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Short Term High Quality Studies to Support Activities under the Eastern Partnership

HIQSTEP PROJECT

STUDY ON THE EFFECT OF THE PLACEMENT OF SOLAR PANELS ON BUILDINGS TO INCREASE ENERGY SECURITY AND ENERGY EFFICIENCY AND DEVELOP CLEAN ENERGY IN THE EASTERN PARTENRSHIP COUNTRIES

Component 2 Report:

Review of EaP Countries' Experience with Building PVs

September 2017

List of abbreviations

AM	Armenia
ANRE	The National Regulatory Authority for Energy in Moldova
AREA	Azerbaijan State Agency on Alternative and Renewable Energy Sources
AZ	Azerbaijan
BY	Belarus
CBA	Cost Benefit Analysis
CEER	Council of European Energy Regulators
DGPV	Distributed Generation from Photovoltaics
EaP	Eastern Partnership
EC	European Commission
EnCT	Energy Community Treaty
EnCS	Energy Community Secretariat
EU	European Union
EUD	EU Delegation
GE	Georgia
GEDF	Georgian Energy Development Fund
GWNERC	Georgian Water and Energy Regulatory Commission
HiQSTEP	Short term high quality studies to support activities under the Eastern Partnership
MD	Moldova
NEURC	National Energy and Utilities Regulatory Commission of Ukraine
PSRC	Public Services Regulatory Commission of the Republic of Armenia
PV	Photovoltaic(s)
R2E2	Armenia Renewable Resources and Energy Efficiency Fund
RES	Renewable Energy Sources
SAEEE	State Agency on Energy Efficiency and Energy Saving of Ukraine
STL	Study Team Leader
T&D	Transmission and Distribution
TOR	Terms of Reference
UA	Ukraine
MS	Member State
SPE	Solar Power Europe
ROO	Renewable Obligation Order

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Preamble

The present report is a deliverable of the "Study of the Effect of the Placement of Solar PV on Buildings in the EaP Countries" carried in the framework of the EU-funded project "High Quality Studies to Support Activities under the Eastern Partnership - HiQSTEP" (EuropeAid/132574/C/SER/Multi). The study covers all six Eastern Partner Countries, namely Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine.

The overall objective of the study is to address the effect of the placement of solar panels on buildings in Eastern Partner countries for the purpose of increasing energy security and energy efficiency and developing clean energy sources.

The specific objectives of the study are the following:

- To present EU policies, rules, regulations, tools and schemes towards the promotion of solar panels on buildings;
- To assess existing policies, rules, regulations and tools towards promotion of solar panels on buildings in the six Eastern Partner countries;
- To develop cost-benefit analysis for the staged development of building PVs in all Eastern Partner countries;
- To formulate recommendations on how to enhance PV penetration in the six Eastern Partners;
- To quantify the impact of building PV penetration to the overall energy mix and on the energy security of each country and to quantify the impact of PV generated energy to greenhouse gas emission reduction.

The present Study was implemented by a Study Team headed by Mr. Nikos Tourlis, Study Team Leader and composed of:
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Special thanks to the Study's counterparties in the Eastern Partner Countries for their support and useful guidance throughout the elaboration of the study including the field missions. In particular the Study Team wishes the best with the future implementation of buildings' solar PV programmes to:

- The Ministry of Energy and Natural Resources of Armenia, represented by Mr. Tigran Melkonyan;

- The Agency for Renewable Energy of Azerbaijan (AREA), represented by Mr. Jamil Malikov;
- The Department of Energy Efficiency in National Standardisation Authority of Belarus, represented by Mr. Andrey Minekov and Mr. Vladimir Shevchenok;
- The Ministry of Energy of Georgia, represented by Ms. Margalita Arabidze and Ms. Natali Jamburia;
- The Ministry of Economy of Moldova, represented by Mr. Denis Tumuruc;
- The State Agency for Energy Efficiency of Ukraine (SAEE), represented by Mr. Sergeiy Savchuk;

1 Introduction

As a deliverable of the second component of the study the present report comprises a review of practices in the Eastern Partner (EaP) Countries in respect of buildings' solar PV technology and application. More specifically, the report briefly discusses the degree of the EaP Countries' harmonisation with the EU policies supporting Renewable Energy Sources (RES) in general and provides an overview of solar PV technology. It discusses the essential features of the legal and regulatory environment the EaP Countries have reached so far, and the current penetration levels of solar PV in buildings. The review of practices relies on individual assessments of each specific national system, based on a common National Report template, and results in identification of gaps. The gap analysis leads to the formulation of some recommendations. It is important to note that the data, information and conclusions included in this report reflect the time at which the report was drafted i.e. the period between March and May 2017.

The target of this Component Two report aims to offer an overview of the six Eastern Partnership countries' energy systems pertinent to PV development policies and practices with specific focus to the buildings' PV segment. The report develops a gap analysis with a view to compare the current PV in buildings market framework for building-PVs in the studied countries with a favourable and adequate one able to *increase energy security, energy efficiency and develop clean energy with the placement of solar panels on buildings*. This "benchmark" framework is introduced in this report since only the Energy Community Treaty contracting parties i.e. Georgia, Moldova and Ukraine have undertaken commitments that make the Energy Community Acquis a proper and universal framework for the purposes of our comparative analysis. In other words, were in this report a gap analysis and comparison is made, this is based on the team's experience on what would be a "favourable and adequate" framework for the development of building PVs. Of course, this ideal framework is not necessary for the Energy Community Treaty contracting parties where an implementation and compliance mechanism is already in place. Beyond the legal and regulatory framework analysis, it was deemed important that this report include market-related information such as for instance the current installed capacity of building PVs, the technology and users' access to finance, as well as, any possible relevant programmes and/or initiatives at a national/regional level that would potentially act for the benefit of the development of building PVs. In that sense, we consider this report to be instrumental for the overall study since it builds on the findings and recommendations of the preceding "Review of EU Experience with Solar PV in buildings" report, includes country specific recommendations and it thereby provides useful inputs for the assessment of building-PVs technical potential report. In addition, it aims to set the requisites for the options and alternatives to be considered during the elaboration of the Cost-Benefit Analyses and programming reports, which in turn correspond to the concluding stage of this study.

1.1 Key considerations

As previously mentioned, the gap analysis is structured as a comparative analysis on the basis of a comparison of the EaP countries' status with the main EU and international buildings' PV development experiences. The latter were collected and presented in the "Review of EU Experience with Solar PV in buildings" report, while the EaP countries' status review was in turn based on six country reports exploring the overall building-PV market context at a national level.

- The aim of "Review of EU Experience with Solar PV in buildings" report was to identify the steps pertinent to the policy and regulatory decisions with a view to support national PV buildings targets in the EU. The present "EaP countries building-PVs status review" report in its turn makes use of a comparative analysis for the development of certain conclusions. The comparative analysis renders EU practices and experiences as a potential

development model. On these grounds, the present report identifies and assesses the presence of certain market conditions, as well as, those policy and regulatory models, which are deemed to form part of certain EU countries' effective legal framework and enabling environment for building-PVs.

- The individual country profiles intend to outline the current status of the energy market with reference to PV policies and, where possible, to the specific framework conditions applying to building-PVs. They offer an overview of the country experiences in development of PV in their specific context. The structure of the country report was suggested during the elaboration of "Review of EU Experience with Solar PV in buildings" report in order for the information contained in the country profiles to be comparable with each other and also reflect on the former's main findings. The country profiles were developed by local energy experts participating in the study – in some cases with the support of the national competent authorities.

The work during the development of this "EaP countries building-PVs status review" report is strongly connected with the different market contexts and the overall energy policy direction of the target countries. Out of the six EaP countries, three, namely Georgia (as of April 2017), Moldova and Ukraine, are Contracting Parties (CPs) to the Energy Community Treaty. The remainder three countries, though retaining their status of Eastern Partner Countries, (Armenia, Azerbaijan and Belarus), are not part of any specific agreement committing them to harmonise their legislation with the EU acquis on energy. This is to say that in Ukraine, Moldova and Georgia energy markets are in the path of harmonisation to the EU acquis and therefore the PV strategies observed in certain EU Member States (MS) offer a comprehensive benchmark for the gap analysis and recommendation proposal. For Armenia, Azerbaijan and Belarus an ad-hoc approximation is more or less sketched out. This implies that an additional effort was actually required in order to tailor the gap analysis and recommendations to the specific market context, strengths and weaknesses with reference to PV in buildings. For example, this may imply a price support mechanism and priority access conditions for building-PVs that would work seamlessly with vertically structured or single buyer electricity models.

In general, all target countries are able to showcase some examples of installation of PV systems and in some cases, these include building-PVs. However, in most cases those installations are merely considered as pilot or demonstration projects. In no country, so far, building-PV development has become an important energy market feature in order to be regarded as an independent driver that would in turn indicate a promising market uptake. This is to say that development of PV in buildings is still strongly individually perceived[1], which appears to be closely linked to an occasional - and in most cases - a specific public[2] or private initiative. Ukraine is the only exception as the country starts to move from a project specific PV development model to a market model sustained by an adequate legal framework based on a feed-in & net-metering support scheme, specifically tailored for small scale building PVs. In spite the country's vulnerable economic condition, the Ukrainian PV market overall has - in recent months - shown a significant growth of PV installation both in terms of capacity as well as in terms of number of installations commissioned.

Still, the existing - and to some extent - the number of installed PV systems in the target countries should not be considered as an absolute indicator of a country's potential, since market maturity or an enabling environment are also meant to play a role. However, the absence of collectively all the above signals in a specific country usually signifies that the current conditions appear far

[1] by a project-specific logic of each potential developer rather than a more consolidated market trend
[2] For example the detached houses rooftop PV development in Ukraine

from being regarded an overall favourable market framework capable of scaling up building- PV solutions in any of the target countries.

In the EU it is often relevant that the so far most successful experiences of building-PVs are connected with a sufficient level of market reform, liberalization and adequate unbundling. The overall energy policy in the EU has equally been based upon the pillars of energy security, competitiveness and environment protection. Under this umbrella the EU energy market reforms ever since the Directive 1992/96/EC have in parallel regarded the need for reducing the negative environmental externalities of the energy sector in conjunction to the need of using cleaner indigenous energy resources. These intertwined policy objectives have been crystallised in the RES directive(s) and climate change commitments and form the basis for the transformation of the Internal Energy Market to an Energy Union[3]. The aforementioned development has catalysed the success of the PV sector in most EU countries. It moreover expected that PV in particular may be a catalyst in consumer empowerment in the new market environment by the broader use of self-consumption (including storage). Ultimately, it is anticipated that the sum of all forces will trigger new innovative business models and electricity modalities in a manner that would lead certain network users to gradually shift from a consumer to a prosumer role.

Contrarily to the above, our assessment on the Eastern Partner countries shows that currently the promotion of PV in buildings represents a relatively limited and somewhat isolated sub-segment of the energy market. Nevertheless, taking good note of the early stages of heavily supported PV technology introduction in the EU, there is no argument that would necessitate the promotion of building PVs only after the energy markets have reached a similar to the EU structure and level of complexity. On the contrary, a favourable support framework may possibly be tailored and embedded to any market structure and condition (i.e. starting point) as long as due care is taken into regard so as to avoid future market distortions. In essence, early stage support frameworks aiming to trigger market uptake are possible to be developed even within a vertically integrated, publicly owned structures, which is then responsible to act as a single buyer of the electricity produced by PVs. For example, a state-led programme can be very appropriate and successful in Azerbaijan in which the energy market structure is still quite far from being liberalised.

These considerations add further methodological complexity in this “EaP countries building-PVs status review” report particularly in respect of countries not being CPs to the Energy Community Treaty. For those countries the estimation of building-PVs market potential and the policy recommendations may be based on two different approaches:

- To consider the adoption of an electricity market structure similar to that of the EU as the prerequisite for PV in buildings policies. In this case the subsequent main recommendation would be to intensify efforts and seek for tailor-made approaches in order accelerate the harmonisation of the targeted countries with the EU acquis;
- To tailor a specific approach for the development of building-PVs. This should require a set of interventions aiming specifically at the promotion of a building-PV favourable framework without any major reform of the electricity sector.

The overall cost considerations are critical for the analysis of market potential and the policy recommendations. PV installation costs have considerably dropped in the last decade (see “Review of EU Experience with Solar PV in buildings” report), making the technology competitive in comparison to other RES and conventional generating alternatives. In most EU MS PV support

[3] Which is further expected to be consolidated by the adoption of the Clean Energy 4 All Europeans package in the next years.

schemes have evolved from a mere feed-in incentive approach to a more complex system of favourable support framework comprising tax incentives, fiscal rebates, obligations and cross incentives between the building and the energy sector, which may be replicated by other countries with limited economic capacity.

The economic dimension is not the only prerequisite for a successful PV development. Whereas it is necessary that the financial viability of a building-PV is ensured, there is still a number of other market characteristics playing a role in the final decision to install a building PV system. The review of experiences and practices in EU countries has served in identifying those conditions affecting the development of building PV applications beyond the economic dimension. It also serves in identifying case studies to develop efficient regulatory provisions as well as administrative and licencing procedures. Overall, one of the key lessons learnt from the EU practices review is that despite any national specificities Directive 2009/28/EC proved to be a quite comprehensive legal instrument. This can be argued on the fact that it considerably helped EU member states to develop and implement a favourable and effective RES policy with a high degree of harmonisation.

The main conditions for a favourable PV in buildings policy coming from EU experiences are:

- Political consensus regarding RES development that is evident by the existence of a national renewable target and a national commitment/plan to achieve the target. The target should also be projected into a verifiable annual RES development trajectory with appropriate monitoring procedures.
- Presence of a clear and accessible licencing and permit procedure with the objective to achieve a “one-stop-shop” approach for the authorisation, connection and operation of RES plants.
- Presence of a non-discriminatory regulation for developing generation capacity and connecting to national distribution and transmission grid.

A key feature of EU building-PVs’ success is the transformation of electricity consumers into potential electricity producers. This has been possible by the adoption of the EU electricity acquis and the detailed secondary regulations development at all subsidiarity level of EU MS. This latest dimension is still not quite developed in the target countries where the relevant stakeholders whether individuals, households, commercial and private companies are still solely appreciated as consumers and are not yet considered as potential electricity producers.

1.2 The structure and contents of the report

This “EaP countries building-PVs status review” report is structured to reflect on “Review of EU Experience with Solar PV in buildings” report outcomes.

Section 2 offers an overview of the target countries. It is structured in three main sub-sections introducing the energy sector of the EaP countries, illustrating the regional policy and regulatory context and the main initiatives and instruments currently defining the variables of the countries’ energy scope. The chapter also provides an overview of the solar potential of each country.

Section 3 provides an overview of the EaP countries current context influencing the development of PV installations. It intends to cover the main market, legal, regulatory and administrative areas which, according to analysis in the “Review of EU Experience with Solar PV in buildings” report are most likely to impact PV development. Most part of the information contained in sub-sections 3.1 and 3.2 derives from a literature review in conjunction to the information contained in the country profile reports. In addition, and where required, information was complemented and verified during the mission of study team experts in the late February/early March 2017.

- Section 3.1 provides an electricity market review with particular reference to the electricity market structure in terms of its institutional setup and status of unbundling. The market structure comprises fundamental information in order for one to understand in which context building-PVs may develop. Although, it is possible to have building-PVs development under any market structure, a good level of unbundling complemented by a robust regulatory framework at all electricity tiers (e.g. regulated Third Part Access) is an indispensably advantageous starting point for the development of RES policies. The market review also encompasses a brief review on the national energy balances in terms of primary energy independence and national electricity generating capacity. Both the above are considered potential drivers for RES/PV policy with relevance to energy security.
- Section 3.2 is an assessment of existing policy targets and commitments with reference to RES/PV development. Whereas for Energy Community members setting mandatory national targets is a requirement stemming from the adoption of Directive 2009/28/CE, this is not necessarily true for the other target countries . The sub-chapter also investigates the existence of a specific legislation for RES/PV development and RES incentive schemes and assesses the consistency with reference to PV technologies.
- Section 3.4 investigates the regulatory dimension and its potential impact on PV development. The presence of a National Regulatory Authority (NRA) is considered a market characteristic with positive impact. In particular, the NRA comprises the key institutional body entrusted to provide a complete regulatory framework which in turn is vital for PV development. The Grid code, connection tariff, net metering mechanism, contracts among parties and other secondary legislation actions are just an example of regulatory tools that are usually introduced and/or administered by NRAs. The existence of a network code is recorded in this review as an indication of the ease of PV integration to the grid. The level of transparency on tariffs, timeline and procedure for connection and regulation of relationships among market players is usually governed by means of the network code. Besides the definition of connection rules regulated third party access has so far in the EU legal context included RES dispatching priority, obligation to purchase RES electricity and other arrangements which are collectively assessed at a country level in section 3.4. Balancing responsibility – though perhaps a currently not developed feature in the EaP countries electricity markets - and the manner it may affect RES profitability is also very briefly observed. Finally, this section identifies the licencing requirements for electricity generation business activity with a view to verify whether this affects PV rooftop installations.
- Section 3.5 provides an analysis of electricity prices at national level and it is structured in two different paragraphs. The first one aims at isolating within the national electricity wholesale price the component referring to generation cost. However, in the current market structure reference wholesale prices it is in most cases impossible to isolate this specific component. This is because analytical reporting on prices is inadequate while they are normally bundled with other charges and levies in each the country's tariff methodology. The generation costs and wholesale price -if valid and broadly available – would have been a reference value to be compared with the estimated Levelised Cost of Electricity (LCOE) of PV installation in the target countries. The second paragraph illustrates final retail price for different customer categories. The retail price can also be considered as a useful indication to assess PV market size by comparing its calculated LCOE with the specific customer category in countries where net-metering option is available. Whereas PV competitiveness may be limited in the generation side (not being competitive with other grid connected generation options) it may be higher in the final

consumers segment according to the overall electricity tariff structure, including taxes, for the different customers' categories.

- Section 3.6 investigates on the existing legislation and policies directly affecting PV and especially PV rooftop sector in case additional to national mainstream RES policy conditions apply.

Section 4 narrows down the analysis into the specific aspects of PV in buildings market and looks at the trends of development in the target countries. It is generally promising that in all countries there are at least some PV experiences to be reported. Nevertheless, the available information and the elaboration of the experiences and performance of the existing installations are still very limited and there is no noticeable literature or research available to the date. The section includes all the available information collected during the deskwork research, including the country reports and consultation with national experts and integrates it inter-alia the information collected during February-March 2017 field missions.

Section 5 reports on barriers found at national level and develop recommendations paying particular attention to the current context of a given country. Whereas the underlying recommendation is in the direction of a higher harmonization of energy markets with the EU acquis, and specifically with reference to the RES legislation and Directive 2009/28/EC, the chapter also tries to offer some tailored recommendations for the non-Energy Community countries group. This is done on the assumption that convergence with the EU energy market in the specific countries will develop in a much slower pace compared to the Energy Community signatory parties and that the current market model will be maintained for a sufficient period in the future.

Chapter 6 provides the gap analysis, country specific conclusions as well as some final remarks.

2 A general overview

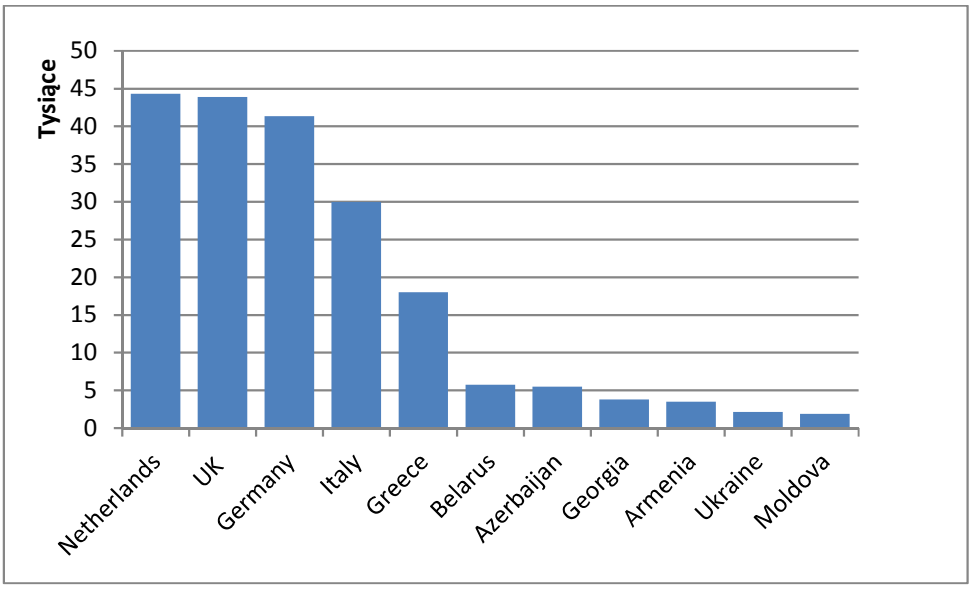
2.1 The target countries

Some fundamental economic and energy indicators of the EaP countries are briefly presented in this section. Distributed generation policies as evident in several EU countries, necessitate leverage of private capital in order to reach a significant market scale. The widespread availability of capital, which in turn may potentially be channelled in the specific segment, is not easily found in the target countries. Hence GDP per capita offers a first rough indicator of building-PVs market potential. Other energy policy indicators, such as energy poverty, energy dependence and per-capita household annual consumption have also been collected to build up national contexts in relation to buildings-PV in development.

A common feature of the six targeted countries is the limited economic potential compared to that of the EU MS where most successful examples of PV deployment have been experienced. The figure below provides a glimpse on this income gap by comparing EaP countries with selected Member States identified as exemplary cases in the "Review of EU Experience with Solar PV in buildings" report.

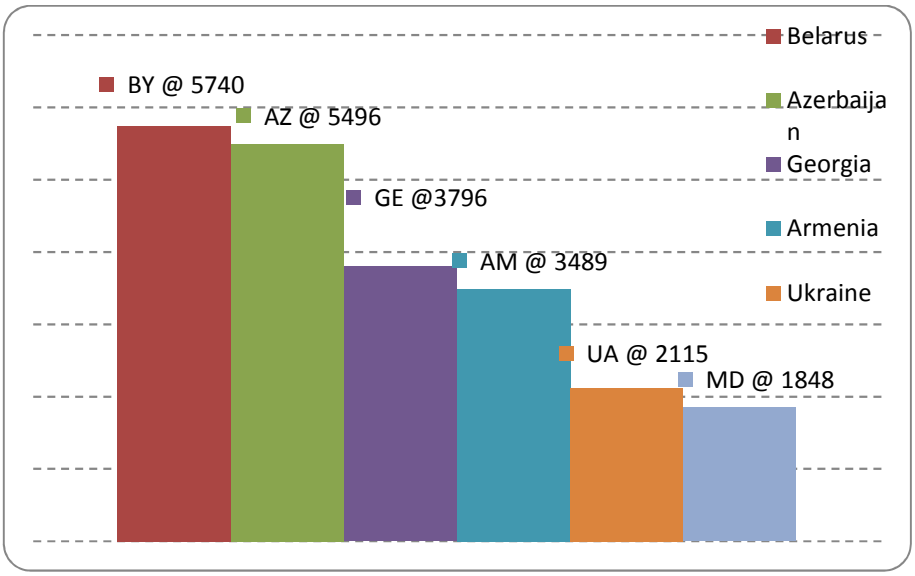
Taking a closer look, significant differences can be observed among the six targeted countries, with Belarus having a GDP per capita nearly 3 times higher compared to that of Moldova and Ukraine. In fact, the above illustration shows that two out of the three signatories of the Energy Community Treaty show the lowest GDP per capita. It is worthwhile to be noted however, that in part Ukraine is in this position due to the recent political situation which led to a steep currency devaluation. On the other hand, the selected indicator (i.e. GDP per capita) also relates with the country's population. In sum, the combination of the current severe financial situation and the size of Ukraine lead to a position which is quite unexpected (compared to its market potential and dynamics) for the country as far as GDP per capita indicator is concerned.

Figure 1 GDP per capita (@ 2015 USD) in reviewed EU MS and the six EaP Countries



Source: World Bank Data

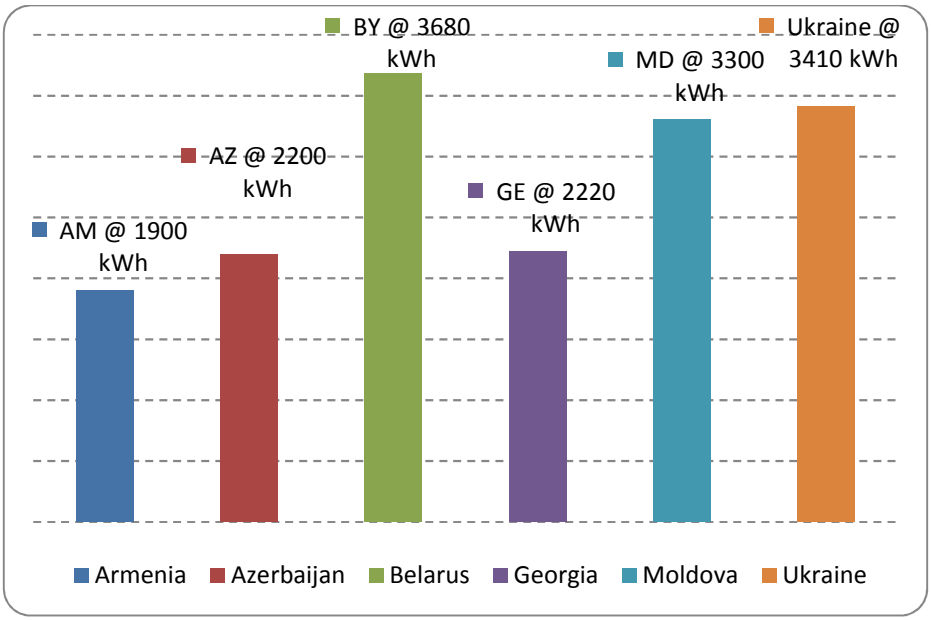
Figure 2 GDP per capita (@ 2015 USD) in the six EaP Countries (Data from The World Bank)



The geopolitical instability in some countries needs also to be taken into account during the assessment study. This may particularly hold true in respect of legal and regulatory framework enforcement but also when it comes to more practical aspects such as equipment or financing availability.

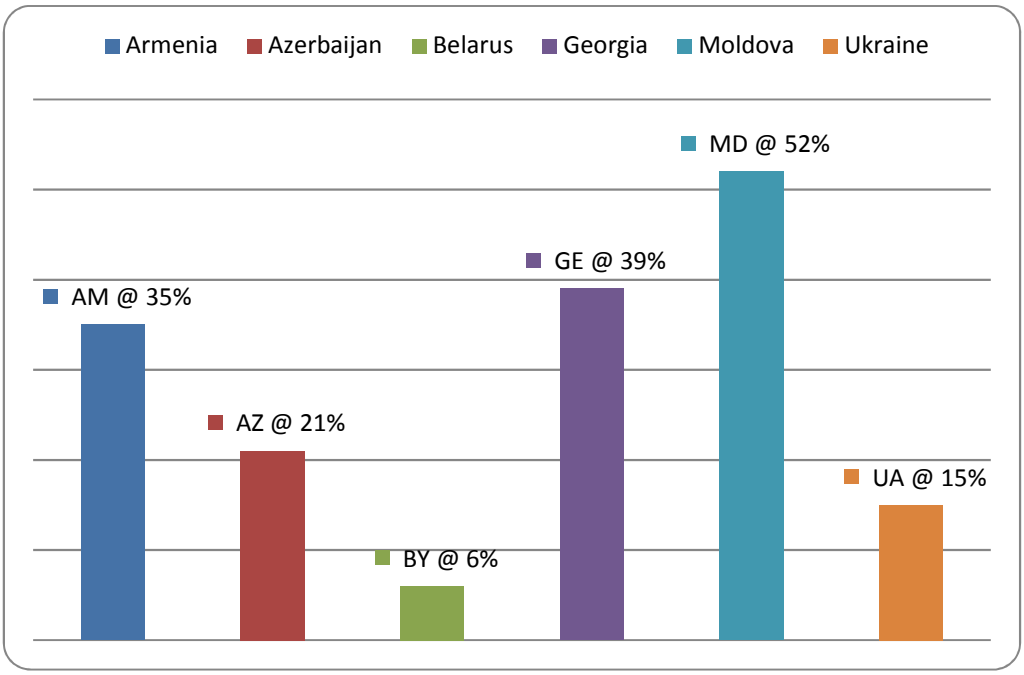
In addition, household electricity consumption data when observed together with the specific GDP data, may offer a quick indication on the level of policy support that may be required for RES development. As per our analysis in "Review of EU Experience with Solar PV in buildings" report, almost all successful PV development experiences in the EU are linked to appropriate incentive schemes which are usually recovered via the final electricity tariffs. It may be argued that, in countries showing high domestic electricity demand (e.g. Belarus, Moldova, Ukraine), the introduction of RES incentive schemes financed by the electricity tariffs (e.g. through a RES surcharge) may not enjoy sufficient political support as they will eventually lead to higher end-user tariffs. This effect may be aggravated especially when the household sector exhibits low income and energy poverty indicators.

Figure 3 Average electricity consumption in the household sector (Data source: IEA Statistics 2014)



The energy poverty index, defined as the share of population spending more than 10% of available income in energy, is an additional important indicator to understand energy market priority in a given context

Figure 4 Energy poverty share in the six EaP Countries (Source: UNECE renewable energy status report 2015)



Another characteristic feature of the development of PV technology in EU countries is that successful building PV policies have often been found to be neither necessarily driven by a high solar potential, nor exclusively dependent on the alignment of the incentive levels the actual natural endowment. A comprehensive and adequate support scheme proved more important than solar potential although it is relatively straightforward to conclude that where the two coincided the market uptake was remarkable and achievable at a lower cost. A more or less similar pattern to the one identified in the EU may roughly be observed in the six Eastern Partner countries where there is often no coincidence between a favourable RES development policy approach and the natural endowment. However, it is fair that this consideration is also weighed against the overall economic indicators in each country and the region as whole. Whereas a high-income country may afford to develop a successful PV policy despite limited solar potential, doing so in a low-income country may reveal a much more challenging policy option compared to other (conventional) alternatives.

Finally, energy net imports also comprise a security of supply-related variable influencing the national development of RES. Although a strong correlation between an energy poor country and its commitment to develop RES is a not necessary condition, the latter may comprise an option for the development of clean indigenous energy resources with a view also to increase security of supply. Table 1below illustrates net energy imports in the Eastern Partner countries. Azerbaijan is a net energy exporting country. Ukraine appears more balanced and its imports account to

some 30% of its energy needs. However, it should be taken into account that in the electricity sector this translates to a strong reliance on coal production, (some 40%), which is expected to face challenging restrictions with the progressive harmonization to EU acquis. This in turn will also affect the energy security of the country. The remainder countries show a high dependence on energy imports ranging from 67% for Armenia to 96% for Moldova. In certain cases, energy dependence is often aggravated by the poor diversification of supply.

Table 1 Energy import dependence of selected countries, 2015 (Data from country profiles and IEA 2012)

	Net Imports of energy in 2015	Generation Mix (IEA, 2012)
Armenia	67%	natural gas 42.3%, hydro 28.9%, nuclear 28.8%
Azerbaijan	-377% (net exporter)	natural gas 89.9%, hydro 7.9%, oil 2.2%
Belarus	86%	natural gas 96.7%, oil 2.6%, biofuels and waste 0.4%, peat 0.1%
Georgia	68%	hydro 74.5%, natural gas 25.5%
Moldova	96%	natural gas 95.1%, hydro 4.6%, oil 0.3%
Ukraine	32%	nuclear 45.4%, coal 40.5%, natural gas 8.1%, hydro 5.3%, oil 0.3%, solar 0.2%, wind 0.1%, biofuels and waste 0.1%

2.2 The regional context

2.2.1 Policy

The European Union recognising the importance of stability, cooperation and development along its borders is following a coherent policy complemented with appropriate instruments. Through the so-called **European Neighbourhood Policy (ENP)**, "the EU works with its southern and eastern neighbours to achieve the closest possible political association and the greatest possible degree of economic integration". This goal builds on common interests and on values — democracy, the rule of law, respect for human rights, and social cohesion. The ENP is a key part of the European Union's foreign policy. In the 2010-11 review of its European Neighbourhood Policy, the EU introduced the **more-for-more principle**: the EU will develop stronger partnerships and offer greater incentives to countries that make more progress towards democratic reform. The ENP is chiefly a bilateral policy between the EU and each partner country; but it is complemented by regional and multilateral cooperation initiatives:

- The Eastern Partnership;
- The Union for the Mediterranean Partnership;
- The Black Sea Synergy[4].

[4]https://eeas.europa.eu/headquarters/headquarters-homepage/330/european-neighbourhood-policy-enp_en

Armenia, Azerbaijan, Belarus, Georgia Moldova and Ukraine – the countries concerned in this study - are all cooperating under the **Eastern Partnership**, which is a joint initiative with the EU. It is based on a commitment to the principles of international law and fundamental values - democracy, the rule of law, human rights and fundamental freedoms. It also encompasses support for a market economy, sustainable development and good governance.

Since 2009, the inaugural year of the Eastern Partnership, the participating countries have showed a different pace of approximation with the EU. As it is described in the European Union External Action Service website, "*the Association Agreements/Deep and Comprehens*ive Free Trade Areas (AA/DCFTAs *), concluded in 2014, have brought the relations between the EU and Georgia, the Republic of Moldova and Ukraine to a new level. These agreements aim at strengthened political association and economic integration. They constitute a plan of reforms that will bring the partner countries closer to the EU by aligning their legislation and standards to those of the EU and improve peoples' lives in a tangible way. A more tailored approach to relations with Armenia, Azerbaijan and Belarus will help ensure the inclusive nature of the Eastern Partnership*[5]*.*"

In terms of its geography the Eastern Partnership area may be distinguished into two regions; the Eastern Europe comprise Belarus, Ukraine and Moldova and Southern Caucasus comprising Georgia, Armenia and Azerbaijan.

Besides the continuous bilateral and multilateral political dialogue in the framework of the Eastern Partnership[6], technical work is structured on four thematic platforms. Among them **Platform 3: Energy Security**, which was established by the Eastern Partnership Summit of May 2009. The current Work Programme of Platform 3 for the period 2014-2017 completes and builds upon the objectives and results of the bilateral Action Plans and Association Agendas. The activities for the period 2016-2017 are defined in the **Revised Work Programme 2014-2017**[7] and continue to aim at:

- approximation of the regulatory framework,
- development of electricity, gas and oil interconnections and diversification of supply,
- stakeholder dialogue in energy efficiency and renewable energy,
- cooperation in establishing and strengthening a regulatory framework in nuclear safety,
- conventional and unconventional oil and gas resources.

As it is characteristically mentioned in the Revised Work Programme 2014-2017 of Platform 3: Energy security there is a "*need and willingness (by Platform 3) to exploit synergies and complementarities with other energy initiatives in the region such as the Energy Community, the Baku Initiative and the Black Sea Synergy*".

2.2.2 Legal framework

In terms of the legal framework that is relevant to the activities of Platform 3: Energy security the "*existing legal frameworks such as the Energy Community Treaty, the Energy Charter Treaty, the relevant provisions of Deep and Comprehensive Free Trade Agreements as well as the EU and international rules and practices in the energy sector*", are referred to in the Revised Work Programme 2014-2017 of Platform 3: Energy security.

[5] https://eeas.europa.eu/headquarters/headquarters-homepage/419/eastern-partnership_en
[6] https://ec.europa.eu/neighbourhood-enlargement/neighbourhood/eastern-partnership_en
[7]https://ec.europa.eu/energy/sites/ener/files/documents/Revised%20Work%20Programme%20Platform%203%202014-2017%20final.pdf

- The Energy Community Treaty in particular provides a comprehensive framework by which signatory parties have agreed a process of approximation of their legal and regulatory frameworks with that of the EU in a number of areas (including, non-exhaustively, energy, environment, competition, infrastructure, etc.).

With their Deep and Comprehensive Free Trade Agreement (DCFTA) Moldova, Ukraine and Georgia have committed themselves to adopting specific pieces of EU legislation in respect of several areas including the energy sector. The DCFTA set a timeframe for the Eastern Partner countries to ensure compliance through the transposition of the relevant directives. In the specific case of the energy sector, the compliance timeframe is conditional on the membership of the specific country to the Energy Community. More specifically, each country is due to follow the compliance timeframe in the DCFTA unless it becomes, within a specified timeframe, a member of the Energy Community and thereby follows the mutually agreed protocol concerning the accession of a country to the Treaty establishing the Energy Community.

Moldova joined the Energy Community in May 2010, Ukraine in February 2011 and Georgia in April 2017 hence the three countries have set their course of compliance with the Energy Community Treaty. Specifically for the EU acquis relevant to renewable energy and the use of renewable energy sources (including PVs) in the built environment, the following directives can - at minimum - be considered relevant:

- Directive 2009/28/EC – commonly referred to as RES Directive[8],
- Directive 2012/27/EU - commonly referred to as EE Directive[9],
- Directive 2010/31/EU - commonly referred to as Energy Performance of Buildings Directive (EPBD)[6].
-

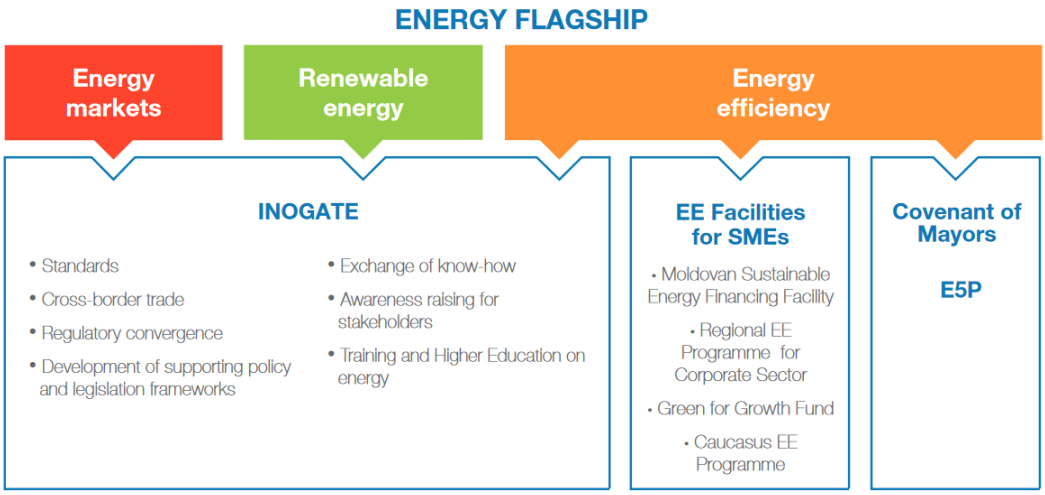
2.2.3 Initiatives and instruments

The key EU financial instrument for cooperation with the Eastern Partnership countries is the so-called **European Neighbourhood Instrument** (ENI) 2014-2020. The "*High Quality Studies to support the Activities under the Eastern Partnership*" (HiQSTEP) project, under which the present study is carried out, is also part of the implementation of the ENI. Besides the ENI, Eastern neighbours also participate in initiatives open to all Neighbourhood countries (Erasmus+, TAIEX, SIGMA and the Neighbourhood Investment Facility), and in cross-border cooperation programmes. In addition, Moldova, Ukraine and Georgia are also eligible to participate in the Horizon 2020 programme and they can also exchange experiences and coordinate efforts through the panel on "Research and innovation (Horizon 2020)" of Eastern Partnership Platform 4.

Specifically, in respect of the cooperation in the energy sector, different instruments have been engaged in the provision of technical assistance and the promotion of investments (including in energy efficiency, which so far comprises the principal area of intervention). The illustration below Figure 5 presents the main thematic areas on which key initiatives have been engaged.

