



•Փորձարարական և տեսական հոդվածներ• Экспериментальные и теоретические статьи•
•Experimental and Theoretical articles•

Biolog. Journal of Armenia, 1 (61), 2009

CLEAN DEVELOPMENT MECHANISM (CDM) POTENTIAL FOR PROMOTING SUSTAINABLE DEVELOPMENT IN ARMENIA

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Armenia is actively engaged in processes of tackling global warming challenges, particularly, within the Kyoto Protocol's Clean Development Mechanism (CDM) framework. Besides being regional leader in number of registered CDM projects, Armenia was the first to have Executive Board's registered CDM project. Currently, there are a number of CDM projects in different status of development in Armenia. However, to avoid falling into the trap of “low hanging fruit” (projects which are cost-efficient, but have poor sustainable development co-benefits) there is a need to concentrate more efforts on designing projects with higher non-carbon benefits, such as renewable energy and energy efficiency, for which the country possesses considerable potential.

Climate change – CDM – sustainable development

Հայաստանը ակտիվորեն ներգրավված է գլոբալ տաքացման դեմ պայքարի գործընթացում, մասնավորապես Կիոտոյի արձանագրության մաքուր զարգացման մեխանիզմի (ՄՁՄ) շրջանակներում: Գրանցված ՄՁՄ ծրագրերի քանակով Հայաստանը հանդիսանալով տարածաշրջանային առաջատար՝ նույնպես եղել է ՄՁՄ ծրագիր գրանցող առաջին երկիրը: Ներկայումս Հայաստանը ունի զարգացման տարբեր փուլերում գտնվող մի քանի ՄՁՄ ծրագրեր: Սակայն խուսափելու համար “մատչելի պտուղներ”-ի (ծրագրերի, որոնք շահութաբեր են, բայց ունեն կայուն զարգացման արդյունավետության ցածր գործակից) ծուղակը ընկնելուց անհրաժեշտ է ջանքերը կենտրոնացնել մշակելու համար ծրագրեր՝ ոչ ածխաթթվային օգուտների ավելի բարձր գործակցով, ինչպես օրինակ վերականգնվող էներգիայի և էներգաարդյունավետության ծրագրերը, որոնց իրականացման համար երկիրը տիրապետում է զգալի կարողությունների:

Կլիմայի փոփոխում - ՄՁՄ - կայուն զարգացում

Армения активно вовлечена в процесс борьбы с глобальным потеплением, в частности, в рамках Механизма чистого развития (МЧР) Киотского Протокола. Являясь региональным лидером по количеству зарегистрированных МЧР проектов, Армения также была первой страной, зарегистрировавшей МЧР проект. В настоящее время Армения имеет несколько МЧР проектов на различных стадиях развития.

Однако, во избежание попадания в ловушку “легко доступных фруктов” (проектов, которые рентабельны, но имеют низкую эффективность по устойчивому развитию), необходимо сконцентрировать усилия на разработку проектов с более высоким уровнем некарбоновых выгод, таких как проекты по возобновляемой энергии и энергоэффективности, для осуществления которых страна обладает значительным потенциалом.

Изменение климата - МЧР - устойчивое развитие

Introduction

The global climate change regime has evolved under the United Nations Framework Convention on Climate Change (UNFCCC) since 1992. The Kyoto Protocol became a subsequent development of climate policy architecture. It stipulates binding targets for industrialized Annex B countries to reduce six greenhouse gases (GHGs) by an average of 5.2% compared with 1990 emissions baseline. The peculiarity of the Protocol is that it does not stipulate any emission restriction targets for developing countries. Nonetheless, it encourages voluntary participation of developing countries in the global effort of mitigating climate change through cooperating in clean development mechanism (CDM) project activities and benefiting from technology transfer and furthering their sustainable development goals.

CDM Market Trends

Among carbon markets, in terms of generated certified emission reductions (CERs), the CDM is the second largest market after European Emissions Trading Scheme. With the first project registered in September 2003, the CDM portfolio in mid 2008 contained 3498 CDM projects in pipeline with the amount of issued 152 million CERs [5].

At the time of writing, there are around 50 developing countries hosting CDM projects. Figure 1 shows the geographical distributional pattern of projects registered and in pipeline. The smallest portion fallen to Europe and Central Asia countries is divided between four countries: Armenia (4 registered projects), Cyprus (2 projects), Moldova (3 projects) and Georgia (1 project).

