German – Armenian renewable energy fund (GAF-RE).



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