[8]https://www.energy-community.org/portal/page/portal/ENC_HOME/AREAS_OF_WORK/Obligations/Renewable_Energy
[9]https://www.energy-community.org/portal/page/portal/ENC_HOME/AREAS_OF_WORK/Obligations/Energy_Efficiency

Figure 5 Energy Flagship Initiative main thematic areas[10]



At municipal level regional support is provided through the Covenant of Mayors East and Sustainable Urban Demonstration Energy projects (SUDEP), as well as through the reinforcement of the Eastern Europe Energy Efficiency and Environmental Partnership (E5P). These activities are also part of the newly created Sustainable Municipal Development Flagship Initiative.

The Neighbourhood Investment Facility (NIF) works complementary with International Financial Institutions (IFIs) in order to stimulate energy efficiency in the private sector and SMEs through sustainable energy financing facilities. In addition, together with IFIs and bilateral donor institutions NIF participates in blending financing aiming at the development and rehabilitation of key energy infrastructure.

Last but not least, the INOGATE[11] programme has worked extensively with the national authorities in the Eastern Partner countries since its completion in end of April 2016. Its successor programme EU4Energy[12] – and in particularly its Component 3 which is implemented by the Energy Community Secretariat and the Energy Charter Secretariat – is designed to build on the achieved outcomes of INOGATE and will carry on from May 2016 onwards.

2.3 Technology overview & status quo

2.3.1 A regional overview

While the potential for the development of PV systems may be considered significant, at least - as shown in Table 2 - in the southern countries, the PV market is not adequately developed in the Eastern Partner countries yet. There are a number of reasons for this, the main ones being the lack of policies and commitment to RES target implementation, subsidised end user electricity tariffs, lack of proper financing sources and low public awareness. However, the market dynamics considerably differ between countries with Ukraine having already introduced a comprehensive support mechanism for building PV; Moldova being the most advanced country concerning the legal and regulatory measures towards the implementation of the EU acquis on RES

[10]https://ec.europa.eu/neighbourhood-enlargement/sites/near/files/neighbourhood/pdf/riga/20150518_flagship_energy.pdf
[11] http://www.inogate.org/
[12] https://www.energy-community.org/portal/page/portal/ENC_HOME/AREAS_OF_WORK/EU4Energy

development; and Georgia having recently joined the Energy Community. Other Eastern Partner countries such as Armenia and to a lesser extend Belarus show some spontaneous signals for building-PV uptake while in Azerbaijan there an increased interest may be observed.

Table 2 Technical potential for solar PV in the Eastern Partner countries

	Average annual solar irradiation (kWh/m²)	Technical potential for solar PV (GW)[13]	Average [14] specific PV output (kWh/kWp)
Armenia	1500-1900[15]	39.7	1450 – 1600
Azerbaijan	1600-2000[16]	115.2	ca. 1250
Belarus	~1300[17]	283	850 – 1100
Georgia	1550[18]	96.9	ca. 1200
Moldova	1280-1370[19]	4.65[20]	1200 – 1400
Ukraine	1070-1400[21]	807.5	1000 - 1200

As it is also discussed in the detailed countries analyses below–some countries in the region still lack specific RES targets on electricity. However even the remaining four countries are lagging behind the targeted share, based on the current status as it is summarised on Table 3 below.

Table 3 Current and targeted share of RES in the Eastern Partner countries (Source: country profiles)

	On Final Energy Consumption		On Electricity Consumption	
	Current	**Target**	**Current**	**Target**
Armenia	7%	NA	11% (2012)	21% (2020)
Azerbaijan	2%	9.7% (2020)	<1%	20% (2020)
Belarus	5%	6% (2020)	1%[22]	NA
Georgia	NA	NA	<1%	NA
Moldova	11.9% (2009)	17% (2020)	2% (2015)	10% (2020)
Ukraine	4.9% (2015)	11% (2020)	7.1% (2009)	11% (2020)

[13] UNDP, Renewable Energy Snapshot Country Reports
[14] Based on own calculations presented in Component 3 report and referring to flat roofs and optimal tilt/orientation
[15] Tamara Babayan, RES in Armenia, R2E2.
[16] Mammadov F, Yearly Average Maps of Solar Radiation in Azerbaijan, Energy and Power 2013, 3(4): 44-50
[17] Based on a 150W/m² average annual irradiation according to ENER2i project country reports on RES potential https://ener2i.eu/
[18] ENER2i project country report on RES potential https://ener2i.eu/
[19] According to Renewable energy feasibility study, 2002 (Energie regenerabilă Studiu de fezabilitate Chisinau 2002), elaborated and edited under the frame of UNDP Moldova MOL 97/G31. Climate change: Promotion of priority activity (Phase II): Implemented by the Ministry of Ecology, Construction and Territory Development and financially supported by GEF (Global Environment Fund).
[20] According to IRENA study Cost-competitive renewable power generation: Potential across South East Europe, January 2017: http://www.irena.org/DocumentDownloads/Publications/IRENA_Cost-competitive_power_potential_SEE_2017.pdf
[21] IRENA (2015), REmap 2030 Renewable Energy Prospects for Ukraine. IRENA, Abu Dhabi. www.irena.org/remap
[22] Estimates from IEA statistics

In Table 4 below installed capacity cost data[23] (in €/kWp) on building-PV systems are presented according to three different sizes.

Table 4 Estimated cost of rooftop PV systems according to system size €/kW (Source: country profiles)

	3kW		20kW		100kW	
	min	**max**	**min**	**max**	**min**	**max**
Armenia						
Azerbaijan	n/a	n/a	n/a	n/a	2400	3200
Belarus	1553	2196	1296	1604	1296	1326
Georgia						
Moldova[24]	1000	1396	1100	1313	1000	1376
Ukraine	1200	1600	1000	1200	800	1000

Evidently, there is considerable variation both in terms of the cost range in each country but also generally at a regional level. Information on installed PV systems in the countries is scarce. Perhaps this provides an explanation on the cost situation described just above. Some of the systems reported have emerged using grant funds (in most cases complemented by loans provided through IFI-led credit lines). Others have most probably just spontaneously emerged by energy users with an increased environmental consciousness and higher disposable income. A brief overview of the current status for each country is provided hereafter.

2.3.2 Ukraine

RES represent about 4% of primary energy supply in Ukraine (3.9% and 4.9% in 2014, 2015 respectively)[25]. Nearly 57% of total RES capacity, approximately 482 MW, is solar PVs. According to the NREAP of Ukraine[26] there is a target of installing 2300 MW of solar PV systems by 2020.

The vast majority of the existing PV facilities, 52 plants with a bit more than 482 MW cumulative capacity, are ground mounted systems owned by private companies. As of the end of 2016 there were 19 non-household building-PV systems with a total capacity of 1,006 kW, 14 of which are bellow 100kW.

A significant share of the PV systems, 51 MW of ground mounted systems and 996kW of building-PVs, were installed within 2016 indicating promising market dynamics. Indeed, there is currently a rapid increase of the number of companies offering complete package deals both for household and other commercial/municipal buildings. Currently, according to market estimates the FiT support, which is indexed to the Euro, provides a 6-8 years payback period for small scale building-PV systems.

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[23] It is worthwhile to be mentioned that majority of data in this section originate from the national country experts' reports and thereby may not considered as a prejudice in respect of the figures that may finally be considered in the financial analysis of Component 4 & 5 reports.

[24] The estimations are based on data collected from: http://biomasa.md/wp-content/uploads/2016/09/11-Revista-Moldova-Eco-Energetica-editia-2013-1.pdf, Revista-Moldova-Eco-Energetica-editia-2014-1.pdf; Revista-Moldova-Eco-Energetica-editia-III-2015.compressed.pdf and other information collected from Internet

[25] Report on Promotion of the Use of Energy from Renewable Sources and Consumption in Ukraine in 2014-2015

[26] National Renewable Energy Action Plan up to 2020 https://www.energy-community.org/portal/page/portal/ENC_HOME/DOCS/3430146/067A653E3AF24F62E053C92FA8C06D31.PDF

2.3.3 Moldova

The PV sector in Moldova is still not quite developed and only a small number of 27 medium and small scales, privately owned installations exist, with a total installed capacity of 1,824 kW. All these installations deliver electricity to the electricity networks at tariffs approved by the energy regulatory authority - ANRE. Apart from these PV plants there are also a few distributed systems for self-consumption. Moldova's RES policy is primarily focused on the promotion of the use of solar heating rather than solar PV systems[27]. At the same time, it is necessary to emphasise that the Low Emissions Developments Strategy and the Action Plan for its implementation approved by the Government of Moldova[28] at the end of 2016 stipulates that PV system will also be promoted.

2.3.4 Georgia

The PV market in Georgia is limited and there are no data on installed systems. Current electricity prices and lack of relevant policy hinder the development of the PVs and only a small number of off-grid, distributed systems exist. Consequently, there is a limited number of companies that are active in the sector. Due to their cost and low payback periods most of the projects are financed with grants from international donors, or government organizations interested in promoting RES in remote areas[29].

However, after the introduction of a Net Metering regulation in the Country, 8 new micro PV power plants were registered in 2016, with total 153 KW installed capacity[30].

2.3.5 Armenia

The PV sector in Armenia is also still not quite developed, with only a limited number of small scale installations, whose total capacity does not exceed 500KW. However, after the initiation of the FiT support scheme for projects up to 1MW in December 2016, a number of installations with a capacity of around 2MW are in progress, while another 5MW of capacity are also expected to be developed within 2017. Moreover, the sector is expected to grow more after the establishment of the "Scaling Up Renewable Energy Program" (SREP) that will facilitate the development of utility scale PV projects with overall capacity of 100 MW within 2018.

In addition, the net metering scheme for solar power plants that has been adopted in December 2015 resulted in the installation of around 10 rooftop systems the capacity of which does not exceed 10kWp.

2.3.6 Azerbaijan

In total only 22 PV systems exist in Azerbaijan with total capacity of 34.3 MW including both large scale facilities and small-scale building-PVs. The major obstacle for developing the PV sector is the generation cost that is still too high to be competitive against the low electricity tariffs in the country.

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[27] National Renewable Energy Action Plan of the Republic of Moldova for 2013-2020, https://www.energy-community.org/pls/portal/docs/3044025.PDF

[28] Resolution of the Government of Moldova No 1470 of December 30, 2016, www.justice.md

[29] An example of such a program for renewable energy and energy efficiency is "Energy Credit", providing low interest loans for households and businesses from EBRD with partnership of Georgian commercial banks.

[30] Georgian National Energy and Water Supply Commission Annual Report 2017, http://gnerc.org/files/wliuri%20angariSi/ANNUAL%20REPORT%202016_opt.pdf

At the same time a plant producing solar PV modules has been in operation since 2012. The AzGunTex Solar Panel Plant LLC in Sumgait city initially had an annual production capacity of 25 MW, which from 2015 was doubled after the installation of a second production line.

2.3.7 Belarus

By the end of 2015 only 29, mostly privately owned, PV systems with a total capacity of 11,507 kW were installed in Belarus. However, based on concluded investment agreements under the quota implementation some 30MW are expected to be installed in the period 2016-2018.

3 Detailed Eastern Partner Countries situation review

3.1 Electricity market

The "Review of EU Experience with Solar PV in buildings" report in the frame of this project highlighted the importance of the overall market context for the development of building-PVs. With the technology being nowadays mature enough, the importance of the market dynamics, which affect the economic viability of building-PV deployment and identify the right business models and possibly the necessary reforms, becomes more important. Indigenous energy sources availability of a given country is an important indicator for favourable RES policies. Countries facing energy scarcity challenges often present the tendency to promote RES sources as an energy security policy and under national budget consideration. This may be the case of Moldova and Belarus. On the opposite site countries relying on indigenous sources of energy, including nuclear in the electricity sector, usually show lower electricity prices and less determined policies to promote renewable. This may be the case of Ukraine, where promotion of renewable is mostly driven by Energy Community commitments and CO2 reduction targets – specifically the adoption of 2009/28/EC directive and Paris Agreement - and rather by energy scarcity concerns since the Ukrainian electricity market relies mainly on coal and nuclear generation. As an exemption to the above logic, Azerbaijan, which is rich in fossil fuel reserves, also seems to pursue a RES favourable policy. In respect of PV technology in particular, the high solar potential is recognised as an opportunity in the overall policy objectives aiming at reducing domestic natural gas consumption in view of exporting larger quantities. On the contrary, Georgia, relying mostly on hydropower in the electricity sector is lagging behind the development of a favourable RES policy a fact that is anticipated to change with its accession to the Energy Community.

A brief overview of the electricity market status quo in each EaP country under investigation is presented below on Table 5, based on the country profiles developed for this study in conjunction to brief review of the most recent data available by publishable sources.

Table 5 Overview of the status of electricity markets in the EPCs

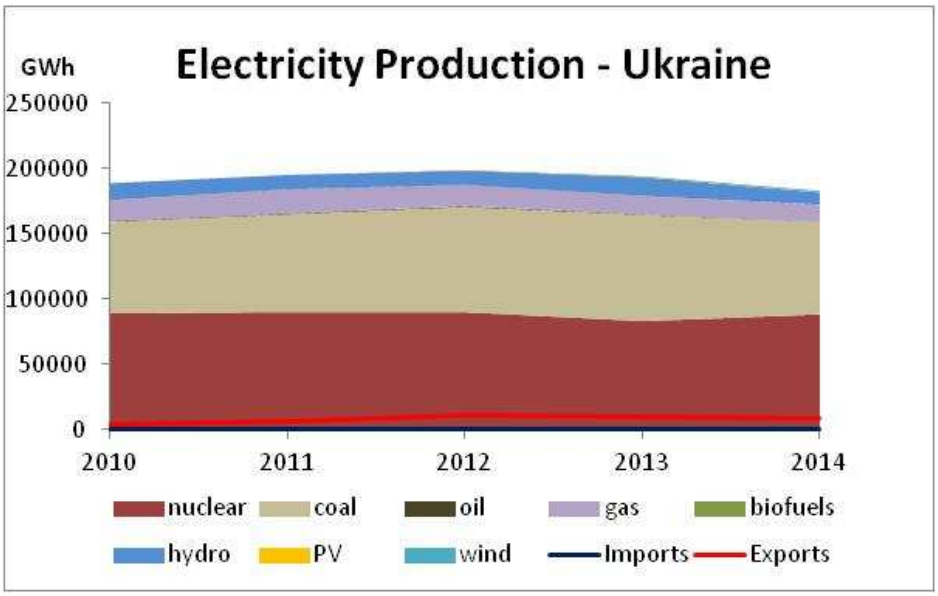
Country	Adoption of 3rd energy package	Import Dependency			Unbundling	Liberalization
		primary energy		Electricity		Generation/ Retail
AM	No obligation	67% all fossil quota	No, it is an exporting country	Yes	yes	n/a
AZ	No obligation	Net exporter - 377%	no	In progress	No with little exceptions	No

BY	No obligation	86% from Russia	8.3%	No	No with little exceptions	No
GE	EnC accession protocol refers to 2019	68%	4% Seasonal need to import	Yes	Yes 60% of capacity privately owned	Yes. A very limited number of eligible customers exist.
MD	Yes (implementation in progress)	86.4%, natural gas mainly from Russia	80%	Yes	Yes	Yes. All final customers are eligible.
UA	Yes (implementation in progress)	32% but strongly reliant on coal as national source	no	Yes	Yes but 73% still state owned	Yes. A limited number of eligible customers exist.

3.1.1 Ukraine

Ukraine is by far the larger country of the six Eastern Partner countries under investigation and its electricity generation mix is one of the most diversified in the region. Electricity generation is produced from various sources the main ones being nuclear (~48%), coal (39%) and natural gas (7%). Figure 6 shows the electricity production be fuel type for the period 2010-2014.

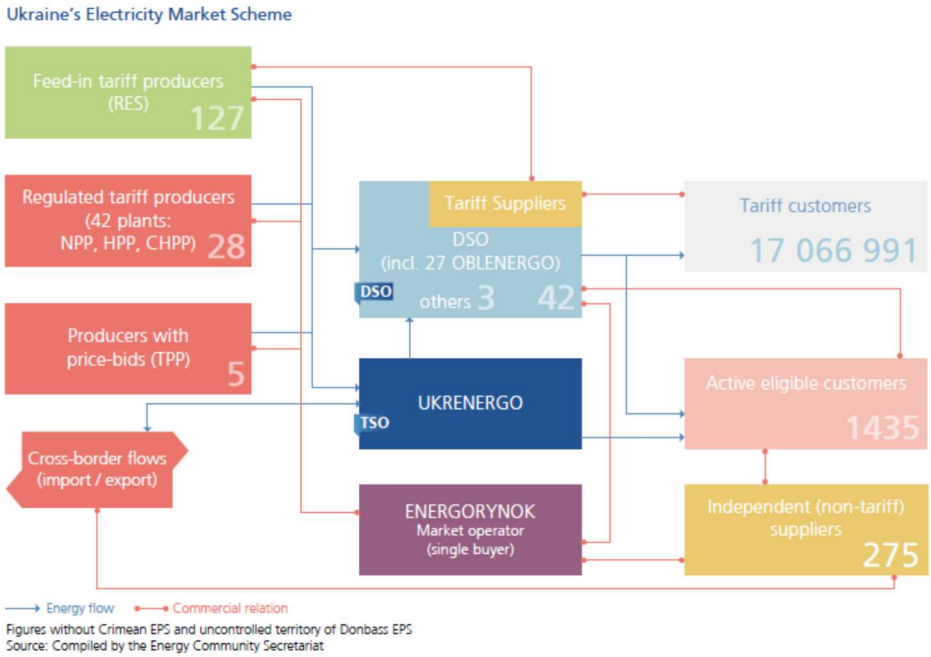
Figure 6 Electricity production in Ukraine (Data form IEA)



Consumption of electricity has been declining during the past years driven by reductions in the industrial (-17%) and transport sectors (-8%), due to political and economic reasons. The electricity market in Ukraine is currently based on the single buyer model under regulated prices and has not changed significantly during the recent past, despite many efforts towards market opening. The recently adopted electricity law transposing the 3rd Energy Package foresees the abolishment of the existing model and the introduction of bilateral trading, and the establishment

of day ahead and balancing markets, along with the phase out of regulated prices on the generation side.

Figure 7 The structure of electricity market in Ukraine (Source: Energy Community[31])



Total installed generation capacity exceeds 54GW and is mostly (ca. 73%) owned by the State. Producers participate in a mandatory pool wholesale market operated by the Market Operator (Energorynok). However, only five of the producers are participating with price-bids while the rest are participating with regulated tariffs. The Market Operator acts as the single buyer and only producers with installed capacity under 20 MW may sell directly to end customers. There is a single TSO (NEC Ukrenergo), whose unbundling is still pending. At the same time, there are 42 DSOs, 27 guaranteed suppliers selling electricity at regulated tariffs and 275 independent suppliers selling electricity at unregulated tariffs. However, only a limited number of eligible consumers exists so far with household consumers still being legally non-eligible.

3.1.2 Moldova

Moldova has limited generation capacity and is strongly dependent on imports for its electricity supply. In 2015 imports accounted for 81% of total electricity supply, the rest being generated from natural gas (17.5%), large HPPs (1.2%) and RES (biogas, PV and wind). Electricity consumption shows a modest but steady growth of 2% p.a. in the period 2010-2015, mainly driven by the industrial and commercial sectors.

Moldova's independent regulatory authority (ANRE) has been established among the first in the region. The country has recently adopted most of the Third Energy Package in its legislation moving towards a market-oriented electricity sector. Generation, transmission and distribution services have been legally unbundled. A single transmission company (Moldelectrica) operates in Moldova and is responsible for transmission, dispatching and balancing, including imports and exports operations. There are three distribution companies, two of which are state owned, and two universal service suppliers, of which one is state owned.

[31] https://www.energy-community.org/portal/page/portal/ENC_HOME/AREAS_OF_WORK/Implementation/IR2016

Figure 8 Electricity production in Moldova (Data: ANRE activities reports 2013-2015[32])

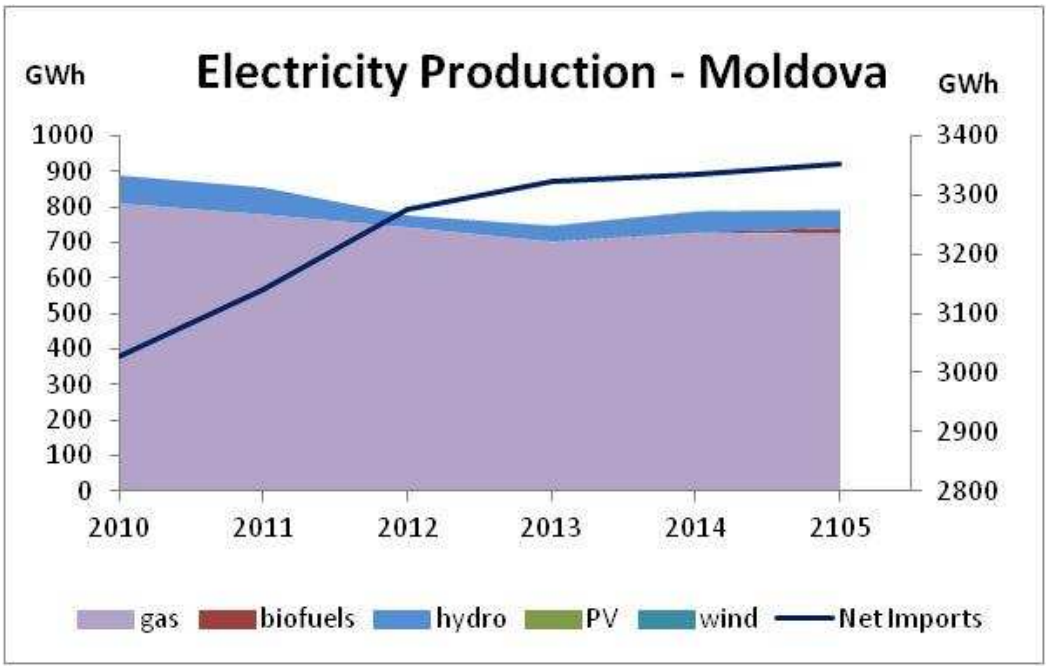
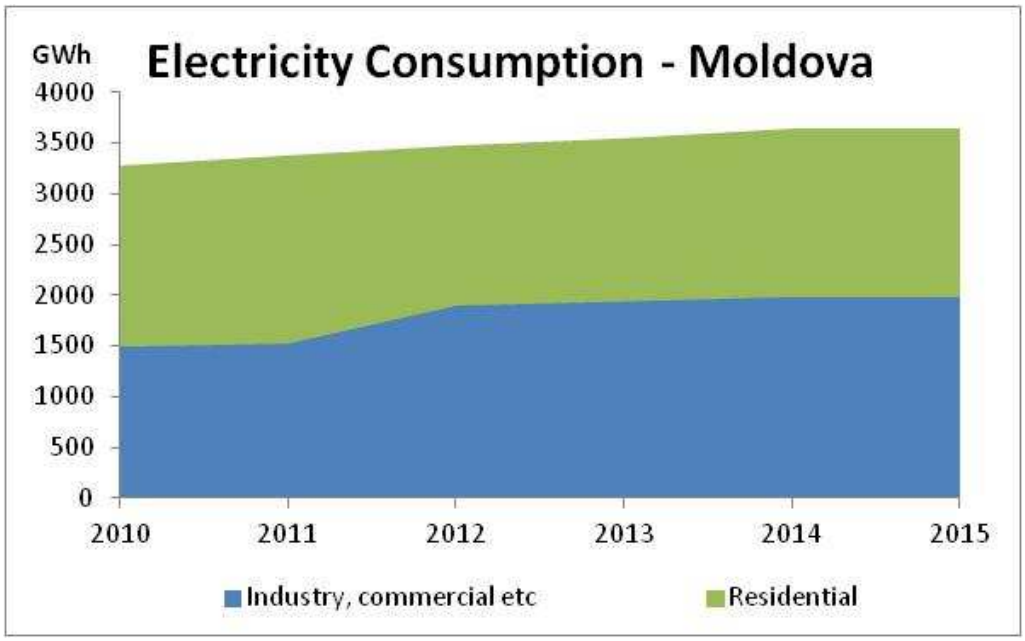


Figure 9 Electricity consumption in Moldova (Data: Energy Community Implementation Reports 2012-2016[33])

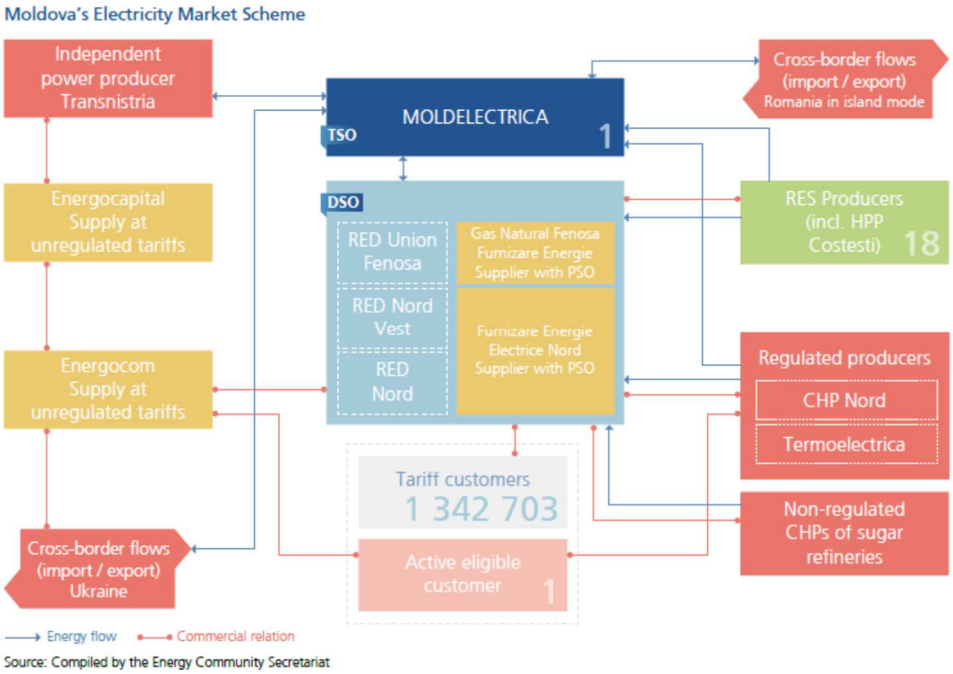


Electricity generation companies are divided between producers which have licences issued by ANRE and producers which are not licensed but the prices for delivered electricity are approved by ANRE (Electricity producers from RES fall within this category). Producers for which ANRE do not approve prices may sell electricity to suppliers at non-regulated prices. However, only one

[32] www.anre.md
[33] https://www.energy-community.org/portal/page/portal/ENC_HOME/AREAS_OF_WORK/Implementation/IR2016

active eligible consumer (a cement company) acquires electricity through freely negotiated bilateral contracts. Figure 10 below presents the structure of the electricity market in Moldova.

Figure 10 Electricity market structure in Moldova (Source: Energy Community, Implementation report 2016)



Source: Compiled by the Energy Community Secretariat

3.1.3 Georgia

Georgia has a considerable hydropower resources' and currently hydropower accounts for nearly 90% of its electricity generation with the rest being produced from natural gas imported from Azerbaijan. Electricity demand has grown rapidly at a rate of 6% p.a. reaching 11 TWh in 2016. The total installed generation capacity is 4106 MW, 2226 MW of which are large HPPs, 934 MW run-of-river HPPs and 925 MW thermal power plants. In November 2016 the first large wind power plant with 20 MW installed capacity started its operation. In order to account for the growth in demand an ambitious capacity expansion plan has been envisaged with new HPPs, wind and TPPs including coal units. It is worth noticing that the power sector of Georgia is characterized by seasonality in generation-consumption; high water inflow in summer generates excessive electricity for exports, and in winter high consumption demand and low inflow increases the need of imports.

As part of the Association Agreement with the EU (signed in June 2014, ratified by Georgian Parliament in April 2016) and the joining of the Energy Community (full member as of April 2017), Georgia is committed to introduce reforms towards the market liberalization. Currently the electricity market in Georgia is partly deregulated and assets are mostly owned by private investors; nearly 60% of generation is privately owned.

Figure 11 Electricity production in Georgia (Data for 2010-2014 IEA; for 2015-2017, ESCO)[34]

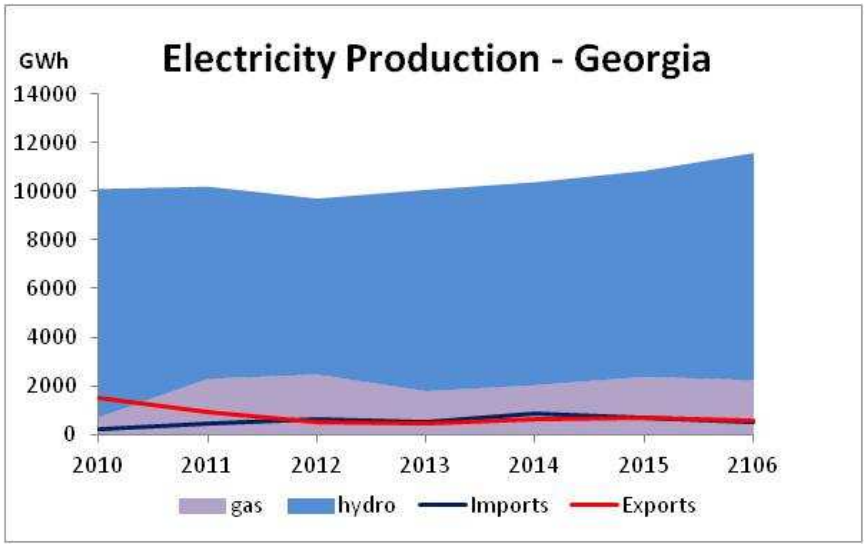
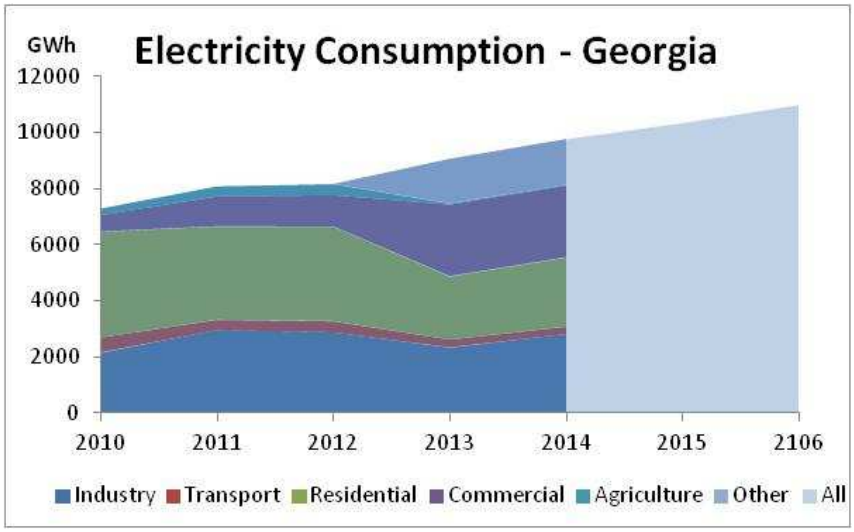


Figure 12 Electricity consumption in Georgia (Data for 2010-2014 IEA; for 2016-2015, ESCO, GNERC, Geostat)[35]



The organization of the electricity market in Georgia is described in Figure 13 below. The market is regulated by the Georgian National Energy and Water Regulatory Commission (GNERC). Electricity wholesale trade is carried out through bilateral power purchase agreements. The Electricity System Commercial Operator (ESCO) is responsible for the trade of balancing electricity and the purchase of guaranteed capacity both through Standard Provision Agreements, while it also forms medium and long-term import and export contracts. The Georgian State Electrosystem (GSE) is the main transmission company and it responsible for dispatching services and cross-border flows coordination. There are also two other transmission companies, Energotrans (a GSE company) and Saqrusenergo, with local transmission operation responsibilities. There are also three independent, privately owned distribution companies acting also as retail electricity suppliers to end-users. The distribution companies and the eligible final consumers[36] are free to negotiate direct purchase contracts with generators as well as

[34] http://esco.ge/en/energobalansi/by-year-1/2017-energy-balance

[35] Georgian Energy and Water Supply Regulatory Commission Annual Report 2016, http://gnerc.org/en/public-information/gazi/tsliuri-angarishi, http://geostat.ge/index.php?action=page&p_id=1895&lang=eng

[36] Consumers which are supplied from 35 kV grid and above will become eligible, and they will be registered as “Direct Consumers” from May 1, 2018. This way it is expected that the total number of eligible customers will be increased from 7 to 56 to that date .

transmission contracts with the TSOs. All direct agreements need mandatory registration with the Dispatch Licensee (GSE), who verifies compatibility of the agreement and Market Rules, satisfying certain conditions of the system. Figure 14 below shows the relationship and agreements signed between market participants.

Figure 13 Organisation of the electricity market in Georgia (Source: GNERC, 2015)

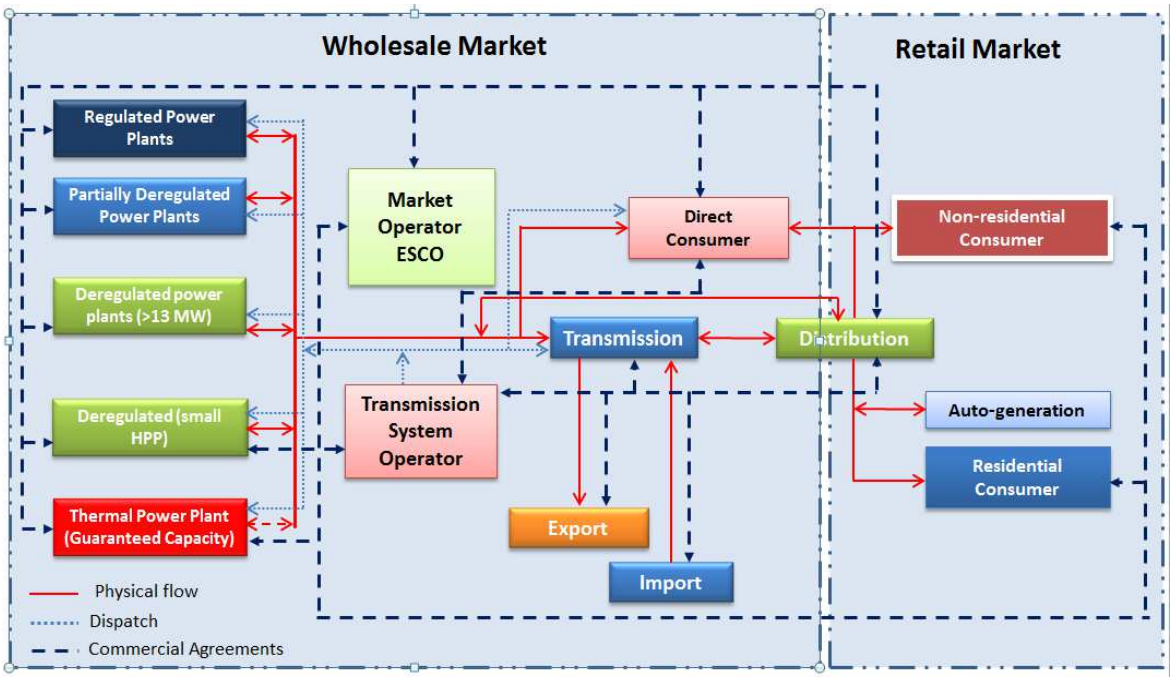
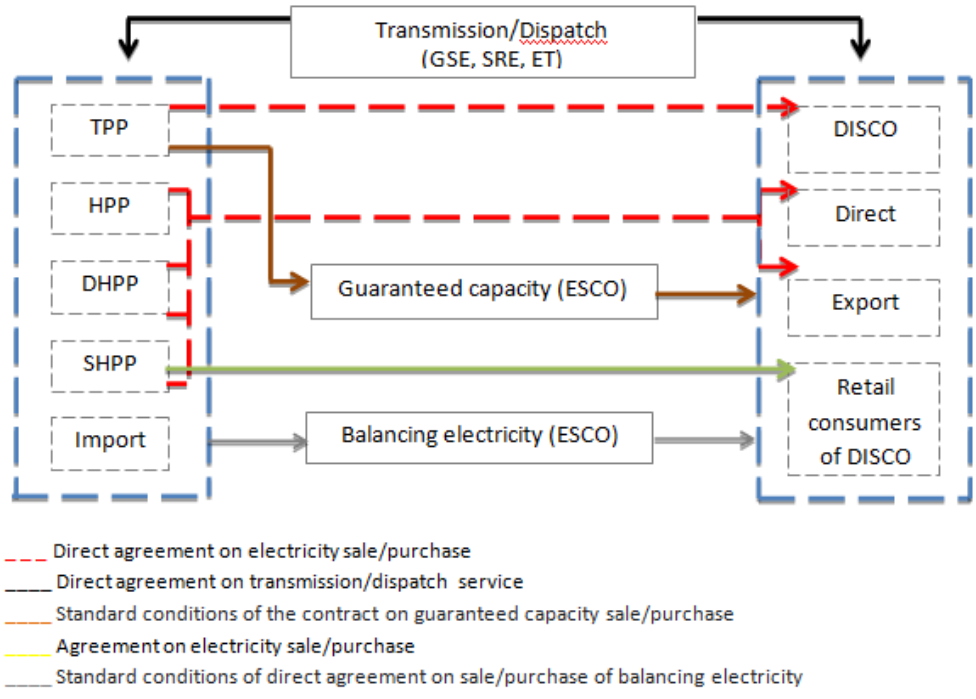


Figure 14 Wholesale market participants and agreements in Georgia

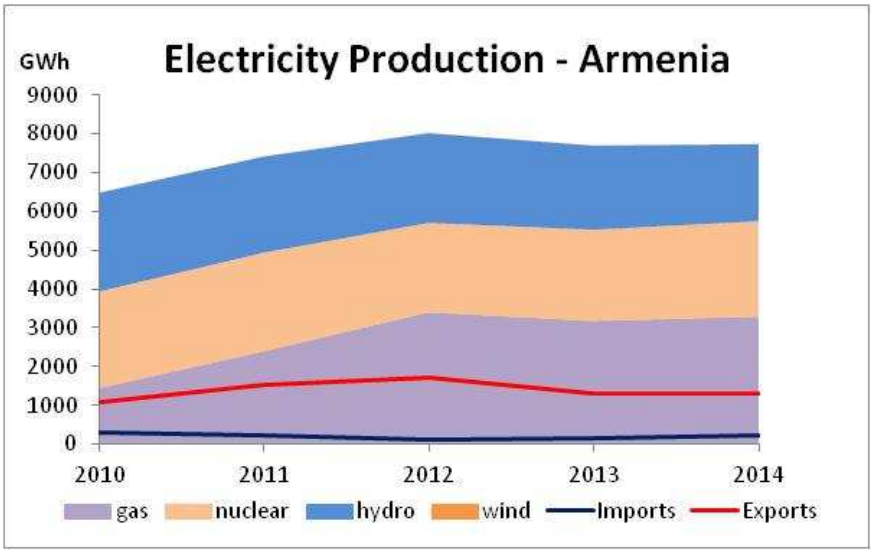


3.1.4 Armenia

With no indigenous fossil fuel resources Armenia is an importer of natural gas and oil from Russia (primarily) and Iran. On the other hand, Armenia is currently a net exporter of electricity to its neighbouring countries, due to the significant capacity of electricity generation, that comprises one nuclear plant (815MW of which half are available), nine large hydro power plants and a small

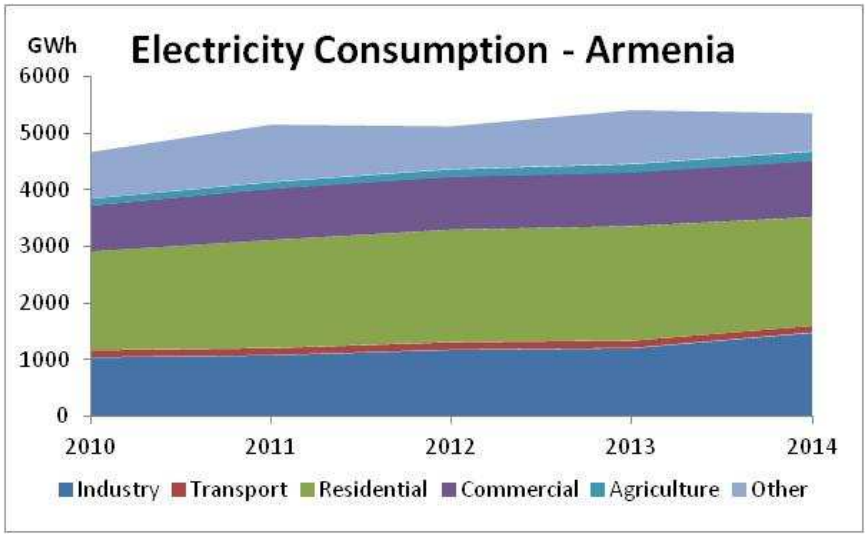
number of RES mainly small hydro plants and wind. Figure 15below shows the production of electricity from different sources as well as the imports and exports.