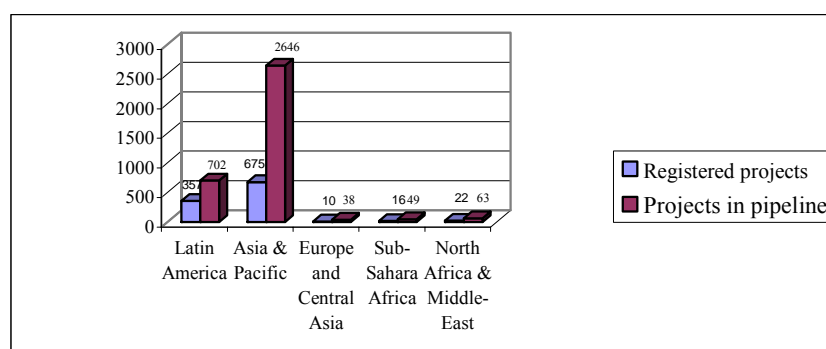


Fig 1. Regional distribution of CDM projects as of July 2008

CDM and sustainable development

Within the Kyoto framework currently there are no specific internationally recognized sustainable development standards. Developing countries need to define

specific country-related sustainable development criteria based on their development priorities. The common approach is based on three dimensions of sustainable development funneled to national level and framed in the CDM context.

Prevailing discussions and analysis suggested that energy sector orientted CDM projects (energy generation, renewable energy, transportation, energy efficiency) have the highest potential of abating GHG emissions together with creating multiple positive side impacts on sustainable development indicators. In particular, energy efficiency and renewable energy projects make valuable contribution to improving energy security supply, enhancing access to energy services, reducing local air pollution, creating local jobs and income, and, thus, alleviating the poverty. Specifically, solar CDM projects rank the highest on provision of development benefits. For example, solar PV (photo-voltaic) creates improved and increased access to electricity, employment, welfare and better learning possibilities [4]. On the contrary, large F-gas projects generate almost no development benefits. End-of-pipe projects, such as landfills or industrial processes, designed for capturing and decomposing N_2O and CH_4 gases are of same category projects – “low hanging fruit”, which are based purely on low cost emission reduction rationality without non-carbon contribution.

CDM framework in Armenia

Armenia ratified the UNFCCC in May 1993. For meeting its commitments under the Convention, Armenia implemented a number of activities and programmes, including development of national GHG inventory, capacity building, technology needs assessment, preparation of National Communications, Action Plans, etc. In December 2002, Armenia ratified Kyoto Protocol as a non-Annex B country, meaning no quantified GHG emission limitation and reduction commitment.

For participating in emission trading within Kyoto, as a foremost step, after Kyoto ratification, there was a need to establish the Designated National Authority (DNA). Already in September 2003, Armenia notified the UNFCCC Secretariat about assignment of the Ministry of Nature Protection as DNA for CDM operations in Armenia [6]. It should be noted, that institutional rigidities such delays in DNA establishment (sometimes due to inter-ministerial conflicts) and inefficiency of DNA performance became a serious impediment for many developing countries to participating in CDM for several years. In Armenia, with technical and financial assistance of different international institutions, the DNA succeeded in welltime organising effective capacity building activities for strengthening its technical expertise and institutional base. A number of CDM-related regulatory and procedural measures were also implemented for creating a favourable environment for CDM operation.

The Armenian DNA does not have official procedure for assessing sustainable development component of CDM projects. For evaluation, the Armenian DNA has developed a list of criteria reflecting environmental, economic, social and political aspects of sustainable development perspectives of the country. The Armenian DNA has identified energy efficiency improvement and development of renewable energy sources as Priority 1 areas for CDM project implementation (see Table 1). Also, projects that claim technology transfer are considered as favorable for achievement of sustainable development in the country [3]. Sustainable impacts of projects are assessed by different governmental institutions that are participating

in the process of CDM project evaluation. However, as practice shows, this kind of approach can cause inter-ministerial conflicts. Different ministries based on their own priorities may claim on completely opposite solutions for the CDM project which is passing assessment, as it was a case with one of the landfill gas capture CDM projects in Armenia. Therefore, development of more formal comprehensive set of sustainable development assessment procedures and rules for weighting and scoring the combination of quantifiable and nonquantifiable attributes of CDM project options is of urgent need. This would allow more balanced and effective decision-making based on the obtained overall values of assessed options with CDM projects that score a maximum score to be finally selected.