Figure 15 Electricity production in Armenia (Data from IEA)



Electricity demand has increased by nearly 3% p.a. in the period 2010-2014 reaching 5,3 TWh. The main drivers for this growth were the industrial and agriculture sector with 9% and 8% annual growth rates[37] respectively. Figure 16 below shows the development of electricity consumption by sector.

Figure 16 Electricity consumption in Armenia by sector (Data from IEA)

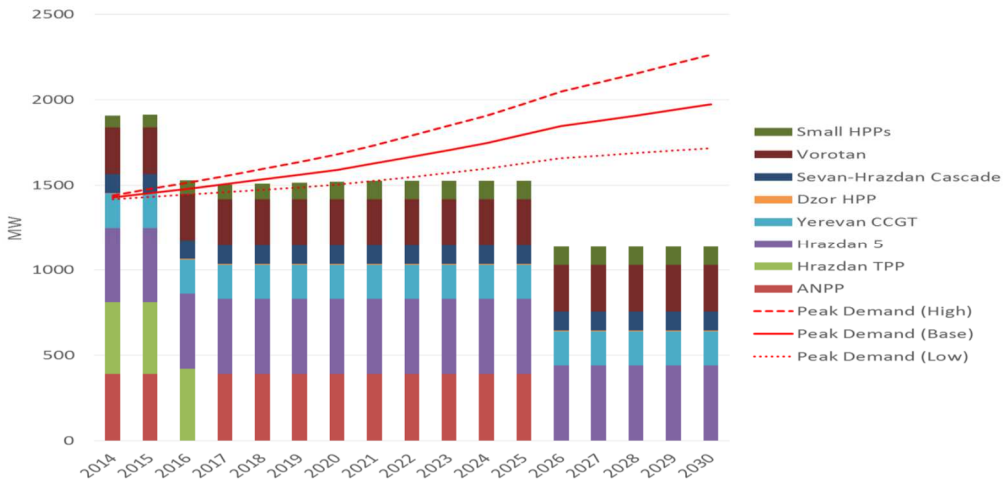


According to the Investment Plan report for the Scaling Up Renewable Energy Program (SREP)[38], Armenia might face deficit in power generation in the future depending on the consumption growth rates, due to the ageing generation fleet and the consequent withdrawals of units.

[37] Although some of this growth might be attributed to improvements in statistical representation as for the same period the "other" sector showed a 19% decrease.

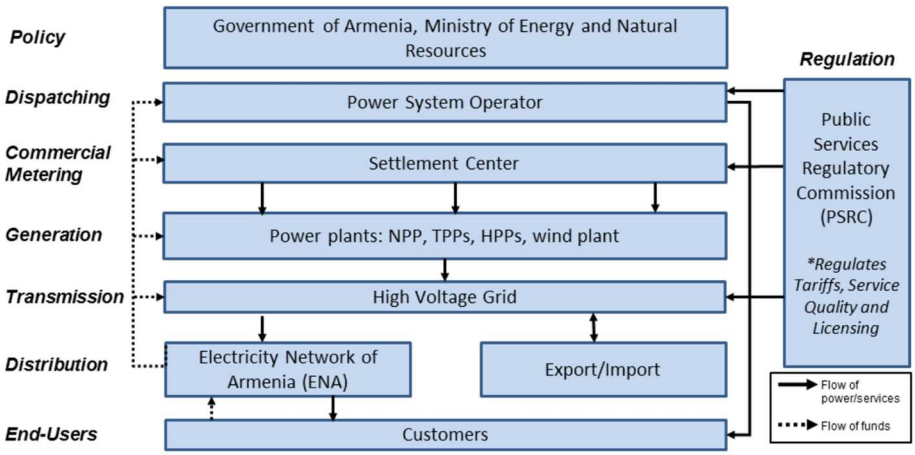
[38] Republic of Armenia, *Scaling Up Renewable Energy Program- Investment Plan for Armenia,* April 2014

Figure 17 Forecast Gap between Installed Capacity and Winter Peak Demand (Source: RoA, SREP Investment Plan, 2014)



The institutional structure of the electricity market in Armenia is shown in Figure 18 below. The market is regulated by the Public Service Regulatory Commission (PSRC). Unbundling between transmission, distribution and (publicly owned) generation activities is already in place[39]. A single state-owned system operator exists that is responsible for the dispatching. The transmission system operator is also state owned, while the single distribution company that is also the exclusive supplier of electricity to end-users is a private company. There are nine major generation companies, both state owned and private. New generation capacity is normally auctioned through open tenders. The market is based on a "single buyer" model with regulated tariffs for generation, transmission and distribution[40].

Figure 18 Institutional structure of the Armenian electricity market (Source: RoA, SREP Investment Plan, 2014



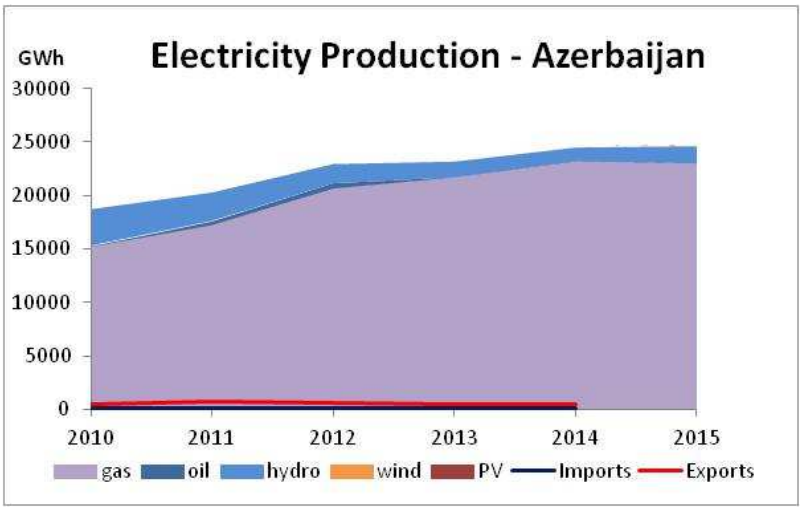
3.1.5 Azerbaijan

Azerbaijan is rich in oil and natural gas; whose exports form the basis of the country's economy. More than 93% of its electricity is produced from natural gas, the rest coming mainly from large HPPs, while a small amount is being equally produced from PVs and wind.

[39] Albeit not in the exact sense of the Third Energy Package since there is no relevant responsibility undertaken by the Republic of Armenia

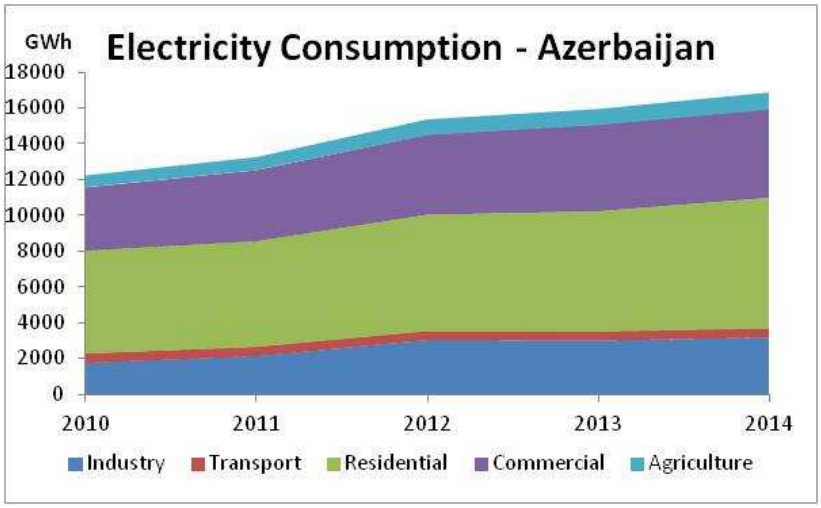
[40] RoA,2014

Figure 19 Electricity production in Azerbaijan (Data for 2010-2014 from IEA, for 2015 from *State Statistical Committee*[41])



Electricity consumption is rapidly growing aver the last years and reached nearly 17TWh in 2014, mainly driven by the industrial sector whose consumption increased at a pace of 16% pa over the period 2010-2014.

Figure 20 Electricity consumption in Azerbaijan (Data from IEA)



The opening of the electricity market is part of the energy strategy of Azerbaijan in an attempt to attract investments for its ageing generation fleet and electricity network and to reduce state subsidies[42,43]. In February 2015 the first step was made with the unbundling of the vertical integrated state-owned energy company into two legally separated entities; one responsible for the generation and transmission of electricity (Azerenerji JSC) and one responsible for distribution and supply (Azerishig JSC). However, as of today no private undertaking is active in the power sector apart from a few RES producers and some self-producers[44].

[41] *State Statistical Committee, www.stat.gov.az*

[42] State Program for the Development of the Fuel and Energy Sector, 2005–2015

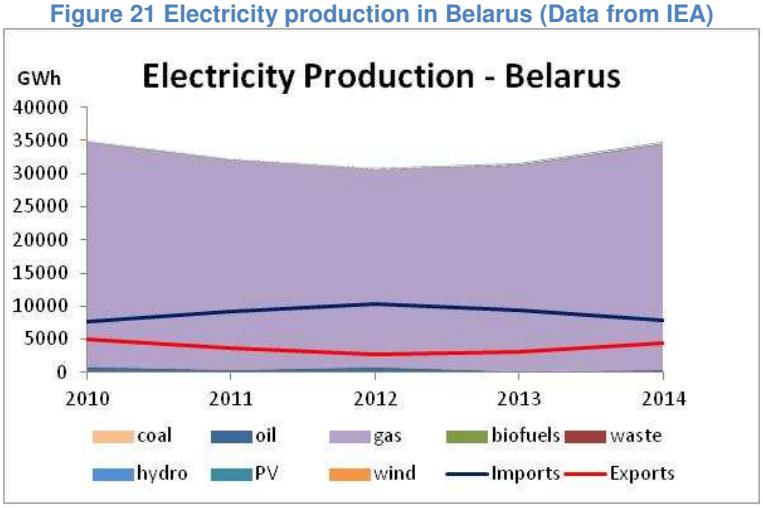
[43] OECD/IEA, Eastern Europe Caucasus and Central Asia- Energy policies beyond IEA countries, 2015 https://www.iea.org/publications/freepublications/publication/IDR_EasternEuropeCaucasus_2015.pdf

[44] According to the ADB, *Country Partnership Strategy: Azerbaijan, 2014–2018, Energy Sector Assessment* report "private sector investments in the generation facilities account for about 1% of the total installed capacity".

3.1.6 Belarus

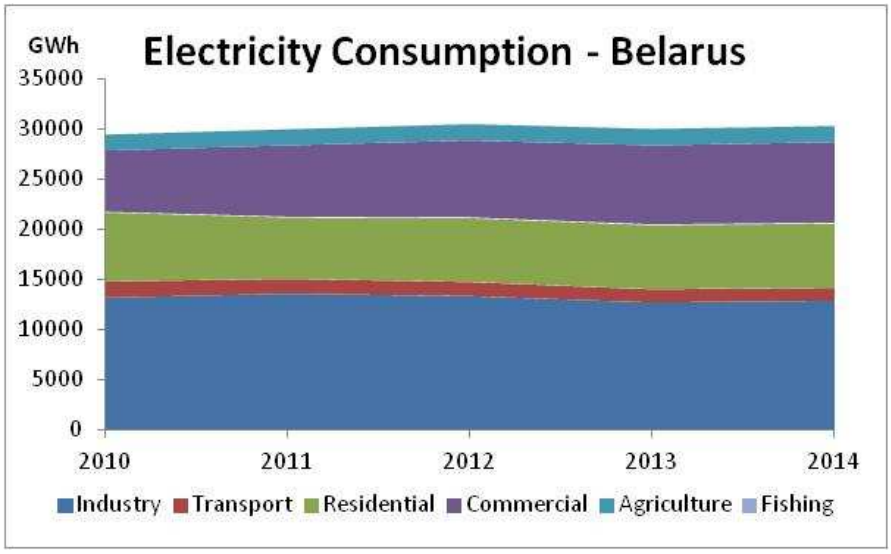
Belarus' has limited indigenous resources and is a net energy importer of nearly 86% of its energy needs. Hence, one of the main energy policy priorities is to reduce its dependency on energy imports. The government is therefore aiming at diversifying the power generation mix, by introducing nuclear, increasing the share of coal and developing RES45. Currently, electricity is mainly generated from imported natural gas at a share as high as 98%, the rest being produced from various sources such as oil, coal and RES as it is shown below in Figure 21:

Figure 21 Electricity production in Belarus (Data from IEA)



Demand of electricity increased modestly at a rate of 1% p.a. in the period 2010-2014 reaching 30TWh in 2014.

Figure 22 Electricity consumption in Belarus (Data from IEA)



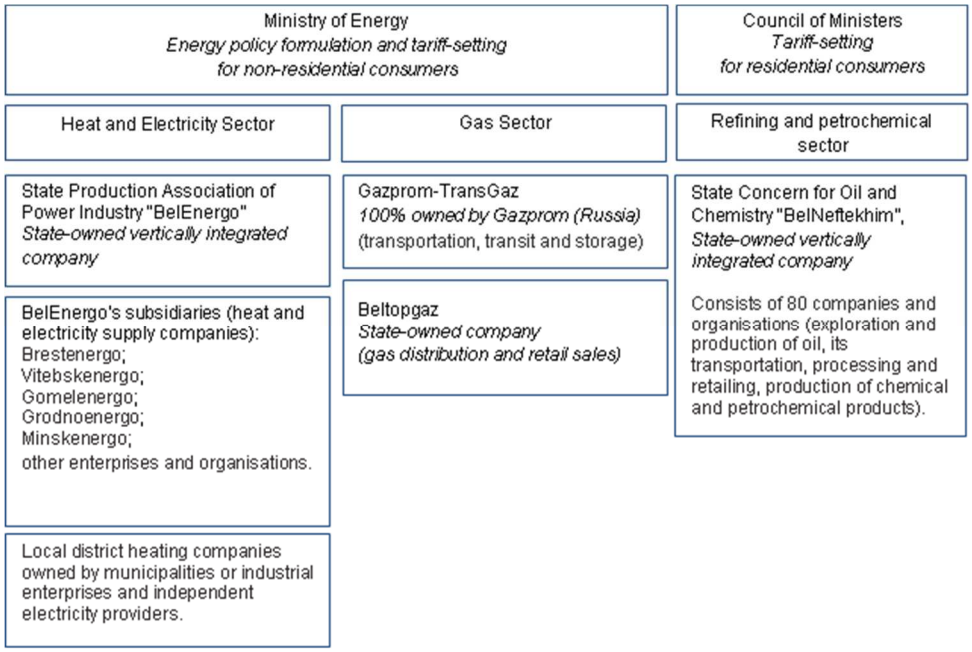
The electricity market in Belarus is regulated by the State and there is no independent regulatory authority. There is one single vertically integrated state-owned company (Belenrgo) in the country that provides all services of both the electricity and the heat sector. Six subsidiary regional distribution companies exist. Figure 23 presents the energy sector's institutional structure.

At the end of 2014, the government was considering introducing unbundling of the vertically integrated company, however no legislative initiative has been taken so far. In August 2014, a new Decree on Grid Connection was approved, allowing access to smaller private generators. As

[45] OECD/IEA, Eastern Europe Caucasus and Central Asia- Energy policies beyond IEA countries, 2015

a result, the number of independent electricity providers (mini-CHP and small and mini-hydro power plants) has increased.

Figure 23 Institutional structure of the energy sector in Belarus



3.2 Renewable market and policy

3.2.1 Policy targets and commitments

Development of RES-in-building systems and building-PVs systems in particular can be considered a sub-section of national RES policy. Specific national programmes may be elaborated for PV sectors, but they are normally part of a coherent renewable energy national policy. On the contrary, it is difficult to find a favourable PV policy framework without a national commitment in RES development. Georgia may be considered an exception where no well-defined renewable policy is in place but some ground based and rooftop-PV installations have been achieved through a spontaneous, project driven approach.

With Decision 2012/04/MC-EnC adopted by the Energy Community Ministerial Council, Contracting Parties have the obligation to implement Directive 2009/28/EC. This is done by amendment of Article 20 of the EC Treaty. As a direct consequence Energy Community Contracting Parties have agreed to adopt, pursuant art 4 of 2009/28/EC directive, a legally binding renewable development target. The target has to be reported with a specific methodology and has to include the technology expected mix and the development trajectory. Contracting Parties have to prepare a National Renewable Energy Action Plan including the presentation of the target and a detailed description of the measures, mechanisms and actions to be adopted in order to achieve the objective.

Three main areas are identified in the Directive 2009/28/EC to monitor renewable energy market and policies, namely:

- The existence of national RES development targets and commitments
- The existence of specific legislation with respect of RES
- The introduction of incentive schemes

Ukraine and Moldova have introduced national RES development targets for the energy sector in general, with a clear identification of targets in the electricity, transport and heat sector for 2020. Other countries have a less structured RES policy in place although relevant policy decisions have been taken with respect to RES.

Five out of six of the Eastern Partner Countries have established a national target to develop RES. In the Energy Community CPs (Moldova, Ukraine, Georgia) the target is binding and stems from Article 2 of the adopted Directive 2009/28/EC. In Georgia no target is set yet, but it needs to be introduced soon following adhesion to Energy Community. In Belarus and Armenia, a reference target is found in national energy policy, without specific development commitments. In Azerbaijan a strategic Roadmap of the development of the Public Utilities Services (including capacity development targets for PV and wind) has been approved by Presidential Decree as of 6 December 2016.

Table 6 Summary of RES policy targets and commitments

Country	Target and commitment compliant or comparable to art 2 of Dir. 2009/28/EC	General renewable development target	Is there a target trajectory?	Is the target specified per technology?	Is there a specific PV target?
Armenia	Not applicable	Yes	No	Yes	Yes
Azerbaijan	Not applicable	Target for PV and Wind included in Public Utilities strategic roadmap	No	Yes	Yes
Belarus	Not applicable	Yes	No	No	No
Georgia	Not yet	No	No	No	No
Moldova	Yes	Yes	Yes	No	Yes
Ukraine	Yes	Yes	Yes	Yes	Yes

3.2.1.1 Ukraine

Ukraine is committed to an 11% RES target in terms of Gross Final Energy Consumption (GFEC) by 2020. In 2014 the country has achieved a 3.9% share of RES, which increased to 4.9% in 2015, still lagging behind the proposed trajectory.

In the electricity sector the target is 11% by 2020 compared to 7.1% in 2009. Heating and cooling sector is planned to contribute significantly to the overall target (mainly through biomass heating systems) by increasing the share from 3.4% in 2009 to 12.4% in 2020. The transport sector relevant RES target is set at 10% in line with EU Directive.

The binding targets from Directive 2009/28/EC have not yet been transposed in the legal framework, despite the fact that National Renewable Energy Action Plan till 2020 (NREAP) developed by the State Agency on Energy Efficiency and Energy Saving of Ukraine (SAEE) was approved by the Cabinet of Ministers in 2014.

Table 7 national renewable targets and proposed trajectory (source: Ukrainian NREAP)

to the National Action Plan

NATIONAL TARGET
for the share of energy from renewable sources in gross final consumption of energy
up to 2020 in heating and cooling, electricity and transport

(percent)

Uses of energy from renewable sources	2009	2014	2015	2016	2017	2018	2019	2020
Renewable energy sources in heating and cooling[1]	3.4	5.7	6.7	7.7	8.9	10.0	11.2	12.4
Renewable energy sources in electricity[2]	7.1	7.6	8.3	8.8	9.7	10.4	10.9	11
Renewable energy sources in transport[3]	1.5	4.1	5	6.5	7.5	8.2	9	10
Overall share of renewable energy sources[4], of which:	3.8	5.9	6.7	7.4	8.3	9.1	10.1	11
from cooperation mechanism								
surplus for cooperation mechanism								

According to the Ukrainian National Renewable Energy Action Plan (NREAP) Solar electricity generation is expected to grow more than twofold between 2015 and 2020 (from 1050 GWh to 2400 GWh) with a total capacity in 2020 at some 2300MW installed. Nevertheless, according to the NREAP, solar looks the least strategic technology option for the country, both in terms of electricity generated and investment needed, while at the same time less than half of the planned capacity was installed in the end of 2016 (482 MW).

Table 8 National renewable target 2020 per source of energy (source: Ukrainian NREAP)

ESTIMATION
of total contribution (installed capacity, gross electricity generation) expected from each renewable energy technology in Ukraine to meet the binding 2020 targets and the indicative interim trajectory for the shares of energy from renewable sources in electricity, 2014-2020

Electricity by source	2009		2014		2015		2016		2017		2018		2019		2020	
	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh
Hydro:	4 549	11 430	4788	12045	4898	12215	4987	12440	5077	12660	5167	12885	5258	13110	5 350	13340
< 1 MW	19	12	28	65	33	75	37	85	42	95	47	110	52	120	55	130
1 MW – 10 MW	30	18	60	130	65	140	70	155	75	165	80	175	86	190	95	210
> 10 MW	4 500	11 400	4700	11850	4800	12000	4880	12200	4960	12400	5040	12600	5120	12800	5200	13000
Geothermal			6	30	8	44	10	56	12	73	14	84	17	105	20	120
Solar			860	900	1000	1050	1250	1310	1450	1520	1700	1780	2000	2100	2300	2420
Wind onshore	76	41	700	1680	1000	2400	1350	3240	1650	4125	1900	4845	2100	5460	2280	5900
Biomass:			40	150	250	1100	380	1680	520	2300	650	2870	780	3450	950	4220
solid			28	105	175	770	260	1180	360	1600	455	2000	540	2415	660	2950
biogas			12	45	75	330	120	500	160	700	195	870	240	1035	290	1270
Total	4 625	11 471	6394	14805	7156	16809	7977	18726	8709	20678	9431	22464	10155	24225	10900	26000
of which in CHP			40	150	250	1100	380	1680	520	2300	650	2870	780	3450	950	4220

Total financing resources to develop the expected incremental solar capacity are estimated in some 1 billion €[46].

[46] At 2014 exchange rate UAH vs Euro

Table 9 Amount of financing estimated to develop the expected technologies 2020 (source: Ukrainian NREAP)

IMPLEMENTATION PLAN
for the National Renewable Energy Action Plan up to 2020

Activity	Implementing entities	Timeframe	Sources of financing	Installed capacity as of 31 December 2020, MW	Production in 2020, GWh, Gcal, kt	Estimated financing*, 1,000 UAH	Energy from renewable sources in gross final consumption in 2020, ktoe
Goal 1. Development of electricity							
Development of electricity generating capacities:		2014 — 2020	Other sources**	10 900	26 000	156 733 000	2 235
based on wind energy use	SAEE, MERT, MECI			2 280	5 900	40 407 000	507
based on solar energy use				2 300	2 420	28 768 000	208
based on hydro energy use, of which:				5 350	13 340	52 914 000	1 147
large hydro	MECI			5 200	13 000	50 000 000	1 117
micro-, mini- and small hydro	SAEE, MERT, MECI			150	340	2 914 000	30
based on geothermal energy use	SAEE, MERT, MECI			20	120	1 140 000	10

It is worth mentioning that Ukraine's richest solar potential is found in Crimea region which annexation has already resulted in a reduction of RES electricity being fed into the rest of the Ukraine power system. The total RES capacity in Crimea amounts to 494.87 MW, including 87.768 MW of wind farms, and 407.09 MW of PV power plants)[47]. Based on the aforementioned is it straightforward to conclude that the crisis in the region had also adverse effects on the RES development trajectory foreseen.

3.2.1.2 Moldova

Moldova is committed to a 17% RES target over its GFEC in 2020 compared to the level of 11.9% in 2009 according to its Energy Community obligations. In addition, according to Renewable Energy Law No.160-XVI dated 12 July 2007, the national overall target for RES energy consumption in 2020 is set at 20%. The target is split as 10% in the electricity sector (compared to 2% in 2009) 10% in the transport sector and 27% in heating and cooling sector (compared to 20% in 2009)

Table 10 national renewable targets and proposed trajectory (source: Moldova NREAP)

National 2020 target and estimated trajectory of energy from renewable sources in heating and cooling, electricity and transport

Years	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
RES-H&C (%)[12]	19.36	19.51	19.89	20.84	21.93	23.02	24.21	25.33	24.90	25.83	26.38	27.19
RES-E (%)[13]	1.75	2.22	2.19	2.07	2.05	1.99	2.02	2.64	4.63	6.49	8.31	10
RES-T (%)[14]	0.00	0.00	0.00	0.00	0.00	0.00	1.12	2.55	4.56	6.27	8.10	10.00
Overall RES share (%)[15]	11.7	11.9	12.2	12.6	13.0	13.5	14.3	15.2	16.5	17.7	18.8	20.0
of which from cooperation mechanism (%)[16]	0	0	0	0	0	0	0	0	0	0	0	0
Surplus for cooperation mechanism (%)[17]	0	0	0	0	0	0.06	0.07	1.01	1.23	2.45	2.69	3.00

[47] Report to EC on Promotion of the Use of Energy from Renewable Sources and Consumption in Ukraine in 2014-2015, Ukraine.

According to 2014/2015 progress report, Moldova is almost in line with the proposed trajectories having reached in 2015 a RES contribution of 14.18%. Most of it comes from the heating and cooling sector where a 26% RES contribution has been achieved. The electricity sector and the transport sector appear as underperforming with 1.98% and 0.03% RES share respectively. However, it is worthwhile to be clarified that trajectories are designed in order to deliver a late accelerated RES development in the electricity and transport sector.

PV development is not considered as a strategic source of energy to reach the proposed RES electricity target which, according to the national NREAP, is limited to the development of small hydro, biogas and wind technologies[48]. Nevertheless, the NREAP also quotes that *"Conditioned by an increase in the equipment' competitiveness, the photovoltaic solar technology will also contribute to the generation of power by the end of the decade"*[49].

At the same time, the Low Emission Development Strategy and the Action Plan for its implementation consider the generation of electricity from PV systems as an action that will help accomplish greenhouse gas emissions reduction targets. These acts enforced in March 2017 have introduced a specific 20MW target in PV technology by 2030 to be achieved "unconditionally" and based even on state budget financial resources. The target is meant to be extended up to 200MW in case the Moldovan market is granted access to international financing resources.

3.2.1.3 Georgia

Georgia is the only country found with no policy targets or commitment with reference to development of renewables in its energy markets. However, the country has ratified the Energy Community Treaty and effectively became Contracting Party in April 2017. Preparations for the harmonisation of the Georgian legislation to the Energy Community Acquis have already started and it is expected that developments in this regard will follow soon.

3.2.1.4 Armenia

In Armenia, the Government's RES strategy is driven by the overarching goals of improving energy security, ensuring tariff affordability, and maximizing the use of the country's indigenous energy resources. However, there is no dedicated document setting a long-term renewable target in the country.

According to the energy security strategy of the country- approved in October 2013 - the target of electricity generation from RES in the overall generation mix has to increase up to 20% from the current 11%-12% level.

The Government's Development Strategy for 2012-2025 specifically calls for the development of indigenous RES setting specific technology targets for 2020 and 2025. Excluding the contribution from large hydroelectric plants, renewable energy generation represented roughly 6%of total generation in 2012. The Government's RES target over total electricity generation is 21% by 2020 and 26% by 2025.

According to "The Strategic Development Program of Hydro Energy Sector of the Republic of Armenia" dated 8 September 2011, the renewable target for the electricity sector, including large hydro is set at 30% of the energy demand in 2020.

[48] Approved by Government Decision No. 1073 dated 27 December 2013 NATIONAL RENEWABLE ENERGY ACTION PLAN OF THE REPUBLIC OF MOLDOVA FOR 2013-2020

[49] Approved by Government Decision No. 1073 dated 27 December 2013 NATIONAL RENEWABLE ENERGY ACTION PLAN OF THE REPUBLIC OF MOLDOVA FOR 2013-2020, page 3.

"Scaling Up Renewable Energy Program for Armenia" (SREP Armenia) was published in April 2014. It is an update to the Renewable Energy Roadmap from 2011. The SREP establishes new renewable energy production targets and underlines importance of the RES deployment in a context of partial replacement of aging conventional energy generation infrastructure of Armenia. It also illustrates a long-term target for each main RES technology.

Table 11 Renewable energy generation capacity and production targets 2020-2025 (Source: SREP Scaling Up Renewable Energy Program IEA/IRENA database)

	Capacity installed (MW)		Electricity Generation (GWh)	
	2020	**2025**	**2020**	**2025**
Small hydro	377	397	1049	
Wind	50	100	117	232
Geothermal	50	100	373	745
Solar PV	40	80	88	176
Total	**492**	**677**	**1627**	**2259**

Reportedly, even the above SREP targets are anticipated to be reached much earlier than the given time-horizon. On the basis of the investment program approved by the Government, 110MW solar power plants are to be constructed in six locations in Armenia with the first 55MW plant to be constructed in Masrik site of Gegharkunik Province.

3.2.1.5 Azerbaijan

A strategic Road Map of the development of the Public Utilities Services (electricity, heating, water and gas) has been recently approved by the Presidential Decree of 6 December 2016. The Road Map as a long-term vision indicates the main directions in RES development until 2025. Those include:

(i) Generation of electricity by the end-users for self-sufficiency distributed power generation approach and
(ii) Development of rooftop-PV systems, mainly in rural areas.

In addition, a target of 50 MW of solar energy capacity and 350 MW of wind energy capacity to be installed by 2020 has been approved. The main driver of RES policy is the diversification of national energy mix and the reduction of internal natural gas demand in order to favour natural gas export.

3.2.1.6 Belarus

Belarus has not introduced a binding RES target in its primary legislation. The third edition of the Concept of Energy Security has been approved by the Council of Ministers by Resolution No. 1084 of December 23, 2015. Belarus energy policy priority is mainly concentrated in the necessity to increase the national energy independence, which is presently confined at some 14% of the national final energy demand. Hence energy independence is the main driver for the development of domestic energy resources and RES. The national target is to increase domestic energy resources, not limited to RES, from 15% in 2015 to 20% in 2035.

The Concept of Energy Security is the main policy document for development of renewables where it is stated that the Government aims to reach 9% of renewables over national energy mix by 2035 compared to a share of below 6% in 2013. The document is complemented by national strategies where PV development however plays a marginal role.

In addition, the following policy documents are of relevant importance for the development of PV systems in the country:

- On 6th April 2016: the new "*Energy efficiency and energy saving plan for 2016-2020*", came into force. The plan defines an initial transition phase, up to 2020 which is embodied in the aforementioned "New Concept of Energy Security" for 2035 policy. The concept refers to targets expressed in terms of primary energy and renewables:
    - the ratio of primary energy to the gross consumption of fuel and energy resources - 16 percent by 2020;
    - the ratio of primary energy production from RES to the gross consumption of fuel and energy resources - 6 percent by 2020;
    - within the RES target, photovoltaic power plants and individual photovoltaic modules with total electric capacity not less than 250 MW should be implemented.
- The "*National Energy Saving Programme 2011-2016*", adopted on 24 December 2010 by Council of Ministry introduces a target for deployment of alternative and renewable energy sources. Specifically: 103 MW of Hydro, 39MW of Biogas, 300MW of wind capacity are envisaged along with a contribution of some 100 toe by other types of alternative energies, including solar.
- The "*National Program of Local and Renewable Energy Sources Development*" adopted on 10 May 2011 aims to increase the use of domestic energy sources in years 2011-2015 to reach a share of local energy sources in the energy balance of no less than 30%. The program aimed at the target through an increased usage of wood, straw, municipal waste and the deployment of biogas, wind, solar installations, heat pumps, construction and rehabilitation of hydropower plants. No quantitative target per technology is set.

Although there is not a binding commitment for RES development, overall Belarus shows strong policy drivers for RES development, with increasing national energy input and reaching higher independence being the top priorities. Policy targets are quantitatively defined by indicative renewable targets in the energy and electricity sector.

3.3 RES legislation

The legislative framework to support the penetration of RES and PV technologies in the Eastern Partner Counties are in various stages of development. In particular, in Ukraine and Moldova the transposition of EU 2009/28/EC Directive in national legislation is progressively contributing to the promotion of a substantially favourable approach for RES technologies. Still in both countries the process of implementing RES legislation and regulation has not been completed yet. Main provisions for RES development have been adopted but not yet translated into a coherent and robust legal and regulatory framework, therefore it is too early to assess the final impact on the PV sector. In Moldova the process seems well advanced; the approval of Law No 10 of 26 February 2016 on promotion of the use of energy from renewable sources will substitute the previous law of the renewable sector which is force since 2007. The Law was originally planned to enter into force on 25 March 2017, while several acts provide for in the law as secondary legislation are still underway the drafting process. In March 2017 it was announced that delays in the implementation of the secondary legislation will postpone the original deadline to March 2018.

Georgia has just recently become an Energy Community Treaty contracting party. The existing legal and regulatory framework will need to be harmonised with the Energy Community Acquis and the electricity sector will necessarily be reformed. The current fragmented legal provisions will need to be incorporated in a single framework and be coherent with a defined RES national target. On the contrary Armenia, Azerbaijan and Belarus have no legally binding commitments towards the harmonisation to the EU Acquis and have developed their own national legal framework. Belarus has an expressed policy objective to improve cooperation with international energy markets, which was introduced by the 2015 new energy concept strategy. The country also has a sufficient primary legislation in place to support the development of RES. Nevertheless, not all principles are well implemented by means of an adequate enabling secondary legislation

framework. Armenia has introduced some legal provisions in favour of RES development, although the market impact of these measures is still not quite visible. Azerbaijan is lagging behind, with no target and poor consistency of its RES legislation.

Table 12 below provides an overview of the RES legislation status in the Eastern Partner countries.

Table 12 Summary of RES legislation in targeted countries

Country	Presence of a specific legislation with respect to RES	Is the legislation establishing incentive scheme?	Does the legislation cover all relevant aspects of RES development?	Any specific reference to PV development
Armenia	Yes	Yes	N/A	N/A
Azerbaijan	No	No	No	No
Belarus	Yes	Yes	The RES law covers issues related to state regulation, state support, financing, tariffs, connection of facilities, metering, potential renewable energy site,	No
Georgia	No	No	No	No
Moldova	Yes, but main secondary legislation provisions not approved yet.	Yes	The framework legislation seems to touch all relevant RES policy issues but lack of secondary legislation make RES policy not implementable yet.	Low Emission Development Strategy and the Action Plan for its implementation approved by Government of Moldova Resolution No 1470 of December 30, 2016.
Ukraine	No, the legislation on RES is found in different legal texts	yes	Existing legislation is progressively in line with EU directive 28/2009/EC requirements. Grid code still missing.	PV is promoted together with other RES via feed-in scheme.

3.3.1.1 Ukraine

Ukraine is obliged to implement Directive 2009/28/EC as a Contracting Party to the Energy Community Treaty. The EU Directive has not been fully transposed in the national legislation yet. The main institutions responsible for the implementation of the RES Directive are the State Agency on Energy Efficiency and Energy Saving of Ukraine (SAEE) and the National Energy and Utilities Regulatory Commission (NEURC). In addition, there is not a comprehensive legal act defining the electricity RES sector. The current key primary legislation consists of the Law "On Electricity", the Law "On Alternative Energy Sources" and the Law "On Alternative Types of Fuel".

"The Law on Electrical Energy Industry" of 16th October 1997 created a legal framework for the "Green Tariff" scheme which is based on a FiT mechanism to buy electricity generated by RES plants. The law was significantly amended in June 2015, and reforms to the pre-existing feed-in tariff mechanism were introduced in order to make it more compatible with EU legislative provisions.

The National Commission for Energy and Utilities Regulation (NEURC) is responsible for the management of the scheme, the modification of the tariffs, as well as the granting and distributing of financial support to the eligible parties. Access to the "Green Tariff" scheme can only be granted after the completion of the installation of a power plant. A net metering scheme is in place for RES installation below 30kW.

Recently[50], Ukraine has adopted a "New Electricity Market Law" which transposes the Third Energy Package. In addition to the provisions related to the organization and operation of the electricity sector the law introduces new provisions related to RES and in particular RES balance responsibility while it reaffirms certain features of the Ukrainian RES support scheme such as the FiT and guaranteed off-take which is meant to be maintained up to 2030.

3.3.1.2 Moldova

Being a Contracting Party to the Energy Community, Moldova is also in the process of harmonizing its legislative framework in the RES sector to the EU acquis, regarding both Directive 2009/28/CE as well as Directive 2009/72/CE concerning common rules for the internal electricity market.

Both Directives have already being transposed into national legislation; Directive 2009/72/CE since June 2016 and Directive 2009/28/CE with Law No 10 of 26 February 2016 on promotion of the use of energy from renewable sources. In March 2017 it was announced that delays in the implementation of the secondary legislation will postpone the original deadline to March 2018.

The Law legislates on the main features of a RES market harmonized with the EU acquis. Specifically, it modifies the existing incentive scheme for renewables, also in terms of obtaining the status of eligible producer of electricity from RES through a competitive process. It also introduces the net metering mechanism and legislates on licensing, permit, priority dispatching, grid access and certification of origin.

3.3.1.3 Georgia

Georgia currently has no special legislative acts or regulation to promote and use of RES. Some regulations that apply for RES are incorporated in the Law on Electricity and Natural Gas and other regulations.

[50]https://redcliffe-partners.com/assets/Ukraine%60s%20electricity%20market%20will%20be%20redesigned%20in%20line%20with%20European%20practices.pdf

In 2008 the Government of Georgia approved the “Renewable Energy 2008” state program, where a renewable development plant was outlined by the publication of a list of a number of RES systems to be developed. The program has been amended and replaced by the Government Decrees №214 and №40.
Specifically, Decrees №214 and №40 outline the approval of the rules of express of interest in regard to the feasibility study, construction, ownership and operation of power plants in Georgia that are included in the list of potential power plants published by the Government as well as for those which are not enlisted.
In addition, a Net Metering rule was adopted by changes in national Law of electricity and natural gas as of 2 March 2016.The Law outlined the definition of a RES micro-power plant as an installation of not more than 100 kW.
In short there are three main categories of potential RES power plants in Georgia:

- Power plants whose pre-feasibility has been done by the Ministry of Energy of Georgia and are enlisted in the List of potential power plants published by the Government
- Power plants that are not included in the abovementioned list,
- Power plants smaller than 100 kW which can qualify for net-metering regulation.

3.3.1.4 Armenia

The Government of Armenia has worked for more than a decade to expand the use of renewable energy. In 2004 the Law on Energy Savings and Renewable Energy was approved. A feed-in mechanism was introduced in 2015 by the energy regulator and a net metering law was adopted in December 2015 for solar power plans up to 150 kWp. Among the main aims of the Law is to strengthen energy independence, increase economic and energy security, establish and develop new industry infrastructure, organise the services promoting energy saving and renewable energy, as well as increase living conditions and preserve natural environment. The Law regulates relations between state administration, municipal governments and legal and physical persons involved in the sphere of energy savings and renewable energy.

The following legislation is also relevant to the formulation of the RES development framework:

- the Law of the RA on Energy (No. AL -148, adopted on 7 March 2001),
- the Law of the RA on Licensing (No. AL-193, adopted on 30 May 2001),
- the Law of the RA on State Duty (No. AL-186, adopted on 27 December 1997),
- the Law of the RA on Energy Saving and Renewable Energy of 09 November 2014, amending previous 2004 version.

3.3.1.5 Azerbaijan

Azerbaijan has not a RES specific legal framework. Although indicative targets have been adopted, realization of RES plants is mainly managed by the national electricity company and its capacity development plants. The electricity market framework is mainly build up by the following legal acts:

- Law "On electricity" (of April 3, 1998);
- Law "On electrical and heat energy plants" (of March 6, 2000);
- Law "On energy" (of November 24, 1998).

Some specific provisions exist for renewables in terms of obligation to buy energy generated by renewable Power Plants. Tariffs to purchase renewable electricity are set by the Tariff Council in accordance with Decree No. 247, December 30, 2005, of the Cabinet of Ministers “On Approval of Rules Ensuring State Control over Formation and Application of State Regulated Tariffs (Prices)”

3.3.1.6 Belarus

The core of Belarus RES legislation is the "Law of the Republic of Belarus on Renewable Energy Sources" of 27 December 2010 (No 204-W) entered into force in July 2011. The Law develops the legislative framework introduces basic definitions of renewable technologies, defines rights and responsibilities of RES producers, defines the authorities responsible for control over the sector and creates the legislative basis for the economic support for renewables. In this respect, the law introduces an incentive mechanism based on FiTs, tax reliefs and other forms of financial support for RES producers and investors. It also ensures guaranteed connection of RES installations to the national grid. In 2015 the government of Belarus has amended the Law on Renewable Energy Sources adopted in 2010 in order to modify the incentive scheme. Amendments concern quotas implementation and the establishment of new rules of tariff determination for renewable energy.

There are two main RES plants categories:

- Those included in the capacity quota having access to specific FIT level
- Those not included in the capacity quota, which do not qualify for market support

3.3.2 RES support schemes

With respect to the RES support schemes there are considerable differences among the Eastern Partner countries. FiT type schemes are introduced in all countries except Georgia. Support schemes in some countries are complemented by a net metering mechanism. In others some fiscal incentives have also been introduced. Some countries have specific incentive for PV and for building-PV systems in particular.

The level of incentive largely differs among countries and is determined by the overall country approach to RES and specific policy targets to develop RES technologies

Table 13 Summary of support schemes in targeted countries

Country	What is main incentive scheme?	Is there a specific incentive for PV?	Is there a net metering mechanism?	Is there a specific incentive for rooftop?
Armenia	FiT	Yes	Yes	Plants < 1MW have a special tariff
Azerbaijan	FiT, not defined for all power sources and not aligned to technology costs.	Not defined within the FiT scheme	No	PV and RES equipment is free of custom duties
Belarus	FiT with capacity quota. 10 + 10 years duration	Yes	No	No
Georgia	No tangible incentive scheme. Ad-hoc PPAs possible.	no	Yes	no
Moldova	FiTs (not published yet)	No	Yes, not implemented yet	No
Ukraine	FiT	Yes	Yes	Yes, specific incentive for <30kW rooftop

3.3.2.1 Ukraine

Ukraine has opted for a FiT mechanism to support RES development, ruled by "green coefficients" calculated for various types of installations and fixed to euro currency up to 2030, in order to avoid inflation risks. Especially for RES installations with a capacity below 30kW a net metering scheme is in place.

The legal basis for the FiT is the Law "On Electricity" which was significantly amended in June 2015 concerning FiT setting.

The design of the Fit is not fully compliant with EU State aid guidelines for environmental protection and energy 2014-2020 as the feed-in includes the *physical* purchase of RES electricity. The electricity currently is not sold separately from the FiT, thus limiting market integration of RES[51]. State Aid Guidelines allows exception for smaller than 500kW RES installations. The current design, with specific reference to building PV sector, although presumably mostly developed within the 500kW threshold, is albeit not coherent with a policy to favour distributed generation. The electricity produced in building PV when consumed on site is remunerated at net-metering value, whereas when injected into the Grid is paid at Fit level. FiT level is higher than net metering value. As a result, the FiT scheme has the effect of distorting building PV market in favour of injecting electricity into the Grid rather than consume on site.

Table 14 below presents the FiTs granted to RES power plants. The tariffs are progressively reduced depending on the date of commissioning. There is no overall cap on capacity. The mechanism is designed in order to promote early development of RES, i.e. the tariff is guaranteed up to 2030, regardless of the date of commissioning. Hence early investments will benefit from a higher tariff for a longer period. A net metering scheme is also in place for RES installation below 30kW.

Table 14 Feed-in tariffs for power producers from RES in €ct/kWh

Type of generating facility	Installed capacity and other conditions	Commissioning date *(dd.mm.yy)*			
		01.01.16 - 31.12.16	**01.01.17 - *31.12.19***	**01.01.20 - *31.12.24***	***01.01.25 - 31.12.29***
Wind Power Plants	up to 600 kW	5.82	5.17	4.52	
	between 600 kW and 2 000 kW	6.79	6.03	5.28	
	Capacity above 2 000 kW	10.18	9.05	7.92	
	Household Wind Production Units (up to 30 kW)	11.63	10.45	9.32	
Solar Power Plants	On-ground Power Stations	15.99 15.03	13.52	12.01	

[51] From section 3.3.2 of EU State aid Guidelines for environmental protection and energy 2014-2020: *Operating aid granted to energy from renewable sources*: Aid for electricity from renewable energy sources (124): "In order to incentivise the market integration of electricity from renewable sources, it is important that beneficiaries sell their electricity directly in the market and are subject to market obligations. The following cumulative conditions apply from 1 January 2016 to all new aid schemes and measures: (**a) aid is granted as a premium in addition to the market price (premium) whereby the generators sell its electricity directly in the market**"

	PVs on roofs and facades of buildings and constructions	17.23	16.37	14.76	13.09
	Household on-roof PVs (up to 30 kW)	19.01	18.09	16.26	14.49
Biomass Power Plants	Biomass is a non-fossil biologically renewable substance of natural origin in the form of products, waste and residues. Biogas is produced biomass.	12.39		11.15	9.91
Geothermal Power Plants	Geothermal power production	15.03		13.52	12.01
Hydro Power Stations	Micro hydropower units (up to 200 kW)	17.45		15.73	13.95
	Mini-scale hydropower plants (between 200 kW and 1000 kW)	13.95		12.55	11.15
	Small-scale hydropower stations (up to 10 000 kW)	10.45		9.42	8.35

3.3.2.2 Moldova

The Parliament of the Republic of Moldova adopted the Law No 10 of 26 February 2016 on the promotion of the use of energy from renewable sources. The Law was supposed to enter in force on 25 March 2017 but its implementation has encountered some delays and a new implementation deadline is currently under discussion. Some key elements of the renewable legislative framework are hence still not defined. The Government will approve the regulation for the organization of auctions for offering the status of eligible producers of electricity.

The support scheme is defined in article 34 of the Law on promotion of the use of energy from renewable sources and is based on:

1) prices for electricity to be delivered into the electric network, established as a result of the public auction to obtain the status of eligible producer that possess or will possess power plants operating on RES with the cumulated capacity that is higher than the capacity cap established by the Government. The status of eligible producers will be confirmed by the Energy Efficiency Agency. ANRE will approve cap prices for the auctions;

2) fixed tariffs approved by ANRE for eligible producers that possess or will possess power plants operating on renewable energy sources with the cumulated capacity that is not higher than the capacity cap established by the Government but no less than 10 kW.

Article 39 of the Law on promotion of the use of energy from renewable sources introduces a net-metering mechanism for power plants with capacities up to 100kW owned by final customers.

The overall support framework will apply also to the PV systems. The PV market will hence be organized in three tiers:

- Electricity prices defined by action mechanisms for PV plants with a capacity higher than the capacity cap established by the Government (not yet known)
- Fixed electricity prices defined by ANRE for PV plans > 10kW but smaller than the capacity cap
- PV system < 10kW without specific fit mechanism but eligible for net-metering

In addition, according to information retrieved by the "Moldova Eco-Energetica" event that took place during 28 November – 2 December the Ministry of Finance declared that for the year 2017 there is proposal to exempt from the Value Added Tax equipment installed in wind parks and PV panels.

3.3.2.3 Georgia

Georgia has currently no special legal acts or regulations to promote the use of RES, however some regulations that apply for RES are incorporated in the Law on Electricity and Natural Gas and other regulations. Third party access and connection rules for RES are defined within the national regulatory framework and apply to RES with no distinction from conventional sources.
An alternative process for RES development by third parties is also possible based on the following process:

- A list of RES plants is published by the Ministry of Energy
- A potential developer has to select one site/project and submit a proposed tariff to sign a long term PPA.
- A RES tariff is hence set on a cost-basis evaluation between the plant developer and the Ministry of Energy

The Net Metering scheme was adopted through amendments on the Law of electricity and natural gas as of March 2, of 2016. The Law outlined the definition of a RES micro-power plant as an installation of not more than 100 kW. Georgian National Energy and Water Supply Regulatory Commission (GNERC) introduced subsequent amendments in Existing Electricity Demand-Supply Rules, introducing Net Metering of micro power plant connected to the distribution grid. Owners of the systems can connect free of charge to the grid and get paid the price equal to the weighted average generation cost of DISCO.

3.3.2.4 Armenia

In 2007, the Public Services Regulatory Commission (PSRC) set renewable energy FiTs for small hydropower plants (SHPPs), wind, and biomass to stimulate private investment.

Table 15 feed-in tariff in the period 2011-2015[52], Armenia (Resolution No 424 U)

		Duration of the support	Tariffs in AMD/kWh excluding VAT				
			2011	2012	2013	2014	2015
Small hydro power stations	Natural water streams	15 years	19,28	19,551	20.287	21.061	21.168
	Irrigation systems		12,853	13,033	13.523	14.039	14.110
	Natural drinking water sources		8,57	8,690	9.017	9.361	9.308
Wind			33,756	35.339	34.957	37.007	38.005
Biomass			36,928	37.447	38.856	40.338	40.642

[52] Exchange rate with Euro 1€=532 AMD, the exchange rate has been almost stable in the last 5 years.

The FiT regime guarantees purchase of all of the power generated by RES plants for a period of 15 years. 65% of the tariff is indexed to the USD/AMD rates. Tariffs are adjusted annually in line with changes in inflation and exchange rates. FIT for purchasing electricity from solar power plant with an installed capacity up to 1MWp has been approved by PSRC in December 2016. The FIT is 9 USD cents per kWh including VAT.

The net metering regulation for renewable energy generators with an installed capacity up to 150kW was adopted in December 2015. Any excess production from the netting process is paid half of the currently operational tariff of electricity supply at 9.5 USD cents per kWh.

More recently, the Government took steps to streamline the process of developing RES projects, including relaxing tax obligations for some investments.

3.3.2.5 Azerbaijan

Notably the market is regulated by the State through the Ministry of Energy and the Ministry of Economy and there is no independent regulatory authority. Electricity tariffs are regulated by the Tariff Council. The Tariff Council has power to set tariffs for any kind of renewable energy, but only wind energy and mini hydropower tariffs have been set. Other renewables are grouped in a single tariff level not differentiated according to technology. Tariffs are not indexed to a foreign currency. There is no net metering mechanism in force in the country.

The regulated entities are required to provide economic justification for the expenses recovered by the tariffs. The calculated tariffs are reviewed by the Tariff Council and published upon approval.

Some specific provisions are assured for renewables in terms of obligation to buy energy generated on renewable power plants.

The tariffs are prepared in accordance with Decree No. 247, December 30, 2005, of the Cabinet of Ministers "On Approval of Rules Ensuring State Control over Formation and Application of State Regulated Tariffs (Prices)". Depending on the specification of the services, tariffs are determined on the basis of the expenses necessary to recover costs and obtain reasonable profits. This cost-plus methodology is generally used for the calculation of the prices (tariffs) for all services and goods which are subject to state regulation.

The latest tariffs are approved by the Resolutions of Tariff Council #17, November 28, 2016 on Regulation of Electricity Price Rates in the Republic of Azerbaijan, and are shown below on Table 16:

Table 16 RES tariffs in Azerbaijan

#	Name of Services	Tariffs for 1 kWh, AZN*10^{-2} (€cent)
1	**Purchase from producer**	
1.1	Private small hydro power stations	5.0 (2.7 €cent)
1.2	Wind power stations	5.5 (3.0 €cent)
1.3	Other RES	5.7 (3.1 €cent)

3.3.2.6 Belarus

Based on the provisions of the Law on Renewable Energy Sources of 27 December 2010 (No 204-W), a FIT scheme was introduced by Resolution of the Minister of Economy No 100, in June 2011. The resolution sets the tariff level and mechanism for RES installation with a capacity up to 750kW for a period of 20 years. There is no net metering mechanism in force in the country.

Decree of the Ministry of Economy on August 7, 2015 № 45, modifies the previous FIT mechanism implementing provisions of 18th May 2015 Presidential Decree No. 209. It introduces three different incentive levels according to the status of the RES installation.

- Facilities put into operation before 20 May 2015 or developed on the basis of investment contracts concluded before 20 May 2015;
- Facilities, put into operation in the period from May 21, 2015 to August 20, 2015, or developed within the allocated quotas;
- Facilities of legal entities and individual entrepreneurs for their own needs not included in the allocated quotas and put into operation after 20 August 2015.

The government has the right to establish and allocate quotas in terms of capacity for the construction of facilities by RES type (solar, wind, water, and biogas) and to determine the economically justified amounts of their construction, to avoid excessive development in certain areas, to ensure the selection of the best technical proposals and the economically optimum facilities. The Interdepartmental Commission for Establishment and Allocation of Quotas for the RES Installations have set the quotas for the period 2016-18 and total 215 MW of renewable energy. PV development is foreseen under a 5 MW annual quota.

Table 17 feed in quota MW

MW	2016	2017	2018	Total
Biogas	10	10	12	**32**
Wind	10	10	30	**50**
Solar	5	5	5	**15**
Hydro	5	5	72	**82**
Total	**43**	**43**	**129**	**215**

Tariffs are calculated by applying a tariff coefficient to a reference price. Tariffs for electricity produced from RES are established based on the electricity tariff for industry end-users (installed capacity up to 750 kVA - see chapter 3.5.2.4) and they are distinguished for different stages of the plants useful lifetime i.e. for the first 10 years of operation, the following ten years and lastly for the period extending to over the 20 years of operation.

As it can be seen on Table 18 below the coefficient is higher than unity (and thus the FiT is higher than the reference price) for the first 10 years following the commencement of operation of power plants within the development quota or being contracted before May 2015. For facilities that are in operation for more than 10 years, the tariff coefficient is less than one. The same applies for new facilities not included in the development quota.

Table 18 Feed-in-tariff for electricity produced by RES in Belarus

№	Renewable energy source	Lifetime of facilities	The coefficient to the tariff	Tariff USD/kWh
1. Facilities put into operation before 20 May 2015 or created on the basis of investment contracts concluded before 20 May 2015.				
1.1	Wind	the first 10 years from the putting into operation	1,3	0,160
		10 following years of operation	0,85	0,105
		over 20 years of operation	0,45	0,055
1.2	Hydropower	the first 10 years from the putting into operation	1,1	0,135
		10 following years of operation	0,85	0,105
		over 20 years of operation	0,45	0,055

№	Renewable energy source	Lifetime of facilities	The coefficient to the tariff	Tariff USD/kWh
1.3	Biomass	the first 10 years from the putting into operation	1,3	0,160
		10 following years of operation	0,85	0,105
		over 20 years of operation	0,6	0,074
1.4	Biogas	the first 10 years from the putting into operation	1,3	0,160
		10 following years of operation	0,85	0,105
		over 20 years of operation	0,6	0,074
1.5	Solar PV	the first 10 years from the putting into operation	2,7	0,332
		10 following years of operation	0,85	0,105
		over 20 years of operation	0,45	0,055
1.6	Geothermal	the first 10 years from the putting into operation	1,3	0,160
		10 following years of operation	0,85	0,105
		over 20 years of operation	0,45	0,055
2. Facilities, put into operation in the period from May 21, 2015 to August 20, 2015, or created within the allocated quotas				
2.1	Wind	the first 10 years from the putting into operation		
		less than 5 years	1,2	0,148
		more than 5 years	1,05	0,129
		10 following years of operation	0,75	0,092
		over 20 years of operation	0,45	0,055
2.2	Hydropower	the first 10 years from the putting into operation with installed capacity:		
		up to 300 kW	1,2	0,148
		from 301 kW to 2 MW	1,15	0,142
		above 2 MW	1,1	0,135
		10 following years of operation	0,75	0,092
		over 20 years of operation	0,45	0,055
2.3	Biomass	the first 10 years from the putting into operation with installed capacity:		
		up to 300 kW	1,3	0,160
		from 301 kW to 2 MW	1,25	0,154
		above 2 MW	1,2	0,148
		10 following years of operation	0,85	0,105
		over 20 years of operation	0,6	0,074
2.4	Biogas	the first 10 years from the putting into operation with installed capacity:		
		up to 300 kW	1,3	0,160
		from 301 kW to 2 MW	1,25	0,154
		above 2 MW	1,2	0,148
		10 following years of operation	0,85	0,105
		over 20 years of operation	0,6	0,074
2.5	Solar PV	the first 10 years from the putting into operation with installed capacity:		
		up to 300 kW	2,5	0,308
		from 301 kW to 2 MW	2,3	0,283
		above 2 MW	2,1	0,259
		10 following years of operation	0,75	0,092
		over 20 years of operation	0,45	0,055
2.6	Geothermal	the first 10 years from the putting into operation with installed capacity:		
		up to 300 kW	1,2	0,148
		from 301 kW to 2 MW	1,15	0,142
		above 2 MW	1,1	0,135
		10 following years of operation	0,75	0,092
		over 20 years of operation	0,45	0,055

№	Renewable energy source	Lifetime of facilities	The coefficient to the tariff	Tariff USD/kWh
3. Facilities of legal entities and individual entrepreneurs for their own needs out of allocated quotas and put into operation after 20 August 2015				
3.1	Regardless of the type of renewable sources energy	the first 10 years from the putting into operation	0,7	0,086
		10 following years of operation	0,6	0,074
		over 20 years of operation	0,45	0,055

Additional incentives based on Belarus fiscal legislation with reference to the RES sector include:

- According to the Tax Code (Tax Code of Belarus of 29 December 2009, No. 71-W) of the Republic of Belarus there is a number of tax advantages available to renewable energy generation companies:
- Equipment used in the production or reception (receiving), transformation, accumulation and (or) the transfer of energy produced from non-conventional and renewable energy sources shall be exempt from value added tax when import into the territory of the Republic of Belarus (article 96).
- Land plots under the objects and Plants for use of non-conventional and renewable energy sources are exempt from land tax (article 194).

3.4 Regulatory framework

Whereas there is not a single approach for developing RES and specifically PV as described in "Review of EU Experience with Solar PV in buildings" report, some specific market characteristics make the development of RES more likely and effective than others. Those market characteristics are collected and reviewed herewith under an overarching assessment of the existing regulatory framework.

Table 19 Summary of the regulatory framework in Eastern Partner Countries

Country	Independent NRA	Grid code	Third party access	Dispatch priority	Obligation to purchase RES	Balancing Responsibility	Licensing
Armenia	Yes	No	No	Yes		No	Licence not required for <150kW
Azerbaijan	No	No	Yes	No	No	No	Licence not required for <150kW
Belarus	No	No	yes	No		No	Licence is issued by Ministry of Natural resources. No exemption for small scale found
Georgia	Yes	Yes	Yes	No		No	Power plants <13 MW installed capacity do not require licencing
Moldova	Yes	In progress	Yes	Yes	Yes	No	needed for > 5 MW or >20 MW for own use
Ukraine	Yes	In progress	Yes, some additional harmonisatio	Yes	Yes	No	Power plants < 30kW do not need licence. The procedure for larger plans is still not fully compliant with EU directive

			n with EU Acquis still required				

3.4.1 National Regulatory Authority (NRA) for Energy

Whereas the presence of an independent energy/electricity regulatory authority does not necessarily mean the development of a favourable Renewable and PV policy, it comprises an advantage since in most case the agency is responsible for the development of the necessary secondary legislation and regulation, which in turn is required for the implementation of national policy. In other words, an independent regulatory agency is an important institution able to develop secondary legislation for market operation that form an indispensable part of a favourable PV framework such as grid code, licensing rules, net-metering regulation.

3.4.1.1 Ukraine

National Energy and Utilities Regulatory Commission (NEURC) was established in 1994. So far, NEURC was mostly occupied by the regulation of the various regulated segments of the Ukrainian electricity market. With the legal reforms made in 2015 in the gas sector and the revised Law on the Regulator in late 2016, the regulator's commitment to develop into an independent expert body has increased to some extent. In Nov 2016, the Ukrainian Law on the National Energy and Public Utilities Regulatory Commission entered into force. Similarly, in the second part of 2017 the new Electricity Law transposing the Third Energy Package to the Ukrainian legal framework has been adopted by the parliament. The Energy Community Secretariat, which provided support to the Ukrainian authorities during the law's drafting stage, is now conducting a detailed assessment of the law as adopted in order to confirm its conformity with the complete set of regulatory competences required under the Third Energy Package.[53] A number of implementing regulations and actual implementation actions e.g. procurement of market management system for the implementation of the new electricity market model are still required to be developed as they are foreseen in the new Electricity Law. These implementing regulations in their majority need to be approved by NEURC.

3.4.1.2 Moldova

Established in 1997, the National Agency for Energy Regulation (ANRE) is the single authority for regulating the energy sector of Moldova with country-wide regulatory competences in the natural gas and electricity sector, as required by the Third Energy Package.

Among its competence ANRE lists licencing procedures and tariff settings for RES power plants and regulates the purchases of RES electricity by suppliers. Similarly to the case of Ukraine as it was discussed above ANRE has to approve a number of implementing regulations relevant to the development of RES in the country as it is foreseen in both the Electricity and RES law.

3.4.1.3 Georgia

Established in 1997, Georgian National Energy and Water Supply Regulatory Commission (GNERC), has relevant competences in the electricity sector including licencing and definition of connection tariffs. RES tariffs and approval of plants within the list is the competence of Ministry of Energy of Georgia. So far, the development of RES (and conventional generation) does not follow an organised authorisation procedure. Investors must provide to the Ministry of Energy a

[53]https://www.energycommunity.org/portal/page/portal/ENC_HOME/AREAS_OF_WORK/Implementation/Ukraine/Regulatory_Authority

financial model and expected IRR which will allow them to get the price. After construction, the Developer will submit an audit report evaluating the incurred CAPEX, which might result in lowering the tariff, while increasing is not considered.

3.4.1.4 Armenia

Established in 1997, the Public Services Regulatory Commission (PSRC) is a multi-regulator. In the energy sector, PSRC is responsible for licensing, regulating and supervising state authority in this sector. By its Resolutions it approves and updates FiTs for RES plants in the electricity sector.

In particular, *PSRC* among others has adopted a number of normative legal acts based on the *Law of the RA on Energy*, that regulate the procedures of and relationships concerning licensing, construction of the power plant, connection to the power system and generation of power.

3.4.1.5 Azerbaijan

There is no independent regulatory authority for the energy sector in Azerbaijan. Ministry of Economy is responsible for energy policy and regulation. A Tariff Council is in place. The Tariff Council implements the state regulations on prices and service fees pertaining public services and oversees their collection in cooperation with central and local executive bodies as well as public organizations. The Council is chaired by the Minister of Economy; representatives of several ministries and agencies are also appointed members of the Council.

The Tariff Council (TC) is in place in Azerbaijan since 2005. Among its main competences, listed below, the definition of RES FiTs is included. Nevertheless, the Council's role is limited and does not include other specific electricity sector regulatory activities.

Main Tariff Council competences areas[54] are:

- To ensure implementation of regulation of prices of commodities (works, services) related to the commodities (works, services) that are classified as those that are regulated by the state, and in accordance with normative and legal acts of the current legislation of the Azerbaijan Republic;
- Adoption of relevant documents on price regulation (choosing the method of regulation, reviewing proposals, preparation, adoption, application, changing drafts, etc.);
- Making proposals on strengthening of the state control over pricing (tariff setting) and application of prices (tariffs), and also on improving the legislation and legal framework for state regulation of prices;
- Preparation of proposals on benefits for investors, certain groups of consumers, enterprises and organizations, including those related to setting norms and limits.

3.4.1.6 Belarus

There is no independent regulatory authority for the energy sector in Belarus. The Ministry of Economy is responsible for public policy and regulating and administering the energy sector. Among its competences the Ministry of Economy also conducts analysis and forecast of economic and social development, outlines public policy development and implementation, undertakes programmes for business and investment development, regulates economic insolvency (bankruptcy), anti-monopoly and competition and natural monopolies' activity, as well as presides

[54] http://erranet.org/member/tc-azerbaijan/

state property and privatization public policy. Mostly relevant for the energy and renewable energy sector the Ministry is also in charge of tariff regulation and control.

3.4.2 Grid code

The presence of a grid code implies transparent rules to regulate the relationships between the market players. For the purpose of this study the Grid Code can be considered an important regulatory instrument, which defines the technical and economic rules between the Distribution companies, final consumers and small power producers connecting generating units. The alternative i.e. the absence of a grid code implies a negotiated or case-by-case approach. A grid code usually simplifies connection procedures of PV systems to the grid/distribution network and provides important information about the technical standards, connection costs, meter requirements and contract management. The grid code, which may encompass regulation for all connection levels (HV,MV,LV)[55], may be considered the prerequisite for a transparent access to national grids including building PV small scale units. Distribution companies or specific regulatory orders may develop and introduce transparent connection rules to the distribution network. The only Eastern Partner country found with a grid code in place is Georgia. It includes distribution network connection rules. In other countries the absence of a grid code has not been compensated by transparent procedures put in place by distribution companies. A grid code may be favourable or less favourable for the development of PV rooftop installation but provides a specific framework that facilitates decision making by interested parties. Its presence is a first regulatory provision to work towards a favourable framework.

3.4.2.1 Ukraine

A Grid code is not in place yet. The drafting of the grid code is in the consultation between national authorities which is organized by NEURC as is it generally provided for secondary legislation Acts under the draft Law “On Electricity Market”.

3.4.2.2 Moldova

There is not an approved grid code yet. According to article 53 of the Electricity Law (No 107 of 27 May 2016) the grid code shall be drafted by the transmission system operator that has the license for centralized management of the power system in cooperation with other system operators and submitted to ANRE for examination and approval.

3.4.2.3 Georgia

The grid code for transmission and distribution networks has been adopted and approved by GNERC on April 17, 2014 and several amendments were made to the code ever since.
The grid code comprises several key chapters, which regulate grid connection and other important issues for PV system:

Chapter II – Rule on connection with transmission grid
Chapter III – Rule on planning of transmission grid
Chapter IV – Rule on operative management
Chapter VI – Rule on scheduling of production availability and dispatching
Chapter VII – Rule on submission of information
Chapter VIII – Metering rule (Wholesale level)
Chapter X – Rule on connection with distribution grid
Chapter XI – Rule on planning of distribution grid
Chapter XII – Rule on operative management of distribution grid
Chapter XIII – Distribution metering rule (Retail level)

[55] Although the term Grid Code in many jurisdictions including in the majority of EU MS refers to transmission network only.

3.4.2.4 Armenia

There is no grid code in the country. Rules for connection of small power producers, including distributed generation by PV systems are quite generic and do not contain enough detail which is required for the timely implementation of RES applications.

3.4.2.5 Azerbaijan

There is no grid code and no legislative framework on RES connection to electricity networks in Azerbaijan.

3.4.2.6 Belarus

A grid code has not been adopted yet. The Rules of electricity supply determine the technical and legal relations between energy suppliers and consumers. The rules determine the order of relations between consumers to energy supply organizations. They in particular regulate the conclusion, performance, modification, extension and termination of the contract of power supply, the conditions of energy supply and use of electric energy, billing metering, payments for electric power and responsibility of the parties, the scheduling limitations and disconnection procedures for consumers of electrical energy and capacity, the disconnection electrical installations of consumers from electric grids, and also determine the procedure of connection of consumers` electrical installations to electric grids.

3.4.3 Third party access and connection rules

Third party access is a key element for the development of RES. Assuring TPA is a requirement of the third legislative package for the internal EU electricity market. TPA, which is a competition measure, is a prerequisite for private investments in the renewable energy sector. Although it is possible to have PV development initiatives by the incumbent - as for instance in the Azerbaijan - the success of building-PV market uptake is very much linked to private capital invested in the market segment. TPA therefore becomes an important indicator to assess PV market viability in the project countries.

In order to ensure effective network access, the operators of transmission/distribution networks must allow the injection of electricity from producers in a non-discriminatory way. TPA is normally assured by legislation whereas the conditions and rules of access to the networks are regulated by national regulatory authorities. TPA rules also include the definition of regulated tariffs in order to avoid any abuse of dominance.

In addition to TPA, Article 16 Directive 2009/28/EC introduces a number of provisions in order to assure transparent and effective renewable access, connection and dispatching rules. Those rules, which are a commitment for EC countries, constitute a benchmark for a favourable legal framework for RES and PV development in any country. As discussed in “Review of EU Experience with Solar PV in buildings” report, the development of PV systems -and in particular building-PVs - is often pursued by new entrants in the electricity sector. For this particular category of “investors”, electricity generation is either not a core activity of their business, or - in the case of the household sector – not a priority. Hence, these stakeholders only proceed to the investment if the market rules are relatively easy and are not perceived as lengthy, complicated and risky. The presence of clear rules for installation, connection and operation of PV systems is therefore a precondition. Connection rules procedures, timing and costs are fundamental to the success of RES development policies. Connection rules have to be clear fair and transparent both in terms of connection duration and costs.

When TPA is not defined by legislation and regulated in its standards, the limited number of building PVs found in selected countries has managed access to national grid on a case by case approach. As evident in Azerbaijan, the promotion of RES/PV infrastructure by the vertically

integrated electricity company may lead to the development of generating units without specific regulatory and legislative provisions. In this case, though, the PV units have been developed within (or with the participation of) the national electricity company and not by third parties.

Table 20 below provides a summary of the status of TPA and connection rules in the Eastern Partner countries.

Table 20 Summary third party access and connection rules

Country	Third party	Connection rules published and defined	Timing defined	Tariffs defined	Is TPA and connection regulation still a barrier
Armenia	No	No	No	No	No relevant experiences found
Azerbaijan	Yes	Yes	Yes	Yes	No relevant experiences found
Belarus	Yes	No	No	No	Yes, although improvement have been recorded in recent years
Georgia	Yes	Yes	Yes	Yes	Yes, especially with distribution grid
Moldova	Allowed but secondary legislation not yet in place	In process	In process	In process	Yes, but soon should be removed to align to EU acquis
Ukraine	Allowed, still not compliant with 2009/72	Yes	Yes	Yes	No but minor, though important TPA aspects need to be aligned with EU acquis

3.4.3.1 Ukraine

TPA is assured by the existing law, which transposes provisions on EU third energy package obligation. However, in respect of requirements of Articles 32 and 34 of Directive 2009/72/EC the existing legislation in not fully compliant as the conditions for exemption, refusals of access and direct lines have not been defined.

The connection procedure of renewable electricity installations to the networks is regulated by the "Rules on connection of electricity installations to networks" (Rules on Connection), approved by NERC Decree No 32 of 17th January 2013. The rules however are not perceived by the investors and industry associations as fully aligned with Article 16 of Directive 2009/28/EC.

Transmission and distribution system operators have to adequately clarify the technical specifications for grid connection, which are currently unclear. Network operators must develop network investment plans to be approved by the regulator in order to accommodate future increases of renewable energy.

The relations between residential household rooftop PV installations (with installed capacity below 30 kW) and local Regional supplier/DSO concerning the issues of electricity purchase, provision of net metering and billing is regulated by appropriate Order, approved by the NEURC Decree of No.170 of the 27th February 2014.

3.4.3.2 Moldova

TPA is generally allowed in Moldova. Article 3, paragraph 2), point d) of the Electricity Law provides for the assurance of the regulated, non-discriminatory access of all legal entities and natural persons to the transmission and distribution networks.

Article 28, paragraph (3) of the Law on promotion of the use of energy from renewable sources stipulates that the connection of the power plants that produce electricity from renewable sources of energy is done on an objective, transparent and non-discriminatory manner according to the conditions, terms and procedures established in the Electricity Law and in the regulations elaborated and approved by ANRE.

At present a restrictive period of time during which the DSO should connect a power plant producing electricity from RES (including the PV systems) to the electric network is not yet established. Presently it can reasonably be regarded that the DSO makes such a connection within 15 days after the relevant request as it was stated in the Electricity Law No 123 on December 23, 2009 that now is abrogated.

According to the Electricity Law the connection tariffs should be approved by the ANRE according to methodology for calculation, approval an application of the regulated tariffs for ancillary services. Neither the methodology nor the tariffs for connection are approved yet.

Similarly, the methodology for the determination of costs for connection of new renewable power plants to the transmission or the distribution networks has not yet been issued. The current practice of the system operators to provide information only on a case by- case basis is not compliant with Article 16 of Directive 2009/28/EC.

With reference to PVs there is not a standard contract template for connection with the Distribution System Operator (DSO). DSO and the owner may sign a contract stipulating that the works on connection will be performed by the distribution system operator.

In general, the 2016 Law on promotion of the use of energy from renewable sources transposes correctly the requirements for non-discriminatory access to the grid, priority dispatch of electricity generated from renewable energy, guaranteed purchase for eligible producers (selected through auctioning) and minimisation of curtailment. Implementation on secondary level needs to be completed.

3.4.3.3 Georgia

TPA is generally allowed in Grid Code and there is a standard provisions agreement for grid connection. There is not a specific and separate regulation for grid access and grid connection for RES. The cost and timing for transmission grid connection is defined in the Grid Code, and for distribution grid connection, cost and timing is defined by the Electricity Demand-Supply Rules. Some specific favourable provisions have been established for connection regulation for micro power plants and it is also regulated under Electricity Demand-Supply Rules.

3.4.3.4 Armenia

TPA is generally not explicitly provided in the relevant legislation. There is neither a specific regulation for renewable grid access and grid connection nor specific connection rules for small scale PV generating units.

3.4.3.5 Azerbaijan

The legislation provides for principles of non-discriminatory access to the network infrastructure, though this has not been implemented in practice due to the current market structure. In principle according the law, TPA is not an obstacle, but detailed procedures are missing and the have to be developed, renewed and/or adapted as the case might be to the new market conditions.

All parties requiring access to the transmission and distribution networks are obliged by law to comply with the same technical specifications, without discrimination or preference for any party over another. In cases where system (transmission and/or distribution) operators refuse to provide access to their systems, the operators are required to provide an explanation of the reasons for refusal.

Currently all generation capacity has been developed by the national electricity company with the exception of few private energy companies owning mainly small hydro power stations and wind power stations as well as some auto-producers. Access to the grid in these cases was contracted bilaterally with the national company. Relationships/obligations are defined in the respective contracts.

3.4.3.6 Belarus

TPA in Belarus has been allowed since 2013. Despite the country has progressed in the opening up of electricity market on the generation side, at least for renewable capacity, TPA is still reserved for renewable plants included in the allocated quota. The procedures, not defined by regulation, are still lengthy and there are plenty of potential barriers for private investors. (e.g. FiT is provided only for plants included in quota. The rest of plants operate under stimulating (decreasing) tariff. The Belarusian Web Portal on Renewable Energy (2015), outlines the procedure to be followed to connect a potential renewable energy generator to the regional energy company.

3.4.4 Dispatching priority and obligation to buy renewable electricity

Dispatching priority is another fundamental feature of a favourable integration of renewable electricity into the power market, at least in the early stages of RES development. Dispatching priority implies renewable electricity, which cost structure is dominated by investment technology cost, to be dispatched first in the merit order. This is to say renewable operators should have adequate certainty that, as long as there are no security issues, their electricity, which is generated when the RES source is available, is dispatched into the market and no priority is given to other criteria.

An important complement of dispatching priority rules, specifically renewables, is the presence of provisions for minimization of curtailment.

Art 16, 2.c, of EU directive 2009/28/CE well formulates the necessary legal and regulatory requirement to assure establishment of dispatching priority rules and reduction of curtailment risk: *"Member States shall ensure that when dispatching electricity generating installations, transmission system operators shall give priority to generating installations using renewable energy sources in so far as the secure operation of the national electricity system permits and based on transparent and non-discriminatory criteria. Member States shall ensure that appropriate grid and market-related operational measures are taken in order to minimize the curtailment of electricity produced from renewable energy sources. If significant measures are taken to curtail the renewable energy sources in order to guarantee the security of the national electricity system and security of energy supply, Members States shall ensure that the responsible system operators report to the competent regulatory authority on*

those measures and indicate which corrective measures they intend to take in order to prevent inappropriate curtailments"

Only in Ukraine, Moldova and Armenia, dispatching priority for RES is assured via legislation. Limitation of curtailment principle can only be found in the new RES Law of Moldova. In other countries although a support scheme and renewable purchase mechanisms are in place they do not seem to be backed by the dispatching priority principle. This implies that there is no obligation set on the TSO/DSO to procure RES electricity on a priority basis and to reduce the risk and the time the grid faces constraints (curtailment). A final contracting counterpart (buyer) of renewable electricity is assured in all countries.

3.4.4.1 Ukraine

Priority access to networks and priority dispatch of electricity produced from renewable energy sources applies since 2009. A system of compensating for curtailments remains to be implemented. Compliance with Article 16 of Directive 2009/28/EC still remains to be fully achieved.

In addition, the single buyer (WEM) has the obligation to purchase the whole volume of renewable electricity fed into the grid, including all electricity generated by PV systems below 30kW.

More specifically, Article 15 of the Law of Ukraine "On Electricity" provides:

- electricity produced from RES (except for blast furnace and coking gases, and in case of hydro energy - only for micro, mini and small HPPs), can be sold to the WEM under bilateral contracts with consumers or contracts with energy suppliers;
- electricity produced from PVs or wind installations of private households, with installed capacity below 30 kW, has to be purchased (by WEM) with feed-in tariff for the difference between the total amount of energy produced and that was directed to domestic needs of the household.

3.4.4.2 Moldova

The 2016 Law on promotion of the use of energy from renewable sources regulates the requirements for non-discriminatory access to the grid, priority dispatch of electricity generated from renewable energy, guaranteed purchase for eligible producers (selected through auction procedure and/or confirmed by the Energy Efficiency Agency) and minimisation of curtailment.

Article 29 & 37 of the Law stipulates the obligations of the central electricity supplier to purchase electricity delivered into the electric networks by the eligible producers and the rights and responsibilities of eligible producers.

3.4.4.3 Georgia

Legislation does not provide for priority dispatching for RES. A quite different priority in the form of rights to the Georgian-Turkey interconnection by which hydro power plants are granted priority allocation of cross-border capacities is in place. Newly built (after 2010) power plants are not eligible for these capacity rights any longer. The Georgian legislation does not set any obligation for consumers to purchase RES. It is worthwhile to be mentioned that what is usually defined as RES in hydropower generation in other jurisdictions (include the EU) i.e. small hydro power plants with a capacity of 10-15 MW

3.4.4.4 Armenia

Law 2007 establishing the FiT mechanism also introduces the obligation to purchase the electricity produced in renewable power plants and to pay for the approved tariff. The TSO has the obligation to dispatch renewable energy on a priority basis.

3.4.4.5 Azerbaijan

The Law on Electrical and Heating Power Plants, 2000, Article 3 “Small Power Plants” states that purchase of energy generated on these Power Plants is guaranteed without any limitations. However, there are is secondary legislation regarding rules/procedures for the implementation of this provision.

3.4.4.6 Belarus

RES dispatching priority is not explicitly granted by national regulatory and legislative framework. According to Article 16 of the Law «On RES» producers of energy from RES are guaranteed the right to sell the electricity produced from RES and deliver it to the public power grids through the state supplying organizations, as well as its payment on the tariffs in accordance with the law.

3.4.5 Balancing

The balancing issue usually pertains advanced electricity market where a significant share of Variable Renewable Electricity (VRE), such as wind and solar, have been connected to the grid. EU directive 2009/28/EC does not address balancing. Introduction of balancing rules and requirements may constitute a penetration barrier for renewable especially for small power plants, adding additional management efforts for the private small-scale producer. In none of the project countries renewables are required to supply balancing services.