Analysis of CDM projects in Armenia

Thanks to prompt actions of the DNA, an effective national institutional structure was established that harnessed the CDM potential and attracted investors at an early stage of CDM market development. Thus, Armenia is a first country among former Soviet countries to have registered project by the CDM Executive Board (EB) in November 2005 [3]. Moreover, at the time of this writing, Armenia is a leader in number of registered CDM projects among non-Annex B countries of Europe and Central Asia region. Armenia accounts for 40% of all registered projects in the region. In addition to 4 registered projects, in the CDM pipeline there are 3 more projects at validation stage. In total, these 7 projects submitted from Armenia are expected to generate 1900 kCERs to 2012. Thus, Armenia's share in CDM market amounts to 0.2% of volumes (number of projects) and 0.1% of value (total 2012 CERs expected from all the CDM projects currently in the pipeline). At first sight, it may look like a small portion, but when considering the Armenia's share of 0.02% in total of non-Annex B GHG emissions, one can see how much the CDM "pie" share is larger than proportion of GHG emissions [2]. With this respect, Armenia is again among top countries (the second after Equatorial Guinea) that have a share of CDM market that is several times greater than its share of non-Annex B GHG emissions.

However, whether Armenia can be considered as a "successful" CDM country depends not only on the value of CER transactions, but also on the quality of CDM project portfolio that Armenia holds. Particularly, the assessment of technology transfer component of the CDM project, the amount of inward investment channeled to the country thanks to CDM projects, and the weight of non-carbon sustainable development co-benefits are also measures for the "CDM success".

Currently, the DNA in Armenia reports about 14 projects in different stages of development [6]. There are a number of different type projects: land-fill gas, methane capture, cement, small hydropower, energy efficiency improvement, and afforestation/deforestation. The analysis of these projects with respect to sectors prioritized by the Armenian DNA is presented in Table 1. More than half of projects (8) relates to Priority 1 projects – renewable energy and recently energy efficiency projects. However, in terms of CER generation, these projects yield in total only 4% per year basis. On the contrary, 1 cement production optimisation (Priority 2) and 3 landfill gas (Priority 3) projects together account for 81.5% of CERs.

The analysis of Priority 1 renewable energy projects shows that all of them are small-scale hydro projects in different regions of Armenia.

Table 1. Distribution of CDM projects by priority sectoral scope [3, 6, *author's calculations*]

Priority	Sector	Category	Number of CDM projects	CERs per year		Investment costs (mln \$US)
				tCO ₂ e	%	
1	Energy	Renewable	6	91 302	2.2	28.7
		Energy efficiency	2	74 899	1.8	40.0
2	Industry	Technological improvements	1	1 147 390	27.7	4.0
3	Waste	Waste-to-energy	3	2 229 700	53.8	14.4
4	Agriculture	Biogas capture	1	439 800	10.6	4.8
5	Forestry	Carbon sequestration	1	160 000	3.9	-
6	Transport	Fuel economy improvement	-	-	-	-
Total			14	4 143 091	100	

The concern here is that even though these projects are under renewable energy classification, there is a growing understanding worldwide that hydropower is the source of both significant and unavoidable adverse environmental impacts. Small-scale hydropower plants are not exceptions, since like large-scale plants they imply a threat to important stream ecosystems level and individual species [7]. Also, according to analysis of technology transfer in CDM projects, hydro projects together with cement projects have the lowest rates of technology transfer [8]. Moreover, according to expert estimations hydropower is already exploited to its most potential in Armenia and the hydro-energy projects are already in the list of plans with possibilities of attracting private capital [10]. Therefore, within the CDM framework, there is a need to shift the focus to non-hydro capacities of renewable options, as many CDM host countries are currently doing because of high sustainable development benefits that these projects generate, especially in the case of solar projects. Indeed, Armenia has a significant potential for solar, wind and geothermal which is practically not used. Currently, only 0.64% of technically feasible renewable energy is exploited in Armenia [10]. According to some expert estimation, in short-term perspective it is technically and economically feasible to generate annually 270 million kWh electricity from a solar energy plant with 100 MW power capacity [9]. Wind energy can be utilized for generation of 120 million kWh per year. In this context, CDM can be regarded as a perfect means for technology transfer and overcoming the barrier of financial resource. Moreover, for promoting renewables, the government guarantees to purchase of energy from renewable sources at a fixed price. This incentive could increase the attractiveness of CDM projects in this field.

With regard to technology transfer, according to some estimates CDM project types such as cement, coalmine methane, fossil fuel switching, and transport involve very little technology transfer, while almost all energy supply, household energy efficiency and solar projects claim technology transfer. According to the study conducted for the UNFCCC with data analysis based on

project characteristics and CDM host country variables, some of project types, including cement, hydro, and reforestation have low rates of technology transfer. Whereas, technology transfer is more likely for agriculture, HFCs, N₂O, and tidal projects [8]. The same study results for technology transfer to Armenia through CDM projects show though not statistically significant but positive trend of technology which can be compared with that of Indonesia and Egypt.