3.4.5.1 Ukraine

Ukrainian stakeholders have had a long debate over RES balance responsibility in the frame of the development and consultation of the new electricity law transposing the Third Energy Package to the Ukrainian legislation. Finally, the new electricity law which was adopted in June 2017 sets the basis for a future assignment of balance responsibility to RES[56]. The provisions include an exception of the RES plant that are completed by the time the law comes into force and also establish an “imbalance tolerance band” on the output of each RES technology. Only imbalances that are found outside the band will be accounted up to 2029.

3.4.5.2 Moldova

RES producers are not responsible for balancing. It is the central electricity supplier’s responsibility to purchase the resources to balance for the renewable generators imbalances.

Article 30, paragraph (2), point g) of the Law on promotion of the use of energy from renewable resources stipulates that the central electricity supplier shall sign a contract for purchasing of balancing electricity to cover the imbalances that may happen in the electric network in relation to the delivery of electricity from renewable power plants.

Article 84, paragraph (4) of the Electricity Law stipulates that the central electricity supplier shall be part of the balancing group comprising also eligible power plants that produce electricity from renewable sources and combined heat and power plants that deliver thermal energy into the district heating systems.

3.4.5.3 Georgia

RES generators are not responsible for balancing.

3.4.5.4 Armenia

RES generators are not responsible for balancing.

[56] See page 3 of: https://redcliffe-partners.com/assets/Ukraine%60s%20electricity%20market%20will%20be%20redesigned%20in%20line%20with%20European%20practices.pdf (last accessed 28 July 2017)

3.4.5.5 Azerbaijan

RES generators are not responsible for balancing.

3.4.5.6 Belarus

Renewables are not subject to a balance responsibility. According to the rules of power supply, in the case of connecting the RES installation to the grid with the purpose of selling electricity, these RES installations are not obliged to provide an output schedule defined by settlement periods and times of the day.

3.4.6 Licensing for electricity generation activity

As discussed in "Review of EU Experience with Solar PV in buildings" report, the presence of transparent, easy to apply licencing procedures with specific time provisions for completion is a key element for small renewable producers and specifically PV systems which are often developed by entities (including families) not necessarily linked to the electricity sector. EU Directive 2009/28/EC art 13 asks to introduce specific rules to make licencing procedure transparent and effective to allow a favourable legal framework for RES.

More specifically Directive 2009/28/EC Art 13 asks Member States to take the appropriate steps to ensure that:

(a) subject to differences between Member States in their administrative structures and organisation, the respective responsibilities of national, regional and local administrative bodies for authorisation, certification and licensing procedures including spatial planning are clearly coordinated and defined, with transparent timetables for determining planning and building applications;

(b) comprehensive information on the processing of authorisation, certification and licensing applications for renewable energy installations and on available assistance to applicants are made available at the appropriate level;

(c) administrative procedures are streamlined and expedited at the appropriate administrative level;

(d) rules governing authorisation, certification and licensing are objective, transparent, proportionate, do not discriminate between applicants and take fully into account the particularities of individual renewable energy technologies;

(e) administrative charges paid by consumers, planners, architects, builders and equipment and system installers and suppliers are transparent and cost-related; and

(f) simplified and less burdensome authorisation procedures, including through simple notification if allowed by the applicable regulatory framework, are established for smaller projects and for decentralised devices for producing energy from renewable sources, where appropriate

Licencing may be different according to the size of the generation unit. Special provisions for small power plants may also be introduced. Licensing is a critical issue particularly for small renewables scale renewables as inappropriate or generic (e.g. full licencing procedure as in the case of large RES power plants) may impose a regulatory burden. Part of best practices in Europe in respect of licensing small-scale RES generation include the DSO as a one-stop-shop and well defined and simplified environmental/installation guidance based on standardisation.

Table 21 Summary of licensing for electricity generation activity

Country	Compliance with EU directive	One stop-shop	Definition of procedure clear	Timing defined	Special provisions for small plants
Armenia	No	No	Yes	Yes	Yes<150 kW
Azerbaijan	No	No	Yes	Yes	Yes<150 kW
Belarus	No	No	Yes	Yes	No
Georgia	No	No	Yes	Yes	Power plants below 13 MW installed capacity does not need license
Moldova	Electricity producers from RES may request the licence even in case the power plant is not built.	Licence is issued by ANRE	Yes	Yes	No license is required for producers with capacity less than 5 MW for public purposes and 20 MW in case the power plants is for own use
Ukraine	Not fully compliant	No	Yes	Yes	Yes <30kW

3.4.6.1 Ukraine

The existing national regulations on licensing are well defined although the may be considered as not fully compliant with Article 13 of Directive 2009/28/EC due to overregulation and lack of transparency of the administrative procedures. Not all administrative procedures are streamlined and expedited at the appropriate administrative level. This is mainly due to the lack of coordination and communication between the authorities. This is easily perceived as a market risk by potential investors in the renewable sector. The full procedure to have the power plant operational and be able to sell electricity according the feed-in support mechanism comprises a number of administrative steps. There is no one-stop shop for permits and licenses, and pre-construction procedures may be lengthy[57]. However for PV systems with capacity below 30kW there is no need of licence and administrative procedures are simplified.

Other renewables need to get a proper licence to operate in accordance with Law of Ukraine “On Electricity”. Law “On Licensing of Economic Activity" defines the procedures for license issuance. The list of the documents which are necessary to submit for obtaining the license, are defined in Article 11 of the Law 20. The law also defines time limits for the issuance of the license. The decision to issue the license is taken within ten working days after an application for a license receipt by the licensing body.

Licence is conditional for FiT access. Moreover, the renewable operator has to sign an “accession to the Wholesale Electricity Market (WEM).” In addition to signing a WEM Agreement, electricity producer must also conclude a bilateral agreement with Energorynok SC. The NERC Decree No. 1314 of 11th October 2012 approved the template of an agreement for the sale of electricity between Energorynok SC and the entity that produces electricity using alternative sources[22]. The procedure of signing a bilateral contract between Energorynok SC and electricity producer is not

[57]https://www.energycommunity.org/portal/page/portal/ENC_HOME/AREAS_OF_WORK/Implementation/Ukraine/Renewable_Energy

provided by AMWEM. According to Article 1 of the AMWEM, this type of contract must be approved by the Council of WEM.

According to the current practices, the electricity producer must submit an application form containing information on the capacity of its units, their settlement, installation of automatic metering devices and a copy of the appropriate license. All other information about the producer is provided by the WEM Council secretary. Following the application's approval, Energorynok SC provides a bilateral agreement that must be signed by the producer and agreed with the relevant local energy supplier. After signing, the contract must be approved by NEURC.

3.4.6.2 Moldova

According to Article 12, paragraph (3) the Electricity Law a specific license is required for power plants used for public service which have a capacity equal to and larger than 5 MW. In the case of self-consumption power plants, a license is necessary for capacities equal to and larger than 20 MW.

The Electricity Law, article 14 paragraph (2) also stipulates the conditions needed to apply for licence. Article 21, paragraph (2) of the Law on promotion of the use of energy from renewable sources stipulates that the activity of electricity production from RES is practiced on the basis of the license for production of electricity issued by ANRE in compliance with the Electricity Law. The license for production of electricity may be obtained before the power plant is constructed, submitting the documents as provided for in the Electricity Law. In this case if within two years from obtaining the license the licensee does not finalise the construction of the power plant, the issued license will be withdrawn by ANRE.

3.4.6.3 Georgia

In Georgia, licenses are required for generation sources (including for renewable) above 13 MW and are issued by GNERC.

In order to acquire permission to commercially generate electricity RES power plant owners with capacity above 100 kW shall become registered to the electricity (capacity) market. This requires them to follow the registration procedures with the Electricity System Commercial Operator (ESCO) as defined by the Market Rules approved by the Ministry of Energy and Grid Code approved by GNERC.

The interested party needs to present standard documentation (company registration document, grid connection technical conditions, letter from GSE (TSO) for having meters already installed and ready for commercial operation etc.) to ESCO and becomes registered in 10 days upon submission of a complete request. Registration of a party as a wholesale market participant with ESCO does not require any payment and it is indefinite.

RES power plants with capacity below 100 kW do not require licensing by GNERC, nor registration with ESCO as electricity market member. There are no special permits and licenses for building PV systems, and no separate construction permits for households. An Environmental Impact Assessment (EIA) is needed for power plants above 2 MW.

3.4.6.4 Armenia

In accordance with the Law on Licensing the activities of generation (including CHP generation), transmission, distribution, import, export of power are subject to licensing (2nd row of the section 8 of the table of Article 43), Public Services Regulatory Commission (PSRC) is the licensing authority in this sector. The overall licensing procedure in the energy sector (including as appropriate any intermediate licenses/permits issued by other authorities) is overseen by the Regulator.

In accordance with the Law of the RA on Energy (Article 23, part 2) the following activities are not subject to regulation (and consequently not subject to licensing):

a. activities of the generation, transmission and distribution of thermal energy exclusively for own needs;
b. activities of the generation, transmission and distribution of thermal energy, when the installed capacity of those systems does not exceed 5.8 MW;
c. the activities of solar power plants with power of up to 150 kW (including during the period of their construction);
d. activities of CHP generation exclusively for own needs, as well as the generation of electric energy in a diesel generator station.

3.4.6.5 Azerbaijan

The State Agency for Alternative and Renewable Energy Sources (SAARES or AREA) is responsible for issuing the permits for RES power plants. The procedure for issuing permissions (licences) in the electricity sector of Azerbaijan is regulated by a number of legal acts and bylaws. According the latest Resolution # 482, 24.12, the special permits for power plants operating on alternative and renewable energy sources are required only for power plants with a capacity higher than 150 kW. Consequently, for most of the building-PVs systems the special permit is no required.

However, there is no actual experience or case studies on the licencing procedure for small scale privately owned PV systems because all of the PV installations to the date were developed by SAARES.

3.4.6.6 Belarus

According to the requirements of the RES Law, guarantees of origin of energy produced from renewable energy sources are implemented via the issuing of a relevant certificate. The certificate is issued by the Ministry of Natural Resources and Environmental Protection and the relevant information regarding the specific RES plant is recorded in the Register of renewable energy in the state cadastre of renewable energy sources. Up to 1 August 2016 152 certificates have been issued. Information is available in open access on the official Ministry of Natural Resources website. The guarantee of origin system is not required in the cases of RES power generators that are not connected to the state electricity networks.

The certificate is required for:

- conclusion and extension of contracts for the purchase of energy;
- the application of tariffs that promote the use of renewable energy.

The procedure for the verification of the origin of energy produced from RES and for issuance (or extending) of the certificate is determined by the "*Regulations on the procedure for confirmation of the origin of energy produced from renewable energy sources, and the issuance of a certificate to confirm the origin of energy*," of the approved Resolution of the Council of Ministers on 24.06.2011 number 836.

For its decision the Ministry of Natural Resources carries out the following procedure:

- verification of compliance of documents submitted for the certificate, the legal requirements in the field of renewable energy use;

- verification of project documentation for the project, the project ecological passport, acts of individual testing and comprehensive testing of installed equipment;
- inspection of the location of facilities and sites of the actual placement of installations, which includes:
  - inspection of the equipment and their relevance to renewable energy production, the compliance verification on the make, model, modification, release year registration marks, and other information specified in the registration documents;
  - the validation of a compliant energy metering system;
  - determination the amount of energy generated from renewable energy sources;
  - in cases of dual fuel or non-RES hybrid plants: evaluation of measures taken to eliminate possibilities of injecting to the national grid energy generated from non-renewable sources of energy.

The decision regarding the issuance of a certificate is carried out within 30 days from the date of registration of the relevant application that includes a set of required documents which are included in the aforementioned Resolution of the Council of Ministers). Inspection of installations and location of sites of the actual placement of installations is carried out in a period not exceeding 15 days from the date of submission of the application.

3.5 Electricity prices

The following section presents information on tariff structure and retail prices in the Easter Partner Countries. Electricity wholesale prices, possibly separated in their main components provide useful information in order to understand the competitiveness of RES and PV in each specific market segment. PV systems may be competing in the generation segment or displacing other generation if priority dispatch is enforced, or under net metering, PV generation may be compared to the retail price of different end-user categories. Understanding the final electricity tariff composition is a good indicator of PV economic potential. In other words, generation and retail electricity costs may be hence compared with calculated LCOE of PV installation in order to assess their economic competitiveness.

When compared to EU country retail prices all Eastern Partner countries have a lower generation and retail price level. The gap is especially remarkable when comparing EU and Eastern Partner countries' wholesale costs and retail costs. On one hand the level of taxation on electricity prices appears to be higher in the EU countries compared to the Eastern Partner countries. Moreover, electricity prices in the Eastern Partner countries are often used as an indirect method of social policy. Subsidies and cross-subsidies on wholesale prices and/or end or end-user tariffs often prevent them from reflecting the actual costs. Whereas in the EU electricity end-user prices provide an incentive for installing PV in the Eastern Partner countries artificially low electricity end-user prices may in the contrary provide disincentives to do so.

3.5.1 Generation and wholesale price

Table 22 below provides a comparison of estimates or reported wholesale electricity prices or costs found in some Eastern Partner countries (where available, reported and accessible). As a brief comparison benchmark the relevant values of Italy are also reported in the last column of the table.

Table 22 Indicative wholesale electricity prices in selected countries

Country	Year	Pmin	Pmax	Generation average cost*	Wholesale price *	Comments in cases it is not possible to have a

						generation/wholesale price
Armenia						
Azerbaijan	2015	n/a	n/a	1.6 €cent /kWh (E)	2.3 €cent /kWh (o)	
Belarus	2016	n/a	n/a	7.4	10.9	There is no electricity market in Belarus
Georgia[58]	2016-2017	5.8 - hydro 34.8 - thermal	34.2 - hydro 54.7 - thermal	32	41[59]	Generation prices are deregulated for small HPPs, and bilateral agreements are confidential. Therefore, it is impossible to calculate generation/wholesale price.
Moldova		11.0 hydro	80.9 natural gas	71.76 estimation without import		
Ukraine						
Italy	2016	10.94 lowest pool price	150.00 highest pool price	42.78	42.78	The cost is the result of electricity market pool

*(E)estimated; (O) official

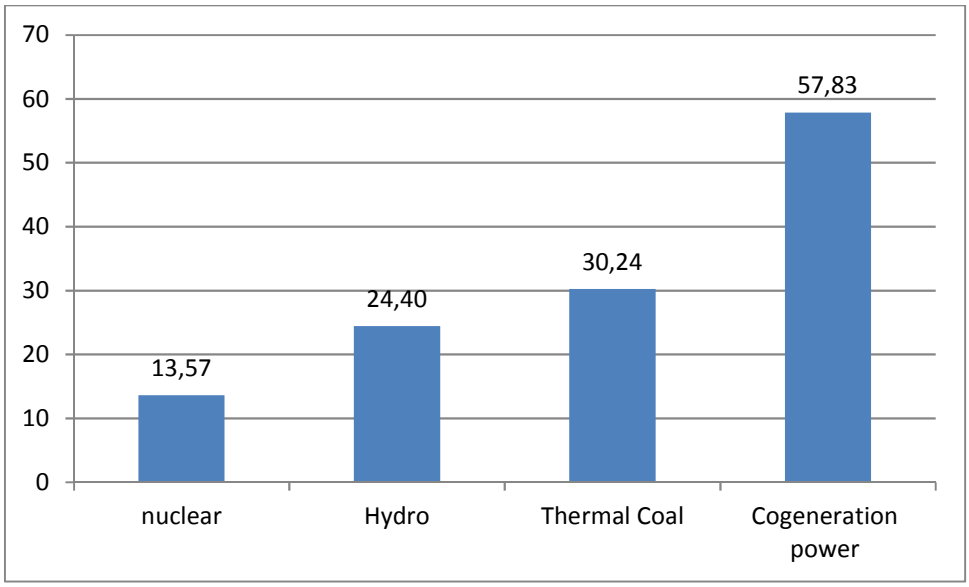
3.5.1.1 Ukraine

NEURC, the independent regulatory authority sets the electricity tariffs for generation, transmission and distribution and also calculates the domestic users' purchase tariffs. Generation tariffs have increased significantly in the last years, as can be seen in, due to an increase in fuel prices both for uranium and coal commodities. WEM (Wholesale Electricity Market of Ukraine) purchases electricity from different types of power generation at different costs. The purchasing prices for different technologies are reported in Figure 24 and 25 below.

Figure 24 Electricity generation cost, €/MWh, Ukraine 2015

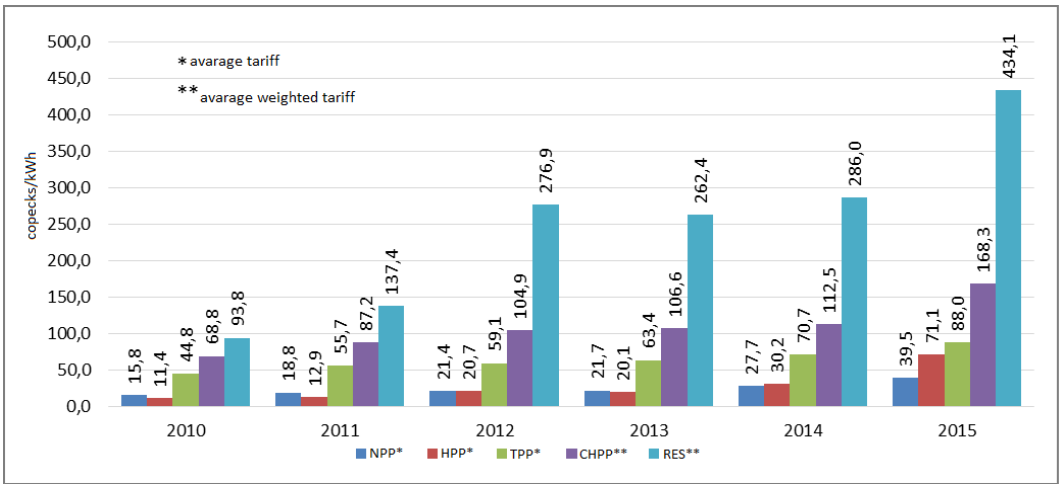
[58] Used conversion rate 1 EUR = 2.6 GEL

[59] ESCO selling balancing electricity price in 2016, which is purchased by distribution companies, exporters and direct consumers in case they have not contracted full amount of consumed electricity



The price increase is visible for all power sources. Average cost of RES has significantly risen in 2015 following the strong depreciation of Ukrainian currency. RES feed-in tariffs are indexed to Euro.

Figure 25 Dynamics of electricity tariffs by type of plant in Ukraine (2015)[60]



The structure of electricity purchase tariff comprises fuel costs, fixed costs, profit from power production and surcharge. Due to extreme raise of coal prices in 2015, the Ukrainian thermal power producers faced financial losses. This is to say final tariffs in 2015 do not incorporate all electricity generation costs.

The electricity purchase tariff structure for nuclear power generation tariff is the same to thermal power production. Again, the strong price increase, also inflation linked, is visible in 2015.

Figure 26 TPP electricity purchase tariff structure[61]

[60]Report on results of the NEURC activity in 2015, approved by the NEURC Decree No. 515 of March 31, 2016

[61] Report on results of the NEURC activity in 2015, approved by the NEURC Decree No. 515 of March 31, 2016

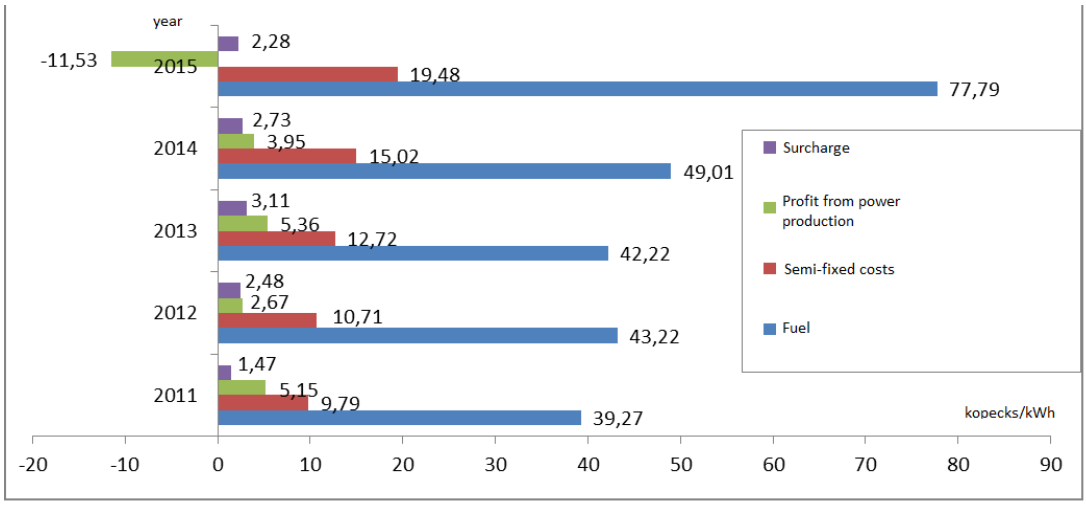
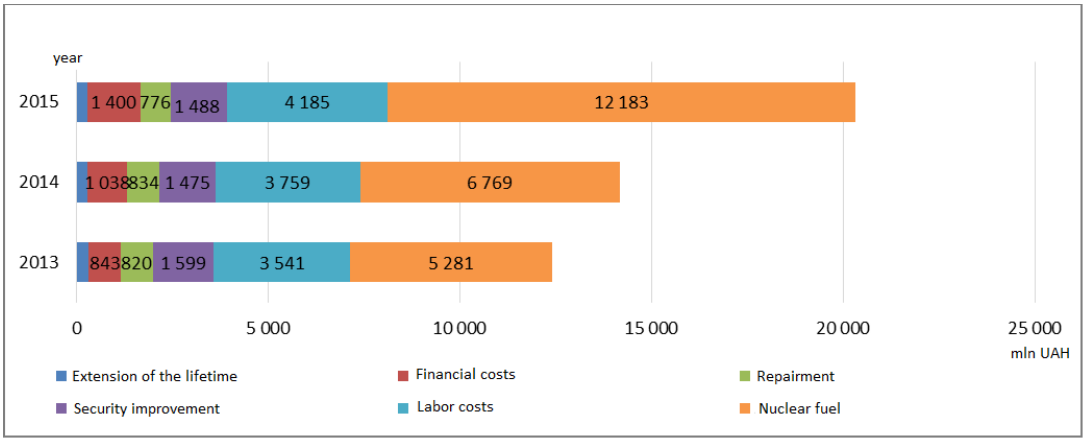


Figure 27 NPP electricity purchase tariff structure



In the long run the expressed intention of lawmakers in Ukraine is to abolish generation regulated price and develop a wholesale market with the introduction of bilateral trading, the establishment of day ahead and balancing market. This is anticipated to bring an alignment of wholesale price to the marginal generation cost but will also most probably mean a potential increase of wholesale price compared to current levels.

3.5.1.1 Moldova

Electricity tariffs are generally regulated by ANRE according to predefined methodologies that accounts separately for generation, transmission and distribution tariff components. Supply charges are also approved by ANRE.

Regulated companies provide electricity at regulated prices that is equal to 11.0 €/MWh for the single Hydro Power Producers and range between 75.5 and 79.0 €/MWh for the three natural gas power plants. Import price at present is s are also regulated and are currently at 47.7 €/MWh. The estimated average electricity purchased price is about 53.46 €/MWh Electricity Tariffs for consumption of electricity at different voltage levels in Moldova are presented in Table 23 below:

Table 23 Electricity tariffs in Moldova for 2017

	MDL/kWh	Euro¢/kWh[62]

[62] Exchange rate of MDL to Euro according to the National Bank of Moldova website www.bnm.md, as of April 27th, 2017.

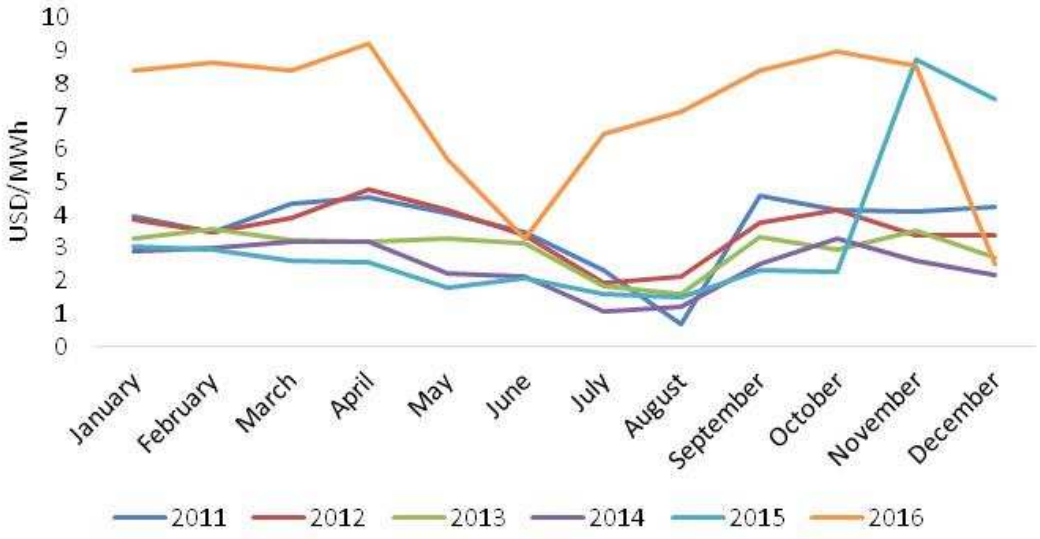
Transmission tariff		0.145	0.690
Distribution tariffs applied by ICS RED Union Fenosa S.A,	HV	0.15	0.714
	MV	0.43	2.046
	LV	0.60	2.855
Distribution tariffs applied by S.A. RED Nord	MV	0.50	2.379
	LV	0.79	3.759
Distribution tariffs applied by S.A. RED Nord-Vest	MV	0.68	3.235
	LV	0.91	4.330

3.5.1.1 Georgia

Electricity tariffs are regulated by GNERC and are separated into generation tariffs for regulated HPPs and TPPs, wheeling[63], transmission, dispatch, and distribution tariffs, Guaranteed Capacity fee, ESCO service fee and end-user tariffs. Generation tariffs for 2017 range between 4.7-33.6 USD/MWh (excl. VAT) for regulated HPPs and 34.2-53.7USD/MWh (excl. VAT) for TPPs.

The Guaranteed Capacity fee is payable by eligible final consumers in order to ensure reliability of supply. Figure 28 shows the evolution of the monthly Guaranteed Capacity fee payable by the final consumers. Capacity fee ranges from 6.6 to 129.7 USD/MWh.

Figure 28 Guaranteed Capacity fee in Georgia



Wheeling, transmission, distribution and dispatch tariffs are generally increasing. Table 24 shows the current tariff levels.

Table 24 Wheeling, transmission, distribution and dispatch tariffs in Georgia for 2017 in USD/MWh.

Wheeling

[63] "Wheeling" refers to the transfer of electrical power through transmission and distribution lines from one utility's service area to another's.

Telasi	220/380V	21.9
	3.3-6-10kV	7.4
	35-110kV	4.9
EPG	220/380V	26.1
	3.3-6-10kV	10.3
	35-110kV	5.8
KED	220/380V	23.9
	3.3-6-10kV	10.1
	35-110kV	3.6
Distribution		
220/380V		21.7
3.3-6-10kV		7.9
Dispatch		
Georgian State Electrosystem		0.3
Transmission		
Georgian State Electrosystem		3.4
Energotrans (500kV)		1.5
Energotrans (400kV)		1.9
Saqrusenergo		0.7

3.5.1.2 Armenia

Generation cost in Armenia is based on an individual cost per plant. The regulatory authority approves a different generation cost for each power station. According to the latest available data in 2013 the generation tariffs ranged between 6.58 AMD/kWh for Sevan-Hrazdan HPP and 59.47 AMD/kWh for Hrazdan TPP (ca 1.2.1 and 10.9 c€/kWh respectively[64]).

Base load is represented by ANPP (nuclear power station) with a generation cost of 10.83 AMD/kWh (ca. 2c€/kWh) Transmission and distribution tariffs in the same year were 1.0657 and 11.786 AMD/kWh respectively (0.19 and 2.2 c€/kWh). Table 25 shows the evolution of regulated tariffs in the period 2009-2013.

[64] According to http://rate.am/en/armenian-dram-exchange-rates/central-bank-armenia the average 2013 exchange rate was 543.03AMD/€

Table 25 Generation, transmission and distribution tariffs in Armenia (Source: RoA, SREP Investment Plan, 2014)

	2009	2010	2011	2012	2013
Generation					
Hrazdan-5	N/A	N/A	N/A	21.65	33.4
Yerevan CCGT	N/A	N/A	11.657	5.328	20.07
Hrazdan TPP	22.559	38.851	43.997	41.219	59.47
Yerevan TPP	22.520	29.379	N/A	N/A	N/A
Sevan-Hrazdan	5.802	4.983	3.866	4.56	6.581
Vorotan	1.448	1.868	4.35	4.778	7.914
ANPP	7.525	7.963	8.428	9.658	10.830
Transmission					
HVEN	0.891	0.710	0.827	0.3322	1.0657
Distribution					
ENA	10.134	11.200	11.152	9.338	11.786

Source: Public Services Regulatory Commission of the Republic of Armenia (PSRC), "Calculation of Electricity Tariffs," 2009-2012.

3.5.1.3 Azerbaijan

Tariffs are regulated by the Tariff Council which determines the retail and wholesale tariffs for electricity, gas, central heating services and refined petroleum products. The latest tariffs are approved by the Resolutions of Tariff Council #17, November 28, 2016 on Regulation of Electricity Price Rates in the Republic of Azerbaijan.

Azerbaijan wholesale price is set at 3.1c€/kWh. This includes the thermal generation with natural gas (nationally produced) and the contribution from other producers whose electricity is remunerated at the level fixed by the Tariff Council as in the table below. No data on generation costs are made available.

Table 26 Tariffs of electricity purchase as on 28 November 2016

#	**Name of Services**	**Tariffs for 1 kWh, AZN*10^{-2} (€cent)**
1	**Purchase from producer**	
1.1	Private small hydro power stations	5,0 (2,7 €cent)
1.2	Wind power stations	5,5 (3,0 €cent)
1.3	Other RES	5,7 (3,1 €cent)
2	**Wholesale**	5,7 (3,1 €cent)
2.1	Enterprises of the chemical and aluminium industry, mining ore-based steel foundries, with direct energy supply from 35 kV and 110 kV lines and for production purposes, with average monthly consumption not less than 5 million kWh	
2.1.1	Day (08.00 - 22.00)	5,8 (3,2 €cent)
2.1.2	Night (22.00 - 08.00)	2.8 (1.5 €cent)
3	**Transit transmission**	0,2 (0,11 €cent)

Note: Exchange rate of EURO/AZN = 1.85 as on 9 November 2016

3.5.1.4 Belarus

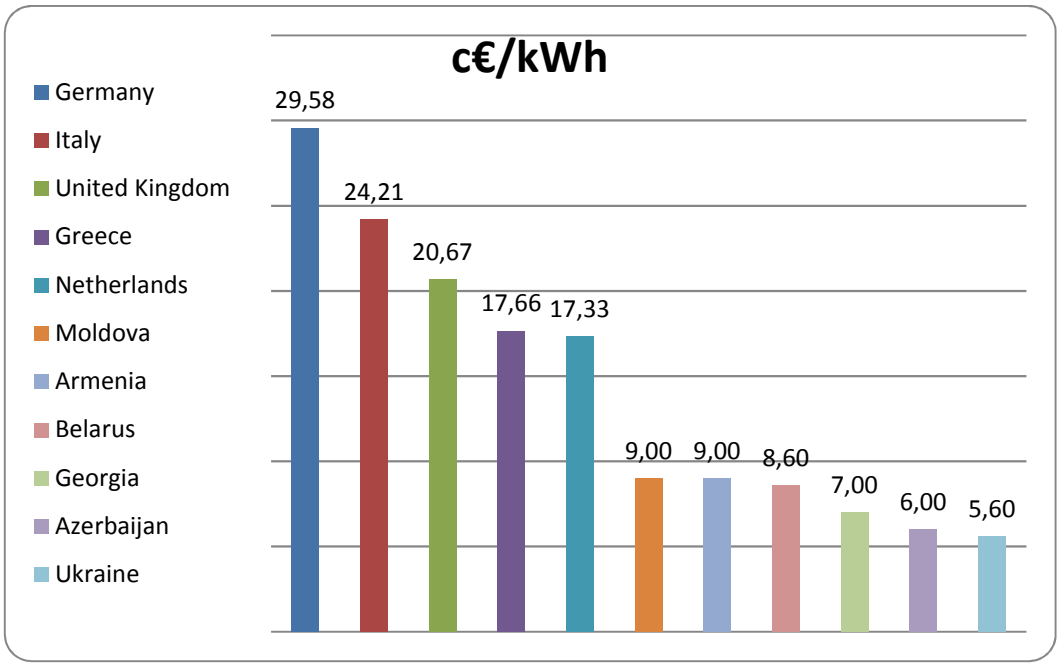
There are no data on generation costs available in the country.

3.5.2 Retail tariffs

Retail tariffs per customer category comprise important information for the estimation of PV rooftop economic potential. Building-PV systems are usually installed directly by end-users and a portion of its output is usually directly consumed on site by the system owner. In this case the retail electricity price corresponds to the reference price against which comparison may be made with the PV output LCOE. When a net-metering mechanism has been introduced it is possible to compare all PV production to retail price. In other cases, the economics of PV will be determined by the FiT or market price taking also into regard the third-party access, dispatching and obligation to purchase RES electricity rules defined in a given country. In addition, for the domestic sector taxed and VAT, which frequently exempt PV and RES equipment, may play a significant role in the final assessment of the financial performance of building-PV system. Furthermore, the presence of block or night and day tariffs may also be an advantage for rooftop potential as the PV production will be able to offset marginal electricity consumption at household level, thus allowing for savings within the highest block tariff level.

Figure 29 below summarizes the electricity tariffs for end-users in per users' category electricity tariffs level while also providing the relevant figures in respect of some selected EU countries for comparison reasons.

Figure 29 Final retail tariffs in Eastern Partner and selected EU countries[65]



3.5.2.1 Ukraine

In Ukraine final electricity tariffs for customers, except domestic sector, according to the voltage class, excluding VAT are defined for each national supplier. The table below summarizes main data as of January 2017.

[65] The figure compare average price recorded in selected EU countries in 2016 (Eurostat) including VAT and other taxes for household sector (2500-5000kWh per year) and the highest recorded prices for the domestic sector category in selected Eastern Partner countries.

Table 27 final electricity tariff as of January 2017 for consumer type, c€/kWh

Consumer type	Average price	Min found	Max found
1st voltage class	5,2	4,6	5.6
2nd voltage class	6.5	4.8	7.0

Household tariff are structured in block tariffs. Tariff blocks have different range according to urban and rural area and the different heating device in the house. VAT level on domestic electricity consumption is set at 20%

Table 28 Min-max and central block tariff level, c€/kWh

	First block (low consumption)	Last block (high consumption)	Central value
cent€/kWh	2.47	5.67	4.46

The table reports electricity price for all consumers, except domestic sector, applied by all suppliers as from January 2017.

Suppliers under regulated tariff (SRT)	**Electricity tariff for consumers, except domestic sector, in accordance with voltage class, without VAT,** *UAH kopecks/kWh*	
	1st voltage class	2nd voltage class
PJSC "Vinnitsaoblenergo"	154.77	202.90
PJSC "Volynoblenergo"	151.47	192.44
PJSC "DTEK Dniprooblenergo"	139.43	163.47
PJSC "DTEK Donetskoblenerho" *	150.90	192.25
PJSC "PC" Zhytomyroblenergo "	152.46	202.90
PJSC "Zakarpattyaoblenergo"	156.33	202.90
JSC "Zaporizhyaoblenergo"	141.37	176.26
PJSC "KYIVENERGO"	146.87	167.49
PJSC "Kyivoblenergo"	151.97	185.39
PJSC "Kirovogradoblenergo"	156.40	202.90
LLC "Lugansk energy association" *	162.00	202.90
PJSC "Lvivoblenergo"	152.44	188.88
PJSC "Mykolaivoblenergo"	151.29	190.96
PJSC "Odesaoblenergo"	150.41	191.29
PJSC "Poltavaoblenergo"	150.90	190.74
PJSC "Prykarpattyaoblenergo"	153.08	202.90
PJSC "Rivneoblenergo"	159.13	202.90
PJSC "Sumyoblenergo"	153.76	200.91
JSC "Ternopiloblenergo"	157.30	202.90
AK "Kharkivoblenergo"	151.96	184.05
PJSC "PC" Khersonoblenergo "	157.30	198.33
PJSC "Khmelnytskoblenergo"	155.40	202.04
PJSC "Cherkasyoblenergo"	149.88	185.25
PJSC "PC"Chernivtsioblenergo"	154.94	197.86

PJSC "Chernigivoblenergo"	155.72	201.53
DPEM PJSC "Atomservis"	140.59	165.30
SE "Regional Electric Network" *	135.86	153.13
PJSC "DTEK PES Energougol" *	133.40	166.56
LLC NPP "Energy-Novoyavorivsk"	151.21	184.25
LLC "New Energy-Section"	151.20	201.51
LLC "DTEK The grid" *	132.43	137.56
PJSC "Ukrzaliznytsia" *	142.94	177.14
*On the territory of SRT licensed activity. except temporarily occupied territories of Ukraine		
Source: NEURC Decree "On retail tariffs setting for electricity supplied to all groups of consumers. except domestic sector within territory of Ukraine during the January 2017 in accordance with transposition to competitive retail market prices" No. 2358 of 23rd December 2016		

Finally, the table for the domestic sector illustrates the structure of domestic customer tariffs including blocks mechanisms as from 1st March 2017.

Category of consumers	**Tariff for electricity,** *UAH kopecks/kWh*		
	Excluding VAT	VAT	Including VAT
1. Electricity supplied to:			
1.1. Domestic consumers (incl. multi-flat buildings equipped with electric stoves) (incl. countryside):			
for the volume of electricity consumed at level W ≤ 100 kWh per month	75	15	90
for the volume of electricity consumed at level W > 100 kWh	140	28	168
1.2. Domestic consumers in multi-flat buildings (incl. hotel-type buildings. dormitories and accommodations) equipped with electricity heating systems (incl. countryside):			
1.2.1. During the period between the 1st of May and 30th of September in accordance with paragraph 1.1			
1.2.2. During the period between the 1st of October and 30th of April:			
for the volume of electricity consumed at level W ≤ 3000 kWh per month	75	15	90
for the volume of electricity consumed at level W > 3000 kWh per month	140	28	168
1.3. Domestic consumers in non-gasified multi-flat buildings without operating district heating system (incl. countryside):			
1.3.1. During the period between the 1st of May and 30th of September in accordance with paragraph 1.1			
1.3.2. During the period between 1st of October and 30th of April:			
for the volume of electricity consumed at level W ≤ 3000 kWh per month	75	15	90
for the volume of electricity consumed at level W > 3000 kWh per month	140	28	168
1.4. For many children. Adoptive Families and family-type homes irrespective of electricity consumption volume	75	15	90
1.5. Domestic consumers calculated by common metering device and united by a legal entity housing maintenance organizations. excl. dormitories	140	28	168
1.6. Dormitories (domestic consumers. calculated by common metering device and united by a legal entity. housing maintenance organizations	75	15	90
Source: NEURC Decree "On tariff setting for electricity supplied to domestic category of consumers" No. 220 of 26th February 2015			

3.5.2.1 Moldova

Table 29 presents the electricity supply tariffs depending on the three distribution regions in the country. The end user tariffs include also the supply charge and are not differentiated between consumer categories but only between voltage levels. The tariffs do not include VAT. Household customers do not pay VAT at present. The supply charge constitutes the expenditures included in the end user tariffs for services rendered by the universal service suppliers that at present are also suppliers of last resort.