Encouraging fact to note here is the global investment increase in emerging renewable and energy efficiency technologies. There is an increase in share of all investment categories along the financing continuum, from research and development financing and venture capital for technology to asset financing for generating capacity projects. In 2007, the wind and solar sectors attracted respectively, the first and second largest investment volumes worldwide with increased share in almost every investment category [1]. Nascent technologies start to come and existing ones are refined. Investors are taking renewable energy and energy efficiency more seriously. This can become a promising message to take into account while framing policies and plans for energy infrastructure development, where CDM can play its role.

Proceeding with the theme of investment in the context of discussing how CDM “successful” Armenia is, as Table 1 illustrates, the investment costs are the highest with energy efficiency and renewable energy projects. Looking at this fact from the perspective of CDM host country, the point is that two small-scale energy efficiency projects attracted to the country 40 million USD inward investment, which is almost three times more than investment amount brought to the country by three landfill gas capture projects, one of which is the largest project in the Armenian CDM portfolio in terms of CERs. In this sense, energy efficiency projects are “gold” projects.

Indeed, in the climate change debate, there is a tendency of shifting focus on the energy saving potential, referred to as energy efficiency. International Energy Agency records that each dollar invested into improving energy efficiency energy produces more clean energy than a dollar invested in production of any other energy source [9]. Energy efficiency is one of most promising sectors for reducing GHG emissions. More than that, energy efficiency improvement is a powerful tool for achieving sustainable development by offering social benefits in the form of improved indoor and outdoor air quality, increased economic competitiveness, increased energy security and enhanced reliability of energy infrastructures through reduced reliance on fossil fuels, particularly when imported, and enhanced energy services. According to the World Energy Outlook, energy efficiency can provide 65% of energyrelated emission reductions. Data provided by the IPCC shows that currently the highest potential worldwide for emission reduction is from building sector, where energy efficiency is the largest and most costeffective mitigation option. Moreover, the IPCC experts emphasize that technologies for energy efficiency projects in building sector exist and have been successfully used [4].

High carbon intensity of gross domestic product (GDP), structure of energy consumption mix and sectoral distribution of GHG emission in Armenia indicates high potential for energy efficiency improvement. Power generation and transmission, transport, drinking and irrigation water supply, industry (mining, chemistry and food) and residential and commercial buildings are

priority sectors for energy efficiency improvement. According to expert estimation, potential for energy efficiency improvement in Armenia amounts to annul 1,008 thousand toe with expected CO₂ emission reduction of 1,279 thousand tons in case energy saving activities are implemented [9].

After all, Armenia is a landlocked country with no fossil fuel resources, thus highly depending on imports for energy, including fuel products which are strategically vital, for daily life, for commerce and for security reasons. With tendency of rapid economic growth with increasing demands for energy, current unstable regional geopolitical situation and oil price shocks, energy saving measures aimed at reducing energysupply demands and development of renewable energy sources are important pillars for enhancing energy security in the country. With this respect, CDM projects can be an appropriate tool for relieving financial and institutional constrains and promoting implementation in Armenia of energy efficiency and renewable energy projects which provide the most sustainable impacts.

Conclusion

Armenia is actively engaged in processes of tackling the challenges of global warming, in particular within the Kyoto Protocol's CDM frame-work - a new kind of global market tool, which strives to promote sustainable development in developing countries. With promptly established CDM institutional framework and actively operating DNA, Armenia succeed to be the first among Europe and Central Asia non-Annex B countries to have registered project by EB. The country is also a leader in the region, holding 40% of registered projects. Currently, Armenia's share of CDM market is much greater than its share emissions. Moreover, according to some assessments, there is a positive trend of technology transfer for Armenia through CDM projects. Also, Armenia CDM portfolio contains the majority of renewable energy and energy efficiency projects referring to Priority 1 project category based on economy structure and sustainable development potential of the country. However, for avoiding falling into the trap of "low hanging fruit" – projects which in terms of cost are efficient, but have poor sustainable development co-benefits, there is a need to concentrate more efforts on designing more projects with higher non-carbon sustainable development benefits, such as renewable energy (other than hydropower) and energy efficiency, for which the country posses considerable potential. In conclusion, Armenia is more likely to be considered as a "CDM successful" country, implying wider opportunities for better achievement of country's sustainable development goals.

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Abbreviations

CDM	Clean Development Mechanism
CER	Certified Emission Reduction
DNA	Designated National Authority
EB	Executive Board
GDP	Gross Domestic Product
GHGs	Greenhouse Gases
PV	Photovoltaic
UNFCCC	United Nations Framework Convention on Climate Change

Received 02.02.2009