Table 29 End user electricity tariffs in Moldova for 2017[66]

Company	Voltage	MDL/kWh	*Euro¢/kWh*
ICS Gas Natural Furnizare Energie S.R.L.	HV	1.53	*7.28*
	MV	1.82	*8.659*
	LV	1.99	*9.468*
S. A. "Furnizarea Energiei Electrice Nord".	MV	1.84	*8.754*
	LV	2.12	*10.087*
S. A. "Furnizarea Energiei Electrice Nord".	MV	2.01	*9.563*
	LV	*2.25*	*10.705*

Table 30 Electricity price and supply charge included in end user tariffs in Moldova in 2017

Company		Voltage	MDL/kWh[67]	*Euro¢/kWh*
ICS Gas Natural Furnizare Energie S.R.L.		HV	1.24	*5.876*
		MV	1.25	*5.924*
		LV	1.25	*5.924*
S. A. "Furnizarea Energiei Electrice Nord".	S.A. Red Nord	MV	1.20	*5.686*
		LV	1.19	*5.638*
	S.A. Red Nord-Vest	MV	1.20	*5.686*
		LV	*1.19*	*5.638*

3.5.2.1 Georgia

End user tariffs differ depending on the three suppliers (DISCOs) and the category of consumer, commercial and household sector. For commercial customers' tariffs are arranged per voltage level. For household, a block tariff mechanism is in place. Table 31 shows the current tariff levels. The low regulated end user tariff levels generally provide no incentive to eligible consumers for

[66] Tariffs approved in March 17, 2017 according to ANRE resolutions No 108 and 110 and the exchange rate MDL/Euro as of April 27, 2017 according to National Bank of Moldova: www.bnm.md

[67] Figures are estimated subtracting the approved transmission and distribution tariffs from the approved end user tariffs.

negotiating direct purchase agreements with power generators. Final consumers pay VAT, which amounts to 18%, but transmission/dispatch service is free of VAT according to Georgian legislation. Other additional taxes do not apply.

Table 31 End user tariffs in Georgia for 2017

In EUR/MWh (excl. VAT)	TELASI	EPG	KED
For Commercial Users			
Voltage level			
220/380V	64.4	64.5	45.0
6-10kV	49.8	48.8	31.2
35-110kV	47.4	44.2	24.7
For Residential users			
Consumption level (per month)			
<101kWh	42.3	42.2	42.3
101kWh - 301kWh	55.4	55.2	53.8
>301kWh	70.0	69.9	57.0

3.5.2.2 Armenia

Retail prices differ depending on connection voltage level and time of use. The night tariff is considerably lower than daily tariff also for the domestic sector. Current electricity prices (updated in 2016) per sector/category (e.g. domestic, LV commercial, MV commercial, MV industrial, HV industrial other) are provided in the table below.

Table 32 End user tariffs in Armenia effective from 2016

Consumption group	Unit	Tariff (including VAT)	Info Date
110kV consumers	AMD/kWh	34.7	01/08/2016
Night tariff	AMD/kWh	30.7	
35kV consumers	AMD/kWh	37.2	
Night tariff	AMD/kWh	33.2	
6/10 kV consumers	AMD/kWh	43.2	
Night tariff	AMD/kWh	33.2	
0.38kV consumers	AMD/kWh	46.2	
Night tariff	AMD/kWh	36.2	
Population	AMD/kWh	46.2	
Night tariff	AMD/kWh	36.2	

3.5.2.3 Azerbaijan

The latest tariffs were approved by the Resolutions of Tariff Council #17, November 28, 2016 on Regulation of Electricity Price Rates in the Republic of Azerbaijan. Household tariff comprises only a single tariff block. There is only one non-residential electricity tariff.

Table 33 End user tariffs in Azerbaijan effective from 2016

4	**Retail**	
4.1	Residential	
4.1.1	For monthly consumption less than 300 kWh	7.0 (3.8 €cent)

4.1.2	For monthly consumption more than 300 kwh	11.0 (6.0 €cent)
4.2	Non – residential	9.0 (4.9 €cent)

The 18% VAT is included

3.5.2.4 Belarus

Electricity tariffs are regulated by the Ministry of Economy and are differentiated depending on the consumer group. Electricity and heat tariffs for non-residential consumers are automatically adjusted according to the USD exchange rate. Case specific tariffs are also applicable for special strategic categories of consumers[68]. Table 34 shows the tariffs for various customer groups.

Table 34 Electricity tariffs for various consumers in Belarus

		Tariffs for 2015 in BYR/kWh	Tariffs for 2015 in c€/kWh[69]
Industrial	**Up to 750kVA**	1,580.2	9.07
	More than 750kVA	1,237.2 plus 139,207.3 BYR/month	7.02 plus 7.90 €/month
Agricultural		1,203.1	6.83
Street lighting		1,652.2	9.38
Public Transport		293.6	1.67
Public Institutions		1,652.2	9.38

Tariffs for residential consumers are differentiated by peak and off-peak time periods and by electricity use. In particular, households with electric stoves for cooking have a lower electricity tariff than those with gas stoves for cooking and heating. Furthermore, households are exempted from VAT. Public health institutions, social service and religious institutions as well some other organisations benefit from tariffs subsidised at the same level as households. Table 35 and shows the tariffs for the household sector categories in 2015 and 2016 while Table 36 for 2017.

Table 35 Electricity tariffs for households in Belarus for 2015 and 2016

		Price as of 1 July 2015		Price as of 1 July 2016	
		BYR/kWh	c€/kWh	BYR/kWh	c€/kWh[70]
Households	With gas stoves and consumption up to 300 kWh per month	953.8	5.416	1,188	5.4
	With electric stoves and consumption up to 400 kWh per month	810.7	4.604	1,009	4.6
	With consumption over the monthly limits	1,467.5	8.333	1,900	8.6

[68] OECD/IEA, Eastern Europe Caucasus and Central Asia- Energy policies beyond IEA countries, 2015
[69] Based on the average 2015 exchange rate of 17,610 BYR/€
https://www.nbrb.by/engl/statistics/Rates/AvgRate/
[70] Based on the average 2016 exchange rate of 22,005 BYR/€
https://www.nbrb.by/engl/statistics/Rates/AvgRate/

Table 36 Electricity tariffs for households in Belarus for 2017[71]

	Monthly consumption	Price as of 1 January 2017	
		BYR/kWh	c€/kWh
Households with electric stoves	Up to 250kWh	1009	4.6
	From 250 kWh to 400 kWh	1312	6.0
	More than 400 kWh (econ. Justified)	19	0.1
Households without electric stoves	Up to 150kWh	1188	5.4
	From 150 kWh to 300 kWh	1544	7.0
	More than 300 kWh (econ. Justified)	1900	8.6
Households not equipped with electric systems and centralized hot water and natural gas supply	Up to 300kWh	1188	5.4
	More than 300 kWh (econ. Justified)	1544	7.0

There is a target to reform tariff calculation and allocation method in order to gradually reduce subsidies. This reform includes separation of tariffs for generation, transmission and distribution. As a rule, for the pace of subsidies' phase-out, an annual increase in the tariffs, based on nominal growth in the average salary is used.

3.6 PV policy outlook

PV technologies and specifically building-PV solutions have not been significantly introduced in the Eastern Partner Countries yet. Some projects have already been commissioned in all six countries but PV and especially building-PV systems are still a marginal generating option. Ukraine shows the largest number of building-PV deployment with some 1,000 households having rooftop systems installed.

Limited resource potential in Belarus, Moldova and Ukraine, (in the majority of the countries area with a bright exception the southern areas), combined with limited disposable income, difficult and expensive financing and low electricity prices are the main obstacles to PV development.

Some support mechanisms have been introduced already in the Eastern Partner countries. And in Ukraine they have already started to show their effect which can be measured in terms of PV development. In Moldova the incentive scheme is still lacking secondary legislation implementation and it is too early to assess whether the designed mechanism will be able to overcome the given resource and economic limitations.

Energy Community adhesion of Georgia will strengthen legislative and regulatory framework and it is anticipated that this may also act in favour of PV. In Azerbaijan, the abundant natural gas resources and the very low electricity prices, suggest that limited support will be directed to PV development and that PVs will mainly become a distributed generation option. Some PV systems have already been developed by the State Agency but no comprehensive market instruments are in place. In Armenia, despite the relatively good insolation, effective instruments to promote PV systems have not yet been developed. Low FiTs and end-users tariffs do not currently allow for a

[71] According to http://www.tarify.by/

noticeable building-PV development despite the fact that the country has so far made good progress in the area of energy efficiency in the buildings sector.

Table 37 Eastern Partner Countries PV policy outlook

Country	Main support for PV	Level of support	Net metering	Estimated value of kWh in net metering	VAT exemption on PV equipment	Other measures
AM	Feed-in with special tariff for 150kW<P<1MW	8,5c€/kWh	Allowed <150 with remuneration of excessive power	9,5c€/kWh	N/A	Financial incentive
AZ	RES support mechanism in place but no FiT defined for PV	3,1c€/kWh	Not allowed	N/A	Yes	No
BY	Feed-in Tariff	Different tariff levels for PV within and out of the quota scheme. Tariff degression. Max 30c€/kWh	Not allowed	N/A	Yes	Land tax exemption
GE	There is no general support mechanism. RES are developed once included in a development list by the Ministry at regulated prices.	Regulated tariffs are defined ad-hoc according to project cost.	Allowed <100kW with remuneration of all surplus electricity	Highest tariff at some 4.8c€/kWh	Yes	New initiative from Georgian Government is that micro power plants are exempt of VAT, profit and income tax
MD	Limited to no less than 10kW	Not yet known	Allowed <100kW with remuneration at the end of the year for the difference between the amount of electricity delivered into the electric network and the amount consumed from the electric network	Average electricity purchased price included in the calculation of the end user electricity tariffs, to be published by ANRE at its official website	No	The works for construction and mounting of PV systems are exempted from VAT[72]: VAT exemption for equipment will possibly be introduced in the future

[72] Tax Code of the Republic of Moldova, article 103

UA	Feed-in with higher tariffs for roof-mounted PV and PV systems <30kW.	Overall promising incentive level	Allowed <30kW with remuneration of all electricity.	Highest block tariff at some 5,7c€/kWh	yes	Premium for national products

3.6.1 Ukraine

PVs benefit from a specific feed-in level differentiated on the basis of the size and the type of system. In particular, electricity produced from roof-top PVs benefits of a higher FiT than that from a ground mounted installations. A specific tariff is also introduced for small household system with capacity bellow 30kW. FIT levels are guaranteed up to 2030 regardless of the time of commissioning of the PV system. Hence, the mechanism strongly incentivises early installation both in terms of the level of the incentive (which is declining in time) and the period of receiving it (which is shorter the later the plant is commissioned). The FiTs are defined in Euro currency up to 2030, in order to avoid inflation risks for investors. Existing legislation has not introduced a maximum capacity limit on PV development.

Feed in tariff reform in 2015 has modified the previous incentive scheme which was based on the support of national PV technology only. Previous PV incentive tariff access was restricted to PV systems whose technical components were produced nationally. . In order to make it compatible with EU acquis flexible rates of premium for Ukrainian equipment usage have been introduced instead.

Table 38 feed-in tariffs for PV, Ukraine c€/kWh

Installed capacity and other conditions	Commissioning date *(dd.mm.yy)*				
	01.01.16 - 31.12.16		**01.01.17 - *31.12.19***	**01.01.20 - *31.12.24***	***01.01.25 - 31.12.29***
On-ground Power Stations	15.99	15.03	13.52	12.01	
PVs on roofs and facades of buildings and constructions	17.23	16.37	14.76	13.09	
Household on-roof PVs (up to 30 kW)	19.01	18.09	16.26	14.49	

The above values are increased if Ukrainian equipment is installed. Specifically, when at least 30% of the equipment is coming from national industries the level of incentive is increased by 5%. When at least 50% of Ukrainian products are installed the final incentive is increased by 10%.

A net metering mechanism has been introduced with an Order, approved by the NEURC Decree of No.170 of the 27 February 2014. The Order regulates the relations between residential rooftop PV installations and local Regional supplier/DSO concerning the issues of electricity purchase, net metering and billing. It allows to individuals to install PV systems of an installed capacity no higher than the contracted connection capacity and up to 30 kW within the territory of the household and defines the rules to sell the electric power, overrating monthly electricity consumption volumes to supplier under the feed-in tariff. The installation of a bidirectional meter is required.

The value of self-consumed electricity assuming substitution of the highest block tariff level in retail tariff structure is equal to some 5,6c€/kWh. Value Added Tax (VAT) is also used in a manner that it may be advantageous for PV systems. Whereas retail electricity tariffs are charged 20% VAT, a VAT exemption is granted to PV technologies procurement thereby effectively reducing the PV LCOE. Even under the most favourable circumstances (i.e. even referring to highest block tariff level including VAT), the benefits appear quite low to provide the right incentives for a broad uptake in building-PV investments. However, it should also be considered that this situation might gradually be reverted with the steady increase of retail tariffs in the coming years.

3.6.2 Moldova

The Law on promotion of the use of energy from renewable sources does not provide for specific provisions for PV installations. PV systems will be included in the main feed-in mechanism. The level of in the FIT and the overall economics of investments in PV will be defined in the secondary legislation after the FIT level is approved and transposed in the national legislative framework.

However, the FIT mechanism is introduced only for power plants with installed capacity of no less than 10kW. This threshold may represent a barrier for household roof-mounted PV systems which do not necessarily reach the required size. Experiences from neighbouring Ukraine show, nevertheless, an average installation capacity of 15kW for household systems[73].

Electricity from PV installations injected into the electric network by eligible producers shall be purchased by the central electricity supplier at tariffs approved by ANRE or at prices established as a result of auction to obtain the status of eligible producer. The support scheme has duration of 15 years. The status of eligible producer will be confirmed by the Energy Efficiency Agency.

Alternatively, final electricity consumers with PV systems with capacities up to 100kW may benefit from a net-metering scheme introduced with Article 39 of the Law on promotion of the use of energy from renewable sources approved on February 26, 2016.

Net metering pays the excess of electricity at end of the year not balanced within the net metering scheme at the average price for electricity on the power market included in the calculation of the end user electricity prices. End-users' electricity prices average around 9.468-10.705 c€/kWh for LV connection (this represents the value of kWh, within the net metering). At the same time the estimated average electricity price for the year 2017 is approximately 5.35 c€/kWh (this represents the remuneration for the kWh in excess of net metering at the end of the year). The economics of PV roof-mounted systems will hence depend on the amount of electricity produced by the PV system and used on site by the final customer to cover its own needs.

Only final customers with power plants that cumulatively can deliver an amount of electricity that is not larger than 1 % of the quantity of electricity supplied by the supplier of electricity at regulated tariffs can benefit from the net –metering mechanism. The "first come first served" principle is applied. The excess electricity produced according to the net-metering annual balance is paid at the average wholesale market price during the same year which is published by ANRE on its official website.

Finally, according to the press at the event that take place during 28 November – 2 December Moldova Eco- Energetica the Ministry of Finance declared that for the year 2017 there is proposed to exempt from the Value Added Tax for electric vehicles and equipment installed in wind parks or PV panels.

[73] Calculation based on information from State Agency on Energy Efficiency and Energy Saving of Ukraine (SAEE), 2017

According to the recent national low emission development target (LEDS) at least 20MW of PV will be developed “unconditionally” in Moldova by 2030 with national resources. The target is increased tenfold in case of adequate access to external capital resources.

3.6.3 Georgia

PV installations with installed capacity above 100 kW may be developed by private investors, by submitting proper application to the Ministry of Energy and sign a Memorandum of Understanding. The Government provides a PPA for 8 winter months (September through April) with a fixed price, which can be changed once after the construction of the plant. Installations with installed capacity bellow 100kW may benefit from net metering.

Net Metering was adopted by changes in the national Law of electricity and natural gas as of March 2, of 2016. The Law outlined provided the definition of micro-power plant as a RES power plant with capacity of no more than 100 kW. Micro generators installed capacity for the net metering mechanism shall be less than 2% of the distribution licensee peak demand. Consumers can connect their micro power plant free of charge to the grid and get paid the price equal to the weighted average generation cost of DISCO determined by GNERC and reflected in the household tariffs for the excess of electricity. The settlement period is one month and net metering is made on a yearly basis.

The current electricity retail price at highest tariff level hardly reaches 7c€/kWh and does not allow for the penetration of PV system if not adequately supported by a specific incentive programme.

3.6.4 Armenia

Solar systems benefit from the overall FIT mechanism. FIT for purchasing electricity from solar power plant with capacity between 150kW and 1MWp has been approved by PSRC in December 2016. The FIT is set at 9 USD cents/kWh including VAT (8,5c€/kWh). 65% of FIT is linked to US currency assuring a warranty for inflation and rate exchange risk.

There is currently no legislative support for larger scale PV plants although such plants may be developed on a project by project basis and signature of PPA.

Net metering is also foreseen by legislation according to which individuals or legal entities can install solar power plants with a capacity up to 150kWp without licensing and apply net metering scheme with the electricity distributor (Electrical Networks of Armenia). Electricity in excess of net-metering balance at the end of the year is paid back half of the currently operational tariff of 9c€/kWh.

3.6.5 Azerbaijan

A FIT mechanism is in place in Azerbaijan but so far, the Tariff Council has not defined specific tariff levels for PV system and the overall RES tariff of 5.7AZN (equal to 3.1c€/kWh) is applied as well.

All PV systems installed so far in Azerbaijan have been commissioned on public buildings and all administrative procedures have been sorted out by the State Agency for Alternative and Renewable Energy Sources (SAARES).

According to the amendments of March 2014 to the Cabinet of Ministers decrees: “Rates of custom duties on export-import operations in Azerbaijan Republic” and “List of goods exempted of VAT imported to Azerbaijan Republic territory” the import of equipment, facilities, parts and

tools used in renewable energy industry and energy efficiency are exempted of custom duties and VAT.

The overall good solar potential in the country is not yet supported by a favourable policy to promote PV systems. Existing installations are developed on a case by case approach and supported by the State Agency. Current electricity generation FiT at 3.1c€/kWh is too low to allow payback of investments in PV systems.

The highest retail electricity price, corresponding to the highest block level in the residential sector, is about 6c€/kWh. This also includes VAT and is also insufficient to allow significant private investments even in presence of VAT exemption on solar equipment.

Despite policy intention to promote renewable in order to increase natural gas export, and the declaration of a 1000MW target by 2020 by the State Agency, coherent legislative framework to achieve the target has not been introduced so far.

3.6.6 Belarus

PV installations operate under the same policy framework as the rest of the RES technologies. The tariffs that are used for sale of electricity produced by PV installations are set by Decree of the Ministry of Economy of August 7, 2015 № 45. Tariffs are calculated based on a coefficient which is linked to the electricity tariff for industry for systems with an installed capacity up to 750 kVA (see chapter 3.5.2.4).

The procedure for setting and allocating quotas, as described in 3.2.3.6, to create installations in accordance with Resolution No. 662 is as follows:

- Applicants for the construction of RES projects submit an application by September 1 of each year to a relevant Executive Committee according to the designated location of the intended installation;
- The Executive Committee shall consider the application and send it to the Ministry of Energy before October 1 of the same year, indicating the possibility of construction of the facility and the provision of the land. The Ministerial decision is then sent to the Commission.
- The Commission until November 1 of the same year considers applications and evaluates them based on a number of criteria (geographic distribution, technical proposal, design, etc.).
- The applicant, who received the highest total score by criteria, obtains the right to proceed with the installations.

Table 39 The FIT for electricity produced by PV in Belarus

№	The type of facilities	Lifetime of facilities	The coefficient to the tariff	USD/kWh
1	Facilities put into operation before 20 May 2015 or created based on investment contracts concluded before 20 May 2015.	the first 10 years from the putting into operation	2.7	0.332
		10 following years of operation	0.85	0.105
		over 20 years of operation	0.45	0.055
2	Facilities put into operation in the period from May 21. 2015 to August 20. 2015. or	the first 10 years from the putting into operation with installed capacity:		
		up to 300 kW	2.5	0.308
		from 301 kW to 2 MW	2.3	0.283

	created within the allocated quotas	above 2 MW	2.1	0.259
		10 following years of operation	0.75	0.092
		over 20 years of operation	0.45	0.055
3	Facilities of legal entities and individual entrepreneurs for their own needs out of allocated quotas and put into operation after 20 August 2015	the first 10 years from the putting into operation	0.7	0.086
		10 following years of operation	0.6	0.074
		over 20 years of operation	0.45	0.055

Table 39 above provides the FITs applicable to electricity produced by installations of legal entities or individual entrepreneurs. According to the Law «On RES» energy producers from renewable energy sources are legal entities and individual entrepreneurs engaged in the production of electrical energy using RES for the purposes of energy supply of their economic activities and (or) sale. For individuals, (not registered as companies or individual entrepreneurs with VAT number) the procedure for obtaining all documents and approvals is not prescribed. Individuals have a right to use electricity only for its own domestic needs, without being connected to the grid.

There is no net metering regulation in place nor is it foreseeable in the near future. The Ministry of Energy is developing the law «On electricity», but at present net metering issues in the framework of this law are not considered.

According to the Tax Code of the Republic of Belarus there is a VAT and land tax exemption available to renewable energy generation companies.

The Decree of the Council of Ministers on 25.04.2016 №336 “Action Plan on implementation of the Directive of the President "On priorities for strengthening the economic security of the state" introduces energy efficiency provisions which may facilitate the development of the building PV sector. Specifically, it provides introduction of the design and construction of energy-efficient multi-storey residential buildings applying modern innovative technologies and equipment, including based on renewable energy sources. However, special funds for this purpose are not provided.

4 PV in buildings market and trends

4.1 Existing installations of PV in buildings

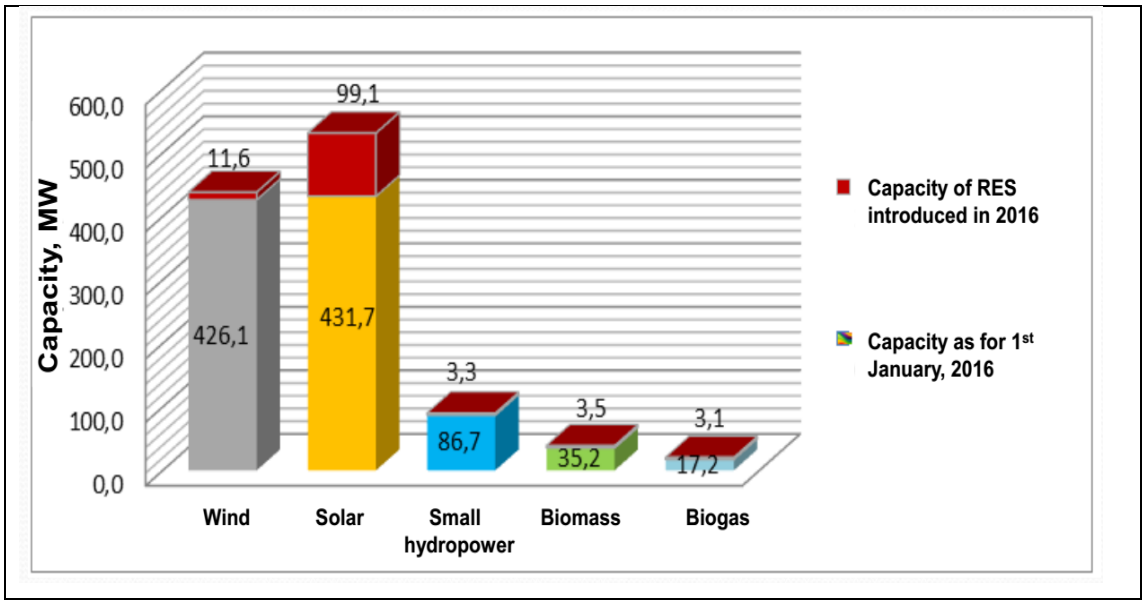
The building-PV sector is at an infant stage in all of the countries with a handful of systems being installed in most of them mainly through development funding facilities and international RES promoting programs. Ukraine, with the introduction of a favourable FIT mechanism is recording the faster growth of PV sector with interesting development in the PV roof-mounted segment. Available information on existing installations of building-PVs in each country is provided hereafter

4.1.1 Ukraine

The introduction of favourable economic incentive based on FIT has initiated a rather promising development of the PV sector in Ukraine. Ukraine shows the fastest growth in all Eastern Partner Countries in terms of installed PV capacity (both ground mounted and building-PV). The FIT is designed to stimulate the development of rooftop systems which are being installed on an increasing number of households. However, the penetration is still very limited at some 0.02% of potential buildings. The rooftop segment is covering a small but significant share of overall PV installation. The feed-in scheme is good enough to be able to overcome the limited PV capacity factor in the country.

At the end of 2016 renewables accounted for some 4% of the primary energy supply mix of Ukraine. Solar PV power plants constitute some 45% of total capacity of RES installed within the FiT incentive scheme.

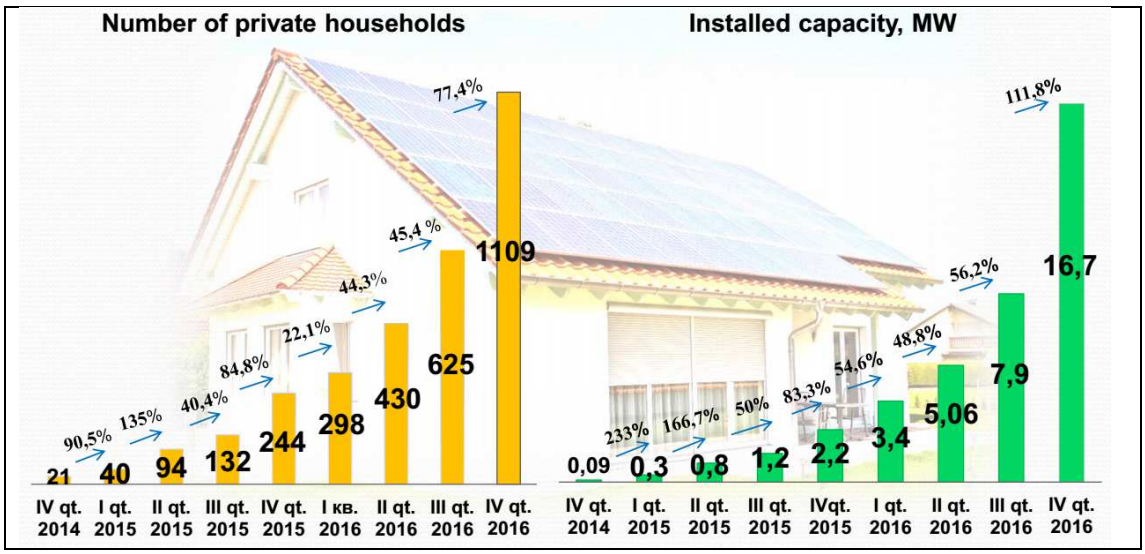
Figure 30 RES capacity in Ukraine, in 2015 and additional capacity installed in 2016 (Source SAEE 2017, Ukraine)



As of 1 January 2017 PV installations have reached nearly 530 MW; a growth of 23% from previous year. PV installations are growing at a faster pace than other RES sources. In 2016 99MW of PVs have been installed as compared to 11MW of wind and 3MW in the biomass, biogas and small hydro sector, each.

The favourable specific rates for root-top mounted systems have had a positive effect on Ukraine household PV sector which has seen an increasing number of installations especially in 2016. More specifically at the end of 2016 nearly 16.7 MW of PV systems have been installed on 1109 households representing some 3% of total PV installed capacity.

Figure 31 Number of households with a PV roof mounted system, and total installed capacity (Source SAEE 2017, Ukraine)



The average household installation in Ukraine is estimated at around 15kW. Most of the roof-top PV development has been achieved in 2016 with a sharp increase in the latest quarter of the year. The data also show a trend to install slightly bigger PV systems in recent period, with installed capacity growing at a faster pace than the number of installations.

Box 1 the Odesa solar initiative

The introduction of a favourable policy framework is posing the base for a faster growth of the building PV sector. A team of enthusiasts created a free online service called “Odesasolar”, which allows one to calculate the cost of equipment, the potential of electricity production, the price of its sale and the payback period of an on-roof solar PV installation.
The calculations are based on the solar insolation coefficient, the efficiency of solar panels, the established green tariff for individuals and legal entities, and the estimated interest rate of the loan.
The calculation algorithm takes into account the following parameters:

- cost of equipment per square meter,
- total useful area,
- amount of generated energy per square meter, according to the coefficient of solar insolation,
- output of electricity per year (kWh) of the selected area,
- payback period (years),
- Income / savings,
- CO_2 savings (compared to the average CO2 emissions from the production of 1 kW of electric power of a thermal power plant),
- the interest rate of the loan.

Figure 32 A screenshot from “Odesasolar” website

The abovementioned on-line service is available by following link: http://Odesasolar.org/

4.1.2 Moldova

A small number of PV installations exist in Moldova, most of which seem to be roof-top PVs owned by private companies, public institutions and households. The list of ANRE-approved PV systems for the FiT scheme is provided on Table 40 below. Apart from these systems there are also other PV installations producing electricity for own use. The largest one is installed at the Oncological Institute of Chisinau.

Table 40 List of approved PV systems by ANRE for FiT

No	Company owning photovoltaic power plant	Installed Capacity [kWp]
1	S.R.L.”Colizei Vechi”	60
2	S.R.L. „Graf-M și A”	10.1
3	S.R.L. "Mihailorina-Com”	10
4	S.R.L. "Amfion-Prim”	25
5	S.R.L. „Slavon Pavlon”	10.3
6	S.R.L. „ASA Business”	14
7	I.P. „Incubatorul de Afaceri Sîngerei”	13.5
8	S.R.L. „Nilcom Prim”	15
9	G.Ț. „Ocară Ștefan Dumitru”	10.5
10	S.R.L. "Opal-Succes”	41
11	S.R.L. „Tasotilex”	35
12	S.R.L. „Colizei Vechi”	145
13	S.R.L. „Vin Select”	200
14	Î.I. „Prenco Grigorii”	15
15	Institutul Internațional de Management ”IMI-NOVA”	20
16	S.R.L.”TiTiTi și C”	100
17	S.R.L. ”Biovolt”	10.5
18	G.Ţ. ”Duca Vitalie Mihail”	20
19	S.R.L. ”Sadisal Auto”	15
20	S.R.L. ”Auto-Mar”	30
21	Î.C.S.”Covoare Lux” S.R.L.	500
22	S.R.L. „G & G Solar 1”	333
23	S.R.L. „Solotrans-Agro”	100
24	Î.I.”Marinescu Aurel”	20
25	Î.I.”Andrieș-Sîrcu”	16
26	S.R.L.”Colizei Vechi”	40
27	S.R.L.”Goloseevo”	15

4.1.3 Georgia

No specific information on building-PV systems is available due to the fact that those systems which have installed by private parties are not recoded in any official record. PV development in Georgia is driven by a case by case approach and is not supported by a favourable national policy.

One of the biggest PV projects in Georgia is a construction of solar PV system at Tbilisi International Airport, and at one of the country’s public tertiary institutions, Ilia State University. Ilia State University’s PV system is able to generate 30,000 kWh electricity per year, which is enough to cover 15% of the building’s total use.

Figure 33 Tbilisi international airport demo PV system

The airport project was initiated by the Government of Japan and was carried out in cooperation with the Ministry of Economy of Georgia, TAV Georgia and United Airports of Georgia. The project was officially inaugurated on July 30, 2016. The development of the airport demo project was based on a $4.8 million grant from the Japanese Government offered for the project in 2010. The Airport system can generate 337,000 kWh electricity per year, which covers 40% of the facility's total consumption.

4.1.4 Armenia

There are currently 2 PV installations with an installed capacity of 1MW each accessing the existing FIT support scheme. An additional 1MW project is under development. The project is funded through a US$58 million program which began in 2015, aiming at boosting alternative energy sources in the country. The six-year program is directed by the Renewable Energy and Energy Efficiency Foundation. The scheme is supported by the Climate Investment Funds, the Armenian Ministry of Energy and Natural Resources, the World Bank, and the Asian Development Bank.

Under the net metering scheme around 10 rooftop systems have been installed during 2015.The capacity of these systems does not exceed 10kWp. Polycrystalline PV modules and mostly single-phase inverters have been used.

4.1.5 Azerbaijan

The total numbers of the installed PV systems in Azerbaijan is still very limited counting only 22 units with total capacity of 34,3 MW. These include PV systems with installed capacity more than 1MW, like Nakhichevan Solar Power Plant – 20 MW, Surakhani Solar Power Plant – 1,4 MW (being expanded to 2.8 MW), Gobustan Solar Power Plant – 1,7 MW, Samukh Solar Plant – 1.5 MW

A number of small PV systems have also been installed on the roofs of the various public buildings, like : Sport Centre in Masally - 70 KW, 5 schools and 2 medical centres in Baku – 132 KW, Sport Centre in Beylagan - 70 KW, 6 schools and 6 kindergarten for internally displaced persons in Bilasuvar – 300 KW.

At the picture below the Sport Centre in Masally with PV installation at the roof with 70 kW All systems are owned by Azalternative, a public company. All administrative and financial

procedures have been developed within the State Agency for Alternative and Renewable Energy Sources of Azerbaijan Republic.

Figure 34 The Masally Sports Centre 70kW PV system (Source: country report)

4.1.6 Belarus

As in all other countries a limited number of systems are in operation in Belarus. Table 41 below provides a list of all the grid connected systems. Total installed capacity is limited to 11.5MW.

Table 41 PV operating in GAP 'Belenergo' operational region as of November 2015 (Source: country report)

№	Ownership	Installed capacity, MW
1	Private	0.02
2	Private	0.01
3	Private	0.01
4	Private	0.02
5	Ministry of Natural Resources	0.1
6	Private	0.01
7	Industrial complex	0.01
8	Private	0.2
9	Ministry of Education	0.02
10	Industrial complex	3.75
11	Private	1.233
12	Private	0.03
13	Belarusian State Food Industry Concern	0.036
14	Private	0.006
15	Private	0.1
16	Private	0.01
17	Ministry of Agriculture and Food	0.07
18	Industrial complex	0.01
19	Private	0.005

№	Ownership	Installed capacity, MW
20	Private	0.005
21	Private	0.005
22	Private	0.12
23	Industrial complex	0.01
24	Private	0.04
25	Private	1.577
26	Private	2
27	Private	2.06
28	Private	0.03
29	Industrial complex	0.01

4.2 PV in buildings systems: options and standardisation

There is quite some variety in respect of the installed capacity of the existing installations. Taking into consideration that most of them have emerged either due to the adoption of a net metering scheme or as a grant-funded pilot project, the sizes are relatively small. In the case of net metering the installations are more or less sized in a manner that excess energy is minimised whereas it is understood that the capacity in the case of pilots is determined by the size of the grant.

The average size is 10 kWp for Armenia, between 70 and 150 kWp in Azerbaijan, 5 to 200 kWp in Belarus, which currently has 5 utility scale installations at the order of a few MW per plant. In Georgia the size of systems developed as net metering or off-grid plants ranges between 3 to 10 kWp. In Moldova most installations range between 10 and 30 kWp with a small number of industrial use plants which are of a 200 to 500 kWp range. Similarly, Ukraine has a number of utility scale projects in progress or underway while in the building sector systems of the size of up to 30kWp (but normally at the size of 10-15 kWp) are more frequent. Of course, this is in coincidence with the capacity cap on household systems benefiting from the net metering roof top programme.

In respect of the technology used it seems that cheaper polycrystalic modules prevail. However, based on the merits that PV panel technology alternatives may present in certain implementations, some of them have been (or will be) implemented using monocrystalic or even amorphous silicon panels. Production facilities of PV modules exist in Ukraine and Azerbaijan whereas in Belarus inverters are assembled locally by imported components.

Despite the limited and often contradicting information that is available, (please also refer to table 4) it is estimated that the total specific equipment cost (modules, inverters and balance of plant) for building PV systems in the region is in the order of €1200 to €1400 per kW. On top of the total equipment costs, design/permitting, transportation and other costs (e.g. contingencies) need to be added in order to come up with a final specific investment cost.

There is currently no indication that a storage system, i.e. battery packs, is considered necessary due to insufficient retail tariff structure i.e. subsidised flat rates or block tariffs instead of market-based time-varying energy tariffs.

4.3 PV in buildings systems: financing opportunities

Financing - at least in the initial market uptake period - is crucial for the development of building-PV systems in the Eastern Partnership area. The regional overview of the situation with respect to financing small-scale sustainable energy investments in general and not only in respect of building PVs suggest that on-lending mechanisms have prevailingly been promoted both at national level but also at regional level by international financing institutions. By analogy to the early EU support schemes and given that RES promotion schemes are currently at a development stage in the region, the connection between ownership (business) models for building PVs and financing options would have been expected to develop along the simple dimension of a loan, which in turn would have been provided on the basis of a Power Purchase Agreement (PPA). This scheme is based on the principles of dispatch priority and mandatory offtake of the PV generation. The generally low electricity end-user tariffs in the region, do not really favour self-consumption. Nevertheless, in certain cases as in Ukraine (but also in Georgia) net metering schemes have been the support mechanism model of choice. It is however not clear if this trend has developed on the basis of comparison of different business models or if it simply emerged due to the growing recent spread of such models globally.

The region presents uniform characteristics in respect of small-scale renewable energy financing and these of course include the relevant financing gaps and barriers. A quite comprehensive analysis of the financial conditions pertaining to energy efficiency and renewable energy investments has been prepared by INOGATE. The so-called "Review Of and Guide for the Financial Support Facilities for Renewable Energy and Energy Efficiency in Energy Community Partner Countries"[74] discusses the barriers and provides some recommendations on the subject following a review on the conditions prevailing in Georgia, Moldova and Ukraine. The report suggests that the three countries in concern have access to ***"a wide variety of financing instruments and sources varying from grants to commercial investment financing"***. It moreover concludes that the key contributors to this situation have to be sought among the International Financing Institutions (IFIs) and donors, which in the absence of local grants and financing, have aided the market opening and continue to work on the improvement of the enabling environment.

However, according to the same report the "***countries face today adverse economic circumstances, low income levels and profitability of the economic units, weak local currency, limited risk-taking ability of the local commercial financiers and lack of local currency grants and affordable long-term loans***". Moreover, the potential investors – energy end-users, most frequently when it comes to Energy Efficiency (EE) and small-scale RES – often miss the positive drivers that would eventually bring them in front of a decision to invest on the aforementioned technologies. Taking into consideration the fact that the majority of small-scale RES users is anticipated to originate from the residential sector, it appears unlikely that building-PVs would be a promising opportunity for reducing residential end-user energy consumption. As it is characteristically mentioned in the INOGATE report: ***"the householders have either low affordability, rising energy prices do not work yet as incentive, or they limit their EE investments into increased comfort when affordable"***.

In sum, the above observations suggest that the external dimension in financing markets should at least in the short run be considered as an indispensable feature for solar building-PVs

[74]http://www.inogate.org/documents/22042016_INOGATE_Financial_Support_Facilities_Study_Draft_Final_KS.pdf

development. Due care however needs to be taken so that the framework conditions and/or the business model selected gradually and as the market matures and grows in size make it possible to remove the multiple barriers discussed above and eventually lead to a non-subsidised development at a certain point in the future. In an initial appreciation, the specific technology does not seem to enjoy favourable conditions in order for self-consumption model(s) to be considered for a market uptake. On the contrary, suitable models based on a FiT (e.g. PPA, leasing, etc.) may - at least in the early stage of deployment (i.e. 7-10 years horizon depending on profitability) - be preferable.

Similar conclusions derive by the IFIs response to a European Commission workshop[75] on "Enhancing infrastructure and interconnectivity investments" which was held in Brussels on 18 June 2015. Though not primarily targeted on small and decentralised RE/EE investments - but rather on energy infrastructure projects - the contributions of the workshop participants, which broadly covered the situation with financing energy investments in general, coincide with the INOGATE report conclusions. This holds particularly true on the grounds providing that local enabling and financing conditions are (currently) unfavourable. Therefore, the intervention logic suggested by the IFIs is based on lending mechanisms that involve local banks, which in turn however need external support in order to perform their assessment tasks. Also, the continuation of work on reforms in the legal and regulatory framework continuous to comprise a very important requisite for the IFI's to be engaged.

In an attempt to look to the foreseeable future of the Eastern Partnership region in respect of a coordinated effort for increasing access to financing for sustainable energy investments it is considered useful to turn to the respective situation of the Western Balkans Six (WB6). WB6 comprises an important political cooperation in the frame of the EU enlargement process initiated following a conference of the heads of states and governments of the Western Balkans states in summer 2014 in Berlin. The European Commission's concept[76] on supporting this initiative was "*to reinforce the integration between the individual countries and with the EU, thus driving forward their European perspective through concrete projects. More specifically, the WB6 means focusing investments on establishing and improving transport, energy and ICT infrastructure and networks, to strengthen the countries' backbone of competitiveness*." The Energy Community works in the frame of the WB6 initiative in order to further promote regional integration and cooperation in the areas of the Treaty. Specifically, in the area of energy efficiency, the Western Balkans Investment Framework has recently published a report[77] entitled "Financing Energy Efficiency investments in the Western Balkans". Albeit the report targets mostly on energy efficiency and in addition the region's characteristics are considered to be more mature in terms of investment climate and enabling framework, it appears that the barriers discussed (see page 14 of the report) are quite similar to those discussed above for the Eastern Partnership region. Among other important findings of the report the need for incentives and concessional finance are also noteworthy and applicable to the situation in the Eastern Partnership region.

In summary, building-PVs currently seem not to be sufficiently promoted in a coordinated manner in the Eastern Partner countries neither from the energy efficiency financing nor from the renewable energy support scheme perspective. The existing spontaneous and fragmented approach of PV systems development reflects also on the differentiation in terms of the building

[75] https://ec.europa.eu/energy/en/events/eastern-partnership-platform-energy-security
[76]https://ec.europa.eu/commission/commissioners/2014-2019/hahn/blog/western-balkans-6-summit-building-networks-connecting-people_en
[77]https://www.energy-community.org/portal/page/portal/ENC_HOME/DOCS/4508400/46ECFCF6F44D6F26E053C92FA8C0EF67.pdf

use i.e. dwellings, commercial, etc. This however may be turned into a promising advantage for the development of specific programmes in which each segment may be customizable in terms of size, business model and – essentially - method of financing. For the time being, there is no solid support scheme i.e. an investment subsidy and/or FIT by analogy to the early stages of PV technology promotion in Europe. Energy services markets are either on the early stage of development or they do not exist at all. Existing installations are very few and have either emerged by means of international financing (through grants or IFI-led financing facilities or a combination of the two) or out of the spontaneous response of certain private parties to net-metering schemes. It is generally understood that a jump-start on solar PV in buildings (e.g. self-consumption models) will be extremely difficult in the Eastern Partner counties unless a structured national approach is devised. We propose that this planning is developed in the first instance as a dedicated programme for the specific technology in the framework of the overall support of RES in the countries. Bundling with national and/or regional/municipal programmes in which energy efficiency activities are also planned should be part of the exemplary role the public sector is intended to play.

4.3.1 Ukraine

There are several sustainable energy financing programmes led by the Ukrainian government, IFIs and Ukrainian state banks, targeted on energy efficient measures in housing and residential sector of Ukraine. Yet, dedicated instruments of PVs' purchase and installation are rare and the systems so far installed have, in their vast majority, emerged on the basis of private funds. Neither the state programme for buildings energy efficiency nor the EBRD-led IQ Energy programme involves explicitly solar PV in buildings. JSB "UKRGASBANK" offers loans to legal entities and condominiums to purchase equipment, services, design and installation of PVs upon credit terms which involve a relatively short term and a widely varying interest rate (3-15% presumably agreed based on the overall solvency of each client). The ESCO scheme although in principle available in the country, misses a standard agreement template and generally a clear business model particularly in respect of the multi-apartment buildings.

4.3.2 Moldova

Moldova has experienced a series of recurring policy and regulatory issues, which affected the investment climate in the energy sector at large. In the past few years this situation appears to be restored but still in respect of the small scale and decentralised nature of building-PVs access to finance appears rather difficult. The situation is reflected on loan interest rates offered by Moldovan banks. The average interest rate for credits offered to legal entities is about 12.69% while for natural persons 13.68 %. The equivalent rates for credit on the base of a foreign currency are at the order of 6-7%. An exception in respect of the general lack of specialised energy credit products in the country seems to exist in the frame of the Moldovan Sustainable Energy Financing Facility run by the EBRD. This facility appears to be the major driver for the already installed PV plants in the country. At a mere national level however, financing for energy efficiency/renovations in buildings which may also include PV systems appear to be relatively unattainable for the larger part of the population primarily due to the short repayment terms and low affordability. The ESCO scheme although in principle available in the country, misses standard agreement template and generally a clear business model particularly in respect of the multi-apartment buildings.

4.3.3 Georgia

Access to finance for solar PV in buildings is currently limited in Georgia. A credit line under the trademark "Energocredit" comprises the second phase of an EBRD Sustainable Energy Financing Facility (SEFF), which in turn constitutes an aggregation of national credit lines (Caucasus Energy Efficiency Programme) of the Georgia and Armenian relevant SEFF and now heads to a transformation to a resource efficiency programme. There has been no PV in buildings proposals

under the programme, which is mainly active in the corporate sector. In general, the current commercial financing terms in the country refer to an 8-10% interest rate and 7-year term of a loan. The cost of equipment is subject to 18% VAT. The PPA is agreed on the basis of a foreign currency and disbursed in GEL. Some limited applications have emerged through international funds or even spontaneously based on the recent net-metering scheme adopted in the country.

4.3.4 Armenia

There is currently no dedicated programme for the support of building-PVs Armenia. The adoption of net metering and FIT support schemes, however have achieved a limited number of installations in the country. Although it can generally be claimed that there is access to finance for these particular small-scale investments based on lending (KfW and local banks) the terms of financing are not considered quite attractive. Furthermore, the activity of energy services companies (ESCOs) could theoretically have no legal obstacles concerning the promotion of PV investments but in practice there is no third-party financing scheme in place in the country for building-PVs.

4.3.5 Azerbaijan

The state budget is currently the main financing source for the development of renewables in Azerbaijan. Dedicated credit lines for EE and RE investments are to a limited extent available (e.g. EBRD Caucasus Energy Efficiency Programme, IFC, Green for Growth Fund, Global Climate Partnership Fund) since solar PV in buildings may mainly be regarded as a part of an overall energy efficiency/renovation investment. Yet, the market absorption is low. On top of that, the current investment climate is considered not quite favourable for EE and RE lending in the wake of the sharp devaluation of the local currency. The interest rates offered in general by commercial banks in Azerbaijan are at a range between 12% to 14% for USD and 18% to 20% for AZN denominated loans respectively. There is only one ESCO in place - GESCO (Green Energy Service Company) established by the SAARES – which is currently working on GEF-financed building renovation pilot projects that include solar PV installations.

4.3.6 Belarus

Access to finance for solar PV in buildings is currently limited in Belarus. Where solar PV in buildings can be regarded as a part of an overall energy efficiency/renovation investment the terms of loans may vary according to the location in the country (e.g. socially disadvantaged & mostly rural areas have access to state-subsidised loans at the rate of 3% versus a commercial rate range between 21-55%). On the other hand, EBRD has in place a sustainable energy financing facility, which so far aimed to large scale RES investments. There is no ESCO scheme provided in the country.

4.4 Subsidiarity

When applied to the context of our study, the subsidiarity principle should be interpreted as the level of decision for developing and implementing PV installation programmes which resides with local decision-making. Local authorities to the extent that they have already undertaken sustainable energy development commitments are in the forefront. The organisation however of the buildings' administration (e.g. operation and maintenance) of the multi-family buildings (blocks) is equally important when it comes to decision making regarding the installation of (common) PV systems including in the case of energy efficiency renovation.

Housing associations and/or municipal companies administering (usually a number of) multi-apartment buildings comprise a legacy of the soviet past of the target countries. They may be regarded as an additional opportunity for local action in which the local authority does not necessarily play the first role – for example, the Baltic States have developed this very model into a facilities management market, which in turn forms the first niche which is aimed to be transformed into a full-fledged energy services market. In both directions the contribution, coaching and material support provided by central authorities is considered imperative. Any model that may be adopted based on the subsidiarity principle has first to have the legal and regulatory framework sorted out. Besides that, human and financial resources and most importantly the ways of attracting expertise and capital for the design and implementation of the programmes require considerable backing from the central administrations.

One pending issue for the EaP countries after the establishment of private property in the housing sector is the management of multi-apartment buildings. The common spaces such as stairs, hallways, roofs, lifts etc have a different property status and are in certain cases still owned by the local government entities e.g. municipalities. Such buildings are still managed by public housing management organisations which often lead to improper building maintenance as local governments sometimes lack the financial as well as the human capacity to manage the large fleet of such buildings.

In all Eastern Partner countries but Azerbaijan, Homeowners Associations (HOAs) have emerged as a need of homeowners to overcome the aforementioned difficulties. HOAs have been successfully introduced in the Eastern European Countries on either a voluntarily (e.g. Slovakia) or mandatory (e.g. Hungary) basis establishing an appropriate and effective building management practice. Members of the HOAs are owners of apartments who also own proportionally the common areas of the building(s). In this way the owners of the building are responsible for the maintenance and refurbishment of the building as well as the necessary utilities (gas, water, electricity). Hence, in a sense HOAs act competitively to the public housing management organisations. Table 42 below provides some rough figures regarding the number of HOAs in the six EPCs based on a report of the International Housing Coalition (IHC) [78] .

Table 42 Rough figures of HOAs in the EPC according to ad IHC report

Country	No of HOAs	Country	No of HOAs
Armenia	700	Georgia	2600
Azerbaijan	40[79]	Moldova	Appr. 20% of houses in Chisinau
Belarus	566	Ukraine	Appr. 6% of all houses

It shall be noted however, that the actual operation and level of activity of HOAs and hence their effectiveness in building management differs substantially both between countries and between HOAs in the same country. According to the aforementioned IHC report only about a relatively small proportion of HOAs in the region are really active. This is due to the enabling framework as well as the awareness and activeness of homeowners. Organisational difficulties are also important especially taking into account the often large number of HOAs' participants.

During the last years substantial efforts by donors and NGOs have been made to strengthen the HOAs in EPCs and increase their role and effectiveness in the management of the building stock.

[78] IHC, Homeowners Associations in the Former Soviet Union, 2015

[79] Ministry of Economic Development of Azerbaijan, 1 February 2017, http://economy.gov.az/index.php?option=com_content&view=article&id=4683:mk-01-02-2017&catid=8:news&Itemid=263&lang=az

The main purpose is to increase the living standards of the inhabitants but also achieve efficiency and environmental protection through appropriate management of the use of water and energy. Energy efficiency in the building sector is a major issue in the EaP countries linked to the level of living conditions but also to energy dependence and security of supply. Energy efficiency programs mainly focus on reduction of the energy demand of the building with measures such as insulation, double glazing etc. At the same the use of renewable energy is also part of the targeted actions and building-PVs are an effective way of achieving reduction in primary energy consumption. In this respect, the HOAs may prove valuable in the attempt to promote building-PVs through their participation in targeted support programs. This approach will have an enhanced multiplication effect as at the same time will strengthen the institution of HOAs in the region and may also provide additional income to HOAs that can be used to further increase energy efficiency or facilitate the payment of utilities' bills. Such programs may combine the benefits of an operational support such as FiT or net metering scheme with soft loans or grants for the installation of PVs. In order to increase the benefits and optimise systems' performance and resources allocation, minimum energy efficiency standards for eligible buildings should apply. Alternatively, the program could include or consider as prerequisite appropriate energy efficiency audits that would result in a CBA of the most appropriate measures to increase efficiency up to the desired standards.

In the cases were HOAs are either not established (e.g. Azerbaijan) public housing management organisations could be targeted in order to promote building-PVs. In order to increase the effectiveness of such programs and overcome the operational difficulties of such organisations, public private partnerships seem to be an appropriate solution. Private entities such as PV companies or ESCOs would be contracted in order to provide turnkey PV solutions (combined if possible with other energy efficiency measures) to buildings managed by local authorities. Compensation of the private entity would be achieved by directly receiving the available support in the form of grant or tariff.

Returning to the exemplary role the public authorities are expected to play by the design and implementation of sustainable energy plans in urban environment we have briefly reviewed the Covenant of Mayors (CoM) signatories in the Eastern Partner countries as to whether their Sustainable Energy Action Plans (SEAPs) include actions relevant to building-PV. In brief, the results of this exercise suggest that there is currently little consideration for on-site electricity production in the SEAPs. Many SEAPs restrain to solar thermal installations when it comes to the use of solar energy in buildings. In certain cases, the introduction of PV is viewed as a non-grid supply or supplementary topical supply source. In terms of size and contribution to the climate targets, these actions appear supplementary and limited to a fraction of the electricity demand of the building/installation they are proposed to be attached to. There is no apparent connection to the contribution of a PV-related action to any national plan for energy efficiency or renewable energy and in most cases the financing of the specific action is planned on municipal/state budget.

4.4.1 Ukraine

Ukraine is by far the most active county in the region in respect of the Covenant of Mayors. There is a number of cities that are signatories which also work in clusters in order to benefit from aggregation in terms of the size of the SEAPs but also in terms of bringing in organisational innovation (i.e. common procurement process, etc.). Component 3 of the present study concentrates on the assessment of the potential of Kiev, Lviv and Odesa. The SEAP of Lviv involves only solar thermal installations. In the SEAP of Odesa there are two types of activities

one directed to private businesses for PV self-consumption and one for street lighting. The private business self-consumption programme is designed to run in the period 2017-2019 and its size is 550 MW while the street lighting programme is designed to be implemented in the period 2018-2020, its size is 201 MW and the required investment is planned to be sourced by the municipal budget.

Table 43 Covenant of Mayors signatories in Ukraine (major cities)

4 Signatory profiles found. *

Signatories	Population	Commitments	Status
Kharkiv, UA	1,443,093	2030 ADAPT	
Kryvyi Rih, UA	667,900	2020	
Lviv, UA	758,351	2020	
Odessa, UA	1,012,277	2020	

4.4.2 Moldova

Compared to the size of country and the overall pattern in terms of regional and urban organisation, Moldova comprises a considerably active in the Covenant of Mayors initiative. Component 3 of the present study concentrates on the assessment of the potential of Chisinau, Balti and Cahul. The SEAP of Balti includes the installation of PV systems on public buildings. Solar thermal technology applications are foreseen in respect of education (kindergarten) and healthcare buildings. The Sustainable Energy and Climate Action Plan to 2030 however provides for a community wind farm.

Table 44 Covenant of Mayors signatories in Moldova

14 Signatory profiles found. *

Signatories	Population	Commitments	Status
Anenii Noi, MD	13,856	2020	
Balti, MD	151,000	2020 2030 ADAPT	
Calarasi, MD	16,100	2020	
Cantemir, MD	6,300	2020	
Causeni, MD	18,000	2020	
Ceadir-Lunga, MD	22,800	2020	
Cimişlia, MD	14,800	2020	
Drochia, MD	87,083	2020	
Festelita, MD	3,111	2020	
Lozova, MD	6,573	2030 ADAPT	
Ocnita, MD	9,170	2020	
Soldanesti, MD	6,278	2020	
Soroca, MD	37,400	2020	
Ungheni, MD	36,000	2020	

4.4.3 Georgia

In Georgia the cities for which the technical potential assessment had to be performed in Component 3 was provided explicitly in the study's terms of reference (i.e. Tbilisi, Rustavi, Kutaisi, and Batumi). Georgia has been quite active in respect of the Covenant of Mayors initiative and has together with Ukraine been of the pioneer countries committing signatories in the Eastern Partnership region.

Table 45 Covenant of Mayors signatories in Georgia

10 Signatory profiles found. *

Signatories	Population	Commitments	Status
Akhaltsikhe, GE	19,200	2020	
Batumi, GE	170,000	2020	
Bolnisi, GE	76,600	2020	
Gori, GE	50,400	2020	
Kutaisi, GE	196,600	2020	
Rustavi, GE	120,800	2020	
Tbilisi, GE	1,100,000	2020	
Telavi, GE	70,900	2020	
Telavi City Hall, GE	21,800	2020	
Zugdidi, GE	76,600	2020	

** The number of signatory profiles is lower than the total number of signatories. This is due to the gathering of signatories developing a joint SEAP under one single profile.*

The SEAPs of Tbilisi and Batumi do not include any intervention in respect of PV. Solar thermal technology applications are foreseen in respect of education and healthcare buildings. Similarly, this seems to be the case in the SEAPs of Rustavi and Kutaisi where solar thermal is planned mainly for kindergartens.

4.4.4 Armenia

Several cities have acceded to the Covenant of Mayors in Armenia. The degree of sustainable energy action plans is varying. Component 3 of the present study concentrates on the assessment of the potential of Yerevan, Vanadzor and Gyumri.

Table 46 Covenant of Mayors signatories in Armenia

11 Signatory profiles found. *

Signatories	Population	Commitments	Status
Aparan, AM	6,500	2020	
Artik, AM	19,500	2020	
Dilijan, AM	17,700	2020	
Ejmiatsin, AM	57,600	2020	
Hrazdan, AM	42,000	2020	
Spitak, AM	18,237	2020	
Tashir, AM	8,700	2020	
Tsakhkadzor, AM	1,700	2020	
Vanadzor, AM	86,199	2020	
Vayk, AM	5,900	2020	
Yerevan, AM	1,077,400	2020	

** The number of signatory profiles is lower than the total number of signatories. This is due to the gathering of signatories developing a joint SEAP under one single profile.*

Yerevan SEAP is still underway its evaluation process by JRC (status as of 3 April 2017). The draft SEAP provides for solar PV but only for specific off-grid battery-equipped small systems (31 systems in medical centres) plus a number of systems (not specifying if these refer to grid connected systems) for lighting outdoor areas in multi-apartment areas in certain neighbourhoods in Yerevan. The first project i.e. the autonomous outdoor PV lighting points as well as the remainder neighbourhood PV installation are expected to be financed mainly by state/municipal funds.

4.4.5 Azerbaijan

Azerbaijan cities are presented at present reluctant to undertake climate commitments. Presumably this may also have to take into account the fact that even at central administration level energy efficiency is currently seeking to materialise from spontaneous actions to a continues

and stable framework. Component 3 of the present study concentrates on the assessment of the potential of Baku, Sumgait and Ganja.

Table 47 Covenant of Mayors signatories in Azerbaijan

1 Signatory found. *

Signatories	Population	Commitments	Status
Icherisheher, AZ	4,000	2020	

* The number of signatory profiles is lower than the total number of signatories. This is due to the gathering of signatories developing a joint SEAP under one single profile.

4.4.6 Belarus

Belarus cities accession to the Covenant of Mayors appears similar in number with those of Armenia with the difference that in the case of the former the capital city i.e. Minks is not a CoM signatory. Most of the participating cities have progressed with the preparation of their SEAPs. Component 3 of the present study concentrates on the assessment of the potential of Minsk, Mogilev, Vitebsk.

Table 48 Covenant of Mayors signatories in Belarus

10 Signatory profiles found. *

Signatories	Population	Commitments	Status
Ashmyany, BY	31,190	2020	
Beryoza, BY	64,217	2020	
Braslau, BY	26,324	2020	
Brest, BY	340,141	2020	
Chavusy, BY	18,545	2020	
Hlybokaye, BY	37,712	2020	
Kobryn, BY	85,928	2020	
Novogrudok, BY	46,098	2020	
Polotsk, BY	108,643	2020	
Rogachev, BY	58,331	2020	

* The number of signatory profiles is lower than the total number of signatories. This is due to the gathering of signatories developing a joint SEAP under one single profile.

5 Barriers assessment and recommendations

5.1 Barriers' assessment

A number of barriers are found in the Eastern Partner countries which are hindering the development of building-PVs. The barriers may be grouped in the following categories:

Solar potential: the research focuses on six countries with quite different resource potentials. Azerbaijan and Armenia have overall a good potential (expressed in theoretical specific annual yield) with about 1200-1500 kWh/kW expected annual production. Georgia follows with some 1200kWh/kW. Ukraine has fair potential in the southern area with some regions reaching 1200kWh/KW per year, but most of the country potential ranges between 800-1000kWh/KW per year. Moldova and Belarus also have a limited potential mostly confined at about 850-950 kWh/kW per year[80].

[80] See table 2 in the report for references

Economic context: All countries present limited economic capacity in terms of GDP per capita. Most of the success of rooftop-PV programmes in the EU is linked to the capacity of private individuals and small companies to invest in such systems. However, this potential is much limited in the Eastern Partner countries where GDP is found at a level at some ten folds lower than EU countries experiencing most successful PV programmes. PPP methodology may show better ranking of selected countries with respect of EU ones, but PPP methodology is not very relevant when assessing the capital investment capacity. That is because neither prices of PV technical components change significantly at national level, nor, according to the country reports, significant installation costs have been recorded.

The above two barriers, which are largely independent from energy policy provisions, regulatory decisions and the design of incentive and support mechanisms, alone circumscribe a context where the development of building-PV may - at least presently and without significant support from external financial institutions - only be confined in niche markets, possibly tailored to specific target groups and supported by national/international incentive schemes.

Energy policy: Overall the selected countries, with the exception of Ukraine and despite the inherent energy policy difference in each of them, do not show strong policy commitments with reference to the development of PV. Being Energy Community signatory parties for some years now, Ukraine and Moldova are progressing with the adoption of a complete and time-tested favourable RES framework. Their resources potential, though, is limited with reference to solar PV. Georgia is anticipated follow soon, thanks to the recent adhesion to Energy Community. Azerbaijan where both the highest solar potential and GDP per capita seem to coincide, has not yet introduced a policy commitment to develop RES in the national legislative framework. The country, rich in natural gas, has so far showed limited interest in PV development. Armenia, also presenting a considerable resource potential, has no specific commitments in terms of RES development. RES policy is based on energy security and promotion of indigenous energy sources, but so far PV is confined to a limited number of installations with weak policy target in terms of MW. Finally, Belarus has not introduced a policy commitment for RES development and has a limited resource potential.

Electricity prices: Electricity prices both in the generation segment (where it has only been possible to proceed with estimations as reference wholesale prices are almost inexistent) and in the retail one are not high enough to make PV investment attractive without the introduction of specific technology incentives. In general, countries with low electricity prices represent a barrier for PV development, both for investors and individual end-users. “Review of EU Experience with Solar PV in buildings” report has associated the successful penetration of roof-top PVs with favourable policies for end-users (consumers) to install PV systems. Such policies are facilitated by the attractiveness of self-consumption for the given retail electricity prices. When comparing the highest retail domestic prices in selected countries with EU countries they are found at less than half of the EU retail prices. In particular the highest tariff found, around 10.705c€/kWh[81] is about half of the electricity price level recorded in lowest selected EU countries in “Review of EU Experience with Solar PV in buildings” report.

Electricity market structure and the legal context: The electricity market structure widely differs in selected countries. Although unbundled and competitive electricity market is not an essential precondition for development of building-PVs, experiences from EU countries associate

[81] Prices for the domestic sector in Moldova for the most expensive suppliers in 2017. Also see Table 27 which records electricity final prices in selected countries in 2016.

high level of liberalisation and unbundling with the development of a legislation allowing third parties, including small PV producers, to access the electricity market. Ukraine and Moldova are moving to a fully liberalized market and a favourable framework for distributed generation experience is getting closer, although some important pieces of secondary legislation still need to be introduced. Vertically integrated market is the current model in Belarus and to some extent, notwithstanding recent efforts in unbundling the market, in Azerbaijan. As a result, all PV experiences in Azerbaijan are linked with the incumbent and, de facto, there is no independent development of PV. In Georgia and Armenia, where the electricity market is unbundled and partly liberalized, a legislation for small PV and RES system is in place and the market structure does not seem to represent a barrier.

Regulatory context: the regulatory framework with reference to building-PV development looks incomplete in all countries. Basic regulatory instruments and principles which may be considered as prerequisites for a favourable PV development regulation are not always in place. Independent regulatory authorities with a function in the electricity sector are not established in Azerbaijan and Belarus; Grid Codes have not been approved in all countries, but Georgia. Third party access, dispatching priority and RES mandatory offtake are generally not recognised in the regulatory framework. Licencing and permit is also lengthy and obscure in most countries. Authorization procedure and connection to the distribution network are still barriers in all countries. The growth of PV sector in Ukraine, combined with a favourable incentive for building PV, has seen the introduction of a good level of secondary legislation and regulation with some pending issues still not harmonized with EU Directive 2009/28. In Moldova, lack of implementation of national legislation, postponed to March 2018 makes development of building PV not yet an option in the country.

5.1.1 Ukraine

Main PV development market barriers in Ukraine are the limited resource potential in most of the country and the fact that the best sun potential is found in the Crimea area. This is connected with limited economic capacity also in consideration of the strong devaluation of Ukrainian currency in recent years. Interest rates in Ukraine are very high which further hinders the financing of PV systems. Electricity prices are at low level, with a highest block tariff tier found at 5.6 c€/kWh. Most of Ukraine generation capacity, based on coal and nuclear, will most likely need a lot of resources in the following years to meet more stringent environmental and security standards. This combines with alarming energy poverty data, some 50% of population is recorded in an energy poverty status, and high household electricity consumption level (see section 2.1). In total, most of the electricity market structural characteristics do not build up a favourable context for PV development. Given the current electricity prices, PV support schemes - especially when directed to building PV sector - are perceived as an expensive policy option. In addition, the process to make final tariff more reflective of electricity costs, although inevitable, is delayed by the underlying economic and energy sector weak fundamentals.

Despite those conditions, Ukraine is building up a strong framework in favour of PV development based on a FiT mechanism that compensates most of the country's investment climate weaknesses.

The mechanism is designed so as to promote early commissioning of PV systems providing higher FiTs and longer electricity purchasing agreement for early implemented facilities. Whereas this works as a strong incentive to start up the building PV sector, showing already interesting growth rates (see section 4.1.1), it represents a structural weakness for PV development, in the long run. PV rush, which has been experienced in some EU countries, results in short term PV

equipment and installation cost rise and in the long run is not beneficial for the creation of a sound PV market.

National regulation still needs to be completed. Connection rules are not yet fully defined in compliance with EU Directive 28/2009EC. Lack of definition of access (incl. curtailment) rules may also represent a barrier, although this should not have a significant impact on the building-PV market segment. Technical skills and commercial offers are catching up within a growing PV market and should not any longer represent a barrier.

5.1.2 Moldova

Lack of secondary legislation implementing national legislation to support RES is currently the main development barrier.

In addition, similarly to Ukraine, structural PV development barriers may be ascribed to the overall natural resources availability and the economic context. In an energy poor country, strongly relying on imported energy resources, RES development is a key energy policy issue. Within RES development strategy though, PV technology is not referred to as an explicit strategic interest, although minimum development targets are included.

Lack of definition of (a) specific incentive scheme(s) is a significant barrier. The capacity threshold of the auction FIT has not been identified yet, nor has the maximum level of the incentive. Secondary legislation approval of national FIT legislation has been postponed to March 2018.

With reference to building PV sector the introduction of a minimum 10kW threshold for RES production accessing FIT defined by ANRE will also represent a barrier for smaller size development. Building PV sector is a niche market within the PV technology segment. The introduction of an access barrier based on minimum system size does not allow small developments which are the backbones of building PV sector. It is also an indicator of the policy maker preference to develop larger installations, rather than promote distributed generation solutions.

In addition, the procedure to qualify as a renewable producer may comprise an additional burden for smaller installations. PV plants smaller than 10kW may qualify for the net-metering scheme. End users' tariffs, 10.705 c€kWh in the highest level, are not high enough to promote PV self-consumption in a significant manner whilst comprising the highest price recorded among the six countries. In general, the market is waiting for the approval of secondary legislation to define the national RES legal framework, in order to understand the main economic market variables. Implementing regulations has been postponed further to March 2018, hindering the realisation of RES investments including PVs.

5.1.3 Georgia

The mechanism to develop RES systems, based on a project based assessment and signature of PPA is cumbersome and impractical in respect of the development of distributed generation (including building-PV systems). Moreover, the same regulation and procedures are applied for small and big PV installations. The net metering scheme which results to easier access is in fact strongly hampered by low electricity prices hardly reaching 7c€/kWh, which are not able to sustain PV economics also in consideration of the high capital and financing cost recorded in the country.

Building-PV systems in Georgia, despite the good resource potential, are not supported by a favourable legislative framework. A national commitment to a RES development target has not been approved yet, and there is not a proper incentive mechanism to promote RES. Development of RES is still done on a project by project basis. The level of regulatory framework completeness and the design of the net-metering scheme is, on the contrary at advanced stage and does not

represent at present a barrier for PV development although there is little experience testing the process. Some limitations for PV in net metering mode connection to distribution network are in place (i.e. relate to the distribution region peak demand) and those may result in a barrier in the long run.

5.1.4 Armenia

Armenia is found with some experience in RES development and in the implementation of a favourable RES-supporting legislation. Nevertheless, overall the policy commitment to develop RES does not seem oriented in the development of distributed generation systems, but rather larger (utility scale) systems. Feed-in tariff set at 9 c€/kWh is directed to mid-scale PV systems, rather than small-scale building-PV solutions. PV installation <150kW do not get access to FiT scheme.

End user' prices, although higher than other Eastern Partner countries, (some 8-9c€/kWh) do not seem good enough to sustain PV rooftop market start-up despite the favourable resource potential.

Net-metering only pays half the distribution cost of electricity for excess PV production.

As a result, only 2 PV installations of 1MW and some 10 small size systems in net metering are found in the country.

5.1.5 Azerbaijan

The current electricity prices are considered too low to support any noticeable development of building-PV system unless a strong support scheme is in place In addition the current FiT design has not a specific tariff to support PV technologies. The current level of FIT at 3.1c€/kWh, (for all technologies rather than wind and hydro) is largely insufficient for ensuring a sustainable financial performance of building-PV systems.

The country has a large hydrocarbon resources endowment and the development of RES has become only recently a policy objective with the approval in December 2016 of a Strategic Roadmap including specific targets for PV development. Still no coherent legislation has been developed.

5.1.6 Belarus

Very low resources potential is combined with a renewable policy which is not transparent in how to access feed-in tariffs and quota. PV systems without PPA are granted low tariffs at 5c€/kWh when selling electricity into the Grid. In addition, private individuals are not allowed to sell electricity produced in domestic installation.

5.2 Recommendations

5.2.1 Ukraine

The adoption of EU directive 28/2009/EC shall fill the missing gaps in RES legislation to support PV system. The country has already put in place a feed-in mechanism which favours building-PV solutions.

Some improvements may be still be achieved in respect of the authorization process notably by introducing a one-stop-shop feature, at least at regional level, for the purposes of promoting building PV. The one-stop-shop procedures should encompass local administrative procedures connection to the grid, as well as, contract assignment (to a bank) in the case of a feed in tariff support scheme or a guaranteed shavings (or shared shavings) agreement with an ESCO in the case of net metering. An "one stop shop "procedure would simplify permits, connection obligations and clarify the business model - thus favouring

a faster involvement of the private sector. In “Review of EU Experience with Solar PV in buildings” report the case of Italy may offer a good best practice for a simplified authorization process, by unifying all authorization requirement, including building permissions, within the connection application.

The feed-in scheme is not integrated with the net metering scheme. The FiT is not intended as a premium to RES electricity production but includes the purchase of electricity by the Grid. This is to say the owner of the building PV does not access FiT when electricity is auto-consumed on site. This is an outcome of the overall FIT design including all RES sources. The FiT scheme could be better designed in order to stimulate PV building by integrating FIT and net metering schemes.

The current feed-in mechanism is delivering generous price signals to potential private investors in building-PV but still its design does not give a long term vision. A PV boom in early stages risks jeopardizing a constant but sound long term growth. The current design, strongly supporting early installations, makes risk to increase equipment and installation costs in the short run. This, not connected with a maximum PV development quota, may result in a high incentive cost which may prove not to be sustainable in the long run. It is recommended to introduce maximum quota in the short term, being coherent with national PV technology overall target and to stabilize the number of years the PV rooftop will access feed-in tariff. The limited resource potential in Ukraine suggests developing the PV segment by reducing at best policy costs which already have the burden of limited solar yields. The PV rush (Germany, Italy, Spain), which has been experienced in the past decade may have led to the reduction of PV equipment cost in the international market but it is advised to be avoided in Ukraine given its limited economic capacity and resource potential.

The current scheme is based on two variables: the first is the feed-in unit price decreasing in time, the second is the timing to access feed-in tariff. According to current legislation feed-in will be paid up to 2030 independently from the year of plant commissioning. This is to say a PV system installed in 2018 will receive 12 years of incentive whereas a system in 2025 only 5 years.

It is recommended to design a building PV strategy based on a longer vision. Other mechanism to promote PV may also be introduced, especially in the building sector, for instance by introducing minimum PV installation in new building and house development.

5.2.2 Moldova

The lack of definition of secondary legislation and regulation implementing RES decree makes it currently not possible to assess the core of future Moldova policy with reference to building-PVs. The feed-in mechanism is still not described in its detail. The limited resource availability and the high cost of incentive scheme to support the growth of small scale PV system, along with energy poverty considerations and final electricity prices, (overall higher than other selected countries), suggest targeting specific niches to start the development of building-PVs.

The cost to support the introduction of a PV incentive scheme will be translated into final electricity tariff. With reference to the building PV sector this may result in an unequal energy and social policy outcome. The installation of building PV is mostly an option for the better off, whereas the electricity tariff is evenly paid by all consumers groups.

In an energy poor country with low GDP per capita access and limited resource potential the risk of all electricity consumers financing few household PV developers, should be adequately addressed.

In this respect, given the limited strategic role of PV in the country renewable mix, it is recommended to evaluate the possibility of focusing first on the installation of PV systems connected with public administration uses schools, hospitals, offices or to connect it with the social housing sector whether public or private. This may also be achieved by the introduction of minimum PV standards in new housing development and/or in conjunction with energy efficiency policies.

In addition, it may be possible to take into consideration a modulation of the incentive over the higher electricity consumption tariff blocks as a tool to balance social effect of building-PV incentive. This has to be carefully studied within the overall tariff regime.

As compared to Ukraine, Moldova PV market is still lagging behind. In order to reduce overall installation costs, it would be useful to standardize the authorization procedures concentrate all administrative requirements in a single procedure encompassing contractual obligation to bank the feed-in and to exchange electricity with the local network, building and local permissions.

An initial program tailored to public administration buildings, within the national feed-in tariff main framework, producing in parallel a “one shop” authorization procedure for private investments is a suggested option to start PV rooftop dissemination in Moldova.

5.2.3 Georgia

Recent accession to the Energy Community Treaty will necessitate Georgia to adopt a more favourable RES legislation including a more detailed a third party access ruleset in the national electricity market. Georgia has a good potential for development of building-PVs but the current legislative & regulatory framework does not sufficiently promote this particular technology. The practices involving a case-by–case project appraisal by the Ministry is not compatible with a distributed generation approach where private individuals and companies develop their own generation units within a fixed favourable legislative framework.

The introduction of net-metering for system <100kw already identifies a niche market where Georgia may start to look at in the effort to develop PV rooftop system. In the long run, and in the view of adoption of RES development targets compliant with EU directive, building-PVs look as a good potential strategic option.

PV technology costs, especially the rooftop systems, will reduce following market growth and technical specialization and experience. PV rooftop development will allow a fast growth in term of RES capacity and the injection of private capital into the electricity market.

It is suggested to tailor a specific programme to develop PV rooftop based on annual development targets and incentivised through feed-in tariffs. The programme shall serve as a pilot to open up the market and to work on authorization procedures in the view of making the electricity market compatible with EU directive requirements. In the long run, thanks to the good sun potential, Georgia may face balancing issues connected with the development of intermittent renewable capacity. This may be addressed by enhancing interconnection capacity and by evaluating the combination of building PV development with storage technologies.

5.2.4 Armenia

Armenia has overall a positive outlook for the development of building-PVs, both in terms of natural resources and legal instruments in place. A feed-in mechanism and a net-metering option is in place. In addition, favourable authorisation procedures are in place. Nevertheless, little capacity has been so far developed. Low electricity prices and access to finance are barriers which cannot be easily alleviated.

Nevertheless, building-PVs represent - given the country solar resources - a good RES potential in the country which is a net importer of energy. It is recommended to launch a specific programme for PV rooftop systems to be financed by a sustainable budget.

To better allocate the budget resources it is recommended, as for the case of Moldova, to target public institutions for the installation of PV systems. This, connected with net metering scheme will reduce electricity costs in the selected institutions evenly distributing the incentive costs among citizens. This may also be the opportunity to speed up building PV systems, thus increasing installation experiences, and stimulating the PV equipment retail market.

The programme, which could be financed through international additional finance, should have the objective of introducing minimum PV rooftop development targets in order to reduce installation costs, increase technical experience and build up a standard and simplified procedure for authorization.

5.2.5 Azerbaijan

The abundant gas resources of Azerbaijan make the development of PV primarily an environmental policy objective. Still the country has a good solar insolation endowment and diversification of national electricity production is within policy targets. Increase of RES generation will result in higher gas quantities being available for exports.

The current low levels of electricity prices are not compatible with end-user PV development. The main recommendation is to introduce a specific building-PVs incentive mechanism to promote at least a minimum capacity in order to develop PV market which otherwise would focus only on large scale system. A FiT scheme tailored to small rooftop PV systems - similar to the Ukrainian design - but integrated by an overall programme incentive cost cap, may be an effective development path. International experience suggests that small size technologies are more effectively developed by small entities and private individuals. It is recommended to facilitate the development of the sector through the participation of third-party entities rather than develop rooftop PV capacity by the national electricity distribution and supply company.

The early phases of private PV rooftop development are also useful to fine tune the administrative and contractual procedures among the stakeholders. It is of little use to develop small scale PV capacity within the incumbent without the formation, in parallel, of a favourable administrative supporting procedure.

5.2.6 Belarus

Installation of building PV is hardly possible in Belarus. Private individuals are only allowed to install PV systems for own needs without the possibility to inject electricity to the grid. It is recommended to supplement the normative acts to open up the possibility for private individuals to become small electricity producers by allowing net metering and access to feed-in tariffs.

The current quota mechanism to promote RES is not transparent. The methodology for determining the quota allocation size and the technology share is not publicly available. It is recommended, as a pre-requisite of the functioning of RES market in general, to work on the transparency of the quota mechanism and of the eligibility rules for accessing the mechanism. In addition, it is recommended to link the annual quota coherently with national renewable development targets.

Similarly, to the recommendations described above for Moldova, it is recommended for Belarus to start the development of building-PVs market by targeting specific niche market, for instance as suggested above to tailor a specific programme for public institutions. The programme may

also be complemented by the introduction of a more open and favourable environment for small production units at end-users' premises.

In general, building-PVs development by third and private parties should be taken a policy option which does not necessarily imply the modification of the national market structure. The quota system offers the possibility to start developing RES systems within a vertically integrated market without relevant regulatory changes.

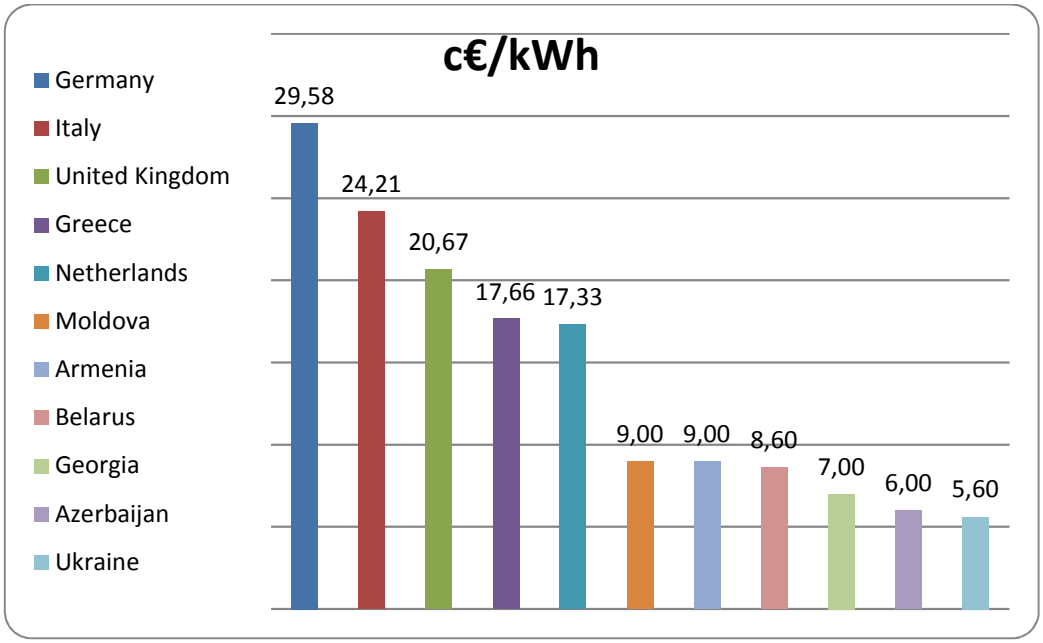
6 Conclusions

The country assessment and the gap analysis, using selected EU countries as benchmark to develop a favourable policy and market for PV rooftop dissemination, has showed a different situation (with some degree of divergence) per Eastern Party country with reference to energy policies to promote building-PVs infrastructure.

The main common feature of all six countries is **the low level of electricity prices**, both at wholesale and retail side, as compared to EU countries. Although significant differences can be found among the target countries, with Azerbaijan having the lowest electricity prices and Moldova the highest, wholesale and retail prices are not generally adequate to sustain the PV market in the absence of further incentives.

When comparing end-user electricity prices of selected EU countries with Eastern Partner countries a remarkable gap emerges. The highest end-user tariff recorded in Eastern Partner countries, often corresponding to the highest block tariff level, hardly reaches 50% of the average tariff level in EU countries.

Figure 35 Final retail tariffs in Eastern Partner and selected EU countries[82]



[82] The figure compare average price recorded in selected EU countries in 2016 (Eurostat) including VAT and other taxes for household sector (2500-5000kWh per year) and the highest recorded prices for the domestic sector category in selected Eastern Partner countries.

One common feature of Eastern Partner countries' electricity price structure is the limited amount of taxes and levies on final prices. Taxes and levies, which build up a significant share of EU electricity prices, make PV generation less attractive for end-users as compared to most significant EU countries' experiences, even in presence of net metering schemes. Block tariffs (still in use in most Eastern Partner countries) providing higher electricity rates for higher consumption levels can be considered advantageous for distributed PV systems in net metering mode. Still, even the highest block price levels appear not to be high enough to achieve a reasonable investment payback.

Referring to Figure 35 above in particular, whereas in Germany the electricity produced by a building PV in net metering has a value of 29.58c€/kWh, in Ukraine the same system would compete with an end user electricity price of 5.6c€ only, when considering the highest block tariff level.

In some countries special incentives have been introduced to compensate the price gap, but so far, the impact on rooftop PV development has been limited, with only Ukraine showing initial signs of a building PV market development at a significant scale.

Electricity prices are the facet of the overall market structure and in general terms of the underlying economic indicators of the country.

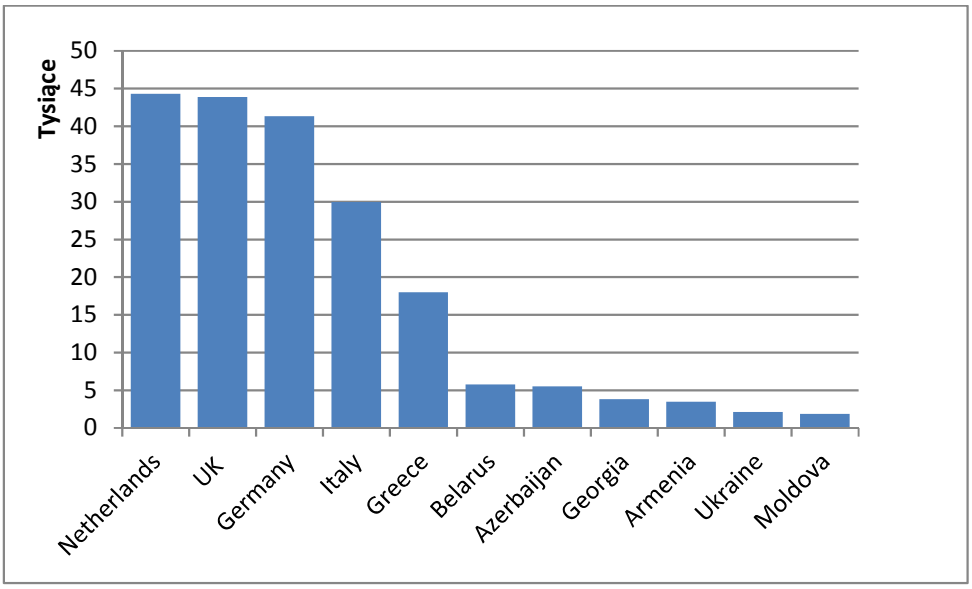
Electricity markets are not yet fully liberalized in Eastern Partner countries. Whereas this should not be taken necessarily as a barrier for penetration of building PV, all experiences of successful supporting building PV programmes in EU countries have followed the liberalization reform. Competitive markets should assure, (among other market characteristic discussed in the regulation section) the presence of fully reflective costs in electricity tariff. Relative differences among the target countries do exist but overall the electricity markets in the reviewed countries do not seem able to deliver fully reflective costs in electricity tariff. When reflective tariffs are established, electricity generated by building PV would most likely result to be more competitive (as compared to the current situation) as conventional electricity cost are fully delivered to final users and subsidies are eliminated. On the contrary, building PV supporting programme may appear too costly to policy makers. The result is limited commitment to the development of building PV solutions. Energy Community CPs is anticipated to embrace a reform trajectory. This however may not be the case for the remainder countries in which the process will be, most likely, slower or not exactly compliant to the EU acquis.

Ukraine and Moldova are in a most advanced stage of adoption of EU Directives, whereas Georgia has just started working on its harmonisation to the Energy Community Acquis. In Azerbaijan and Belarus electricity prices are still under government control and there are no independent energy regulatory authorities.

The current economic situation in the Eastern Partner countries showing a low GDP per capita and still high percentages of energy poverty indicators (in some countries connected with high domestic electricity consumption level), suggests that the path towards full cost reflectivity of electricity prices will not be an easy and fast one.

The economic capacity of the Eastern Partner countries is found significantly limited as compared with EU countries with successful building PV experiences. GDP per capita hardly reaches €5000 in Belarus and Azerbaijan and is lower in other Eastern Partner countries. Those data make the economic variable an important if not a limiting factor for building PV development.

Figure 36 GDP per capita (@ 2015 USD) in reviewed EU MS and the six EaP Countries



Source: World Bank Data

On the contrary, most countries are in need of increasing investment in the electricity sector and current electricity prices will likely be adjusted in order to achieve the necessary improvements. This will be a long term variable in favour of PV installation.

Overall, at present, electricity prices represent a significant gap for the development of a specific building-PV policy on the model embraced in EU countries. A policy response to this gap analysis, taking into consideration each country's own specificities, would imply the introduction of tailored policies and programmes for the development of PV capacity. The challenges of this policy design would among others include the manner by which overcoming the current electricity price barrier may be achieved without introducing excessive costs on end-users.

Building PV in all Eastern Partner countries are in need of financial support to fill the gap between the total production cost from a PV installation and the current electricity price level; The higher the gap the higher the need of support.

In the recommendation section the possibility to link building PV development with public institutions' electricity needs or the social housing sector is proposed, in order not to make supporting PV colliding with other energy priorities based on the economic status of Eastern Partner countries.

When assessing the current renewable energy market and policies in place significant gaps have emerged as compared to the EU approach**. A renewable development target is found in 5 out of 6 countries** with only Georgia not having introduced any. Not always the target is detailed per technology and only in few cases there is a specific building PV target.

Little coherence is found between the established target and the respective development of RES policies, with the exception of Ukraine.

Whereas Ukraine and Moldova have introduced a RES development target and a trajectory compliant with EU Directive 28/2009/EC and are in process of introducing policy instruments coherent with the mandatory targets, other countries are far from establishing a direct link between the policy targets and the relevant regulation and policy mechanisms. In the case of Georgia, a national target is still missing.

The gap here consists in the fact that energy legislation does not incorporate in a coherent manner the identified development targets. The targets are established but the development of policies and mechanisms to achieve it, are lagging behind.

In addition, not always the target is detailed by technology. Only in Ukraine and Moldova, specific technology targets have been approved together with a RES development trajectory on the model of EU directive.

Ukraine is found compliant with 28/2009/EC with reference to the establishment of a national renewable target, with technology details and a verifiable trajectory. The FiT scheme, recently amended to comply with EU legislation, results in a supporting mechanism coherent with the national target.

Instruments and policies aiming to the achievement of the specific targets are not yet well defined in Moldova where secondary legislation implementing renewable policy has not yet been introduced. Implementation is required in order for Moldova to be in track with EU requirements. Nevertheless, a proper gap analysis will need to be done once secondary legislation will be developed. At present the gap consist in the delay in the implementation of primary policy.

Our review finds Georgia without a clear RES policy target. Nevertheless, Georgia has become a Contracting Party of the Energy Community in April 2017. Preparations for the harmonisation of the Georgian legislation to the Energy Community Acquis have already started and it is expected that developments in this regard will follow soon. The gap will need to be filled out as an effect of the signature of the Energy Community Treaty. The lack of policy target is for Georgia the main gap identified.

Armenia RES target is found in the national development strategy. It includes specific technology targets. The Government's RES strategy is driven by the overarching goals of improving energy security, ensuring tariff affordability, and maximizing the use of the country's indigenous energy resources. The strategy though does not establish a direct link with national policy and regulation in order to develop PV capacity, and a project-by-project approach still prevails in the country. At present larger PV ground-mounted installations are probably the preferred option.

Azerbaijan has recently approved a Public Utility Roadmap where end-user distributed generation and building-PVs are highlighted as policy target. An overall 50 MW PV target by 2020 has also been introduced. The Road Map has been approved in December 2016. So far, the country has developed some PV capacity on a project-by-project approach through the National electricity company. The secondary regulation to implement the road map is still missing.

Belarus energy policy priority is mainly concentrated in the necessity to increase the national energy independence. A target, not supported by binding instruments, has been introduced in order to increase national RES contribution in the energy mix. No specific target for PV is found.

All countries have some mechanisms in place to promote renewables but they are not always effective. They may be insufficient in terms of prices or in terms of supporting secondary legislation able to deliver the expected capacity. With reference to PV policies none of the countries has a single legal instrument specifically dedicated to the development of the PV segment, and consequently PV-related legislative framework is mostly scattered among energy policy legislation and regulation. In some cases, the main RES legislation does not include the PV segment, and rarely the building PV segment finds a specific place in national policies.

Ukraine is the most advanced country in the promotion of building PV and has introduced a favourable supporting scheme for the sector within the mainframe of the FiT scheme. Still gaps

are found in the specific design of the scheme. In particular, the feed-in mechanism introduced is able to deliver good economic signals in the short term but not to depict a long term sustainable growth for the technology. The mechanism consists in two premiums for early investments namely a higher FiT and longer time to access the FiT. Later investments, consequently, will collect lower FiTs for a shorter period of time. Reducing FiT levels is a common and effective feature of PV feed-in mechanism. Nevertheless, the combined effect of the two variables introduces long term market uncertainties which in turn lead to risks that may jeopardise the development of a sound and coherent policy on PV rooftop. A net-metering scheme complements the legislative framework in favour of building PV, although, as anticipated, end user prices do not provide enough support for the technology.

An incentive mechanism in Moldova is being outlined in primary legislation but so far not implemented in its secondary legislation. The mechanism is based on FiT tariff defined by a coefficient and maximum development quota. It is expected the quota (not yet defined) to be in line with the national RES development trajectory. The lack of implementation of the defined policy targets represents a relevant barrier for the development of PV. The market is waiting for the implementation of the policy and no other initiatives are taken in the view of a more positive policy environment. The approval of legal instruments to implement primary legislation has been postponed to March 2018. Net-metering is also in place for system <10kW but not implemented yet.

Georgia is found without a proper framework able to develop building-PVs. The main mechanism to promote PV systems is based on a list of potential projects which do not include small PV systems. Net metering alone is not considered enough to fill the existing gap between investment costs in PV rooftop solutions and low electricity prices.

In Armenia a FiT is in place for solar power plant with capacity between 150kW and 1MWp. The FiT is set at 9 USD cents/kWh. 65% of FIT is linked to US currency assuring a warranty for inflation and rate exchange risk. A net metering is also in place. The exclusion of PV system with a capacity less than 150kW is a barrier for the building PV sub-sector.

In Azerbaijan a FiT is in place for RES but the price level set at 3.1 c€/kWh is far below the estimated LCOE. Despite the presence of a national target the supporting mechanism is not coherent.

Belarus on the contrary, has an adequate FiT level for building-PV systems, but rules to access the technology quotas are still not transparent enough to attract small private initiatives.

In the regulatory dimension important gaps have emerged. The development of secondary legislation and regulation, as experienced in EU countries goes together with the implementation of favourable RES and PV supporting policies. The absence or inconsistency of supporting policy implies a weak definition of regulatory mechanism aimed at facilitating distributed generation and development of building PV solutions. Again, Ukraine is the most advanced country also in this respect although some gaps may be found in this area as well.

In the regulatory dimension still two countries, namely Azerbaijan and Belarus, are found without an independent regulatory authority. Whereas the institution of a regulatory authority does not imply a favourable approach to RES or PV development, regulation plays an important role to fill the gaps which may jeopardize PV development in term of third party access and transparency of rules.

Grid Code is in place in Georgia only and it is under preparation in Ukraine and Moldova. Despite the fact that third party access is assured in all countries, (with the exception of Armenia), de

facto, there is little experience of private small size systems being installed and connected to national grids, including systems under the net metering mode. In some cases, the absence of a Grid Code is partially compensated by the introduction of distribution network connection procedures by the utilities (e.g. in Ukraine and Georgia).

The general approach is usually to proceed on a project by project basis where the interface with the national grid is the outcome of a bilateral negotiation; in some cases, such as in Azerbaijan, the connection is agreed within different branches of the national company. Ukraine is the only country where a significant number of independent systems have been able to connect to the national network through a transparent procedure. With reference to connection rules a gap to fulfil EU 28/2009/EC requirements is found in Ukraine as the conditions for exemption, refusal of access and direct lines have not been defined.

Only in Ukraine, Moldova and Armenia, dispatching priority for RES is assured via legislation. Limitation of curtailment principle can only be found in the new RES Law of Moldova. In other countries although a support scheme and renewable purchase mechanisms are in place they do not seem to be backed by the dispatching priority principle. This implies that there is no obligation set on the TSO/DSO to procure RES electricity on a priority basis and to reduce the risk and the time the grid faces constraints (curtailment).

Balancing does not represent an issue connected with the development of building-PV capacity, yet. In Georgia, only, a connection restriction is introduced in areas where intermittent res capacity reaches 2% of peak demand.

With reference to the licencing and authorization procedure, some gaps are still found in Ukraine and Moldova regarding the establishment of a “one stop shop” licencing procedure to have the building-PV system approved within a single authorization procedure.

Whereas most selected countries have introduced some facilitation on licencing the authorization procedure, this still needs to be tested in practice and in particular on whether the procedures are sufficient to handle a large number of applications. The limited experience in terms of the number of installed systems is not enough to be able to identify the specific barrier at local level. In addition, in most countries, the systems installed have managed to work out their own authorisation procedures, but those are not traceable as a transparent procedure encompassing all subsidiarity levels.

The incomplete regulatory framework represents an evident gap for a sound building-PV market development where the growth of the PV sector is the outcome of private initiatives based on favourable economic incentives and transparent procedures.

As suggested also from the EU experiences, this specific regulatory dimension has to proceed hand in hand with the provision of economic incentives for the small size PV sector. Regulation for the building-PV segment is usually very specific and focused on distributed generation needs, metering issues, exchange of electricity in LV, economic balancing, contract template among parties etc. Those pieces of regulation are only developed by secondary legislation in presence of a national target to incentivise small scale building-PV systems. This gap needs to be filled but it represents a further step following stronger policy commitment and a completed regulatory framework.

In the regulatory domain some remaining gaps in respect of the provisions of the EU directive can be identified in Ukraine. In Moldova it is too early to make an assessment. Georgia, having just recently joined Energy Community, will need some time to harmonize its regulation. In Armenia,

Azerbaijan and Belarus the main gap consists in the overall policy framework rather than in the regulatory sector.

The depicted economic, policy and regulatory contexts end up in a limited development of building PV capacity in selected Eastern Partner countries. The quantitative data of current building-PV installations show, with the exception of Ukraine, that building PV is still a marginal energy policy option in selected countries.

In Ukraine the introduction of an incentive mechanism, with generous FiT level, has resulted in the installation of over 1000 rooftop systems. In 2016 PV sector has grown more than other RES technologies reaching 99MW out of which 17 MW are recorded in the building PV segment. The average building PV size is 15kW.

In Moldova less than 30 small size PV system are recorded, most likely roof-top PVs. The aggregate capacity is at 1.7MW. Their size, in order to fit within the FiT supporting framework is in the range of 10-100kW. They all belong to private companies or institutions and there is no participation of the residential sector in the development of building PV given the complicated procedure to apply to FiT.

In Georgia building PV experiences are limited to few systems of large size developed on a project by project approach, such as national Airport and University. No sign of participation of the private or residential sector in PV development is found.

In Armenia little development of PV sector is recorded. Only some 10 building PVs are found in the country in net metering mode. Other few PV commissioning are completed within the FiT scheme which is reserved to 150kW – 1 MW systems. PV projects were in their majority supported by international financial institutions and they comprise projects of integrated sustainable energy programmes.

In Azerbaijan 22 systems are found with an aggregated capacity of some 34MW. One single installation amounts at 20MW. Few systems are recorded in the building PV segment. They are installed in public institutions (sport centres, schools). All systems are owned by Azalternative, a public company. All administrative and financial procedures have been developed within the State Agency for Alternative and Renewable Energy Sources of Azerbaijan Republic and there is not a transparent procedure to be followed by third parties.

In Belarus 29 PV systems are recorded, 25 with a capacity <1MW. The aggregated capacity amounts at 11MW. They are developed by private companies.

The sum up the identified barriers, emerging by the gap analysis in selected countries may be grouped in the following dimensions:

Economic context: all Eastern Partner countries have limited GPD level, this combined with low end-user electricity price, further reduce the economic resource availability to support incentive schemes in the electricity sector without significant support from external financial institutions. Other priorities, such as relevant share of households recorded in energy poverty conditions, are also found.

Energy policy: with the exception of Ukraine and Moldova, implementing EU Directive 28/2009/EC, little policy commitment is found to support RES development. Within RES sector, negligible commitment is found to support the building PV sub-sector. Ukraine is an exception. Lack of policy commitment plays an important role as building PV, referring to the distributed

generation domain, need specific policy and regulatory provisions to flourish. A good policy to promote RES may not equal to a favourable policy for building PV solutions.

Electricity prices: as anticipated the gap between end-user prices and technology costs is a main barrier in all selected countries. Supporting mechanisms are needed at least in the short term to develop building PV. This links with the economic variable.

Electricity market structure: only EC signatories are going toward the reform of the electricity market. In other countries different model of electricity market structures exist. Markets are not fully liberalized. This may restrict third party participation in PV capacity development.

In terms of the regulatory context it can be argued - as it is often observed – that without strong policy commitment, regulation alone will not be able to develop a complete favourable legal framework for penetration of building PV. Significant gap(s) in the regulatory dimension represent(s) a barrier for building PV. Connection rules and authorization procedures are hardly defined for small PV systems. To date the existing (limited in number) installations have not emerged as the result of a harmonised and transparent procedure which is readily available to be adopted by other independent developers.

Finally, the solar resource potential, though not the one and only determinant of the attractiveness of PV technology, needs to be taken into consideration when policy support costs need to be assessed. Inevitably the development of the PV sector will be more expensive in countries where the resource endowment is relatively low. Annual expected specific production (in kWh) may fall below 1000kWh in significant area of the Northern Eastern Partner countries, Belarus and Moldova and to some extent Ukraine.

Box 2: A summary of recommendations

- A Specific recommendation to fill the connection and RES authorization procedures to comply with EC Directive 28/2009/EC maybe relevant to Georgia, Ukraine and Moldova. A “one shop” procedure to fulfil all authorization tiers comprises a useful regulatory tool for building PV. Although not even all EU countries have already put in place a “one shop” procedure, this should remain as a priority policy target for the building PV sector.
- Ukraine may consolidate the existing positive results in the building PV sector by better balancing the PV development economic support between the short and the long term period in the current FiT scheme.
- The Fit scheme in addition should be designed to better integrate net metering with the FIT scheme in order to stimulate distributed generation solutions. The premium component should be additional to the electricity component in order to allow electricity auto-consumption in building PV sector.
- Moldova needs to speed up and complete the development of secondary legislation in the RES sector in order to implement national legislation dated 2016.
- Minimum capacity threshold to access support schemes should be removed in order to promote building PV sector. As an alternative, specific sectoral supporting scheme should be in place. The level of support should not be lower than what is assured by the main incentive scheme. For instance, when net-metering is the only option for small scale PV plants it is important to verify it assures an electricity remuneration aligned to technology costs, or at least that it assures an electricity value not lower than other existing incentive in the country. If this is not the case net-metering should be combined with premium scheme, in order to be effective.
- Building PV development should contribute to the solution of current energy market priorities and not aggravate them. Given the economic restriction of the

reviewed countries, supporting schemes have to be carefully designed and able to reduce overall infrastructure costs of a country.

- Net metering system alone seems not sufficient to promote building PV due to low end-user tariffs and FiT tariff are often reserved to larger capacity development. When this is the case it is recommended to support the building PV sector with specific programmes. The programmes may be tailored to public institutions and the public housing sector in order to show a double dividend for the dedicated budget. The measure will allow the development of building PV sector as a strategic option within RES towards distributed generation and will contribute to reduce electricity costs in public institution and social housing also in consideration of high energy poverty level. The described dedicated supporting scheme may more easily access international financing opportunities.
- Finally supporting mechanisms may not only be confined in the electricity market. Other mechanism to promote PV may also be introduced, especially in the building sector, for instance by introducing minimum PV installation in new building and house development.

6.1 Gap analysis & Recommendations

	Armenia	Azerbaijan	Belarus	Georgia	Moldova	Ukraine	Remarks
Electricity market & its structure	Single Buyer Model Transmission unbundled Distribution and supply integrated	Generation and Transmission integrated Distribution and supply integrated	Vertically integrated	Decentralised model (currently under review) Transmission unbundled Distribution and supply integrated (3 regions)	Decentralised model (reform currently planned) Transmission unbundled Distribution unbundled	Single Buyer Model (reform currently underway) Transmission unbundled Distribution unbundled	Reforms in the EnC parties should enable DSOs to act as key counterparts for PV in buildings. Electricity markets are also a requisite for future better regulatory schemes for PV pricing (FiP, Net metering, etc.) to be implemented.
Recommendations (Agency[83])	AM is moving towards a more liberalised model but not necessarily in line with the EU Acquis (Ministry, IFIs). In order to have a PV rooftop efficient policy it is recommended to tailor some specific rules for the distributed generation sector only without	AZ should aim at a simple PPA model with a reasonable FiT degression. Both connection/access and PV generation offtake should be organized by the (integrated distribution company). A niche market for distributed generation should be tailored with specific	AZ should aim at a simple PPA model with a reasonable FiT degression. Both connection/access and PV generation offtake should be organized by the (integrated distribution company). The present market structure does not allow private	GE is gradually moving towards the necessary reforms (EnCS/Ministry). The electricity market structure does not represent a barrier for PV rooftop development and is generally favourable. It is suggested to support minimum quotas of PV development in order to complete secondary legislation in parallel with building PV installation experiences	MDs need to implement their recently adopted new electricity laws transposing the 3rd Energy Package along with the new RES law in order to comply with the EnC Acquis and effectively promote RES in	UA needs to implement their recently adopted new electricity laws transposing the 3rd Energy Package along with the RES law in order to comply with the EnC Acquis and effectively promote RES in the country (EnCS/Ministry)	The PPA (FiT) model should work for the early stage implementation of EnC countries as well as Armenia.

[83] Means who may be assigned responsibilities and show leadership in implementing the recommendation

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	interfering with the overall process of reforming the electricity market. This would help to speed up the process in a country with good resource potential	reference to PV rooftop in a country with overall good potential. Presently all systems have been developed within the national company. It would be useful, in order to promote PV rooftop, to introduce market liberalization for what concerns end-user installation.	individual to sell or exchange electricity with the network. This is the first barrier which should be overcome. Allowing small producers installing building PV does not necessarily modify the overall electricity market structure.		the country (EnCS/Ministry.		
RES Law (transposition of the directive)	Not required	Not required	Not required	Will be required	In progress	In progress	
Recommendations (Agency)	Even though the country is not supposed to follow EU directive requirements, some provisions of 28/2009/EC are indispensable steps for PV rooftop policies. Third party access and a simplified authorization procedure are musts for attracting third-party resources in the PV market.	The country is far from adopting an EU like building PV supporting environment. Low level of electricity cost and supporting mechanisms combined with the commissioning of PV within the incumbent, have not allowed so far, any third party PV development. It is suggested to tailor a specific building PV programme in order at least to open up the market.	The current favourable Fit scheme is not complemented by a transparent connection and authorization procedure. In order to achieve the desired policy targets, it is recommended to adopt at least some minimum provisions of 28/2009/EC with reference to connection and authorization procedures	The current legislative framework has not favoured significant PV development so far. EC signature will introduce a favourable RES acquis. One of the priority will be the facilitation of authorization procedure which is currently cumbersome and not directed to distributed generation policy targets, despite good resource potentials.	Lack of secondary legislation does not allow a gap analysis at present. Secondary legislation implementation has been postponed to March 2018	Transposition is almost completed. Some additional effort should be dedicated to the connection rules by establishing more transparent procedures. Additional improvement may be reached in the simplification of authorization procedures. Finally, electricity sales should be kept separate from FIT incentives to better stimulate distributed generation.	

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Specific PV-related implementing regulations	The policy commitment to develop RES does not seem oriented in the development of distributed generation systems, but rather larger (utility scale) systems. Feed-in tariff set at 9 c€/kWh is directed to mid-scale PV systems, rather than small-scale building-PV solutions. PV installation <150kW do not get access to Fit scheme	Very low Fit prices assured to RES do not allow PV development. Existing installations have been developed within the national company. There is not a transparent regulatory framework to attract third party investors in building PV. Final retail prices do not support self-consumption mode.	The RES quota development mechanisms supported by FIT does not support in fact small PV developments. Procedures are cumbersome and not transparent. Access to Fit is restricted to business entities and not private individuals.	The mechanism to develop RES systems, is cumbersome and impractical in respect of the development of distributed generation. the same regulation and procedures are applied for small and big PV installations. The net metering scheme which results to easier access is in fact strongly hampered by low electricity prices	Primary legislation introducing green premium coefficient for the development of RES, based on annual quota could be a good base for building PV development. So far, no secondary legislation has been implemented and it is not possible to assess the impact on building PV.	Ukraine has introduced a supportive building PV regulation with FIT tariffs specifically directed to small size installations <30kW. Secondary legislation is also in place with some amendments needed to fully comply with EU acquis.	
Recommendations (Agency)	Building-PVs represents , given the country solar resources, a good RES potential in the country which is a net importer of energy. It is recommended to launch a specific programme for PV rooftop systems to be financed by a sustainable amount of budget. The programme to be tailored to social housing/public institution sector and to be combined	It is recommended to introduce a specific building-PVs incentive mechanism to promote at least a minimum capacity in order to develop PV market which otherwise would focus only on large scale system. A FiT scheme tailored to small rooftop PV systems - similar to the Ukrainian, may be an effective development path. It is recommended to facilitate the	Making authorization and connection procedures transparent and open is a prerequisite for third party development of PV capacity, which is the backbone of building PV sector. Net metering should also be introduced and the development of PV should be extended to individuals and not	It is suggested to tailor a programme to develop PV rooftop based on development targets and incentivised by FIT. The programme shall serve as a pilot to open up the market and to work on authorization procedures in the view of making the electricity market compatible with EU directive requirements. In the long run, thanks to the good sun potential, Georgia may face balancing issues. This may be addressed by enhancing interconnection capacity and by evaluating	Speed-up approval of secondary legislation with reference to the process of transposition of EU Directive 28/2009/EC. Tailor a specific programme for building PV, also including specific targets for public institutions, and the	To complete EU directive transposition in terms of connection and authorization rules. To improve FIT design in order to give longer term market perspective and assure a stable PV sector development. Separate FIT from electricity sale, in order to favour self-consumption and better combine Fit with net metering functioning.	

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	with the current net metering scheme, in one of the country found with higher end-user electricity prices.	participation of third-party entities rather than develop rooftop PV capacity by the national electricity distribution and supply company	restricted to company status.	the combination of building PV development with storage technologies.	building sector.		
Grid connection	Distribution Code is set to be developed with the assistance of WB; There is one general norm for <5MWp; No r-TPA implemented; The connection procedure is negotiated and usually lengthy.	There is no distribution code and/or connection rules for PV in Azerbaijan; No r-TPA implemented; The connection procedure is negotiated and usually agreed between governmental agencies (as in the case with existing PV installations).	There is no distribution code and/or connection rules for PV in Belarus; No r-TPA implemented; The connection procedure is negotiated in its essence since much of the decision depends on a case-by-case evaluation of a connection.	There is no separate distribution code adopted in Georgia (distribution is collectively dealt with in the Grid Code). There is a capacity threshold of <100 kW for a plant to be considered as micro-generator. Micro-generators become eligible for the net metering scheme if the on-site capacity is equal (or less) the demand connection capacity & less than 2% of the distribution company overall annual average peak demand. The above sound a bit constraining for PV provided that capacity factor is expected to be at the order of 10-15% (PV is energy constrained). Connection procedure is defined with time limits and indicative costs per connection capacity size.	There is no distribution code approved in Moldova but r-TPA is provided in the electricity law transposing the 3rd Energy Package to the Moldovan legislation. The overall grid connection for RES appears favourable in terms of the primary legislation with shallow connection cost adopted as well as dispatch priority. However, there are no specific connection conditions for the small-scale PV. This adds complexity to	There is no distributing code to which the many Ukrainian DSOs must abide to. In general, the notion of distribution unbundling is not well consolidated in the country. The connection however as a process seems well defined in terms of time-limits and having the network company as the central authority. The 30 kW capacity threshold may be too low for multi-apartment and commercial buildings. Implicitly the net metering regulation allowing for more than 30 kW (but less than the demand connection capacity which can sell surplus energy at FiT resembles the prosumer notion.	

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					the procedure of connecting distributing generators. At this scale the procedure seems to be negotiated since the network operator shall impose technical conditions on a case by case basis. There is no net metering scheme in place at the moment but this is foreseen in the new RES law.		
Recommendations (Agency)	With the opportunity of the development of the distribution code, rules & procedures for connection should be adopted; Detailed connection rules for PV including standard templates for connection offers for LV-connections (up to 150 kWp) would be advisable	Connection and access for small – scale PV should be provided for in the law. The distribution company shall then establish the procedures and issue general requirements and a connection charging methodology.	Connection and access for small – scale PV is provided for in regulation. The established procedures (6-steps involving different authorities) should be reduced to two (connection offer + town planning approval). There is no common published connection charging methodology. Standardized cost	There is little experience with the implementation of the net metering scheme (3 connections) and perhaps this might need to be reviewed in terms of its PV-friendliness. Also, connection procedures appear sufficient for the movement but for the movement the low number of applications has not stressed the network in terms of managing the requests in due time.	Moldova is in the process of developing its secondary legislation following the transposition of the 3rd Energy Package. While it is assumed that the connection charging methodology should remain unchanged and thus favourable for RES	It appears that the connection procedure is really efficient as long as one stays within the 30 kW threshold and can classify as a “household” - thereby be addressed as a “standard” connection. The whole process seems to get more complex for other types of prospective rooftop PV developers particularly we higher installed	

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			elements should be used for PV in buildings		generators at large, small PV would require a standardized approach in terms of the technical conditions. It is proposed that the each (of the 3 DSO) is appointed as a single point of responsibility in their area while the technical conditions for connection of building PV should be standardized. The redundant procedural step of state energy inspection approval should be abolished.	capacities. Selling excess energy at FiT while constraining the PV installed capacity at demand connection capacity does not seem to be beneficial provided that the capacity factor of an average PV system is expected to be at the order of 10-15% . Both the above issues need to be reviewed and amended as appropriate.	
Licensing & permitting	License exemption up to 150 kWp No specific regulations exist either specific to building PV or in the frame of the construction/building codes	License exemption up to 150 kWp No specific regulations either specific to building PV or in the frame of the construction/building codes	Connection and licensing/permitting seem to be intertwined. There seems to be no license for PV generation (as a business activity) and several authorities collectively regulate safety	The net metering criteria appear too restrictive (although generally adequate for domestic applications). No specific regulations exist for either specific to building PV or in the frame of the construction/building codes though authorisations for the installation have to come from the architectural department of the	Small PV do not require a license since generation licensing is required for plants with more than 5 MW (20 in the case of autoproducers) installed capacity.	No specific regulations exist either specific to building PV or in the frame of the construction/building codes. There is no one-stop shop for permits and licenses, which significantly increases the period for pre-	

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			and environmental conditions.	municipality which needs to specify some requirements for the installation	The law on buildings' energy performance provides for the introduction of RES in buildings. Town planning and environmental permitting do not seem to deviate from the usual EU practice.	construction procedures.	
Recommendations (Agency)	The exemption from licensing threshold (150 kWp) is too low (should not to be confused with LV connection limit!); Regarding permitting, uniform and simple town planning rules should be developed (i.e. roof coverage margins, overall height/type of mounting structures. EIA exemption if it is a rooftop installation)	The exemption from licensing threshold (150 kWp) is too low (should not to be confused with LV connection limit!); Regarding permitting, uniform and simple town planning rules should be developed (i.e. roof coverage margins, overall height/type of mounting structures. EIA exemption if it is a rooftop installation)	Substantial simplification in the development process is required. There should not be additional approval for PV in existing buildings. Exemptions may include historical or religious buildings. Uniform and simple town planning rules should be developed (i.e. roof coverage margins, overall height/type of mounting structures. EIA exemption if it is a rooftop installation)	Uniform and simple town planning rules should be developed (i.e. roof coverage margins, overall height/type of mounting structures. EIA exemption if it is a rooftop installation). This will enforce a common framework and prevent from different interpretations/requirements on permits issued by the architectural department of each municipality. Other than that, it is generally positive that the distribution company is mainly responsible for addressing the issue.	While the high threshold for exemption from generation license is positive for the small scale PV, it is evident that the bottleneck is transferred to the network operators' front desk. The implementation of the new RES law should move to the direction of auctions and this may provide a remedy for the current stockpiling of	It appears that the licensing procedure is really efficient as long as one stays within the 30 kW threshold. For a typical RES generator however, the process goes through the market operator (Energorynok) and requires approval by the NRA and agreement with the supplier before the FiT is granted to the plant. It appears that there is a legal/regulatory gap for PV rooftop installations that are larger than 30 kW and envisage to operate as regular RES generators.	

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					RES applications. It is positive that there are no EIA requirements in respect of PV in buildings. Structural integrity of the roof is also provided in a 1996 law. Reportedly static integrity has not been a limiting factor for the so far implemented rooftop PV plants (up to 30 installations in total).	Regarding permitting and with a focus on multi-apartment buildings uniform and simple town planning rules should be developed (i.e. roof coverage margins, overall height/type of mounting structures. EIA exemption if it is a rooftop installation)	
Ownership	Legal and natural persons are allowed to own and operate rooftop PV systems. Tacit/cultural specificity implies the roof is administered by the owner(s) of the last floor	No limitations found. However, the to the date there has been no installation of PV in multi-apartment and/or non-public building.	Individuals are prohibited from owning a PV connected to the grid. They can do so as isolated auto-producers (i.e. covering only their own needs)	Legal and natural persons are allowed to own and operate rooftop PV systems. Tacit/cultural specificity implies the roof is administered by the owner(s) of the last floor	Legal and natural persons are allowed to own and operate rooftop PV systems. However, administrative issues become a barrier when it comes to a multi-apartment building. There are different models of	Ownership of the building including the roof by a single entity is required. For individual family buildings this seems not to be a problem but it is quite rare that other buildings can cope with this requirement. The situation gets even more complicated when housing associations (OSBB in the Ukrainian	

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					administration (owners' association, communal service company, private facility manager company, individual owners with delegated authority, etc.).	abbreviation) come in to play.	
Recommendations (Agency)	Legal issues pertaining to the rights of multi-apartment buildings' rooftops need to be resolved. Same applies to the meter of commonly used electricity; The above is a requisite for leasing and TPF schemes to flourish	Further legal review is required	The existing legal framework provides an important legal barrier given the fact that the very nature of building PV is anticipated to enable individual consumers. Amendments should be required.	Legal issues pertaining to the rights of multi-apartment buildings' rooftops need to be resolved. Same applies to the meter of commonly used electricity; The above is a requisite for leasing and TPF schemes to flourish	Legal issues pertaining to the rights of multi-apartment buildings' rooftops need to be resolved. Same applies to the meter of commonly used electricity; The above is a requisite for leasing and TPF schemes to flourish.	A new regime that allows the OSBBs and communal services to act complementary when it comes to facilities management is anticipated to be introduced by a new law in Ukraine. This may comprise an opportunity for EE retrofits and PV buildings included via ESCOs.	While it does not form a general rule, it seems that household owner associations are somewhat weaker in terms of influence in Caucasus compared to Eastern Europe region. In both cases it is useful for look further on the legal issues pertaining to the decision making, fiscal and taxation issues.
Finance	Access to market at current interest	So far, all projects where financed out	IFI credit lines are present in the	So far projects on buildings have happened either	IFI credit lines are present in	So far projects on buildings have	

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	rates is possible (though difficult due to collateral expectations) only to utility scale projects.	of state budget. IFI credit lines are present but generally, commercial lending is somewhat expensive. There is no private ESCO activity in the country.	country although it is not considered sufficient to bring online the full potential. Generally, commercial lending is somewhat expensive. There is no ESCO activity in the country.	solely on owners' equity or with the support of the externally led credit lines. IFI credit lines are present but generally, commercial lending is somewhat expensive. There is no private ESCO activity in the country.	the country although it is not considered sufficient to bring online the full potential. Generally, commercial lending is somewhat expensive. There is ESCO activity in the country but so far there is no evidence that there is a market for them in PV.	happened either solely on owners' equity and they comprise single family houses. IFI credit lines are present but generally, commercial lending is somewhat expensive. There is good ESCO activity in the country currently working mainly on municipal and industrial energy efficiency projects. Most importantly it is with the Ukrainian authorities plans to develop national programmes financing sustainable energy investments.	
Recommendations (Agency)	An increased participation from IFIs would be promising. KfW is already active but aims for utility scale projects. There is still a perception of high risk for PV technology which needs to be addressed (perhaps via the continuation of the EBRD/CEEP?)	An increased participation from IFIs would be promising. In the first instance and until the private sector gets more acquainted with the technology and its benefits/risks a public funded programme would be advisable. The national ESCO pilot should operate within the aforementioned programme so that	An increased participation from IFIs would be promising. In the first instance and until the private sector gets more acquainted with the technology and its benefits/risks a public funded programme would be advisable. ESCO involvement should better off evolve for energy	An increased participation from IFIs would be promising/desirable. In the first instance and until the private sector gets more acquainted with the technology and its benefits/risks a public funded programme (National and/or municipal in the frame of CoM) would be advisable. ESCO involvement should better off evolve for energy efficiency purposes (main business) and if successful then expand to building PV.	An increased participation from IFIs would be promising. In the first instance and until the private sector gets more acquainted with the technology and its benefits/risks a public funded programme	An increased participation from IFIs would be promising/desirable. In the first instance and until the private sector gets more acquainted with the technology and its benefits/risks a public funded programme (National and/or municipal in the frame of CoM) would be advisable. ESCO involvement can expand to	

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		the model is then spilled over to any interested party.	efficiency purposes (main business) and if successful then expand to building PV.		(National and/or municipal in the frame of CoM) would be advisable. ESCO involvement can expand to building PV if framework conditions are clearly defined.	building PV if framework conditions are clearly defined.	